

**Framework for the preservation of medical records in selected public healthcare facilities
in Malawi**

by

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Submitted in accordance with the requirements for the degree of

DOCTOR OF PHILOSOPHY IN INFORMATION SCIENCE

in the subject of

Records Management

at the

UNIVERSITY OF SOUTH AFRICA

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September 2025

DECLARATION

I declare that **framework for the preservation of medical records in selected public healthcare facilities in Malawi** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged through complete references.



Signature

31 July 2025

Date

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ABSTRACT

The purpose of this study was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records. Through a pragmatic research paradigm, the investigation integrated quantitative and qualitative methodologies, employing a mixed methods approach, to comprehensively comprehend the subject matter. The study targeted 415 healthcare staff from five public healthcare facilities in Malawi. Additionally, documents such as policies, standards, and budget documents were sourced from healthcare facilities as primary data for document analysis. The study employed stratified and purposive sampling techniques, with a sample size of 200 healthcare staff. Data collection methods consisted of questionnaires, interviews, observations, and document analysis. Quantitative data was analysed using IBM's Statistical Package for Social Sciences, and results were presented through frequencies, percentages, and tables. Qualitative data was analysed using ATLAS.ti, and results were presented through verbatim extracts. This multifaceted approach enabled a nuanced analysis of diverse facets of preservation. The overall significance of the study is in its potential to offer a reshaping policy direction on the preservation of medical records in healthcare facilities in Malawi. By examining the aspects of preservation, the research offered practical insights for policy formulation, institutional strategies, standards and best practices, thereby steering healthcare facilities towards evidence-based medical practice. The study showed that implementation of preservation strategies was inadequate with a lack of metadata for preserving records; lack of relevant policies, standards, procedures, guidelines, and legislation; lack of robust technologies for storage of medical records such as cloud storage, blockchain technology, artificial intelligence, and Deoxyribonucleic acid storage; and low level of knowledge and skills of staff handling records. The study concluded that the preservation of medical records in the public healthcare facilities in Malawi was somewhat poor. Based on the findings, the study recommends the development of specific policies, standards, guidelines and procedures for preserving records; the Ministry of Health and all relevant stakeholders such as Malawi Liverpool Wellcome Trust and Lighthouse should support healthcare facilities in Malawi in improving its ICT infrastructure; and healthcare facilities in Malawi should support staff to attend short courses, seminars, and workshops on preservation of records.

Keywords: Preservation; Preservation strategies; Preservation framework; Medical records; Preservation policies; Preservation standards; Records management; Malawi.

ACKNOWLEDGEMENTS

I firstly and foremost would like to thank Almighty God for giving me strength, wisdom, dedication, and motivation to embark on my PhD journey in 2022 until now. God, you have been a strength and source of inspiration through my PhD studies at the University of South Africa. I owe everything to you.

Secondly, I would also like to express my profound gratitude and thanks to Prof. Antonio Rodrigues, my supervisor, for the dedication, hard work and commitment towards this research project.

Thirdly, I recognise the dedication and hard work of Ms Hleziphi Napaai, Librarian at the University of South Africa Library. You provided me with the relevant information resources within the shortest time possible for my research project.

Fourthly, I register my appreciation to my employer, Mzuzu University, for supporting me during the entire period of study. My colleagues in the Department of Information Sciences, Dr George Chipeta, Dr Winner Chawinga and Dr Sellina Kapondera, you have been a source of hope and inspiration, which has made it possible for me to pursue a PhD programme.

Lastly, I give my utmost gratitude and thanks to my wife, Ruth Jobe, and my daughter, Chloe Phiri, for their understanding, support and belief in me. I deprived you of family time, but you supported and encouraged me to continue with my studies. I also acknowledge my mother, my father-in-law and my mother-in-law, my brothers, sisters and all relatives who supported me physically, morally and spiritually during my PhD studies.

DEDICATION

I dedicate this thesis to Ruth Jobe – my wife, my partner and my life coach; the one who convinced me to venture into my PhD studies. Thank you for standing by me through hard times in my academic journey.

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ABBREVIATIONS AND ACRONYMS

CCSDS	Consultative Committee for Space Data Systems
DANIDA	Danish International Development Agency
DCC	Digital Curation Centre
DHIS	District Health Information System
DIRKS	Design and Implementation of Record Keeping Systems
DNA	Deoxyribonucleic Acid
EDRMS	Electronic Document and Records Management System
EMR	Electronic Medical Record
HMIS	Health Management Information Systems
HRORBN	Health Records Officers' Registration Board of Nigeria
ICT	Information and Communication Technology
IRMT	International Records Management Trust
ISO	International Organization for Standardization
KCN	Kamuzu Central Hospital
KTRH	Kisii Teaching and Referral Hospital
LDI	Laboratory and Diagnostic Information Systems
MCH	Mzuzu Central Hospital
Moreq	Model Requirements for the Management of Electronic Records
MSI	Medicine and Supply Information
MZUNIREC	Mzuzu University Research Ethics Committee
NARA	United States National Archives and Records Administration
NARS	National Records and Archives Services
NAZ	National Archives of Zimbabwe
OAIS	Open Archival Information System
PREMIS	Preservation Metadata Implementation Strategies
PRISM	Performance of the Routine Information System Management
QECH	Queen Elizabeth Central Hospital
SMART	Specific, Measurable, Achievable, Realistic, and Time-bound
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISA	University of South Africa
WHO	World Health Organization
ZCH	Zomba Central Hospital
ZMH	Zomba Mental Hospital

CHAPTER ONE

GENERAL INTRODUCTION

1.1 Introduction

The need for evidence-based practice in medical care globally has prompted healthcare facilities to pay close attention to the implementation of a framework for the preservation of medical records in Malawi. In both developed and developing countries, healthcare facilities are investing significant resources in preserving medical records to inform the provision of care to patients. Partly, this trend emanates from the revelations of medical errors leading to death due to a lack of access to medical records resulting from poor preservation practices in healthcare facilities. The alarming statistics from the WHO (2019:37) have revealed that millions of patients are harmed each year due to medical errors, resulting in 2.6 million deaths annually in low and middle-income countries alone. In addition, a study by Johns Hopkins (2019) has revealed that medical errors are the third leading cause of death in the United States of America, after heart disease and cancer, although the deaths are preventable. Therefore, the preservation of medical records contributes to a sustainable and effective healthcare delivery system.

Even though the preservation of medical records has gained momentum in recent times in Africa, the concept has been in use in the healthcare system in developed countries. Originally, preservation has been commonly used in libraries, records centres, archives, and documentation centres. In general, preservation encompasses a set of processes and tasks performed to protect records against damage or deterioration (Millar 2017:146). The processes and tasks include maintenance, examination, conservation, and restoration. However, the focus of preservation in many sectors has been on the maintenance of records due to the nature of records in the current and semi-current states. By extension, maintenance is more concerned with the daily care of records in the current and semi-current state in the offices, storage areas, registry centres, and records centres (Dada 2022; Millar 2017). People involved in maintaining records include records-creating officers, records staff, and senior management staff. Other activities of maintenance include protection of records from unauthorised access and environmental risks through activities such as the implementation of storage methods for records, preservation policies, standards, and procedures, and training of staff in handling records. Therefore, the present study focused on the preservation of medical records occurring in offices, storage areas, and registry centres at public health facilities in Malawi.

However, it is important to highlight the critical relationship between preservation and records management. Preservation is commonly considered a practice in records management. This implies that preservation is part of the broader concept of records management (Saffady 2021; Touray 2021; Yeo 2021). Records management is regarded as the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records of business activities (Franks 2018; Saffady 2021). Although preservation is part of a broader concept of records management, the focus of this study is on preservation with a focus on preservation strategies, preservation policies and standards, storage mechanisms, preservation knowledge and skills, and a framework for preservation. Other concepts of preservation, such as conservation and restoration, were outside the scope of the study.

In the healthcare system, the goal of preservation is to improve long-term access to medical records by healthcare staff. By definition, a medical record is any relevant record made by a health practitioner at the time of or after a consultation and/or examination or the application of health management (Health Professions Council of Zambia 2019:1). Examples of medical records are personal notes, laboratory results, radiology reports, doctors' clinical reports, and nurses' patient reports (Hui, Gilmore & Khan 2021). Information in medical records supports clinical audits (doctors' peer reviews), nursing audits (nurses' peer reviews), further patient treatment, statistical purposes, the compilation of performance indicators, response to litigations, public access to information, investigations and support to police/court cases (rape cases and common assaults) (Marutha 2021; Marutha & Ngoepe 2018). Medical records constitute an important component in preservation.

In the best scenario, the preservation of medical records needs to be guided by a preservation programme within the preservation framework. A preservation programme provides direction on priority areas for preserving medical records, while a preservation framework is the overall mandate for conducting preservation activities such as proper storage, environmental control, disposal, security of records and disaster planning in healthcare facilities. In addition, the preservation framework formalises the health facilities' commitment to the preservation of medical records at all management levels and across all departments or sections (Tufts University 2019). Tufts University (2019:6) further defines preservation framework as a model for guiding preservation practices such as storage, access and use of records in an institution (Tufts University 2019). Therefore, the adoption of a preservation framework ensures long-term access to medical records through the implementation of preservation strategies, dissemination of policies and standards, the establishment of best practices on storage mechanisms, and training of staff responsible for the preservation of medical records (Tufts University 2019; University of Minnesota 2022). According to the University of Minnesota (2022), preservation activities must be perpetual or continuous. The preservation framework also guides decision-making on the preservation of medical records by the personnel involved, such as hospital directors, hospital administrators, nurses, doctors, records officers, data entry clerks and ICT officers. Consequently, medication errors, missed diagnoses, and treatment lapses may be reduced as they are usually associated with poor preservation practices in healthcare facilities (Adetunji 2021; Marutha 2021). Overall, the preservation framework coordinates all the functions and activities of the preservation of medical records in healthcare facilities.

The literature on the preservation of medical records in healthcare facilities in developing countries in Africa has revealed that preservation of medical records in public healthcare facilities is often done in an uncoordinated and unsustainable manner without following any established preservation strategies, policies and standards; inadequate storage mechanisms; and lack of knowledge and skills on preservation by healthcare staff (Adeleke, Suleiman-Abdul, Aliyu, Ishaq & Adio 2019; Amin, Yatin, Jali, Sahid, Shuhidan, Noordin & Abdullah 2020; Gisemba, Ng'eno & Bosire 2022; Marutha 2021; Masuku & Ngulube 2020; Tough & Lihoma 2018). This implies that healthcare facilities in some African countries, such as South Africa, Malawi, Nigeria and Kenya, lack proper guidelines for preserving medical records enshrined in a preservation framework. Implementation of a preservation framework would support the proper implementation of preservation strategies, policies and standards; improve storage mechanisms for records; and improve the knowledge and skills of healthcare staff on the preservation of records

through training among others. As a result, medical records would be properly managed, and access to medical information by healthcare staff would improve. This would positively impact the provision of quality care to patients by healthcare staff.

Due to the prevailing circumstances in the preservation of medical records in healthcare facilities in developing countries, the purpose of this study was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records.

1.2 Background to the study

Preservation of medical records is important in the provision of quality care to patients in healthcare facilities in Malawi. In other words, quality healthcare services are dependent on good medical records (Bulombola 2019; Kayira 2023; Mavazika 2022; Tough & Lihoma 2018). Preservation ensures the accessibility of good medical records and information by healthcare staff, which is critical to the provision of care to patients. Medical records contain useful healthcare information about the patient's history and treatment. Preservation of medical records can support timely access to healthcare information, as most public healthcare facilities in Malawi continue to generate vast amounts of medical records daily.

Healthcare facilities in Malawi create and receive different types of records, such as personal notes, laboratory results, radiology reports, doctors' clinical reports, and nurses' patient reports (Ministry of Health 2020). Healthcare facilities have data entry clerks and Health Management Information System (HMIS) officers who manage medical records. Data entry clerks are positioned in various medical departments such as the outpatient department, dermatology, eye, laboratory, and oncology. Medical records are stored in offices, computers and hospital departments such as nursing and clinical wards. Medical records in public healthcare facilities are preserved through manual and electronic systems such as filing cabinets, storage rooms and health information systems (Ministry of Health 2020). Medical records serve different purposes, such as supporting proper diagnosis, administration of drugs, continuity of care to patients, budgeting, and recruitment of staff to support the provision of healthcare delivery. Therefore, medical records are vital in the service delivery in the healthcare system in Malawi.

Healthcare delivery in Malawi is managed by the Ministry of Health. The Healthcare system is tagged on a three-tier system, namely primary care, secondary and tertiary (Makwero 2018; Ministry of Health 2020). Primary care consists of community-based outreach, dispensaries, urban centres, and rural community hospitals. There are 22 community-based outreach, 68 dispensaries, 328 urban centres, also called health centres, and 35 rural community hospitals (Ministry of Health 2020). Secondary care is provided by district hospitals spread over Malawi's 26 districts. Malawi has a total of 24 district hospitals. Lastly, tertiary care is provided by the central hospitals located in the urban areas of Mzuzu in the northern region of Malawi, Lilongwe in the central region, Blantyre in the southern region and Zomba in the eastern region. Malawi has a total of five (5) central hospitals, namely Mzuzu Central Hospital (MCH) located in Mzuzu City, Kamuzu Central Hospital (KCH) located in Lilongwe City, Queen Elizabeth Central Hospital (QECH) in Blantyre City, Zomba Central Hospital (ZCH) and Zomba Mental Hospital (ZMH) in Zomba City. Across these three tiers of medical care, there are fewer than 300 registered doctors and about 7,000 nurses (WHO 2024). Malawi has an existing total of 18,252 healthcare professionals against the established vacancies of 31,358 (Ministry of Health 2020). The statistics demonstrate the critical

shortage of health personnel to provide critical healthcare services to the population in Malawi. The five public healthcare facilities were purposively selected for this study, and they are discussed in the subsequent sections below.

1.2.1 Mzuzu Central Hospital

Mzuzu Central Hospital was constructed by the Taiwanese Government and was officially opened on 11th November 2000 (Bulombola 2019:12). The mission of Mzuzu Central Hospital is to be a leading provider of specialised, evidence-based and quality health care for people in Malawi and its vision is to provide cost-efficient quality driven health services to our patients and clients with attention to clinical excellence, patient safety and a health promotive environment (Mzuzu Central Hospital Handbook 2020). Mzuzu Central Hospital is one of the tertiary referral health facilities situated in the northern region of Malawi. The hospital offers health services to Mzuzu City and surrounding districts in the region, such as Chitipa, Karonga, Rumphi, Nkhata-bay, Likoma and Mzimba. The hospital provides care for communicable and non-communicable diseases in the northern region of Malawi. The hospital has approximately 200 health staff allocated to different departments within the hospital (Mavazika 2022:46). Some of the health staff at the hospital include hospital directors, hospital administrators, records officers, data entry clerks, ICT officers, nurses, mental health clinicians, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, paediatricians, dieticians, and physiotherapists. The health staff operate in different departments such as administration, records management unit, accident and emergency, dental, general surgery, obstetrics and gynaecology services, internal medicine, intensive care unit and paediatric medicine (Kayira 2023:123).

Mzuzu Central Hospital creates and receives different types of medical records for the provision of health services to patients. The medical records created and received are both in physical or analogue and digital formats. Examples of medical records created by the health facility include personal notes, laboratory results, radiology reports, doctors' clinical reports, and nurses' patient reports. The physical medical records are managed in offices, registries, and records storage rooms. In addition, the health facility has records storage management facilities, such as filing cabinets for storing medical records. Digital records are stored on computers located in administration offices and hospital departments such as nursing and clinical wards. Other digital medical records are maintained in health information systems such as District Health Information System (DHIS), HMIS, Electronic Medical Record (EMR) System, Laboratory and Diagnostic Information (LDI) System, and Medicine and Supply Information (MSI) System (Ministry of Health 2020). Despite the improvements in the use of electronic health systems, most of the medical records are in physical format. Responsibility for preserving medical records falls within the offices of hospital directors, nursing department staff, clinical department staff, records management staff, data entry clerks, and ICT officers. The hospital faces serious challenges in preserving medical records such as a lack of preservation strategies; lack of storage space for records; lack of security for medical records; inadequate disaster preparedness equipment such as fire extinguishers, and fire alarms; lack of policies and standards; and lack of funds for professional training in the preservation of medical records (Bulombola 2019; Kayira 2023; Mavazika 2022; Ministry of Health 2020). In addition, the ICT infrastructure is inadequate to handle the growing number of medical records received and created at the hospital (Kayira 2023).

1.2.2 Kamuzu Central Hospital

Kamuzu Central Hospital was built in 1977 by the Danish International Development Agency (DANIDA) with funding from the Danish government (Meguid & Mwenyekonde 2005:12). From 1977 until 2004, the hospital was known as Lilongwe Central Hospital and in 2004, it was rebranded to its current name of Kamuzu Central Hospital (Meguid & Mwenyekonde 2005:15). Similar to Mzuzu Central Hospital, Kamuzu Central Hospital is also one of the tertiary referral hospitals in Malawi, located in the city of Lilongwe (capital city of Malawi). The hospital serves approximately 5 million people from Lilongwe city and surrounding districts in the central region of Malawi, such as Dowa, Mchinji, Ntchisi, Ntcheu, and Kasungu and neighbouring countries such as Tanzania, Zambia, Mozambique and Zimbabwe (WHO 2020; The Electives Network 2020). The hospital is estimated to have 780 beds, although the number of patients exceeds the total bed capacity (WHO 2020:125). Until May 2020, the hospital had approximately 60 doctors and 300 nurses (WHO 2020:129). According to the University of North Carolina School of Medicine (2019:3), the hospital admitted about 25,000 children annually. The hospital has several departments such as accident and emergency, dental, general surgery, obstetrics and gynaecology services, internal medicine, intensive care unit, paediatric medicine, administration unit, and records management unit.

Kamuzu Central Hospital also creates and receives medical records in different formats: physical and digital. However, the majority of medical records are in physical format. Some of the medical records maintained at the health facility include personal notes, laboratory results, radiology reports, doctors' clinical reports, and nurses' patient reports. Physical medical records are managed in offices, registries, and records storage rooms spread across the various departments. Digital medical records are maintained in computers and health information systems such as HMIS, EMR, LDI, and MSI (Ministry of Health 2020:1). The Records Management Unit at the health facility is responsible for all preservation-related activities for medical records.

There are still challenges regarding the preservation of medical records, despite several attempts that have been made to improve the situation. The major challenges include a lack of policy and standards, inadequate space, lack of trained staff, lack of disaster preparedness equipment such as fire extinguishers and fire alarms, and outdated ICT infrastructure for managing medical records (Ministry of Health 2020).

1.2.3 Queen Elizabeth Central Hospital

Queen Elizabeth Central Hospital (QECH) was opened in 1958 by the first president of the Republic of Malawi, Dr H. Kamuzu Banda (Ministry of Health 2020:6). The hospital was named after the late Queen Elizabeth II of the United Kingdom. Queen Elizabeth Central Hospital (QECH) is the largest and oldest referral public hospital in Malawi and is located in the city of Blantyre. The hospital provides healthcare services in Blantyre City and surrounding districts in the southern region, such as Chikwawa, Chiradzulu, Mulanje, Mwanza, Neno, Nsanje, Phalombe, and Thyolo. The hospital has a bed capacity of 1,350. As of 2022, the hospital had a total of 1,503 health staff (Ministry of Health 2020:9). As the largest referral health facility in Malawi, the hospital provides advanced specialist care services such as obstetrics/gynaecology, oncology, neurosurgery, pathology and general surgery (WHO 2020).

Concerning medical records, the health facility creates and receives a large volume of medical records, such as personal notes, laboratory results, radiology reports, doctors' clinical reports, and nurses' patient reports. The medical records are in different formats and are stored in registry units, offices, storage rooms, and computers. Health information systems have been installed and are functional, such as DHIS, HMIS, EMR, LDI, and MSI (Ministry of Health 2020). The Records Management Unit at the facility is the one responsible for the preservation of medical records. Despite the installation of systems for managing records, the hospital has an inadequate number of qualified personnel to manage the records (Mavazika 2022). The storage space for medical records is inadequate, leading to loss and damage to medical records (Mavazika 2022). The staff responsible for preserving medical records rarely attend professional training due to a lack of funds resulting from underfunding by the Malawi Government through the Ministry of Health (Ministry of Health 2020).

1.2.4 Zomba Central Hospital

Zomba Central Hospital was opened in 2000 by Jolyon Ralph (Ministry of Health 2020:9). However, the construction of the most present buildings of the health facility dates back to the 1930s (Sakala & Kazembe 2011:58). In comparison with other public health facilities, Zomba Central Hospital is the smallest referral public hospital in Malawi. It is located in the city of Zomba. The hospital provides services to Zomba City and surrounding districts in the eastern region, such as Balaka, Machinga, Mangochi and Chiradzulu. The hospital has a bed capacity of 350 (Ministry of Health 2020:2). The staff complement at the hospital is 1,503 health staff (Ministry of Health 2020:2). Some of the health staff at the hospital include hospital director, records officers, data entry clerks, ICT Officers, nurses, mental health clinicians, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, paediatricians, dieticians, and physiotherapists. The health staff operate in different departments such as administration, records management unit, accident and emergency, dental, general surgery, obstetrics and gynaecology services, internal medicine, intensive care unit and paediatric medicine (Kayira 2023).

Like other public health facilities, Zomba Central Hospital also creates and receives physical and digital medical records in the course of the provision of care to patients. Some examples of medical records created and received by the hospital are laboratory results, radiology reports, doctors' clinical reports, and nurses' patient reports. The records are maintained in the registry, storage rooms, offices, and computers. The routine creation and receipt of medical records at the hospital create pressure on the existing space at the hospital (Ministry of Health 2020). Some digital medical records are managed using health information systems such as DHIS, EMR, and LDI (Ministry of Health 2020). Despite the existence of such systems, ICT is outdated and needs to be modernised with modern hardware and software such as servers, computers, routers, and high-speed cables (Kayira 2023). Other challenges experienced by the hospital include undocumented policies and standards for preserving medical records, a lack of preservation strategies, and a lack of trained staff for the preservation of medical records (Kayira 2023).

1.2.5 Zomba Mental Hospital

Zomba Mental Hospital started as an inpatient psychiatric hospital in 1910 at Zomba Central Prison in Zomba, Malawi (Chorwe-Sungani 2021:103). Prisoners with mental illnesses were isolated and kept in a special area called Zomba Lunatic Asylum within the prison. Eventually, Zomba Lunatic Asylum evolved into Zomba Mental Hospital in 1953 (Chorwe-Sungani

2021:112). Zomba Mental Hospital is also one of the referral tertiary hospitals in Malawi, located in the city of Zomba in the eastern region of Malawi. Unlike other public health facilities, Zomba Mental Hospital is the only referral tertiary hospital in Malawi that specialises in the treatment of mental illness. The hospital has a bed capacity of 330 (Chorwe-Sungani 2021:106). The hospital provides mental health services to mentally ill patients southern region of Malawi and other parts of the country (Chorwe-Sungani 2021:106). The providers of services at the facility include nurse technicians, psychiatric nurse practitioners, psychiatric clinical officers, occupational therapists, psychiatrists and psychiatric registrars (psychiatrists in training). Some of the services and treatments at the hospital include inpatient admissions, treatment with medication (pharmacotherapy), shock treatment (electroconvulsive therapy), occupational therapy, and forensic assessments, among others (Ministry of Health 2020). The hospital also provides teaching services to various health professionals, including doctors, psychiatrists, nurses, clinical officers and medical assistants.

To support the provision of services and treatments, the hospital also creates and receives medical records in different formats, such as personal notes, laboratory results, radiology reports, doctors' reports, and nurses' patient reports. Physical medical records are managed in offices, registries and storage rooms, while digital records are kept in computers and databases. The responsibility for the preservation of medical records rests with the Records Management Unit. Despite the investment in preservation practices, several challenges exist such as a lack of policies and standards for the preservation of medical records, lack of adequate qualified staff for the preservation of medical records; inadequate storage facilities for medical records; lack of disaster preparedness equipment such as fire alarms and fire extinguishers; lack of support from management; lack of funds towards preservation of medical records (Chorwe-Sungani 2021; Ministry of Health 2020).

This exposition above on the landscape of public healthcare in Malawi demonstrates that public healthcare facilities in Malawi create, receive and preserve medical records. This is characterised by the presence of records management units, records storage facilities and health information systems. Despite these initiatives in the preservation of medical records in the public healthcare facilities in Malawi, several challenges existed in the preservation of medical records such as lack of space for preserving medical records, lack of preservation strategies, lack of disaster preparedness equipment such as fire alarms and fire extinguishers, inadequate storage facilities for medical records, and lack of adequate qualified staff for preservation of medical records (Chorwe-Sungani 2021; Kayira 2023; Mavazika 2022; Ministry of Health 2020). These challenges contribute to missing medical records and improper destruction of medical records without following procedures (Tough & Lihoma 2018). Missing medical records and improper destruction of medical records may lead to medication errors, missed diagnoses, and treatment lapses due to a lack of timely access to medical records by healthcare staff. Overall, the situation revealed a lack of a preservation framework for guiding preservation activities among healthcare staff in the selected public healthcare facilities in Malawi. Therefore, this study was designed to investigate preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records. This study aimed to develop a framework to guide preservation activities by hospital administrators, records management staff, clinical staff and nursing staff to prolong the useful life of medical records and avoid deterioration for future access.

1.3 Problem statement

The preservation of medical records is essential because medication errors, missed diagnoses, and treatment lapses are usually associated with poor preservation practices in healthcare facilities (Adetunji 2021; Marutha 2021; University of Minnesota 2022). However, despite the importance of these medical records, the preservation of medical records in public healthcare facilities in Malawi is done in an uncoordinated and unsustainable manner without following any established preservation policies and standards, inadequate storage mechanisms, and a lack of knowledge and skills in preservation by healthcare staff (Chorwe-Sungani 2021; Kayira 2023; Mavazika 2022). This results in missing medical records and improper destruction of medical records. For example, Tough and Lihoma (2018) argued that medical records were removed from the health facilities in the Chikwawa District in Malawi and found in communities without authorisation. It was also evident that the health facilities in Chikwawa District lacked filing cabinets or cupboards to store records, and instead, they were left lying around without proper attention (Tough & Lihoma 2018). The health facilities were also disposing of records without following proper procedures (Tough & Lihoma 2018). Furthermore, a Circular dated 7th May 2012 from the Chief Secretary to the President and Cabinet also highlighted issues of poor storage and retention of records, resulting in the accumulation of valueless records and the loss or destruction of important records in public institutions in Malawi, including healthcare facilities. Poor preservation practices negatively affect patients, as health personnel take too long to locate medical records to provide care to patients, which leads to medication errors, missed diagnoses and treatment lapses (Adetunji 2021; Marutha 2021). Consequently, medical errors, missed diagnoses, and treatment lapses may lead to harm to patients and death (WHO 2019). This situation demonstrates that no preservation framework currently exists for preserving medical records in public healthcare facilities in Malawi.

Furthermore, poor preservation practices in healthcare facilities were also reported in other countries in Africa, such as South Africa and Nigeria. A study by Marutha (2021) in Limpopo Province in South Africa reported that hospitals and healthcare professionals struggle to access medical information in their custody because the records were not properly preserved for timely accessibility. Most of these records, both print and non-print, were affected by dust, high temperature, air pollution, bad storage, overcrowding, wear and tear due to excessive filing and retrieval, oxidation and excessive light (Marutha 2021). In addition, a study by Adetunji (2021) in Nigeria also noted that hospitals lacked preservation policies and storage facilities. Consequently, hospital and health staff oftentimes waste excessive amounts of time sorting through messy filing cabinets and waste valuable office spaces to store paperwork (Adetunji 2021). This forced the hospital to pay premium prices for the storage of medical records, vital records were misplaced, buried, and lost, communication between coworkers eroded, and employee stress levels rose as their ability to find and share information became unnecessarily challenging (Adetunji 2021). Adetunji (2021) concluded by saying that poor preservation practices implied that healthcare facilities in Nigeria pay little attention to the implementation of a framework for the preservation of records.

Ideally, the preservation of medical records in public healthcare facilities needs to be guided by established standards and procedures in a preservation program within a preservation framework (Marutha 2021). The framework recognises that preservation and enduring access to the health facilities' medical records must be fully supported by a preservation programme that includes the implementation of preservation strategies, dissemination of policies and standards, the

establishment of best practices on storage mechanisms, and training of staff, and these activities must be perpetual (University of Minnesota 2022).

Therefore, the study addressed the overarching question: What new framework is needed for the effective preservation of medical records at selected public healthcare facilities in Malawi? The study aimed to develop a framework for the preservation of medical records at selected public healthcare facilities in Malawi. The proposed framework aims to guide all preservation activities such as backup, migration, disposal, security, disaster planning, proper storage and environmental control by hospital administration staff, records management staff, clinical staff and nursing staff globally. The study aimed to achieve this aim by investigating preservation strategies of medical records at selected public healthcare facilities in Malawi, as outlined in the purpose of the study below.

1.4 Purpose of the study

The purpose of this study was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records.

1.5 Research objectives

The specific research objectives of the study were to:

1. Establish the preservation strategies that are currently in place at selected public healthcare facilities in Malawi.
2. Examine the preservation policies and standards of the selected public healthcare facilities in Malawi.
3. Examine the storage mechanisms for medical records at the selected public healthcare facilities in Malawi.
4. Assess the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi.
5. Develop a new framework to promote best practices for preserving medical records at selected public healthcare facilities in Malawi.

1.6 Research questions

The study was guided by the following research questions:

1. How are the preservation strategies currently in place at selected public healthcare facilities in Malawi?
2. What are the preservation policies and standards of the selected public healthcare facilities in Malawi?
3. What are the storage mechanisms for medical records at the selected public healthcare facilities in Malawi?
4. What are the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi?
5. Which new framework may be proposed to promote best practices for preserving medical records at selected public healthcare facilities in Malawi?

Table 1.1 highlights the research objectives of the study, corresponding research questions, possible sources of data and the conceptual framework.

Table 1.1. Objectives, Research Questions, Possible Sources of Data and Conceptual Framework

No	Research objective	Research question	Possible source of data	Conceptual framework
1	Establish the preservation strategies currently in place at selected public healthcare facilities in Malawi.	How are the preservation strategies currently in place at selected public healthcare facilities in Malawi?	• Questionnaire • Interviews	• Records Lifecycle • OAIS Model • DCC Curation Lifecycle Model
2	Examine the preservation policies and standards of the selected public healthcare facilities in Malawi.	What are the preservation policies and standards of the selected public healthcare facilities in Malawi?	• Questionnaire • Interviews • Document analysis	• Records Lifecycle • OAIS Model • DCC Curation Lifecycle Model
3	Examine the storage mechanisms for medical records at the selected public healthcare facilities in Malawi.	What are the storage mechanisms for medical records at the selected public healthcare facilities in Malawi?	• Questionnaire • Interviews • Observations	• Records Lifecycle • OAIS Model • DCC Curation Lifecycle Model
4	Assess the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi.	What are the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi?	• Questionnaire • Interviews • Document analysis	• DCC Curation Lifecycle Model • OAIS Model
5	Develop a new framework to promote best practices for preserving medical records at selected public healthcare facilities in Malawi.	Which new framework may be proposed to promote best practices for preserving medical records at selected public healthcare facilities in Malawi?	• Questionnaire • Interviews • Document analysis	• Records Lifecycle • OAIS Model • DCC Curation Lifecycle Model

1.7 Originality of the study

Originality is one of the primary goals of social sciences research (Chikomba, Rodrigues & Ngoepe 2021). Originality creates value for the study and contributes meaningfully to the existing

body of knowledge in a particular field of study. Different criteria have been proposed for measuring the originality of the study. However, Chikomba, Rodrigues and Ngoepe (2021) offered a simplistic way of measuring originality as follows:

1. The ability of the study to generate new data.
2. Application of new methods to existing data.
3. Ability to create new interpretations of existing data.
4. The ability of a study to provide additional support for existing theories, models or interpretations.
5. The study's ability to provide new solutions to problems.
6. Sample new populations.
7. Analyse phenomena in new ways.
8. Devise new investigative methods.

Similarly, Silverman and Patterson (2021) argue that evidence of originality is achieved by discovering new facts and/or exercising independent critical thought. Researchers can successfully display professionalism or independent critical thinking by undertaking the following:

1. Thinking critically about one's research approach;
2. Being prepared to change the direction of their research;
3. Building on existing studies, and;
4. Developing concepts and/or methodology (Silverman & Patterson 2021).

Cognisant of the above views, the study generated new data and information on the preservation of medical records in public healthcare facilities in Malawi. These were based on a sample of new populations such as hospital administrators, records management staff, clinical staff and nursing staff. Consequently, the study provided new solutions to challenges in the preservation of medical records in public healthcare facilities in Malawi through the development of a framework.

Literature on the preservation of medical records suggests that several studies have been done globally on the preservation of medical records. The majority of studies have focused on general aspects of preservation such as preservation actions (Anyira 2020; Edmund, Ramaiah & Gulla 2009; Marutha 2021; Masuku & Ngulube 2020; Tough & Lihoma 2018), policies and standards (Alnashmi, Salman, AlHumaidi, Yunis & Al-Enezi 2022; Amin *et al* 2020; Katuu & Van der Walt 2016; Gisemba, Ng'eno & Bosire 2022; Luthuli 2017; Marutha 2018; Masuku & Ngulube 2020), storage mechanisms (Gisemba, Ng'eno & Bosire 2022; Masuku & Ngulube 2020; Mensah & Adams 2014; Zhan & Xuan 2021), and knowledge and skills (Adeleke *et al* 2019; Amin *et al* 2020; Luthuli 2017; Mensah 2011; Mensah & Adams 2014). None of the studies above has proposed a framework for the preservation of medical records. This demonstrates a lack of a framework for preserving medical records in healthcare facilities in Africa. Other similar studies by Luyombya (2010), Marutha (2018), Marutha (2016), and Mbofung and Popoola (2014) in Uganda, South Africa and Nigeria, respectively, have reported on the existence of the general frameworks for records management focusing on records appraisal, digital records, and legal and ethical issues. However, a study by Marutha (2021) on the preservation of medical records in South Africa developed a framework guiding preservation activities in public healthcare facilities in Limpopo Province, South Africa. The study was conducted in a South African context with an emphasis on

public healthcare facilities in a particular location, namely Limpopo Province (Marutha 2020). Locally, a study by Tough and Lihoma (2018) on health information systems and medical recordkeeping in Malawi focused on information systems and medical recordkeeping in health facilities in Chikwawa District. The study covered aspects of the preservation of medical records, such as preservation actions and storage mechanisms (Tough & Lihoma 2018). These studies show that a specific framework for the preservation of medical records in public healthcare facilities in Malawi is required. The new framework is intended to promote best practices for preserving medical records in public healthcare facilities in Malawi. It is anticipated that the implementation of the best practices in preserving medical records will reduce the cases of missing medical records and improper destruction of medical records without following procedures (Tough & Lihoma 2018).

1.8 Scope and limitations of the study

Scope and limitation of study are very important elements of good social science research and sometimes underrated. Akanle, Ademuson and Shittu (2020) argue that a lack of attention to issues of scope and limitation is a recipe for failure of a research study. Scope and limitations are different, but they are sides of the same coin. According to Simon and Goes (2013:19), the scope of the study refers to “the parameters under which the study will be operating”. The goal of scope is to make the research manageable, handy, researchable, optimal and SMART [Specific, Measurable, Achievable, Realistic, and Time-bound] (Akanle, Ademuson & Shittu 2020). Hennink, Hutter and Bailey (2020:5) defined limitations of the study as characteristics inherent in the research methodology or design that change the meaning and interpretation of the research results. Mostly, limitations are unforeseen and inevitable in any research study. Therefore, researchers should plan to minimise or eliminate the negative impact of limitations in their studies.

The scope of the study was related to the study setting, study population, and study concepts. The study focused on five (5) public healthcare facilities, namely Mzuzu Central Hospital located in Mzuzu City, Kamuzu Central Hospital located in Lilongwe City, Queen Elizabeth Central Hospital in Blantyre City, Zomba Central Hospital and Zomba Mental Hospital in Zomba City. The public healthcare facilities were selected because the preservation of medical records exists with infrastructure and staff complement. Other public healthcare facilities were excluded because medical records are rarely preserved and frequently transferred to central hospitals for proper maintenance.

The study targeted staff involved in the preservation of medical records, such as hospital directors, hospital administrators, records officers, data entry clerks, ICT Officers, nurses, mental health clinicians, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, paediatricians, dieticians, and physiotherapists. The hospital directors and hospital administrators were drawn from the hospital administration unit, records officers, data entry clerks and ICT Officers were drawn from the records management unit, nurses were drawn from the nursing unit, and mental health clinicians, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, paediatricians, dieticians, and physiotherapists were drawn from the clinical unit. Other categories of staff, such as counsellors, librarians, drivers, receptionists, and cleaners, were not targeted as they were not heavily involved in the preservation of medical records.

This study did not discuss the general aspects of preservation of medical records but rather focused on specific concepts such as preservation strategies, preservation policies and standards, storage mechanisms, preservation knowledge and skills, and framework for preservation. Other concepts of preservation, such as conservation and restoration, were outside the scope of the study.

The major limitation of the study was the limited access to the respondents. This is because healthcare staff are extremely busy due to the nature of their work. To circumvent this challenge, the study used various data collection instruments such as questionnaires, interviews, observations and document analysis to complement data collected using either of the instruments. The study also used online questionnaires and interviews due to the limited time for the respondents to fill out physical questionnaires and grant an audience for the interviews. The online questionnaire and interviews were developed using the Google Forms application.

1.9 Research methodology

This section provides a summary of the research methodology for this study. A detailed description of the methodology is highlighted in Chapter Four (Research Methodology) of this report. The study was underpinned by the pragmatism paradigm. The study adopted mixed methods research (MMR) owing to the choice of a pragmatism paradigm. In line with a mixed methods approach, the research selected a convergent mixed methods design where the quantitative approach was a predominant one, while the qualitative approach was a lesser one, symbolised as QUAN+qual. The study setting was the five referral public healthcare facilities in Malawi, namely Mzuzu Central Hospital, Kamuzu Central Hospital, Zomba Central Hospital, Zomba Mental Hospital and Queen Elizabeth Central Hospital. The study population consisted of hospital directors, hospital administrators, records officers, data entry clerks, ICT officers, clinical, and nursing staff, with a total of 415. A sample size of 200 was determined using the Raosoft sample size calculator (Raosoft 2004). Stratified and purposive sampling techniques were adopted for the study. Quantitative and qualitative data were collected using questionnaires, interviews, observations and document analysis. Quantitative data was analysed using IBM Statistical Package for Social Sciences (SPSS) version 20.0, while qualitative data was analysed thematically using ATLAS.ti.

1.10 Significance of the study

Significance of the study in research refers to “the potential importance, relevance, or impact of the research findings (Hassan 2023:1). Significance outlines how the research contributes to the existing body of knowledge, what gaps it fills, or what new understanding it brings to a particular field of study (Hassan 2023; Hiebert, Cai, Hwang, Morris & Hohensee 2023). In general, the following factors can be used to assess the significance of the study:

1. Originality: The extent to which the study advances existing knowledge or introduces new ideas and perspectives.
2. Practical relevance: The potential implications of the study for real-world situations, such as improving policy or practice.
3. Theoretical contribution: The extent to which the study provides new insights or perspectives on theoretical concepts or frameworks.
4. Methodological rigour: The extent to which the study employs appropriate and robust methods and techniques to generate reliable and valid data.
5. Social or cultural impact: The potential impact of the study on society, culture, or public perception of a particular issue (Hassan 2023; Hiebert *et al* 2023).

In addition, Creswell and Creswell (2022) argued that the key research purpose of a study should be to contribute to the existing body of knowledge and improve practice and policy development. The present study was motivated by the poor state of preservation of medical records in public healthcare facilities in Malawi. The findings of the study will contribute to the body of knowledge on records management in general and preservation in particular. The study revealed that no study had been undertaken in Malawi focusing on the framework for the preservation of medical records in public healthcare facilities in Malawi (See Section 1.8). The recommendations of the study and the proposed framework for the preservation of medical records can thus be adopted for implementation by public healthcare facilities in Malawi. The recommendations can be used to improve preservation practices. It is expected that the study may promote the culture of preservation of medical records among healthcare staff in public healthcare facilities, as it has been observed that hospitals in developing countries pay little attention to the preservation of medical records (Adetunji 2021). This may reduce incidences of loss and premature destruction of significant medical records and prolong their useful life and access. Lastly, this study is expected to inform policy implementation at institutional and national levels on the establishment of best practices for preserving medical records in all formats.

1.11 Availability of data

The Malawi health system operates on an open system to encourage research as stipulated in the National Health Research Agenda (2012 – 2016) and other related research frameworks, which guarantee the availability of research data for the study. Furthermore, previous studies on medical records management by Marutha (2021), Marutha and Ngulube (2012), Marutha and Ngoepe (2018), Masuku and Ngulube (2020), and Tough and Lihoma (2018) done in South Africa, Zimbabwe and Malawi have proved the existence of data for the present study on the preservation of medical records in public healthcare facilities.

1.12 Motivation for the study

There were three motivations for pursuing the study:

1. The health sector is the fourth national spending priority in Malawi, with 9.4% of the national budget in the 2021/2022 financial year (UNICEF 2021). This means that the health sector is an important sector and a major contributor to the socio-economic development of Malawi. The current study, therefore, intended to contribute to this significant sector by recommending a framework that guides the preservation of medical records and prolongs the useful life and access to records by healthcare staff for improved service delivery.
2. The researcher is passionate about offering practical solutions to the challenges facing the health sector in Malawi. One of the major challenges in this sector is the lack of a framework for preserving medical records, leading to loss of records, poor storage, and destruction of records without following proper procedures. Therefore, the framework that this study will develop will minimise the challenges and improve access to records for healthcare delivery. It is also anticipated that medical errors, missed diagnoses and treatment lapses leading to patients' harm and death may also be reduced. This will result in effective healthcare service delivery.
3. The researcher is also geared towards making a significant contribution to the body of knowledge on the preservation of medical records from a developing country perspective. The framework that will be proposed by the study will form a significant

conceptual/theoretical foundation for further studies on the preservation of records in general.

1.13 Conceptual framework

This section provides a summary of the theories and models that underpinned this study. A detailed description of the conceptual framework will follow in Chapter Two (Conceptual Framework). The present study was guided by three models, namely the Records Lifecycle model, the Open Archival Information System (OAIS) Model, and the Digital Curation Centre (DCC) Curation Lifecycle Model. The study used the models to test the research questions deductively in the quantitative section and afterwards developed a theory or model to explain the phenomena under investigation inductively in the qualitative section. The Records Lifecycle model was appropriate in answering the first, second, third, and fifth research questions of the study, but is incapable of addressing the fourth research question, necessitating the use of the OAIS Model and DCC Curation Lifecycle Model to compensate for this deficiency. The OAIS Model was appropriate in answering the first, third, fourth and fifth research questions of the study, but inadequate in answering the second research question, necessitating the adoption of the DCC Curation Lifecycle Model, which answered all the research questions of the study.

1.14 Ethical considerations

This section provides a summary of the ethical considerations for this study. A detailed description of the ethical considerations is highlighted in Chapter Four (Research Methodology) of this report. This study adhered to ethical principles of informed consent, anonymity, confidentiality, autonomy, beneficence, nonmaleficence, and justice as stipulated by the University of South Africa Research Ethics Policy document (2016). In addition, ethical clearance was sought from the University of South Africa (UNISA) Ethical Clearance Committee in South Africa and the Mzuzu University Research Ethics Committee (MZUNIREC) in Malawi to conduct the study in the public healthcare facilities in Malawi. The ethical approval reference numbers for the research proposal from the University of South Africa (UNISA) Ethical Clearance Committee was 6672313_CRECHS_2023, and Mzuzu University Research Ethics Committee (MZUNIREC) was MZUNIREC/DOR/23/120.

1.15 Key concepts

Healthcare system

According to the WHO (2020), a health system consists of all organisations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence determinants of health as well as more direct activities that improve health. A health system is, therefore, more than the pyramid of publicly owned facilities that deliver personal health services, but includes the institutions, people and resources involved in delivering health care to individuals.

The health system is a mix of private and public institutions that deliver medical services to all patients or a specific segment of them (Mouloudj, Bouarar, Asanza, Saadaoui, Mouloudj, Njoku & Bouarar 2023).

Healthcare facilities

Institutions/facilities are institutions charged with the responsibility of treating illnesses and diseases of people (Anyira 2020).

Healthcare facilities are any location where care is provided (Ministry of Health 2020).

Healthcare staff

A healthcare staff delivers care and services to the sick and ailing either directly or indirectly such as hospital directors, hospital administrators, nurses, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, counsellors, paediatrics, dieticians, physiotherapists, records officers, data entry clerks, ICT officers, and librarians (WHO 2020).

Medical records

Medical records are “any relevant record made by a health practitioner at the time of or after a consultation and/or examination or the application of health management” (Health Professions Council of Zambia 2019:1).

A medical record, also called a health record, is a history of someone’s health (Adetunji 2021).

Preservation

Preservation is “the total sum of processes and tasks performed to protect records (in form) against damage or deterioration” (Millar 2017:146).

Preservation is “the continuous process of creating and maintaining the best environment possible for the storage and/or use of an artefact to prevent damage and to enable it to live as long a lifetime as possible” (Northeast Document Conservation Centre 2015:1).

Preservation activities

Preservation activities, also called preservation strategies, are activities implemented to protect records in all forms against damage or deterioration and prolong their life, such as proper storage, environmental control, disposal, security of records and disaster planning (Northeast Document Conservation Center 2024:1).

Preservation framework

A model for guiding preservation practices such as storage, access and use of records in an institution (Tufts University 2019).

Preservation policies

Preservation policies are a “set of guidelines for the preservation of records in registries, records centres and archives” (Crockett 2017:36).

Preservation standards

Preservation standards are “published documents setting out specifications and procedures designed to ensure products, services and systems are safe, reliable and consistently perform the way they were intended to” (Standards Australia 2023:1).

Records management

Records management is the “systematic control of the creation, receipt, maintenance, use and disposition of records, including processes for capturing and maintaining evidence of and information about business activities and transactions in the form of records” (Read & Ginn 2015:4).

Records management is the “discipline and organisational function of managing records to meet operational business needs, accountability requirements and community expectations” (Saffady 2021:89).

Records management is the “field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records, including the processes for capturing and maintaining evidence of and information about business activities and transactions in the form of records” (ISO 2016:1).

Storage mechanism

A storage mechanism is a “system of keeping medical records to prevent damage and improve their security” (Crockett 2017:30).

1.16 Structure of dissertation

The thesis is organised into six chapters that are discussed below.

Chapter One: Introduction and Background

This chapter introduces the research topic and study area. The chapter includes a general introduction of the study, consisting of the background to the study, the motivation behind the study, the theoretical framework within which the study was conducted, the statement of the problem, the main research objectives of the study, the purpose of the study and the research questions, delimitation of the study, and a definition of key concepts featured in the study. The chapter also introduces the research methodology of the study, the research contribution of the overall study, and the key concepts governing the study. Finally, the chapter closes with an outline of the thesis.

Chapter Two: Conceptual Framework

This chapter provides a critical review of the conceptual frameworks related to the study, which include the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model. It also includes a discussion on the justification for the selection of the models, and further discusses the triangulation of models, developing into the formation of the conceptual framework for the study. The conceptual framework relates the study to established studies in the literature.

Chapter Three: Literature Review

This chapter is guided by the research questions to offer a comprehensive review of the relevant empirical and theoretical literature. The review adopts a theoretical framework as a guide. The empirical and theoretical literature reviewed is from both print and electronic sources in journal articles, books, conference proceedings, book chapters, databases, and technical reports. In addition, the review presents literature on the themes derived from the research objectives, namely preservation strategies for medical records, preservation policies, standards and best practices, storage mechanisms for records, and knowledge and skills of health staff on preservation.

Chapter Four: Research Methodology

This chapter presents the research methodology, which covers the pragmatism paradigm, research approaches, research designs, population of the study, sampling procedures, data collection instruments, data collection procedures, data analysis and ethical issues of research.

Chapter Five: Presentation and Analysis of Findings

This chapter analyses and presents the results of the study based on the specific research questions of the study, the literature and theoretical constructs informing the study. The chapter analyses and presents both the results of quantitative and qualitative data. Quantitative data is analysed statistically through SPSS version 20.0 to generate descriptive and inferential statistics, while qualitative data is analysed thematically with the aid of ATLAS.ti to produce themes and sub-themes which formed the major findings of the study.

Chapter Six: Interpretation and Discussion of Findings

This chapter interprets and discusses the findings using extant literature and theory. The chapter is organised according to the themes derived from the research questions highlighted in Chapter One. The findings for each research question are thematically discussed and interpreted according to the pragmatic paradigm synonymous with the mixed methods research approach adopted by this study.

Chapter Seven: Summary of Findings, Conclusions and Recommendations

This chapter summarises and provides conclusions and recommendations based on the interpretation and discussion of findings. The chapter is organised according to the themes derived from the research questions.

1.17 Summary

This chapter has introduced the research idea. It expounded on the landscape of medical records in Malawi and the scope of the study area. In the background, the concepts of medical records, preservation of medical records, the significance of preserving medical records, and challenges in the preservation of medical records were discussed. The situation of the preservation of medical records at the selected public health facilities was also discussed. The chapter also indicated the statement of the problem, research objectives and research questions of the study. The chapter discussed the originality of the study and offered justification for conducting the study. The chapter additionally defined the key concepts that were used in the content of this study. Furthermore, the chapter also outlined the conceptual framework of the study in which the Records Lifecycle model (Shepherd & Yeo 2003), DCC Curation Lifecycle Model (Higgins 2008), and OAIS Model (OAIS 2002) were adopted for the study. The chapter also discussed the scope and limitations of the study. The scope and limitation make it clear that the focus of the study was limited to the preservation of medical records and selected healthcare staff working with medical records at the selected public healthcare facilities in Malawi. Research methodology relevant to the study was also introduced using a summary with a focus on the research paradigm, research approach, research design, population, sampling, data collection tools, ethical considerations and data analysis techniques. Lastly, the chapter outlined the structure of the dissertation in terms of chapters.

The next chapter discussed the conceptual framework that was used for this study. The discussion on the conceptual framework is centred on theories and models relevant to the preservation of medical records in public healthcare facilities.

CHAPTER TWO

CONCEPTUAL FRAMEWORK

2.1 Introduction

Chapter One introduced the study and gave the background of the study. This chapter aims to provide a critical review of the conceptual framework related to the study. The chapter also highlights the theories and models that focused on the research study in terms of research questions/research objectives for quantitative research and the topic and context for qualitative research. The chapter also discusses the historical development of the theories and models and defines, explains, and critically analyses the main concepts used in the theories and models. In addition, research evidence of the theories and models will be appraised and critically evaluated to justify their application to the context of the study.

2.2 Theories, models, theoretical and conceptual framework

Theory is important throughout the research process, from research formulation to data analysis and interpretation. The importance of theory is exemplified in the following paraphrase: “Experience without theory is blind, without theory – nothing to learn, without theory – there is no learning and theory is a window into the research/world” (Sparkes 2012:8). Theory helps researchers to understand complex social phenomena in the world (Neuman 2019). Theory also provides researchers with different “lenses” to study complicated problems and social issues by focusing on different aspects of the data and providing a framework for conducting analysis (Reeves, Boet, Zierler & Kitto 2015:1). Theory is “a set of interrelated constructs (variables), definitions, and propositions that presents a systematic view of a phenomenon by specifying relations among variables, to explain natural phenomena” (Creswell & Creswell 2022:52). Fried (2020:336) also consider a theory as bodies of knowledge that are broad in scope and aim to explain robust phenomena. Creswell and Creswell (2022) argue that theories develop when researchers test a prediction about the relationship between the variables repeatedly with different populations and in different settings. Researchers use theories to enable them to develop the existing body of knowledge by understanding and explaining relationships between variables and concluding phenomena, thereby providing a basis for further research, understanding and theorisation (Kivunja & Kayuni 2017). Therefore, the purpose of theory is to demonstrate linkages between constructs (variables) and help explain the phenomena under study.

The term theory is closely related to the term model. While theories are broad in scope and aim, models are narrower in scope and often more concrete, commonly applied to a particular aspect of a given theory, providing a more local description or understanding of a phenomenon (Fried 2020). Models are a representation of all or part of the system that is constructed to study it. While a theory tries to explain a phenomenon, a model tries to represent a phenomenon (Bhattacharjee 2023). Ngulube (2019) explained that models are not theories, but they may be used to represent or test theory, thereby qualifying as conceptual frameworks rather than theoretical frameworks. Models serve different purposes in research as posited by Hofman (2021) as follows:

1. They help to understand how things interact or have interacted based on an analysis and interpretation of collected empirical data (case studies).
2. They envisage and reflect ideas and theories or theoretical concepts and help to facilitate understanding within or across domains.

3. They help to design something that does not yet exist with the intent to develop or build it.
4. They support and stimulate cross-disciplinary communication.

The use of theories and models in research results in the formation of a theoretical framework. A theoretical framework is a foundational review of existing theories and models that serve as a roadmap for developing the arguments you will use in your work (Vinz 2023:1). This framework is defined as an interrelated set of constructs or variables formed into propositions, or hypotheses that specify the relationship among variables in form of a diagram (Creswell & Creswell 2022). The purpose of the theoretical framework is to offer an opportunity for a researcher to explain the existing theories and models relevant to the study and demonstrate that the study is relevant and grounded in literature (Vinz 2023; Creswell & Creswell 2022). According to Salomao (2023), the theoretical framework strengthens the study in the following ways:

1. Provide a structure for the complete research process.
2. Assist researchers in incorporating formal theories into their study as a guide.
3. Provide a broad guideline to maintain the research focus.
4. Guide the selection of research approach, data collection, and data analysis.
5. Help understand the relationships between different concepts and develop hypotheses and research questions.
6. Address gaps in the existing literature.
7. Analyse the data collected, draw meaningful conclusions and make the findings more generalisable.

Therefore, the function of a theoretical framework is to support the researcher throughout the research process, specifically in developing hypotheses or research questions, defining the research focus, drafting a literature review and selecting of research methodology for the study.

The terms theoretical framework and conceptual framework appear most often in social science research and are often used by researchers. The term “theoretical framework” is used when only one theory guides the study (Ngulube 2018; Varpio, Paradis, Uijtdehaage & Young 2020). However, the use of more than one theory in a single study is a conceptual framework (Ngulube 2018:11). A Conceptual framework is adopted in a study to complement the weakness of the other theory, referred to as theoretical triangulation or theoretical pluralism (Hoque, Covaleski & Gooneratne 2013). Oswick, Fleming and Hanlon (2011) in Ngulube (2019:29), liken theoretical triangulation or theoretical pluralism to “conceptual blending”, where contextual variables are added to conceptual theories, resulting in a conceptual framework which is contextually relevant. The adoption of more than one theory is supported by scholars such as Ngulube (2018), who argues that theories help the researcher gain insight into the data and conduct a literature review to discover more theoretical frameworks to address the research problem of the study. This results in the adoption of the new theory to guide the study through a selection of research approaches, presentation of results, discussion, conclusion and recommendations, as is the case with the present study. Section 2.4 gives a detailed discussion of the conceptual framework for this research study.

2.3 The use of theories and conceptual frameworks in quantitative, qualitative and mixed methods research

From the above discussion, it is clear that theories and models play an important role in the research process. Theoretical and conceptual frameworks bring meaning to components of the research study (Ngulube 2018). According to Polit and Beck (2020), theoretical and conceptual frameworks stimulate research and knowledge extension by giving direction and motivation. Theoretical and conceptual frameworks apply to all types of research, such as qualitative, quantitative and mixed methods (Creswell 2018). Therefore, any good research study must be guided by a relevant theoretical and conceptual framework.

In qualitative research, a theory is used inductively, using data and concepts from other existing theories, to generate an understanding of the phenomena and generate a theory and model as the output from a study (Creswell 2018). The goal of the use of theoretical frameworks in a qualitative study is to approve or disapprove constructs or variables and generate a theory that is relevant in a particular study context (Creswell 2018; Leeming 2018). In sharp contrast to the use of theory in qualitative studies, theories in quantitative studies are used deductively and are positioned at the beginning of a proposed study (Creswell 2018; Salomao 2023). The researcher tests or verifies a theory by examining hypotheses or questions derived from it (Creswell 2018). This is achieved by collecting data and analysing it, as opposed to developing a theory, as is the case with qualitative studies. The theory doubles as a framework for the study and at the same time testing or verifying it.

The use of theory in a mixed methods study is both through inductive and deductive means. The theory is used to generate new theories, as is the case in qualitative studies, and to test or verify existing theories, as is the case in quantitative studies. This means that mixed methods studies can test and develop theories and vice versa. For example, convergent mixed methods designs can use theory to test the hypotheses or research questions deductively in the quantitative phase, and then develop a theory or model to explain the phenomena under investigation in the qualitative phase. The present study adopted a mixed methods design combining quantitative and qualitative approaches, with a quantitative major. This study triangulated three models, namely, the Records Lifecycle (RL) model, the Open Archival Information System (OAIS) model and the Digital Curation Centre (DCC) Curation Lifecycle Model to guide the entire study. The justification for adopting the models is highlighted in the proceeding paragraphs.

The Records Lifecycle model was relevant to the study because of its flexibility and relevance to the themes of the study, which include preservation strategies, policies and standards, storage mechanisms, and knowledge and skills. Therefore, the model was appropriate in answering the first, second, third, and fifth research questions of the study, but is, however, incapable of addressing the fourth research question, necessitating the use of other models to compensate for this deficiency.

The DCC Curation Lifecycle Model was relevant because the constructs of the model address all the themes of the study. For example, the construct of preservation action is aligned with the theme of preservation strategies. Specifically, the variables such as migration, data cleaning, validation, preservation metadata, data structures or file formats addressed the theme of preservation strategies. Therefore, the model is appropriate in answering the first, second, third and fifth

research questions of the study but inadequate in answering the second research question, necessitating the use of the DCC Curation Lifecycle Model.

Lastly, the OAIS model was adopted because concepts such as preservation action, preservation planning, migration, and storage methods were relevant to the themes of the study. For example, the theme of preservation strategies in the study is related to the concept of preservation action in the OAIS model. The theme of policies and standards in the study is adequately addressed by the concepts of administration and management in the model. The theme of storage mechanisms in the study is addressed by the archival storage concept in the model. The theme of the framework for preservation in the study is addressed by all the concepts in the model, namely producers, consumers, management, archive, ingest, archival storage, data management, administration, and access. Therefore, the model is appropriate in answering all the research questions of the study.

2.4 Theories and theoretical underpinning of the study

The present study dwells on records management with a focus on preservation. According to Millar (2017), preservation is part of the broader field of records management. This generates a discussion on records and archives management theories and preservation theories, which address the variables of the study. Therefore, a discussion about records and archives management theories in general and preservation theories in particular is necessary.

The records management profession has witnessed growth in theoretical and conceptual perspectives over the last three decades. Some of the theories and models include the Records Lifecycle model (Adu & Ngulube 2017; Amin *et al* 2020; Luthuli 2017; Luthuli & Kalusopa 2017; Masuku & Ngulube 2020; Mensah & Adams 2014; Ngwenya 2020), Records Continuum (Adu & Ngulube 2017; Luthuli 2017; Mensah & Adams 2014; Ngwenya 2020; Pyrene 2015), Digital Curation Centre (DCC) Curation Lifecycle Model (Higgins 2008), Open Archival Information System (OAIS) Model, International Records Management Trust (IRMT) E-records Readiness Tool (Moatlhodi & Kalusopa 2016), ISO 15489 framework (Luthuli & Kalusopa 2020; Luthuli & Kalusopa 2017), International Records Management Trust (IRMT) good practice indicators (Luthuli & Kalusopa 2020), Performance of the Routine Information System Management (PRISM) framework (Msiska, Kunitawa & Kumwenda 2017).

The next section presents the three models that formed the theoretical foundation of the present study, namely the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model. The concepts from the models were used to develop a conceptual framework to inform the present study.

2.4.1 Records Lifecycle (RC) model

The Records Lifecycle (RC) model was first developed by Phillip Brooks and Emmett Leahy of the United States (US) National Archives in the late 1930s, and first appeared in print in Brooks' article, "The Selection of Records for Preservation", in the *American Archivist* of October 1940 (Brooks, 1940) (See Records Lifecycle model in Figure 2.1). The need to effectively control and manage physical records after World War II signified the practical birth of this concept (An 2003).

The records lifecycle concept indicates that "records are not static, but have a life similar to that of biological organisms: they are born, live through youth and old age and then die" (Shepherd & Yeo 2003). A record is said to be created, distributed, used for as long as it has value and then

disposed of by destruction or transfer to an archival institution (Barata, Cain & Routledge 2001; Frank 2018). It presupposes that records are transferred to an archive so that they may be used for historical and cultural purposes after their value for business purposes has been exhausted or they are destroyed (Tough & Moss 2006). The records life cycle concept illustrates the life span of any records in any format, whether it is paper-based or electronic, as expressed in the five phases of creation, distribution, use, maintenance and final disposition (Marutha 2018). The records life cycle is an important concept as it shows that many interrelated parts must work together for an effective records and information management program (Marutha 2018; Read & Ginn 2015).

The Records Lifecycle model provides the records manager with a useful starting point and basis for developing a records management programme. It enables the records manager who acknowledges the importance of each separate phase to develop policies and procedures that are supportive of the other phases in a coordinated way. For instance, how a document is titled and formatted will substantially affect the efficiency with which it can be retrieved in the maintenance phase. Likewise, when a document is created, it must be given a retention period, which will inevitably affect various processes in the maintenance and disposal phases, for example, how and where the document will be stored and how and when it will be destroyed (Kennedy 2007). The following are the phases of the Records Lifecycle model:

1. Create phase: In this phase, a record is said to be created when, for instance, a letter is produced, an e-mail written, a form completed or a pamphlet printed in any government ministry. The management of records during the later stages in their life is dependent on the records creation phase. Some records are created while others are received and adopted as part of the records management programme of the organisation. Records created and received by the organisation take many forms, such as reports, forms, letters, Email messages, other electronic records, and directives. The management of a record once created and/or received, and the length of its retention period, are dependent on its value to the organisation.
2. Maintenance and use phase: Maintenance and use is the second stage of the Records Lifecycle model. Records that have been generated or received by the organisation are now being used and reused to conduct business. The records are active or semi-active. Records remain in the maintenance and use stage until they become inactive. When active, they need to be stored in a record-keeping system that permits retrieval and protects them from loss or damage. The benefit of managing the maintenance and use stage is that record loss is minimised and retrieval time is shortened. The integrity of the record can be assured. When records are no longer active, that is, they are no longer needed for active use, they may be restored and protected using appropriate equipment and environment and human controls to ensure record security. Records management may take an active role in managing records during this phase through the operation of a central file system, or may only provide the systems and procedures for the management of records by the line organisations. The records management program elements in this stage benefit the records users but also begin to have a greater impact on the organisation.
3. Disposition phase: The fifth and last phase in the Records Lifecycle model is disposition. For this phase, records retention schedules are written to establish policy on the retention and disposition of records. The role of records management during this phase is to set retention schedules and make appropriate storage available for inactive and archival

records. Records management also monitors and/or executes the destruction of records once their retention periods have expired. Records retention ensures that records are retained for the required period. Records disposal ensures that records are removed to low-cost storage or destroyed once they become inactive or their value declines. After the retention period indicated in the records and the retention period has elapsed, records are disposed of either by destruction or by transfer to a permanent storage place. Records are transferred to less expensive storage sites within the organisation or to an external records storage facility called archives. The importance of this phase of the life cycle is proper retention and disposition of records, which protect the rights and interests of the organisation and are cost-effective concerning the use of space. Other important aspects of this phase are vital records identification and protection, and disaster recovery planning. This ensures that the organisation remain functional in the event of a disaster.

2.4.1.1 Relevance of the Records Lifecycle model to this study

This research will use the Records Lifecycle model because it is flexible and relevant to the themes of the study, which include preservation strategies, policies and standards, storage mechanisms, and knowledge and skills. Constructs of the model, such as maintenance (store, file, retrieve, and protect/preserve), are directly related to the themes of preservation strategies, policies and standards, and storage mechanisms. Specifically, the variables from the model, such as damage repair, dehumidification, backup procedures and tracking records, were adopted in studying preservation actions. Variables such as policies, standards, and best practices were adopted in studying preservation policies and standards. On the theme of storage mechanisms, the variables to be addressed included storage methods, storage equipment, storage environment, and safety and security.

Several studies have adopted the Records Lifecycle model in the study of the preservation of medical records globally. For example, a study by Amin *et al* (2020) conducted a quantitative study on the role of medical records management practice in improving decision-making in a University Hospital in Malaysia. The study was guided by the Records Lifecycle model. The data was collected using a structured questionnaire. The study purposively selected 90 health staff and a records staff. The findings of the study showed that the hospital had a records management programme that outlined how records were created, captured, used, maintained, preserved and disposed of. Furthermore, the study revealed that the University Hospital was guided by guidelines and procedural manuals designed by the Ministry of Health and the National Archives of Malaysia in the management of records.

Another study by Masuku and Ngulube (2020) was guided by the Records Lifecycle model. A qualitative case study design was employed, and data was gathered through questionnaires, interviews, observation and document analysis. The study was guided by the Records Lifecycle model. The study focused on all public and private hospitals in the Bulawayo and Matabeleland South Provinces and the National Archives of Zimbabwe (NAZ). The findings of the study revealed that 8 out of 11 hospitals did not have documented health records management standards, whilst only three hospitals had health records management standards.

A similar study was conducted by Mensah and Adams (2014) on the nexus between corporate governance and records management in private and public hospitals in Ghana. The study was informed by Upward's (1980) Records Continuum theory and Freeman's (1984) stakeholders'

theory. Data used for analysis were drawn from 90 respondents from four hospitals with the use of questionnaires and personal observations. The findings of the study revealed that the surveyed private and public hospitals in Ghana lacked preservation strategies characterised by a lack of metadata, and backup procedures, though they had fire extinguishers, smoke detectors and fire detectors for preserving medical records in case of disaster. The findings further revealed that, unlike private hospitals, the disaster management equipment available in public hospitals was not in good condition (Mensah & Adams 2014).

Ngwenya (2020) conducted a qualitative study on the management of medical records at Diepsloot clinics in the Gauteng Province of South Africa. The study was guided by the life cycle model and the continuum model. An interpretive paradigm was used to guide the case study. Interviews, focus groups, and observations generated data from 50 participants. The population of the study consisted of the staff members of the two primary healthcare facilities, namely the OR Tambo Clinic and Diepsloot South Clinic. The population included managers, medical records staff, nurses, laboratory technicians and community health workers of the health centres of Diepsloot. The purposive sampling method was used to select the sample. The findings of the study indicated that the primary healthcare facilities lacked detailed policies to govern medical records.

A study by Luthuli and Kalusopa (2017) on the management of medical records in the context of service delivery in the public sector in KwaZulu-Natal, South Africa, with a focus on Ngwelezana Hospital. The study was guided by the Records Lifecycle model. The study utilised a case study research design with triangulation of a semi-structured questionnaire, semi-structured interviews and observations. The target population was forty-eight records handlers (doctors, nurses), twenty-four records managers/medical clerks and fifty patients. Convenience sampling was used to select patients, twenty-two medical records clerks and a manager for interviews. The findings of the study revealed that Ngwelezana Hospital lacked a medical records management policy, procedures and tools to manage medical records.

2.4.1.2 Gaps in the model

Karabinos and Jeurgens (2015) have argued that the name lifecycle is in some ways a misnomer. This is the case because records in the Records Lifecycle model move in one direction towards destruction or preservation, and there is little to suggest any cycling back to the start. Lane and Hill (2011) have called it a linear model in which records progressively work through usefulness until they degrade into uselessness and death, which becomes synonymous with the archive. As such, it only offers one temporal dimension of existence for the archive (Lane & Hill 2011).

The Records Lifecycle concept has been subjected to criticisms that are based on the trends in the work environment and on the logic of the concept itself. Jay Atherton (1985-86) identified three changes in the work environment that made the life cycle concept ineffective in its traditional approach. Firstly, organisations began to combine records manager and archivist functions. Secondly, computers changed the working environment. With electronic records and documents, the stages in the life cycle cannot be separated. Thirdly, external pressures, such as access to information legislation that permitted access to records that were still in administrative use, made a re-evaluation of the traditional approach unavoidable; the formal differentiation between the active, dormant and dead stages in the life of a record became decidedly fuzzy. Critics of the Records Lifecycle model have also argued against the logic behind the concept. For example, they argue that some records do not die but are retained indefinitely because of their continuing value;

that the concept focuses on records as physical entities and on operational tasks when electronic records rely on logical rather than physical structure; that system design should be the first stage in the recordkeeping system; and that some records can be of value for the business, and historical and cultural purposes at the same time hence the stages can be blurred (Shepherd & Yeo 2003; Tough & Moss 2006). There is a convergence in the criticism of the Records Lifecycle model, that it cannot be effective in the electronic environment. Organisations in the twenty-first century are increasingly operating in an electronic environment.

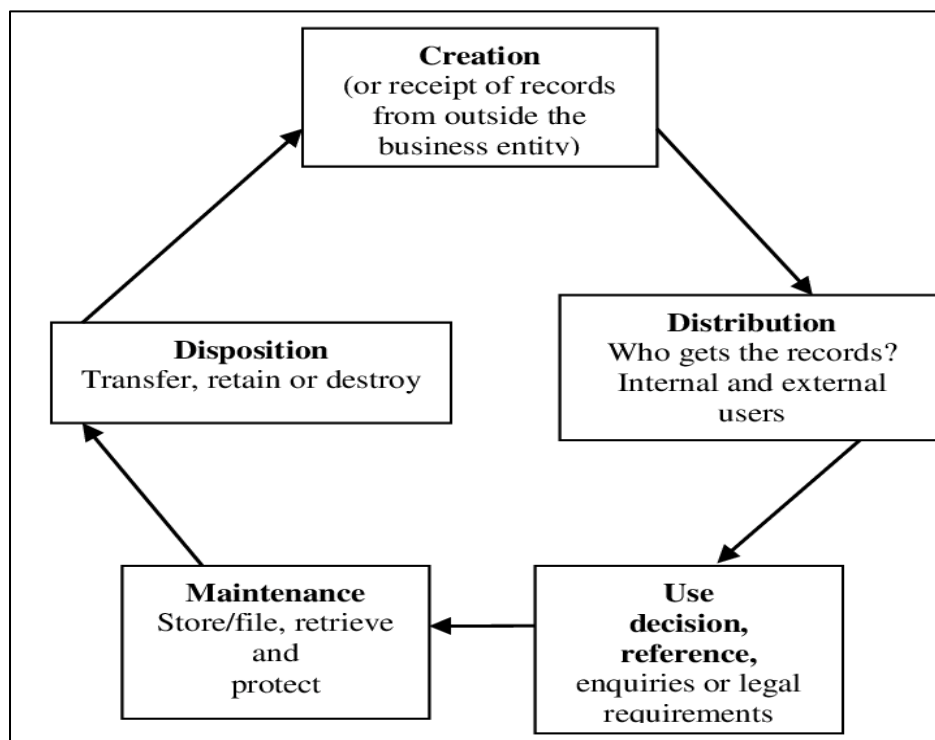


Figure 2.1: Records Lifecycle Model (Source: Read & Ginn 2015)

2.4.2 Digital Curation Centre (DCC) Curation Lifecycle Model

The DCC Curation Lifecycle Model (Figure 2.2) was launched on 1 March 2004, following a successful response to Joint Information Systems Committee (JISC) Circular 6/038 by a consortium comprising the University of Edinburgh, University of Glasgow, UK Office for Library and Information Networking (UKOLN) at the University of Bath, and Science and Technology Facilities Council (STFC) (Higgins 2008). The model was developed by different groups of people involved in the preservation of digital objects and curation from UK higher and further education, such as data specialists, records managers, librarians, archivists, and researchers (as data creators). The public and commercial sectors, international organisations and standards working groups were also engaged during the development phase of the model (Higgins 2008).

The model works with data of different types and structures. According to Higgins (2008:137), data is “any information in binary form.” Examples include digital objects such as textual files, images or sound files and related identifiers and metadata. Another type is complex digital objects, such as websites. The DCC Curation Lifecycle Model (Figure 2.2) offers a graphical representation of the overview of the lifecycle stages for successful data curation. The model is not exhaustive

but rather indicative, and it can be used in several curation activities such as preservation planning, defining roles and responsibilities, building frameworks of standards and technologies, and developing processes and policies for data curation. According to Higgins (2008), the DCC model can also be used as a training tool for preservation activities in organisations.

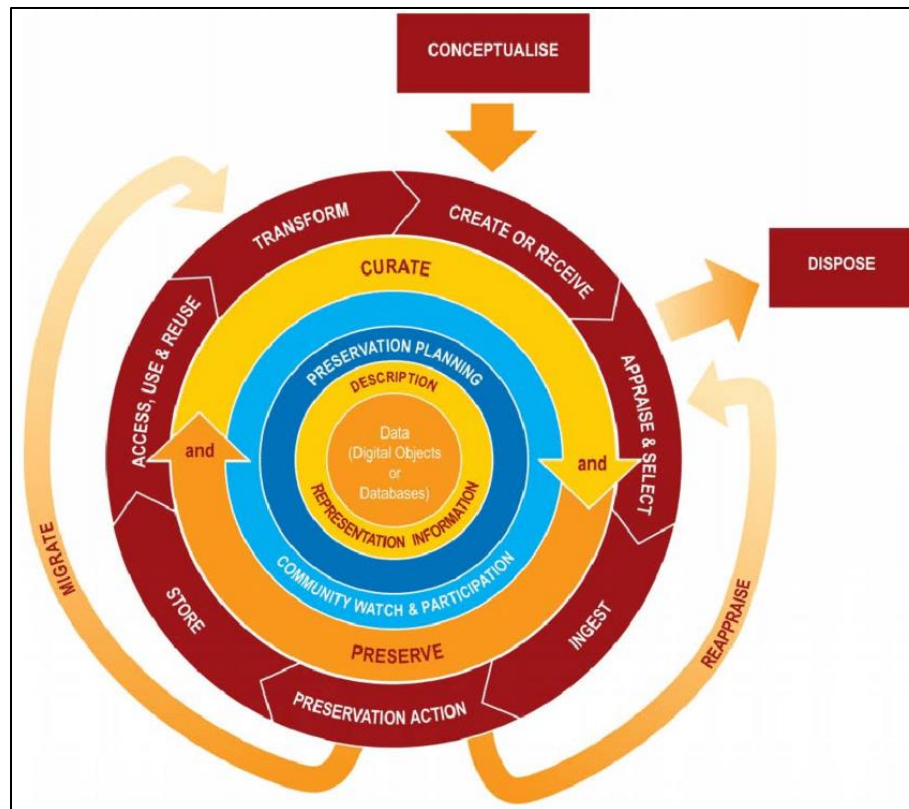


Figure 2.2: DCC Curation Lifecycle Model (Source: Higgins 2008)

The stages of the DCC Curation Lifecycle Model are categorised into three groups, namely full lifecycle actions, sequential actions, and occasional actions. These activities take place at any time during the digital curation lifecycle and are discussed hereunder.

Full lifecycle actions – The full lifecycle actions represent curation activities across the whole digital lifecycle (See the first three inner rings of Figure 2 surrounding the data). The list of actions of full lifecycle actions is as follows:

1. The first action that is performed on data is a description and representation of information. Description and representation information are meant to provide appropriate identification of data to ensure adequate description and control over the long term. Types of metadata assigned to data include administrative, descriptive, technical, structural and preservation metadata based on appropriate standards.
2. Preservation planning includes making plans for the curation of data throughout the lifecycle, while community watch and participation include being updated about community activities and participating in the development of shared standards, tools and suitable software.

3. Lastly, curate and preserve include management and administrative actions planned to promote curation and preservation throughout the curation lifecycle.

Sequential actions – The sequential actions represent curation activities that need to be undertaken if curation is to be successful (See the outer ring of Figure 2.2). Examples of sequential actions include conceptualise, create or receive, appraise and select, ingest, preservation action, store, access, use and reuse, and transform. Sequential actions are discussed hereunder.

1. Conceptualise involves conceiving and planning the creation of data, including capture methods and storage options.
2. Create or receive includes adding administrative, descriptive, structural and technical metadata to the data. Preservation metadata may also be added at the time of creation. Data may also be received following documented collecting policies, from data creators, other archives, repositories or data centres, and if required, assign appropriate metadata.
3. Data received is evaluated and selected for long-term curation and preservation. This is done according to the documented guidance, policies, or legal requirements.
4. Data is transferred to an archive, repository, data centre or other custodian according to documented guidance, policies or legal requirements.
5. Preservation action includes all activities undertaken to ensure long-term preservation and retention of the authoritative nature of data. The purpose of undertaking preservation action is to ensure data remains authentic, reliable and usable while maintaining its integrity. Examples of preservation actions include data cleaning, validation, assigning preservation metadata, assigning representation information and ensuring acceptable data structures or file formats.
6. Data is stored in a secure manner, adhering to relevant standards.
7. The purpose of storage is to ensure data is accessible for use and reuse by designated users and re-users daily. Security mechanisms may need to be implemented to safeguard the data assets during access, such as passwords, CCTV cameras, firewalls, and encryption.
8. Data may be transformed to create new data for further preservation through methods such as migration.

Occasionally actions – The occasional actions represent activities which are undertaken occasionally, as circumstances dictate (See the arrows interfacing with the outer surface of Figure 4). Examples of occasional actions include dispose, reappraise, and migration, which are discussed below.

1. Dispose involves discarding data which has not been selected for long-term curation and preservation according to policies, guidance and legal requirements. Data may be transferred to another archive, repository, data centre or other custodian. Due to the legal requirements, data may warrant secure destruction.
2. In other cases, other data sets may be reappraised and reselected to the repository for permanent preservation.
3. Data may be migrated to a different format due to the storage environment and threats of hardware or software obsolescence.

2.4.2.1 Relevance of the DCC Curation Lifecycle Model to this study

The DCC Curation Lifecycle Model was specifically developed for curation and preservation of digital information throughout its lifecycle (Higgins 2008). It is the focus of the present study to study the preservation of medical records throughout their lifecycle, from description of digital information to disposal. In addition, the development of the model points to the relevance of the model across various fields such as library science, records management, archives management, and digital curation. Considering the multidisciplinary nature of the study, cutting across records management and archives management, the model is sufficient and relevant in the study of the preservation of medical records. Although the model is aligned with digital objects as postulated by Higgins (2008), the application of the model to the digital preservation of medical records is relevant.

Furthermore, the model addresses all the variables derived from the research objectives of the study. For example, the construct of preservation action is aligned with preservation actions. Specifically, the variables such as migration, data cleaning, validation, preservation metadata, data structures or file formats addressed the theme of preservation actions. The development of preservation policies, standards and best practices is done during preservation planning in the full lifecycle actions phase, and implementation is done across other phases of the model, namely sequential actions and occasional actions. In addition, the model is also flexible in complementing other standards, policies, and reference frameworks at the implementation level, such as OAIS and ISO 15489 (ISO 2016). It is the aim of the present study to examine policies, standards, and reference frameworks that adequately address the challenges of the preservation of medical records in the public healthcare facilities in Malawi. This argument is also supported by Higgins (2008) that the DCC Curation Lifecycle Model complements, rather than restates, many standards, which provide frameworks for the management of digital materials. The model supports the implementation of storage methods for records according to the relevant standards (Higgins 2008). The third objective of the study was to identify the storage mechanisms for medical records in public healthcare facilities in Malawi. The study intends to assess the level of knowledge and skills of healthcare staff on preservation. Higgins (2008) argues that the DCC Curation Lifecycle Model can be used as a training tool to help curators and preservers understand the processes involved in curation and preservation for their organisations. Therefore, the model was used to identify the training gaps of healthcare staff on various aspects of the preservation of medical records throughout the lifecycle (Higgins 2008). Lastly, the DCC Curation Lifecycle Model will also provide a framework for the researcher to develop a framework for the preservation of medical records.

2.4.2.2 Gaps in the model

One of the weaknesses of the DCC Curation Lifecycle Model is that it was developed to cater for curation and preservation of digital information (Higgins 2008). The preservation of physical records using the model may be inadequate, though some principles may apply, such as preservation action, storage, policies and standards, and disposal. Triangulation of models was inevitable because the present study aimed to address the preservation of physical and electronic medical records. This was the basis on which the study adopted the lifecycle model. Another weakness is that the model is in the process of development and only acts as a guide for curation and preservation activities at the organisational level. This renders the model inadequate

when implemented in isolation. The model should be supported by other models, standards, and reference frameworks as postulated by Higgins (2008) for the successful implementation of curation and preservation projects. The model is also weak in defining critical elements of an archive system, namely Submission Information Package (SIP), Archival Information Package (AIP), Descriptive Information (DI), and Dissemination Information Package (DIP). These elements are adequately described by the Open Archival Information System (OAIS) Reference Model discussed in the next section.

2.4.3 Open Archival Information System (OAIS) Reference Model

The OAIS Model originated from the work of the Consultative Committee for Space Data Systems (CCSDS) to develop archive standards for the long-term storage of digital information (See OAIS Functional Entities in Figure 2.3). To embark on this process, a reference model was developed with common terms, concepts, and relationships among entities. This activity resulted in the OAIS reference model draft recommendation in May 1999. The OAIS Model is both a set of requirements for an archive repository and a standard for an OAIS archive. The set of requirements is general and discipline-independent and meant to guide the long-term preservation of digital information as follows. To:

1. Negotiate and accept appropriate information from information producers.
2. Obtain sufficient control of the information to ensure long-term preservation.
3. Determine the scope of the Designated Community.
4. Ensure the information is understandable by the Designated Community without the assistance of the information producers.
5. Follow documented policies and procedures to ensure the information is preserved against reasonable contingencies, and to enable the information to be disseminated as authenticated copies of the original or as traceable to the original.
6. Make the information available to the Designated Community.

The standard spells out the set of responsibilities to be fulfilled by the OAIS archive and distinguishes it from other uses of the term archive. The composition of the OAIS archive are organisation of people and systems with the responsibility of preserving information and providing access to the designated users. The model has been adopted by the Consultative Committee for Space Data Systems (CCSDS) as an OAIS archive and ISO standard. It has also been widely adopted by digital preservation communications for the implementation of the OAIS archive and as a standard for improving new or existing preservation systems. Communities such as librarians, curators, records managers, archivists, and ICT officers have used the model to implement their digital preservation initiatives.

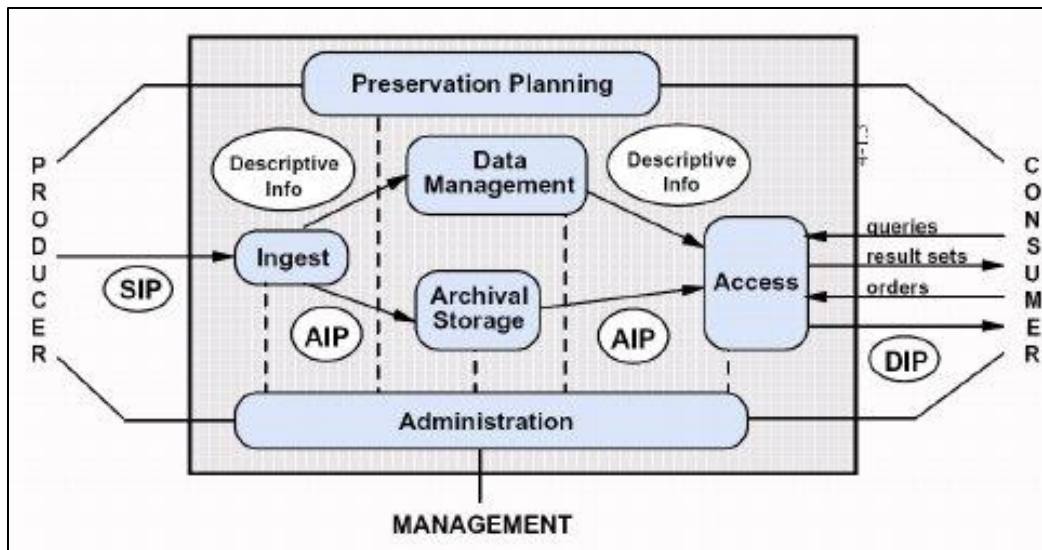


Figure 2.3: OAIS Functional Entities (Source: Consultative Committee for Space Data Systems [CCSDS] 2002)

The OAIS Model constitutes the interaction of four entities, namely producers, consumers, management and archive (See OAIS Functional Entities in Figure 2.3). Producers supply the information to the archive for preservation. They are the creators of the content. Consumers are the users of the preserved information. They are at the receiving end of the content from the OAIS archive. A subset of consumers is called the Designated Community, who are expected to understand the archived information. The management entity is responsible for establishing the broad policy objectives of the archive, such as types of information and funding sources for archiving activities. The management entity does not include the day-to-day administration of the archive. This task is performed by a functional entity within the archive itself. However, the management entity interfaces with the administrators of the system for periodical updates on the functioning of the archive.

Besides the four entities outside the OAIS system, five functions reside within the system, namely ingest, archival storage, data management, administration, and access. The five functions have been discussed below.

1. **Ingest** – this function is responsible for receiving information from producers and preparing for storage and management within the archive in the form Submission Information Package (SIP). In addition, quality checks are done by the system and generate an Archival Information Package (AIP). The AIP is transferred to the Archival Storage and Descriptive Information to Data Management.
2. **Archival storage** – the function handles the storage, maintenance and retrieval of the AIP. Some of the responsibilities of the archival storage function include migrating AIPs to new media as required, error checking, implementing disaster recovery strategies, and providing copies of requested AIPs to the Access function.
3. **Data management** – this function coordinates the Descriptive Information (DI) related to the AIPs. Data management also maintains and administers the database, executes query requests received from the Access function and generates result sets to be returned to the

requestor, creates reports in support of the Ingest, Access or Administration functions; and performs updates on the Data Management database, including the addition of new Descriptive Information received from Ingest or new system data received from Administration.

4. Administration – this function manages the routine operations of the archive, such as negotiating submission agreements with producers of information, system engineers, access control and customer services; and develops policies and standards related to the system's data standards (e.g., data format standards, documentation requirements, storage, migration and security policies). The administration acts as an interface between the archive and the other two entities of the system, namely management and the Designated Community.
5. Access – this function helps to identify and obtain descriptions of relevant information from the archive, and delivers information to consumers. This function involves the provision of a single user interface to the archive's holdings for both search and retrieval purposes; generating a DIP (Dissemination Information Package) in response to a user request by obtaining copies of the appropriate AIP(s) from Archival Storage; obtaining relevant Descriptive Information from Data Management in response to a query; and finally, delivering the DIP or query result set to consumers.

2.4.3.1 Relevance of the OAIS Model to this study

The OAIS Model was designed to provide a set of requirements for developing archive systems and standards for the preservation of digital information. The present study also focuses on developing policies and standards for the preservation of medical records according to established standards such as ISO 15489. The model also complements existing reference frameworks for the preservation of digital information, such as the DCC Curation Lifecycle Model (Higgins 2008), which has been selected to guide the present study. Furthermore, the model adequately addresses the critical entities of the archive system such as producers, consumers, management and archive (See OAIS Functional Entities in Figure 2.3). The study aims to identify critical entities that are involved in the preservation of medical records in public healthcare facilities in Malawi. Producers represent healthcare staff (for example, doctors and nurses) involved in the creation and supply of information to the archive for preservation. The healthcare staff also act as consumers of the content from the system. Healthcare staff are expected to understand the nature of archived information and are called the Designated Community. Healthcare facilities management, such as hospital directors and hospital administrators, is responsible for establishing broad policy objectives of the archive, including identifying funding for preservation activities. The management entity does not include the day-to-day administration of the archive. This task is performed by a functional entity within the archive itself. The records managers, data entry clerks and ICT officers are responsible for the daily operations of the archive, such as ingest, archival storage, data management, administration, and access.

In addition, the concepts of the OAIS Model are directly related to the variables of the study. For example, the variables of preservation actions in the study are directly related to the concept of administration in the OAIS Model. The variables of policies and standards in the study are adequately addressed by the concepts of administration and management in the model. The variables of storage mechanisms in the model are addressed by the archival storage concept in the model. Lastly, the variables of the framework for preservation in the study are addressed by all the

concepts in the model, namely producers, consumers, management, archive, ingest, archival storage, data management, administration, and access.

2.4.3.2 Gaps in the model

One of the weaknesses of the OAIS Model is that it is silent in addressing the concept of training people involved in the preservation of digital information. This is in sharp contrast to the DCC Curation Lifecycle Model, which was designed to guide the training of personnel involved in the preservation of digital information across its lifecycle (Higgins 2008). Another weakness of the OAIS Model is that it is simply a reference model and an abstract framework. This implies that the model needs to be used with other existing standards, technologies and implementation guidelines. For the fact that it is a guideline, the OAIS Model may not be implemented independently without other established implementation guidelines. Therefore, the model is meant to guide the users of the OAIS system to conform to its concepts in the context of other existing frameworks. Based on this understanding, the present study triangulated the OAIS Model with the DCC Curation Lifecycle Model and Records Lifecycle model to provide a concrete theoretical basis for the study.

2.4.4 Conceptual framework

Conceptual frameworks are important in any research study, especially at the doctoral level (Berman & Smyth 2015). Conceptual frameworks are defined differently by different authors depending on their perspectives on research. However, three definitions by Antonenko (2015), Mugizi (2019), and Ravitch and Riggan (2017) on conceptual frameworks are outstanding in the literature. According to Mugizi (2019), conceptual frameworks comprise concepts which can be developed into constructs and value added to them to become variables. Therefore, the major aspects of the conceptual framework include variables which are demonstrated through a series of connections or relationships (Mugizi 2019). Ravitch and Riggan (2017:5) consider the conceptual framework in a broader sense and describe it as an argument about the significance of the topic and the appropriateness and rigorous nature of the methodology adopted for the proposed study. The argument by Ravitch and Riggan (2017) is that the conceptual framework guides the entire study from problem identification, formulation of research objectives and choice of methodology for addressing the research objectives. Antonenko (2015) also agrees with the conceptualization of conceptual framework by Ravitch and Riggan (2017) and posits that a conceptual framework is both an evidence-driven and theory-based perspective, formulated to define relevant concepts, justify the significance of the problem, establish empirical and theoretical rationale, guide selection of appropriate methods, and carry out data analysis and interpretation. Conceptual frameworks originate from different sources. In general, conceptual frameworks provide a rationale for the whole study (Marshall & Rossman 2016). The common sources of conceptual frameworks are literature, existing theories and models, and observations. This view is supported by Maxwell (2017) and Ravitch and Riggan (2017) that constructs or variables of a conceptual framework originate from different sources, such as personal experience, prior research, and published theory. Conceptual frameworks are significant in a study in several ways. Ravitch and Riggan (2017) argue that the conceptual framework helps to provide significance to the topic and justifies the choice of methodology for the study. Ashcraft (2020) argues that conceptual frameworks provide meaning to research findings and generalisation. In addition, the conceptual framework also stimulates research and the extension of knowledge by providing both direction and impetus for the study (Ashcraft 2020). Ngulube (2019) supported the idea of using constructs or variables from

several theories, termed theoretical triangulation, to enhance the understanding of the phenomenon under investigation.

Development of the conceptual framework was very important for the study to provide meaning and demonstrate the relationship among multiple constructs and variables relevant to the study. The development of the conceptual framework was informed by three of the models discussed above, namely the records lifecycle, the DCC Curation Lifecycle Model, and the OAIS Model. Key variables in each model were carefully isolated according to their relevance to the research questions and subject matter, as displayed in Table 2.1.

Table 2.1: Relationship between Theoretical Models and Research Questions

No	Research question(s)	Theoretical model(s)	Key variables addressed by the model(s)
1	How are the preservation strategies currently in place at selected public healthcare facilities in Malawi?	- Records Lifecycle - OAIS Model - DCC Curation Lifecycle Model	dehumidification, backup, migration, safety and security, metadata, file formats, damage repair, and disposition.
2	What are the preservation policies and standards of the selected public healthcare facilities in Malawi?	- Records Lifecycle - OAIS Model - DCC Curation Lifecycle Model	Policies, standards, guidelines, procedures.
3	What are the storage mechanisms for medical records at the selected public healthcare facilities in Malawi?	- Records Lifecycle - OAIS Model - DCC Curation Lifecycle Model	Storage methods, storage equipment, storage environment
4	What are the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi?	- OAIS Model - DCC Curation Lifecycle Model	Knowledge and skills, competencies, qualifications
5	Which new framework may be proposed to promote best practices for preserving medical records at selected public healthcare facilities in Malawi?	- Records Lifecycle - OAIS Model - DCC Curation Lifecycle Model	Preservation strategies; storage mechanisms; legal and regulatory frameworks; capacity building

Table 2.1 outlines the research questions, corresponding theoretical models used to address the research question and key variables emerging from the models. Based on this information, a diagram representing the relationship of the key concepts of the study is displayed in Figure 2.4.

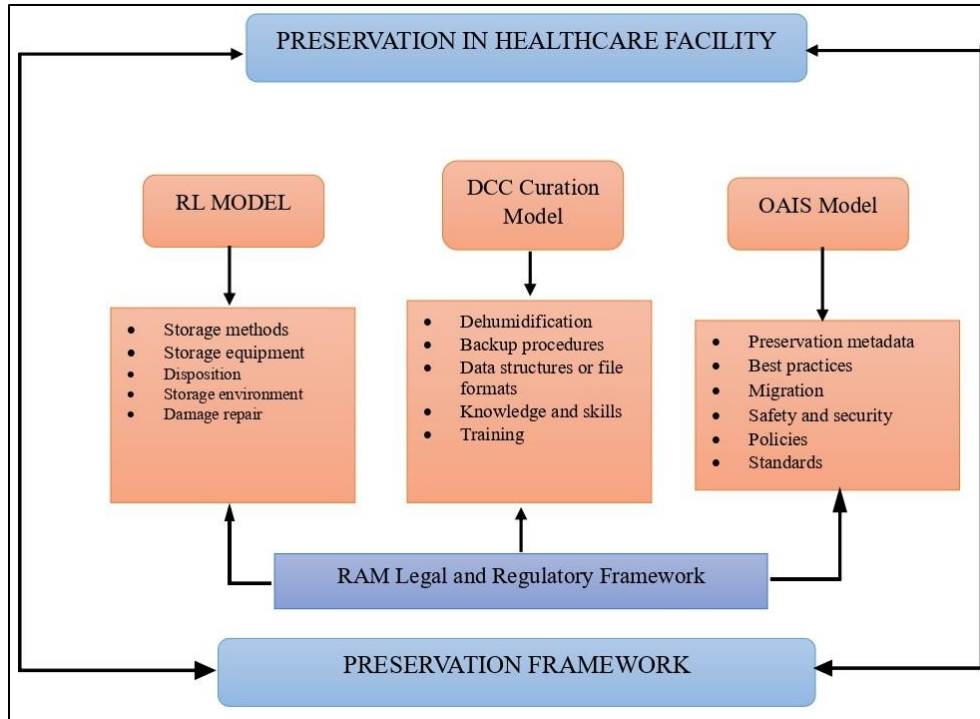


Figure 2.4: Conceptual Framework (synthesised by the researcher)

The study largely adopted the deductive approach that commenced with a theory to test or verify a theory by examining hypotheses or questions derived from it, as opposed to the inductive approach that starts with observations to develop theories and generalisations (Creswell 2018; Salomao 2023). However, the study also adopted the inductive approach to develop a theory and generalisations from observations, being a mixed methods study approach supported by scholars such as Creswell (2018) and Ngulube (2019). A preliminary literature review was conducted to identify the three relevant models for the study: the Records Lifecycle model, the DCC Curation Lifecycle Model, and the OAIS Model. Key variables were isolated from the models that were relevant for addressing the research questions. Data was collected related to the key variables of the models, and literature which informed the development of the preservation framework.

2.4.4.1 Utility of the conceptual framework in the study

The use of the conceptual framework was based on its significance in identifying the problem of the study, formulation of research objectives, and choice of methodology addressing the research objectives (Ravitch & Riggan 2017). The conceptual framework guided the development of the literature review by identifying the themes and structure.

The understanding of the research problem prompted the researcher to develop content on the current situation of the preservation of medical records in public healthcare facilities in Malawi. The information would support the choice of methodologies to improve preservation practices, including the development of the framework. This process required synthesising all the concepts from the three models adopted for the study in a single conceptual framework. Consequently, the conceptual framework guided the study in the key terms to use and the context of the research problem.

The conceptual framework also guided the study in bringing coherence to the entire research process from the research problem, research questions, research approaches, and data collection. The concepts from the research questions were included in the conceptual framework, which was used to guide the development of the research methodology. The research questions and themes were mapped to the conceptual framework. The research methodology was designed according to the research questions in the conceptual framework.

2.5 Summary

This chapter has provided an in-depth discussion of the models that guided the study to enable an understanding of the phenomenon under investigation. The present study is relevant to both records and archives management. The descriptions of models, theories, and theoretical and conceptual frameworks were outlined, and relevant theories were discussed to place the study into context. The literature has revealed that no one model is sufficient to address all the concepts or variables of the study, motivating the use of three models and the development of the conceptual framework rather than the theoretical framework.

The chapter reviewed three models relevant to records and archives management and preservation of records. These included the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model. The models were selected for the study to inform the study and create a basis for developing a conceptual framework for the study, namely the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model. The justifications for the choice of the models were also provided. The gaps of all the models relevant to the phenomenon under study were discussed.

The chapter concluded with a section on the conceptual framework. The conceptual framework developed in this chapter formed a guide for the next chapter on literature review. The concepts in the conceptual framework resonated to be the themes for the literature review, namely preservation actions, preservation policies and standards, storage mechanisms, knowledge and skills, and preservation framework. The literature review provides a context for the research problem and provides a framework for addressing the research questions.

CHAPTER THREE LITERATURE REVIEW

3.1 Introduction

Chapter Two presented the theories and conceptual framework guiding the study. This chapter provides an extensive review of the literature according to the themes derived from the research questions and variables from the conceptual framework of the study. The literature review was organised according to the themes devised from the research questions, variables from the conceptual framework and general issues from the research problem. The literature review for this study is organised into five major themes, namely preservation actions, preservation policies and standards, storage mechanisms, knowledge and skills, and preservation framework. Furthermore, the literature review within the themes was further organised according to the global literature (USA, UK, Europe, and Asia), Africa (North Africa, Sub-Saharan Africa, Central Africa and Southern Africa), and local setting (Malawi). As part of the introduction, the section has provided the meaning, importance and process of literature review. Consequently, a literature review map was developed to guide the chapter.

3.2 Literature review in research

Regardless of the type of inquiry, whether qualitative, quantitative or mixed methods, Creswell (2018) encourages researchers to review the literature about a topic under investigation. A literature review helps the researcher to learn what is known and not known about the topic in order not to “reinvent the wheel” (Babbie 2017; Bell, Bryman & Harley 2022). Thomas, Fowler and Johnson (2017:15) define a literature review as a scholarly survey which extensively reviews scholarly work conducted both within and outside the study setting to inform the present study. Bell, Bryman and Harley (2022) further argue that the literature review helps the researcher to develop an argument about the significance of the study and its direction. According to Kothari and Garg (2019), a review of the literature enables the researcher to understand the approaches or methodologies employed by other scientists in similar studies. The literature review provides the framework and foundation of the entire study because they are essential in understanding and developing the topic of study. They bring coherence to the body of knowledge about the field of study or topic (Snyder 2019). Kumar (2019) summarises the functions of literature review as follows:

1. It provides a theoretical background to your study.
2. It helps you establish the links between what you are proposing to examine and what has already been studied.
3. It enables you to show how your findings have contributed to the existing body of knowledge in your profession.
4. It helps you to integrate your research findings into the existing body of knowledge.

A literature review is very important in academic research because it helps to shape the research problem, define research questions, justify the significance of the study, define the scope of the study and inform the choice of methodology of the study. This view is supported by Arshed and Danson (2015) that the literature review provides context, informs methodology, maximises innovation, avoids duplicative research, and ensures that professional standards are met. A

literature review helps to gain an understanding of the existing research and debates relevant to a particular topic or area of study and to present that knowledge in the form of a written report. The literature review is described as a list comprising pertinent items representing the literature of the subject (Bell, Bryman & Harley, 2022:93). Bell, Bryman and Harley (2022:93) also define a literature review as a process of identifying relevant information about the topic from different sources such as articles and databases. Therefore, literature is a summary of the research content and other relevant information about the topic under investigation. Discussion for the literature review is arranged from general to specific or broader to narrower perspective (Kumar, 2019). Further, Creswell (2019) identified four types of literature reviews, which included the following:

1. Integrate what others have said and done.
2. Criticise previous scholarly works.
3. Build bridges between related topics.
4. Identify the central issues in a field.

Contrasting perspectives exist in the process of conducting a literature review, regardless of the approach to be followed. Creswell (2019) and Leite, Padilha and Cecatti (2019) argued that there is no single way to conduct a literature review, but many scholars adopt a systematic fashion to capture, evaluate and summarise the literature. Creswell (2019) recommends the following procedures for conducting a literature review:

1. Identifying keywords which are used to locate materials for the study.
2. Use the keywords to search for databases such as journals and books.
3. Initially, locate about 50 reports of research in articles or books.
4. Skim the initial group of articles or chapters, and collect those that are central to the topic.
5. Begin designing a literature map based on the useful literature identified.
6. Begin to draft summaries of the most relevant literature.
7. After summarising the literature, assemble the literature review, structuring it thematically or organising it by important concepts.

Likewise, Kumar (2019) also emphasises that the process of conducting a literature review should follow a series of steps as follows:

1. Searching for the existing literature in your area of study;
2. Reviewing the selected literature;
3. Developing a theoretical framework;
4. Developing a conceptual framework.

Furthermore, Snyder (2019) proposed a practical approach for conducting a literature review informed by various standards and guidelines for literature review. The approach consisted of a four-step process as follows:

1. Designing the literature review;
2. Conducting the review;
3. Analysing;
4. Writing the review.

Lastly, Leite, Padilha and Cecatti (2019) observed a lack of consensus on the appropriate method for conducting a literature review. However, Leite, Padilha and Cecatti (2019) argued that five main steps are generally accepted for conducting a literature review: 1) defining the main topic, 2) searching the literature, 3) analysing the results, 4) writing, and 5) reflecting on the information that has been written in previous publications. Therefore, the study adopted an approach proposed by Creswell (2019), though the steps were not fulfilled linearly but rather repetitively throughout the process to achieve exhaustivity and rigour.

One of the criteria for evaluating the goodness of the literature review is the quality of the sources consulted by the researcher. Snyder (2019) recommends that researchers should read widely on the sources consulted, focusing on the title and abstract when compiling the literature review. Babbie (2020) underscores the importance of consulting different sources of literature for addressing the research problem and objectives of the present study. The sources of information consulted in the present study were categorised into three primary, secondary and tertiary sources. Examples of primary sources were theses, reports, government publications, unpublished manuscripts and conference proceedings. Secondary sources included books, journals and newspapers, while tertiary sources included catalogues, databases, indexes, bibliographies and encyclopaedias. The majority of the sources reviewed for this study were published between 2015 and 2024. The study used mind maps and concept maps in the literature review to organise information from different sources and demonstrate the relationships between the concepts.

3.3 Literature map

One of the tasks of the researcher embarking on a new research project is to organise the literature on a topic under investigation. This organisation helps a person understand how the proposed study adds to, extends, or replicates research already completed (Creswell & Creswell 2022). One of the approaches for organising the literature is through literature mapping. According to Creswell and Creswell (2022:34), a literature map is a visual summary of the research that has been conducted by others, and it is typically represented in a figure. It is an overview of the literature relevant to the topic of study, organised according to concepts and relationships among the concepts. Creswell and Creswell (2022) advance several models that exist for organising maps as follows; 1) hierarchical structure with a top-down presentation of literature, ending with at the bottom with a proposed study, 2) a flowchart in which the reader understands the literature as unfolding from left to right with the farthest right-hand section advancing a proposed study, 3) a series of circles, each circle represents a body of literature and intersection of the circles as the place in which the future research is indicated. Another technique for organising literature is the use of mind maps and concept maps. In a mind map, a central idea or keyword is plotted in the middle and is surrounded by other keywords, creating a web of relationships. Figure 3.1 depicts an illustration of a mind map of a company.

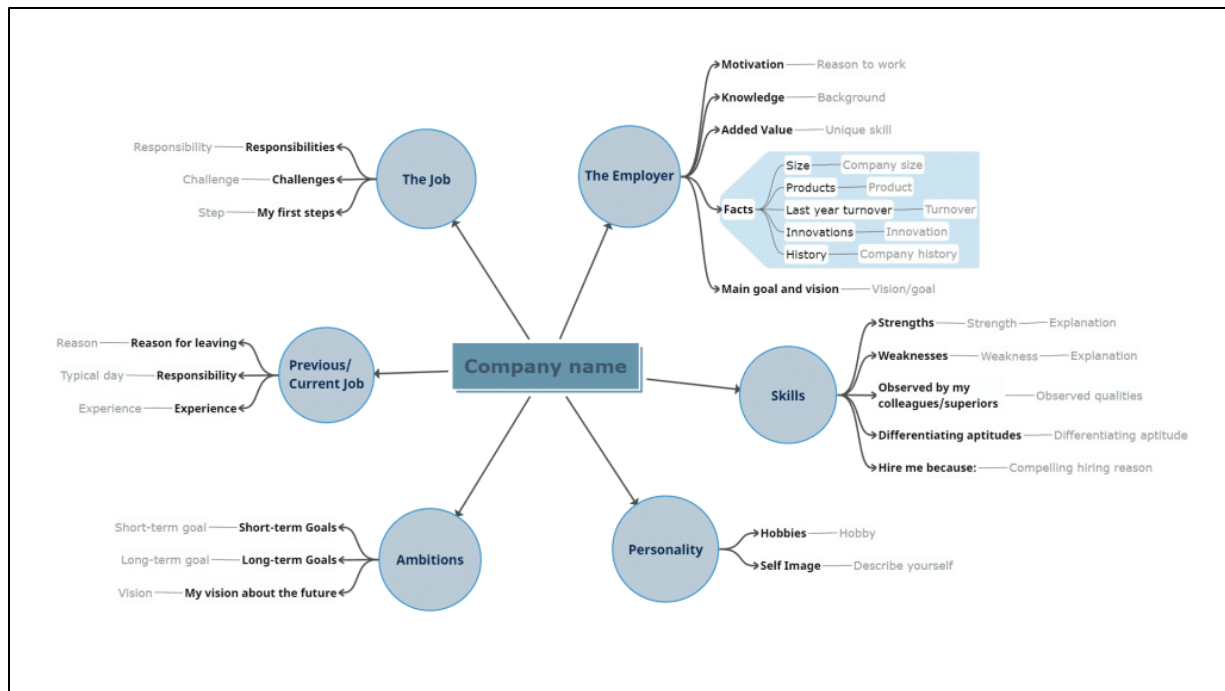


Figure 3.1: Illustration of Literature Review Mind Map (Source: Daley, Morgan & Black 2016:632)

Another technique related to a literature review is the concept of mapping. Concept maps were created by Novak and Gowin (1984:15) and are “a schematic device for representing a set of concept meanings embedded in a framework of propositions.” Daley, Morgan and Black (2016) outline three steps of creating a concept map: 1) identification of concepts of the topic, 2) general concepts are placed on top of the map and more specific concepts below the general concepts, 3) linking words are used to create connections from one side of the map to the other. Figure 3.2 depicts an illustration of a concept map.

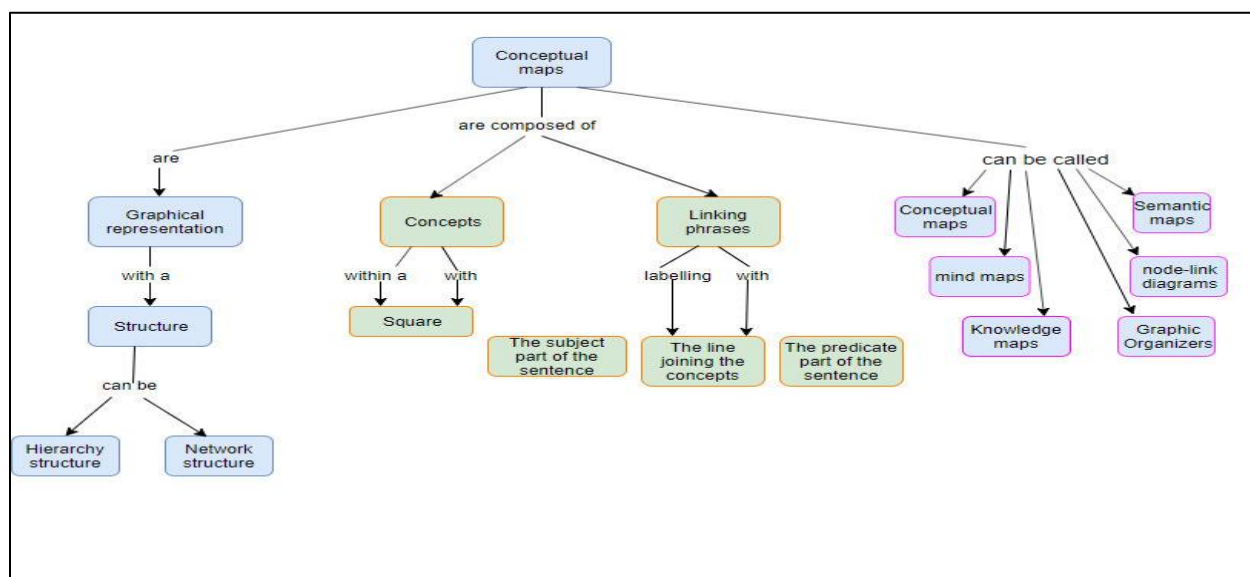


Figure 3.2: Illustration of a Concept Map (Source: Rovira 2016:61)

With consideration of the discussion on mind map and concept, the current study adopted the main concepts derived from the research questions and key variables gleaned from the models guiding the study to create a roadmap for the literature review. The key variables gleaned from the research questions and the models have been highlighted in Table 3.1.

Table 3.1: Mapping the Research Questions to Conceptual Framework Variables

No	Research question(s)	Literature review concept(s)
1	How are the preservation strategies currently in place at selected public healthcare facilities in Malawi?	Migration, backup, file formats, metadata, dehumidification, damage repair, security, disposal.
2	What are the preservation policies and standards of the selected public healthcare facilities in Malawi?	Policies, standards, guidelines, procedures
3	What are the storage mechanisms for medical records at the selected public healthcare facilities in Malawi?	Cloud storage, blockchain technology, computers, portable storage mechanisms, storage rooms, physical storage equipment
4	What are the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi?	Knowledge and skills, competencies, qualifications
5	Which new framework may be proposed to promote best practices for preserving medical records at selected public healthcare facilities in Malawi?	Frameworks for the preservation of medical records

Table 3.3 displays the research questions and corresponding concepts from the models which are discussed in the literature review. The literature review was developed based on the ideas from Daley, Morgan and Black's (2016) mind-mapping model (Figure 3.1).

3.4 Review of literature based on the main themes of the study

The purpose of this study was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records. The following sections discuss the key themes originating from the research questions and models guiding the study, as displayed in Table 3.1.

3.4.1 Records management

To fully understand the term records management, the concept of "record" needs to be discussed. The term record has several definitions in the literature, casting doubt on the acceptable definition of the term. According to Saffady (2021:1), a record is information that is "written down" as opposed to merely memorised or exchanged verbally. Furthermore, Cook (2017:54) has provided an abridged definition of a record as "information media that have been generated by the administrative system." Franks (2018:31) further draws a definition from ISO 15489 (2016) standard on records management and defines a record as "recorded information, regardless of medium or characteristics, made or received by an organisation in pursuance of legal obligations or the transaction of business." Despite the differences in the terminology, authors agree that records are recorded information that supports the business activities of an organisation.

Examples of records are budgetary reports, organisational policies, receipts and vouchers. These must be authentic, reliable, of good integrity, and usable (ISO 2016).

The ISO (2016) explained records management as the field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records, including the processes for capturing and maintaining evidence of information about business activities and transactions in the form of records. Saffady (2021:1) expands the definition of records management provided by ISO and considers records management as a specialised business discipline that is concerned with the systematic analysis and control of recorded information, which includes any information created, received, maintained, or used by an organisation under its mission, operations, and activities. It is obvious that records management is important and plays different roles in the organisation. According to Cook (2017), some of the roles of records management are managing records as assets and information resources, and promoting efficiency and economy through sound recordkeeping practices. Failure to manage records results in damage to the organisation's reputation, high costs for information management, lost files and risk of spoliation, and audit and compliance violations (Franks 2018).

Therefore, effective records and information management should constitute records management policies and procedures, well-trained personnel, and advanced information systems that will reduce risks to the organisation (Cook 2021). The programme must ensure that records and information are managed properly throughout their lifecycle – from creation to destruction or preservation (Franks 2018). Preservation is one of the functions of records management besides creation, distribution and use, and disposition (Cook 2017; Franks 2018; Saffady 2021). From the archival perspective, Millar (2017:148) describes preservation as the passive protection of archival material, in which no physical, technological, or chemical treatment is performed. However, a generic description of preservation applicable in most organisations is that it considers all processes and tasks performed to protect records and archives (in any form) against damage and deterioration (Millar 2017:148). The processes and tasks include sound preservation strategies, preservation policies, maintaining adequate environmental and storage conditions, housing records and archives in a stable storage environment, and the safety of records and archives (Millar 2017). The next section will discuss the concept of preservation from an African perspective. This perspective focuses on its historical contingency, significance, and challenges in the preservation of records.

3.4.2 Historical context

The history of preservation of medical records is as old as the origin of medicine itself (Aujoulat 2005; Black 2019). It is argued that the first instance of an earlier medical record was created around 17,000-15,000 years old in the early Magdalenian period, unearthed in the Lascaux cave complex in the Nouvelle-Aquitaine region of southwestern France (Gillum 2013; Karim & Amin 2018). The medical records inform of paintings showing an injury of a man attacked by an animal (Gillum 2013). As civilisations emerged, writing became an important mode of communication and preserving history, which included the creation of medical records. Proto-writing became prominent in the Vin'ca culture (5500–4000 years ago). Subsequent writing, such as the advanced logographic script, was mastered by Egyptians, Elamites, and Sumerians circa 4000–3000 B.C (Valladas, Clottes, Geneste, Garcia, Arnold, Cachier & Tisnérat-Laborde 2001). Furthermore, the first informed cuneiform writing consisting of hieroglyphics is believed to have originated in Egypt and Sumer of southern Mesopotamia circa 3000 B.C. (Aujoulat 2005; Black 2019; Gillum 2013;

Karim & Amin 2018; Ramadan, Abdulla, Al-Shimmery 2009; Valladas *et al* 2001). In ancient times, medical records were used to identify the patient and document all details about his health history, clinical symptoms and signs, diagnostic and treatment procedures, medications and justification for their use, and the follow-up continuity (Aujoulat 2005; Black 2019; Gillum 2013). Such medical records were in the form of written and graphic formats.

In terms of use, ancient medical records in the form of papyrus originating from the Egyptian civilisation were mainly used for educational purposes. For example, in 1862, Edwin Smith, an American Egyptologist, acquired a papyrus manuscript written between 1600–1700 B.C (Salem, 1999). This papyrus manuscript is believed to be the oldest medical script about injuries and describes the examination and determination of diagnosis and treatment plan. Another notable example is the Papyrus Ebers, which was acquired by Georg Ebers, a German Egyptologist and novelist, in 1873, and the manuscript dates back to 1550 B.C (Montinari, Minelli & De Caterina 2019; Salem 1999). The manuscript was for extensive source of knowledge on treatments, surgical procedures, and healing herbs (Montinari, Minelli & De Caterina 2019; Salem 1999). Another prominent figure connected with the preservation of medical records is Moses ben Maimon (1138–1204) (Salem 1999). He is also known as Maimonides and was a celebrated rabbi, philosopher, and physician. Originally from Spain, Moses ben Maimon left Europe and settled in North Africa. It is believed that Moses ben Maimon was a doctor to the vizier Al-Fadhil, a regent of Egypt. It is on record that he created and preserved medical records, focusing on the guiding principle “treat the ill, not the illness,”.

Besides the prominent contributors to medicine and medical records in the preceding paragraph, modern medicine has been greatly influenced by the Hippocrates of Kos (460–370 B.C). Hippocrates wrote and compiled 70 medical scripts, which resemble modern medical records, in the book titled *Corpus Hippocraticum*, which formed the foundation of medicine (Conti 2008). The medical scripts were a collection of his work and physicians of the time in the second half of the 5th century and the first part of the 4th century B.C. (Conti 2018; Conti 2011). The contents of the scripts included the physicians’ recommendations, descriptions of medical procedures, and prescriptions. In addition, elements of biomedical law were also included, and they were used mainly for academic purposes. This priceless collection of ancient medical records was accidentally destroyed by Julius Ceaser in 48BC in the fire that gutted the Library of Alexandria in Egypt (Conti 2018; Conti 2011; Conti 2008; Erksine 1995; Mironidou-Tzouveleki & Tzitzis 2014; Reiser 1991; Walshe 1997). However, the rules and knowledge of Hippocrates were introduced to the Roman world by Claudius Galenus (130–200 AD), known as Galen of Pergamon, a Greek physician, surgeon, and philosopher (El-Abbadi 1992; Marketos, Eftychiadis, Diamandopoulos 1993; Diamandopoulos 1999). Nevertheless, the medical records were mainly used for educational purposes rather than informing practice. However, the ban by the Roman Empire on ancient medical knowledge adversely affected the development of medical progress and the preservation of medical records (Reiser 1991; Walshe 1997). Despite this ban, ancient medical knowledge and records remain the foundation for the modern European legal system (Azizi, Nayernouri & Azizi 2008; Kanz & Grossschmidt 2006; West 2014).

The history of the preservation of medical records is incomplete without a discussion of the contribution of Islamic civilisation in the early Middle Ages. Two influential figures of the Islamic culture have contributed to medical knowledge: Ab ū Bakr Muhammad ibn Zakariyy ū al-R

ʿazī, known as Rhazes (865–925 AD), and Ab ʿu Ali Husain ibn Abdallah Ebn-e Sina, known as Ibn Sina or Avicenna (980–1037 AD) (Alvarez Millan 1999; Amr & Tbakhi 2007). Rhazes made a compilation of medical knowledge from the Arabic and Indian civilisations. The most famous work by Rhazes was the nine-volume “Al-Kitab al-Hawi” (The Comprehensive Book on Medicine or *Continens Liber* in Latin). The book included clues and elements of creating known today as medical records (Alvarez Millan 1999; Amr & Tbakhi 2007; Eknayan 1994; Haddad 1986; Khan, Daya & Gowda 2005). In contrast to Rhazes, Ibn Sina was trained in law and natural sciences and wrote over 400 books on medical practice based on an analytical approach. The prominent volume by Ibn Sina was “*Kanun fi’t-tibb*” (The Canon of Medicine). The collection consisted of five books with parts and chapters on descriptions of a variety of diseases based on past medical records. This encyclopaedia edition becomes the tenet of medical education beyond the 18th century (Amr 2007; Hatami, Hatami & Hatami 2013; Magner 2005; Markatos, Androutsos, Karamanou, Kasetta, Korres & Mavrogenis 2019; Moosavi 2009; Richter-Bernburg 1994).

Eventually, medical records were preserved in different locations close to patients in hospitals, especially in Europe. In medieval times, hospitals were managed as asylums for the poor and ill (Eknayan 1994; Haddad 1986). The people in charge of the hospitals were the converts, which was an effect of the Christian moral imperative to do good and show mercy to the needy (Gillum 2013; Haddad 1986). This entails that the primary purpose of the medical records was for administrative purposes and was always connected to the church. The list of patients admitted and released from hospitals was kept in religious institutions. Such records are considered the original examples of medical data archiving in Europe (Gillum 2013). Although medieval records share many characteristics with ancient ones, the latter have become a constant element of doctors’ practice (Gillum 2013). This trajectory of creating and using medical records for medical practice, besides education and administrative purposes, has persisted until the 21st century.

In modern times, the contributing factors to changes in the preservation of medical records are the Renaissance and the work of Leonardo da Vinci (1452–1519). The Renaissance led to major developments in branches of science which were based on da Vinci’s anatomical Sketches (Afek 2009; Afshar, Steensma & Kyle 2019). Handmade sketches became a mechanism for producing educational medical records in areas such as orthopaedics until the end of the 20th century (Steensma & Kyle 2019). However, handmade sketches do not meet the requirements of eHealth records anymore (Middelkoop, Noble, Wadum & Broos 1998; Mitchell 1994). Another major contributor to medicine and medical records was Andreas Vesalius (1514–1564). Andreas wrote a book called “*De Humani Corporis Fabrica*” (On the Fabric of the Human Body), which was a compilation of post-mortem sketches by different contributors (Middelkoop *et al* 1998). The famous contributors were Jan van Calcar, a pupil of Titian and Rembrandt Harmenszoon van Rijn (1606–1669) (Afshar, Steensma & Kyle 2019; Ghosh 2015; Steele 2014). It is argued that the book revolutionised the field of medicine and medical records.

Consequently, different countries adopted the use of medical records for medical practice, besides educational purposes. Countries such as the USA and Europe adopted the use of books of admissions, registers, and case files (Siegler 2010). The purpose was to preserve the knowledge in a written form for future use by medical practitioners and students (Jaffe 2004; Siegler 2010). Challenges emerged in the use of registers in that entries were initially few and retrospective rather

than taken at the bedside (Jefte 2004; Reiser 1991). Due to the prevailing challenges in recording patients' details in registers, the authority resorted to hiring conservators to supervise the registers. In addition, standards were also proposed for creating entries in the registers (Siegler 2010). Hospitals created a database of acronyms and abbreviations to ensure consistency in creating medical records among medical professionals (Jefte 2004). Staff duties concerning medical records were outlined such as including hospital admissions, discharges, treatment results, and expenditures, which were linked to their promotions (Siegler 2010). The same changes were also made to most European countries in the mid-19th century, with doctors mandated to register data of all patients. Eventually, universal templates of records were introduced to avoid inconsistencies in the documentation of medical cases (Reiser 1991; Siegler 2010). Developing countries in Africa and Asia followed suit, and hospitals saw the introduction of case files, registers and health passports (Marutha 2021). Despite this move, the preservation of medical records in developing countries is marred by several challenges, such as a lack of equipment, funding, slow adoption of ICTs and a lack of expertise (Marutha 2021; Tough & Lihoma 2018).

3.4.3 Digital preservation

The development of ICTs has had a profound impact on the preservation of medical records globally. The change to digital preservation in health has been fast-tracked by the desire of governments to embrace the digital transformation of public services to improve administrative and operational efficiency (Mosweu 2023). The global adoption of e-government has expanded over time, with countries digitalising their business processes, including preservation of medical records (United Nations 2024). This has led to the widespread use of the concept of digital preservation in health (Mosweu 2023). Digital preservation encompasses a set of procedures that ensure that digital information and evidence remain accessible and usable over time (Upward *et al* 2019). Digital preservation ensures data integrity and long-term accessibility of medical records (Adetunji 2021; Shahrul Asari, Hussin & Samsudin 2017). According to Shahrul Asari, Hussin and Samsudin (2017), data integrity is the process of implementing measures to protect data against improper maintenance, modification, or alteration. Data integrity ensures the accuracy of information, authenticity, trustworthiness and long-term accessibility (Shahrul Asari, Hussin & Samsudin 2017; United Nations 2024). Data with high integrity is critical and very useful in medical practice, while data with low integrity is unimportant to support the functions of healthcare facilities.

Some of the strategies for preserving digital records that ensure data integrity and long-term accessibility are digitisation, backup, migration and file formats (Miller 2022). Digitisation is an important activity for preserving physical records and rendering them accessible over time. Digitisation is the transfer of analogue or physical documents, photographs or sound recordings into digital format for electronic access and use (Miller 2022:166). The advantage of digitisation is that it reduces the wear and tear of physical documents. To ensure successful digitisation, the process needs to be guided by relevant standards and guidelines. These standards and guidelines stipulate file formats for storage, selection of software and systems for reproduction and storage, and decision on compression to reduce space. The standards and guidelines ensure a high-quality digital object that is beneficial to the users. However, failure to adhere to the standards and guidelines renders the digitised object useless and unacceptable as evidence for legal and administrative purposes.

Digital content can also be protected by implementing backup procedures (Upward *et al* 2019). According to Magama (2018), backup is the process of making multiple copies and storing them in different locations, far apart from each other. Backup entails the creation of primary storage and secondary storage of data or records. There are several reasons for creating a backup of records. According to Hofman (2021), the backup of records saves time and money and increases the productivity of an organisation in the case of a disaster. Backup of records also helps the organisation to prepare for disaster, eliminate the threats of accidental deletion of records, mitigate the negative impact of software bugs and hardware failures on the organisation and the ability to reproduce results of the past for the continuity of business of the organisation (Crocket 2017; Yeo 2021). Miller (2022) has also argued that backup systems support access to records and respond to data requests from clients. Several media can be used for the backup of records, namely compact disc (CD), digital versatile disc (DVD), flash disk, hard disc drive (HDD), solid-state drive (SSD), Cloud storage, and Deoxyribonucleic acid (DNA) (Hofman 2021; Saffady 2021).

The history of digital storage is marred by outdated technologies designed to preserve digital records and information using devices such as drives, cartridges, and tapes (Louisiana State Archives 2020). To counter the challenges of obsolete technologies, digital records have to be moved to newer systems and storage devices such as hard drives, flash disks, servers, and cloud computing (Louisiana State Archives 2020). This change in technologies has called for the transfer of data or system from one device to the other in the process called migration (Lowry & Nduna 2015; Magama 2018). Franks (2018) and The National Archives (2017) categorise migration into two, namely data migration and system migration. Data migration is the movement or transfer of data from one storage device to the next, while system migration is upgrading or replacing the old systems to achieve maximum security of data, increased productivity and decreased costs (Franks 2018:159-160). Migration can be an expensive, complex and time-consuming process. Therefore, a cost-benefit analysis should be done to determine the value of the entire migration process (Franks 2018). The National Archives (2017) argues that the process of data and system migration should follow a project management approach with a series of steps for implementation to be successful. As such, Franks (2018) identifies three major steps for performing migration: pre-migration testing, post-migration testing, and creating records of the migration.

To ensure access and long-term preservation of records, healthcare facilities need to adopt reliable file formats. File format is the organisation of data within files, usually designed to facilitate the storage, retrieval, processing, presentation, and/or transmission of the data by software (InterPARES2 n.d.). Different file formats exist, such as tagged textual formats, wrapper formats, and “true” file formats (McLellan 2007). One of the challenges with the adoption of the file formats is the large number of file formats on the market. As such, Drago (2019), the Library of Congress (2017), and Universitat Wien (2024) have proposed simplified format selection criteria such as openness, portability, quality and functionality, development support, diffusion, transparency and self-documentation.

Different types of documents require specific file formats for long-term preservation. For example, records in document format can be preserved with file formats such as PDF (Portable Document Format) and DOC, PPT (PowerPoint Presentation), QXD (QuarkXPress Document), and INDD (InDesign Document) (Drago 2019; Han & Wan, 2018). For Video files, the recommended file formats are AVI (Audio Video Interleave), MPEG-2 (Moving Pictures Expert Group 2), MKV

(Matroska Video files) and MP4 (Universitat Wien 2024). Audio files recommended file formats are WAV (Waveform Audio File Format), FLAC (Free Lossless Audio Codec), MPS (Mathematic Programming System), and OGG, while WMA (Windows Media Audio), AAC (Advanced Audio Coding) are not recommended (Franks 2018). Lastly, picture files recommended file formats include TIFF (Tag Image File Format), JPG (Joint Photographic Experts Group) and PNG (Portable Network Graphic), while BMP (Bitmap Image File) and GIF (Graphics Interchange Format) are not recommended file formats (Pham, Böhme, Santosa, Căciulescu & Roychoudhury 2019).

3.4.4 Impact of technological advances

The proliferation of ICTs has impacted healthcare and the management of medical records. This change resulted in the surge of electronic records or eHealth records in the 1960s (Blumenthal & Dixon 2012; Decker, Jamoom & Sisk 2012). As such, synonymous terms for digital medical records have emerged, such as Electronic Medical Records (EMR), Electronic Health Records (EHR), Personal Health Records (PHR), and Electronic Health Data (EHD) (Yi, Miao, Bertino & Willemson 2013). EMR and HER relate to patients' records managed by health professionals, while PHR is data managed by health personnel and patients' relatives (Yi *et al* 2013). EHD is a computerised system for managing patients' records (Yi *et al* 2013). Initially, data were filled in using punch cards, which was a tedious process (Chenthara, Ahmed, Wang & Whittaker 2019). The use of computers has enabled the collection of data more efficiently compared to a paper-based system for research, education, therapy and administration (Blumenthal & Dixon 2012; Decker, Jamoom & Sisk 2012). Other advantages of digital records are that they require less manpower, time and physical space compared to paper-based records (Kruse, Mileski, Vijaykumar, Viswanathan, Suskandla & Chidambaram 2017). Furthermore, digital medical records offer easier and swift clinical data access, the ability to maintain effective clinical workflows, mitigation of medical errors, enhanced patient safety, reduced medical costs and better and stronger support for clinical decision-making (Chenthara *et al* 2019).

The advances in technology have also resulted in the adoption of cloud computing, blockchain, and artificial intelligence in the preservation of medical records. Rashid and Chaturvedi (2019:421) also define cloud computing as the use of hardware and software to deliver a service over a network, usually the Internet. The concept of the cloud is a 'hypothetical' or 'metaphor' to represent the Internet (Rashid & Chaturvedi 2019:421). Cloud computing as a model supports the provision of cloud services to customers (Cloud 2017). Some of the common cloud service providers are Google, Microsoft and Amazon. They provide cloud computing resources and services such as Office 365, OneDrive, Google Docs, and Google Drive (Franks 2018). The services are accessible on the Web using a web browser and login details, while the data, software and hardware are located in the data centres (Rashid & Chaturvedi 2019).

Some of the opportunities of cloud computing are access to IT services on demand from any device and at any time (Sunyaev & Sunyaev 2020). Cloud computing also provides broad network accessibility, resource pooling, multitenancy, reliability and scalability, and lower IT costs of purchasing and operating IT infrastructure at an institutional level (Franks 2018; Jamsa 2022; Rashid & Chaturvedi 2019). Despite the glowing influence of cloud computing, several risks exist. Franks (2018) and Sunyaev and Sunyaev (2020) have voiced concerns with cloud services, such as a lack of data security and privacy, cost management, performance challenges, interoperability, high demand on the network, and lack of knowledge and expertise in the use of the service. Franks

(2018) further argued that organisations should be clear enough on the storage and disaster preparedness services offered by cloud service providers.

The adoption of blockchain technology is critical in the era where medical records are increasingly being created in electronic format. Blockchain technology was first introduced by Nakamoto in 2009 (Nakamoto 2008). Originally, the technology was invented to solve the problem of double spending of bitcoin, but later it has been adopted in other applications. Blockchain technology comprises a series of blocks that are connected and are continuously growing by storing data on the blocks (Shahnaz, Qamar & Khalid 2019:147783). It utilises a decentralised approach that allows the information to be distributed and each piece of data to have shared ownership (Gordon & Catalini 2018; Shahnaz, Qamar & Khalid 2019). In addition, the technology uses a harsh system of providing security to a batch of data available in a peer-to-peer network (Shahnaz, Qamar & Khalid 2019). The architecture of blockchain eliminates third-party intervention or centralised control of data.

Several researchers have recommended the use of blockchain technology for the storage of medical records (Boonstra, Versluis & Vos 2014; Gordon & Catalini 2018; Gunter & Terry 2005; Shahnaz, Qamar & Khalid 2019). Blockchain technology offers several benefits, including security, anonymity, data transparency, integrity and a tamperproof platform for storing medical records (Shahnaz, Qamar & Khalid 2019). Overall, the blockchain technology-based system is efficient and secure in storing medical records with decentralised storage of medical metadata (Haddad, Habaebi, Suliman, Elsheikh, Islam & Zabidi 2023). As with any other technology, blockchain technology is associated with several challenges. The major challenges are scalability and storage capacity, threats of malicious attacks, lack of social skills, and lack of universally defined standards for using the technology (Kuo, Kim & Ohno-Machado 2017; Shahnaz, Qamar & Khalid 2019; Zhang, White, Schmidt, Lenz & Rosenbloom 2018). It is assumed that these challenges may negatively affect the speedy adoption of blockchain technology in the healthcare system (Shahnaz, Qamar & Khalid 2019).

In some European countries, such as Estonia, hospitals are connected to a database for digitised documents called the X-Road network (Mosweu 2023). The infrastructure has enabled the creation of a nationwide system called the Estonian National Health Information System to replace the paper-based system. The system is based on blockchain technology with a decentralised file system on a peer-to-peer network. The system has enabled simultaneous access to the system and enhanced the privacy and security of medical records encrypted by cryptographic hash functions (Mosweu 2023). As a result, the system has made Estonian society free of paper-based documents, which helps save 2% of GDP annually (Mosweu 2023). Despite this positive development, Verma (2022) argued that the majority of European countries have not adopted blockchain technology for storing medical records.

China has invested a lot in ICT systems for preserving medical records with the use of mobile systems, cloud computing and blockchain technology (China Academy of Information and Communications Technology 2020). By the first half of 2020, China had 1,309 companies providing blockchain services and more than 80 blockchain research institutions (Cai, Sun, Zheng, Xiao & Qiu 2021; China Academy of Information and Communications Technology 2020). In Malaysia, a generic Patient-Centred Blockchain-Based EHR Management System has been

adopted for preserving medical records (Haddad *et al* 2023). Advanced research on blockchain technology is being conducted at the IoT and Wireless Communication Protocols Laboratory at the ECE department at International Islamic University Malaysia (IIUM).

The term artificial intelligence (AI) was first coined by John McCarthy in 1956. AI refers to the capability of computers to perform tasks similar to those performed by humans (Khalid, Qayyum, Bilal, Al-Fuqaha & Qadir 2023). Unlike cloud computing and blockchain, artificial intelligence is a collection of technologies that offer seamless services to users. AI mimics human thinking through computer programs. To fully function and achieve optimum results, AI relies on a lot of data besides computational capability. Due to its potential, AI is widely used in business and society and is being adopted in healthcare. Milana and Ashta (2021) further argued that every industry will benefit from AI. This is partly due to the huge amount of data being created in health, which surpasses the human's capacity to process and use (Khalid *et al* 2023). Artificial intelligence has the potential to transform the entire healthcare system and improve service delivery (Davenport & Kalakota 2019). Some of the common AI technologies in health are machine learning, natural language processing, rule-based expert systems, physical robots and robotic process automation (Davenport & Kalakota 2019).

The use of AI has several opportunities, such as the ability to process large amounts of data to support complex decisions within the shortest time (Khalid *et al* 2023). This is practically impossible for human beings to achieve such huge and complex tasks. The use of AI can address critical global health challenges. For example, AlphaFold, an AI-powered protein structure prediction algorithm, solved the problem of protein folding, which has hampered the growth of biology and medicine for the past 50 years (Jumper, Evans, Pritzel, Green, Figurnov, Ronneberger, Tunyasuvunakool, Bates, Židek, Potapenko & Bridgland 2021). In preservation, AI could transform the mechanism for storing and retrieving medical records, thereby improving access to patients' data and information.

The major risks with the use of AI in the preservation of medical records are concerns about data privacy and confidentiality (Hall & McGraw 2014; Qayyum, Qadir, Bilal & Al-Fuqaha 2020). Medical records contain sensitive and confidential data and information about patients. As such, there are strict legislation that regulate access and use of patients' data and information. Some of the legislation are the General Data Protection Regulation in the European Union, the Data Protection Act in the UK and the Health Insurance Portability and Accountability Act (HIPAA) in the USA (Coventry & Branley 2018; Rose, Kumar & Kass 2023; Hoofnagle, Van Der Sloot & Borgesius 2019). Therefore, the unwarranted use of health data and information in AI could result in a serious breach of patients' rights, privacy and confidentiality and could result in lawsuits (Khalid *et al* 2023). The use of AI in the preservation of medical records also has consequences for ethics. There is an urgent call to adopt AI that respects the privacy and confidentiality of patients' data, including medical records (Kaissis, Makowski, Rückert & Braren 2020). Therefore, AI ethics advocates for algorithms that are fair, unbiased and transparent (Khalid *et al* 2023). This entails that there should be a mechanism to check the algorithm's underlying decision-making logic (Khalid *et al* 2023).

In Africa, the status of penetration of digital technologies for preserving medical records is relatively low. The majority of healthcare institutions in Africa are stuck with legacy systems

inherited from colonial regimes (Marutha & Ngoepe 2018; Marutha 2019). As such, most healthcare facilities in Africa rely on physical medical records stored in shelves, cabinets, boxes and registries (Gisemba, Ng'eno & Bosire 2022; Luthuli & Kalusopa 2020). Electronic records are managed using outdated media such as microfilm, cassettes, and compact disks (Marutha & Ngulube 2012). The use of cloud computing offers many opportunities for cloud storage of medical records in public healthcare facilities in developing countries in the midst of dwindling health budgetary allocation, obsolete ICT infrastructure, lack of trained ICT personnel, and ineffective disaster recovery procedures (Marutha 2021; Masuku & Ngulube 2020).

Until recently, some countries like South Africa, Zambia, Botswana, Tanzania and Malawi have adopted health information systems such as DHIS, HMIS, EMR System, LDI System, and MSI System (Ministry of Health 2018; Tough & Lihoma 2018). Despite the adoption of systems for preserving medical records, countries such as Nigeria, Zambia, Botswana, Tanzania and Malawi face the challenge of inadequate supply of computers and other ICT devices for record preservation, outdated or non-existent hardware and software and network connectivity (Asunmo & Yaya 2016; Yaya, Asunmo, Abolarinwa & Onyenekwe 2015).

However, several initiatives have been implemented to address the issues of digital preservation in Africa. One of the significant initiatives was a three-day regional consultation meeting in 2002 in Addis Ababa, Ethiopia, organised by the United Nations (Adu & Ngulube 2017). The 40 participants comprising Ministries, National Commissions for the United Nations Educational, Scientific and Cultural Organization (UNESCO), national libraries and archives, museums, communities, Universities, producers, preservers and users of digital heritage materials for the meeting were drawn from 25 countries (UNESCO 2002). The meeting aimed to discuss digital preservation challenges in Africa due to the large volume of information being created in digital form (UNESCO, 2002). However, it has been argued that the proposed policies and techniques from the meeting to improve digital preservation issues in Africa have not yielded any results (Adu & Ngulube 2017).

3.4.5 Ethical considerations

Medical records are beneficial as they support the delivery of care to patients. However, recent developments in technology have compromised the security and privacy of patients' information. As such, several ethical challenges have emerged due to the rise of different technologies in healthcare (Afzal & Arshad 2021; Varkey 2021; Miesperä, Ahonen, Reponen 2013). The major ethical issues are autonomy, beneficence/non-maleficence, privacy and confidentiality, justice and fidelity.

Autonomy is the ability to make an independent, informed decision. As such, the patient has the privilege to approve access to their records (Afzal & Arshad 2021). Health personnel, on the other hand, have to lawfully reveal patients' data, guarantee agreement, and permit patients to make choices about their data (Layman 2020). Consequently, autonomy is adhered to through informed consent, which enforces honesty and privacy (Porsdam Mann, Savulescu & Sahakian 2016; Varkey 2021; Miesperä, Ahonen & Reponen 2013). However, innovation in healthcare, such as e-health, brings a compromise to the autonomy of patients. It is extremely difficult for patients in resource-limited settings to maintain their autonomy and grant access to their records in electronic format. Patients may need access to the technologies to approve access to their records and maintain their right to independence (Pinto 2018). Several ethical challenges emerge with access to patients' records

without authorisation. This includes a breach of patients' privacy by uncovering their socioeconomic and various health factors (Salerno, Knoppers, Lee, Hlaing & Goodman 2017). Buttigieg, Rathert, D'Aunno and Savage (2015) further argue that health professionals must abide by healthcare principles such as autonomy concerning disclosure, consent and the willingness of the patient. The use of technology for handling electronic data requires consideration of patients' rights in terms of independence, freedom, and decision-making (Barina 2015).

The other important twin principles in ethics are beneficence/non-maleficence. Beneficence highlights the importance of doing good and promoting the patient's best interests (Afzal & Arshad 2021). Conversely, non-maleficence covers the idea of not harming patients either intentionally or carelessly (Varkey 2021). Porsdam *et al* (2016) further argue that the concept of benefiting patients with minimal cost and restricted resources is the essence of generosity. Healthcare personnel are encouraged to use e-health in a more cautious and preventive manner to minimise harm to patients (Afzal & Arshad 2021). The use of the technologies should be in the best interest and assistance of the patient's health (Pinto 2018).

The use of electronic medical records must be preceded by adherence to the privacy and confidentiality of patient data. Electronic medical records improve the retrieval and exchange of information, but they also pose a threat of unauthorised access, disclosure of confidential information and security breaches (Sulmasy, López & Horwitch 2017). This implies that healthcare facilities must implement strict privacy policies to protect patients' data contained in medical records. With a large number of patients patronising healthcare facilities, instances of breach of security and privacy are high (Afzal & Arshad 2021). Other activities, such as research by healthcare professionals and other allied personnel, also cause serious breaches of the confidentiality of patients' data (Jacquemard, Doherty & Fitzsimons 2020).

The use of mobile devices is also on the rise for sharing medical data among healthcare personnel. However, the mobile device lacks stringent security measures to uphold the privacy and confidentiality of patients' data (Ruotsalainen & Blobel 2020). The lack of privacy protection and mobile applications for sharing personal information is causing a lot of damage and needs the enforcement of privacy protection policies for user data (Ruotsalainen & Blobel 2020; Tangari, Ikram, Ijaz, Kaafar & Berkovsky 2021). An online survey by Daniel, Jabak, Sasso, Chamoun and Tamim (2018) between April and June 2016 among 834 physicians at the American University of Beirut Medical Centre in Lebanon revealed that the majority of the doctors found Web-based apps and social media for sharing patients' data a breach of privacy and confidentiality. Adherence to privacy and confidentiality supports access and sharing of health data. A study in Japan that sampled 1200 participants between ages 15-79 showed that participants using the internet to retrieve health-related information were more confident and satisfied because they were assured of their privacy and confidentiality (Daniel *et al* 2018). As such, people are willing to share information if the respective authorities maintain their data's privacy, autonomy, and confidentiality (Hilty, Snowdy, Shoemaker, Gutierrez & Carli 2016; Porsdam *et al* 2016).

Justice is another important ethical principle in healthcare. The ethical principle of justice promotes equal access to services and information sources resulting from differences in ethnicity, age, or gender (Layman 2020). It is anticipated that the establishment of e-health locally and internationally would improve equity and fairness in the provision of care to patients (Qureshi,

Qureshi, Khan, Nawaz & Shah 2014). However, this is not the case as the provision of care to patients is characterised by biases (Pinto 2018). This challenge is worsened by the unequal distribution of resources, which impacts access to equipment, internet and knowledge (Pinto 2018). Hilty *et al* (2016) further argue that every person has a right to an equal chance to use the same facilities available at the healthcare centre. This is the core of the ethical principle of justice, which promotes the provision of care to patients at an individual level. This is possible through the provision of equal resources to all individuals (Afzal & Arshad 2021). Porsdam *et al* (2016) argued that the use of electronic medical records according to the principles of autonomy, beneficence and justice may improve the quality of life and distribution of healthcare services.

It is also significant that healthcare professionals possess the right character in discharging their duties. This involves keeping a promise and loyalty and being true to one's words (Afzal & Arshad 2021). According to Layman (2020), a breach of fidelity may occur when the electronic data of patients is exposed by the doctor unintentionally or intentionally as part of stealing. Considering the significance of patients' privacy and confidentiality, justice, patience, fidelity, and honesty are crucial professional and ethical obligations for healthcare professionals (Chaet, Clearfield, Sabin & Skimming 2017; Salerno *et al* 2017). Highlighting the significance of fidelity, Buttigieg (2015) noted that health professionals need to embrace loyalty and trustworthiness when dealing with medical records.

3.4.6 Challenges in preservation

The literature has unveiled several challenges to the preservation of medical records. For paper or analogue records, the following challenges exist, such as temperature and relative humidity, abuse and mishandling, acidity, light, pollution, fire and water, and biological agents (Cook 2017; Upward *et al* 2019; Alayeh 2019). These challenges also reflect the current situation in the healthcare system in developing countries in Africa (Marutha 2021). There are serious consequences that arise due to failure to properly preserve medical records. If records are not well preserved, access to information is difficult for healthcare practitioners in their quest to provide vital services to patients (Marutha & Ngoepe 2018; Marutha 2018). For digital records, the major challenges are technological obsolescence, security and privacy concerns, knowledge and skills, lack of effective policies, and funding towards preservation practices in healthcare settings (Upward *et al* 2019).

One of the major challenges with the preservation of medical records is technological obsolescence. This is partly due to the rapid developments in ICT, which result in media volatility, mutability and fragility of digital records (Shannon-Baker 2015). The frequent changes in hardware and software have implications for the long-term preservation of digital records. Consequently, medical records may become inaccessible if not migrated to newer media (Adu & Ngulube 2017). This process of frequently changing the storage media and mechanisms for reading becomes costly to healthcare facilities over a while (Shannon-Baker 2015). For example, floppy disks of the 1990s and the early part of 2000 are not in use because computers no longer have disk drives for reading them. This technology has been replaced with modern media such as DVDs, CDs and Flash drives. Equally, low-quality CDs may become obsolete with continuous use over a period, and the technology needed to repair them is expensive. In addition, the file formats in the older media, such as Floppy disks and CDs, may not be supported by the newer software (Asogwa 2012). The threat of technological obsolescence is further exacerbated by the harsh environmental conditions in sub-Saharan Africa, which are not conducive to electronic machines (Asogwa 2012).

Other challenges in the preservation of medical records were a lack of computers, printers and networking equipment for implementing electronic medical records systems (Katurura & Cilliers 2016; Luna, Almerares, Mayan, de Quirós & Otero 2014; Thompson, Castle, Lubeck & Makarfi 2010), a lack of internet connectivity and intermittent power supply for running the systems (Akanbi, Ocheke, Agaba, Daniyam, Agaba, Okeke & Ukoli 2017; Cline & Luiz 2013; Juma, Nahason, Apollo, Gregory & Patrick 2012; Katurura & Cilliers 2016). Some of the contributing factors to the challenges are a lack of adequate funding, a lack of long-term financial commitment to fund the maintenance of the systems after implementation, and poor management of donor funding for the implementation of electronic medical records systems (Luna *et al* 2014; Mostert-Phipps, Pottas & Korpela 2013; Sikhondze & Erasmus 2016).

Preservation of medical records is affected by security and privacy issues due to the nature of the information contained in them and their susceptibility to alteration (Bantin 2008). Unlawful alteration to records compromises the nature of records such as authenticity, reliability, integrity and authentication at the expense of information accessibility (ISO 2015). In addition, systems containing medical records are susceptible to threats if security measures are not put in place (Asogwa 2012). The security threats originate from different sources such as computer-assisted fraud, sabotage, vandalism, theft and fire. One way of addressing the threats to records includes implementing policies, procedures and technical measures. These measures prevent unauthorised access, alteration, theft, or physical damage to information (Ngoepe, Mokena & Ngulube 2010). Furthermore, the overdependence on information systems has proved to pose a major security and privacy concern to medical information. Medical information is regarded as the most private and confidential information and is accessible upon the request of a medical officer (Adu & Ngulube 2017). Unauthorised access to medical information may breach the privacy of patients. Some laws enacted by countries have worsened the challenge of security and privacy. For example, the State of California in the USA enacted a law that protects the privacy of patients called the California Law (Scassa 2018). This law requires the disclosure of patient information to an individual in the event of unauthorised acquisition of computerised data that compromises the security, integrity or confidentiality of an individual's information (Scassa 2018). In Ghana, the government is pushing for the passage of the Postal Packets and Telecommunication Messages Bill (Adu & Ngulube 2017). The bill would allow security agencies to listen, tap, copy, record and intercept telecommunication messages of individuals who pose a threat to national security. The privacy of individuals can no longer be guaranteed with the existing pieces of legislation.

Another challenge with the preservation of medical records is the lack of knowledge and skills among healthcare practitioners. Kalusopa, Bwalya, Kwanya, Britz, Ngoepe, Ocholla, Onyancha, Too & Shongwe (2021), Mosweu (2023) and Porogo (2022) have argued that a lack of skills and competencies in digital preservation is a major challenge among archives and records management professionals in most African countries, such as Botswana, Tanzania, Zimbabwe, and South Africa. This challenge is pronounced in developing countries in Africa compared to the developed world (Adu & Ngulube 2017). Adu and Ngulube (2017) further argued that information professionals in Africa fare poorer than their European counterparts in the acquisition of technical skills required for digital preservation. Although the concept of digital preservation is gaining momentum in European and Asia countries, a lack of knowledge and skills in the area has been widespread in healthcare facilities (Akanbi *et al* 2017; Juma *et al* 2012). The International Records Management Trust similarly revealed a lack of knowledge, skills and abilities of information

professionals in the management of digital records (Chikomba, Rodrigues & Ngoepe 2021). The skills gap portends danger to the digital world (Kay Rinehart, Prud'homme & Huot 2014). With the study of digital preservation methods becoming an integral part of information science education (Higgins 2008), the acquisition of skills in technical (systems), metadata (categorical) and collection specialists are needed to empower digital preservationists in the healthcare sector (Corrado & Moulaiso 2014:56). Mosweu (2023) buttresses the idea that skills and competencies in digital preservation are critical for preserving digital records and in keeping them accessible and usable over time. Improving the skills and competencies in digital preservation can be achieved through formal education and continuous professional development courses (Adu & Ngulube 2017; Mosweu 2023).

Besides knowledge and skills, the lack of standards in digital preservation is another challenge in Africa (Osedo 2013). Firstly, standards help in providing a framework for benchmarking digital preservation initiatives (Chikomba, Rodrigues & Ngoepe 2021). Secondly, the use of standards helps in organisational compliance and interoperability between diverse systems nationally and internationally (Digital Coalition Preservation, 2023). Specific standards such as e-Governance Standard for Preservation Information Documentation (eGOV-PID) and MoReq2: Model Requirements Specification for the Management of Electronic Records and ISO 16175-2: Guidelines and functional requirements for records in electronic office environments are useful in guiding preservation activities (Chikomba, Rodrigues & Ngoepe 2021; Digital Coalition Preservation 2023). Thirdly, healthcare facilities in Africa are facing the challenge of unsustainable funding for digital preservation. Lack of funding towards digital preservation is apparent in the wider Sub-Saharan African region (Adjin-Tetey 2016; Rakemane & Mosweu 2021; World Intellectual Property Organisation 2018). Digital preservation requires hardware and software for implementing preservation strategies such as copying of data (refreshing), and construction and maintenance of data (emulation) (Adu & Ngulube 2017). The ICT infrastructure required for digital preservation is expensive (Mosweu & Bwalya 2024). Often, healthcare facilities face competing budgeting allocations with other sectors by the government (Mosweu & Bwalya 2024). Consequently, healthcare facilities lack adequate and sustainable financial resources for implementing digital preservation activities, including purchasing ICT infrastructure. Despite the budgetary constraints, Keakopa (2016) posits that records preservation efforts need to be budgeted for and cost within the national budget. However, healthcare facilities in Africa must exploit other avenues for funding, such as donors and private organisations, as government funding has proved to be unsustainable.

Enacting responsive policies and procedures is one of the ways to address the challenges in the preservation of medical records in Africa. It has been revealed that healthcare facilities in Sub-Saharan Africa pay less attention to implementing digital preservation policies despite the huge volume of digital records (Adu & Ngulube 2017; Asogwa 2012). Asogwa (2012) underscored the irrelevance of the existing legislation on preservation in Sub-Saharan Africa in the technological era, as archival laws cover only paper records instead of digital records or both. For instance, the archival laws covering the management of records at the Public Records and Archival Administration Department Act 535 of 1997 in Ghana make room for only paper records as against the phenomenal growth of digital records in public sector organisations (Asogwa, 2012). In some instances, the policies lack coordination and harmony. In South Africa, the National ICT Strategy conflicts with the National e-Health Strategy in terms of the objectives and goals of the strategy

(Katurura & Cilliers 2018; Mugo & Nzuki 2014). The lack of legislation and regulations has the potential to promote misuse and poor compliance with standards (Ojo & Popoola 2015). Furthermore, A study by Gisemba, Ng'eno and Bosire (2022) in Kenya revealed the absence of a comprehensive internal policy framework to anchor medical records management and preservation activities in different sections of the hospital. The study further revealed that staff were not aware of a written medical records management policy, and the policy had not been adopted by the top management. Consequently, procedures for titling, indexing, classifying, and describing medical records were lacking at the hospital.

3.4.7 Future trends and directions

The impact of the growth in artificial intelligence (AI) is being felt in every sector of the economy, such as in business and health. Milana and Ashta (2021) argue that every industry will benefit from AI. As such, healthcare facilities are adopting AI to support their activities. The potential for the growth of AI in health is partly due to the huge amount of data being created, which surpasses humans' capacity to process and use (Khalid *et al* 2023). Therefore, AI has the potential to transform the entire healthcare system and improve service delivery (Davenport & Kalakota 2019). This is demonstrated by the growth in AI technologies in health, such as machine learning, natural language processing, rule-based expert systems, physical robots and robotic process automation (Davenport & Kalakota 2019). Despite several benefits of the use of AI in the preservation of medical records, potential future challenges exist, such as concerns about data privacy and confidentiality (Hall & McGraw 2014; Qayyum *et al* 2020). Medical records contain sensitive and confidential data and information about patients. To address this challenge, the current legal and regulatory frameworks such as the General Data Protection Regulation in the European Union, the Data Protection Act in the UK and the HIPA Act in the USA may need to evolve to address privacy and confidentiality issues (Coventry & Branley 2018; Hoofnagle, Van Der Sloot & Borgesius 2019; Rose, Kumar & Kass 2023). Healthcare facilities may need to adopt AI ethics that address issues of privacy and confidentiality of patients' data, including medical records (Kaissis *et al* 2020). In future, mechanisms will need to be developed to check the algorithm's underlying decision-making logic (Khalid *et al* 2023).

The use of blockchain technology for the storage of medical records is gaining momentum in some countries in Asia, such as China and Singapore (Boonstra, Versluis & Vos 2014; Gordon & Catalini 2018; Gunter & Terry 2005; Shahnaz, Qamar & Khalid 2019). Blockchain technology offers several benefits, including security, anonymity, data transparency, integrity and a tamperproof platform for storing medical records (Shahnaz, Qamar & Khalid 2019). As with any other technology, blockchain technology is associated with potential future risks such as scalability and storage capacity, threats of malicious attacks, lack of social skills, and lack of universally defined standards for using the technology (Kuo 2017; Shahnaz, Qamar & Khalid 2019; Zhang *et al* 2018). Therefore, medical records staff may need to adapt and acquire new knowledge and skills in using blockchain technology (Shahnaz, Qamar & Khalid 2019). In addition, healthcare may need to modernise its ICT infrastructure to accommodate new requirements for blockchain technology. The existing standards may need to be revised to address blockchain-related issues (Kuo *et al* 2017; Zhang *et al* 2018). This may be challenging for healthcare facilities in developing countries facing challenges of inadequate finances, lack of ICT skills and outdated ICT infrastructure. It is assumed that these challenges may negatively affect the speedy adoption of blockchain technology in the healthcare system in developing countries (Shahnaz, Qamar & Khalid 2019).

Cloud computing is being adopted in every sector, including health. Some of the health facilities in developing countries have resorted to using the technology to preserve medical records. The common cloud service providers are Google, Microsoft and Amazon with services such as Office 365, OneDrive, Google Docs, and Google Drive (Franks, 2018). The use of cloud computing for the preservation of medical records is expected to increase in future due to its potential. The services can be accessed from any device and at any time (Sunyaev & Sunyaev 2020). Cloud computing offers lower IT costs of purchasing and operating IT infrastructure at an institutional level, broad network accessibility, resource pooling, reliability and scalability (Franks 2018; Jamsa 2022; Rashid & Chaturvedi 2019). However, future challenges exist, such as a lack of data security and privacy, cost management, performance challenges, interoperability, high demand on the network, and a lack of knowledge and expertise in the use of the service (Franks 2018; Sunyaev & Sunyaev 2020). Franks (2018) further argued that organisations should be clear enough on the storage and disaster preparedness services offered by cloud service providers.

The recent advancements in technology have resulted in an exponential increase in data. Approximately, the global demand for data storage is expected to grow to 1.75×10^{14} GB by 2025 (Carmean, Ceze, Seelig, Stewart, Strauss & Willsey 2018). As such, the demand for long-term storage devices is also increasing (Gu, Li & Cao 2014). Therefore, innovative methods are required for long-term preservation of data with reduced labour and storage costs, energy consumption and insufficient data density (Hilbert & López 2011). Deoxyribonucleic acid (DNA) storage is one of the innovative solutions that offer long-term preservation of data at a reduced cost (Doricchi 2022). Storage of data through DNA technology involves translating data directly into the nucleotide sequence using chemical DNA synthesis (Caruthers 2011; Doricchi *et al* 2022).

Six steps are involved in sequence-based DNA data storage: (1) encoding digital information, (2) data writing (synthesis of new oligonucleotides), (3) storing the DNA in physical or biological conditions, (4) random access, (5) data readout via DNA sequencing, and (6) decoding the DNA sequences back into the original digital code (Ceze, Nivala & Strauss 2019; Hao, Li, Fan & Wang 2021; Meiser, Nguyen, Chen, Nivala, Strauss, Ceze & Grass 2022; Meiser, Antkowiak, Koch, Chen, Kohll, Stark, Heckel & Grass 2020). Due to developments in technology, different technologies have emerged in DNA data storage. The common ones are polymerase chain reaction (PCR) for DNA amplification (Kubista, Andrade, Bengtsson, Forootan, Jonák, Lind, Sindelka, Sjöback, Sjögreen, Strömbom & Ståhlberg 2006), chemical and enzymatic DNA syntheses (Lee *et al* 2019; Lee *et al* 2020) and DNA sequencing (Shendure, Balasubramanian, Church, Gilbert, Rogers, Schloss & Waterston 2017). Initially, these DNA technologies were developed for other purposes, but have capabilities for storing data.

Some of the risks in the use of DNA data storage are data readout, sequencing and the high cost of the technology. DNA sequencing must be employed for data readout for information stored in individual oligonucleotides. Sequencing often requires expensive fluorophores, optical equipment, trained personnel and long reading times (Doricchi *et al* 2022). This problem can be addressed by using other technologies such as Nanopore methods (Doricchi *et al* 2022). The use of DNA storage is estimated to cost 800 million USD per terabyte of data, while tape storage costs are approximately 15 USD per terabyte (Ceze, Nivala & Strauss 2019). The high cost of using DNA storage may prohibit healthcare facilities in developing countries from adopting the technology. Future potential use of DNA storage may rely on the programmable three-dimensional structure

of DNA compared to its primary sequence. Based on this approach, information may be stored in 3-dimensional structures rather than in the DNA sequence and reading using imaging techniques such as super-resolution imaging or single-molecule nanopore measurements (Chen, Zhu, Boskovic & Keyser 2020; Dickinson, Mortuza, Clay, Piantanida, Green, Watson, Hayden, Andersen, Kuang, Graugnard & Zadegan 2021). The structure-based methods may reduce the amount of reading time for erasing and rewriting data (Chen *et al* 2020). In addition, the technology may eliminate the high cost of using expensive fluorophores, optical equipment, and trained personnel (Chen, Jarrell, Carpenter, Cohen & Huang 2019; Dickinson *et al* 2021). The next section discusses the strategies for preserving medical records in public healthcare facilities.

3.5 Preservation strategies

One of the critical components in the preservation of medical records is the implementation of good preservation strategies. Implementation of good preservation strategies can improve access, security and timely disposal of records (Marutha 2021; Masuku & Ngulube 2020). However, poor preservation strategies can cripple a health facility, halting efficiency, sucking up precious time, and causing unnecessary stress for employees (Anyira 2020). Several terminologies exist in the literature for the methods or activities for preserving medical records. This shows a lack of a universally acceptable definition for preservation methods or activities. For example, Anyira (2020) used the terms preservation activities and preservation strategies interchangeably, Alayeh (2019) used the concept of preservation methods rather than preservation strategies, and Higgins (2008), in his DCC Curation Lifecycle Model, coined preservation actions, which are synonymous with preservation strategies. However, the majority of studies on preservation (Magama 2018; Marutha 2021; Masuku & Ngulube 2020; Millar 2017) have unanimously used the concept of preservation strategies as an umbrella term to refer to all activities undertaken to ensure long-term preservation and retention of the authoritative nature of data to ensure data remains authentic, reliable and usable while maintaining its integrity. Equally, Millar (2017:146) defined preservation as the total sum of processes and tasks performed to protect records and archives (in any form) against damage or deterioration. These tasks apply both to physical or analogue records and digital or electronic records. This study adopted the term preservation strategies to refer to all activities, methods, and approaches that are implemented to preserve medical records and prolong their lifespan for future reference.

Several examples of preservation strategies have been suggested in the literature. Smith and Rowley (2012) proposed safety and secure storage, damage repair and humidification with a focus on physical records, while Magama (2018) outlined several preservation strategies such as migration, refreshing, emulation, byte replication, conversion, application programming interfaces (APIs), backup, cloud computing, and preservation metadata with focus on digital or electronic records. Besides, other authors such as Adetunji (2021), Gisemba, Ng'eno and Bosire (2022), Marutha (2021), Masuku and Ngulube (2020) and Shahrul Asari, Hussin and Samsudin (2017) have also suggested the following as the types of preservation strategies: file formats such as PDF, SQL, and TIFF; fire extinguishers; smoke detectors and fire detectors; refreshing.

Several considerations need to be made when implementing preservation strategies. Hoke (2012) further argued that four major issues need to be considered when implementing digital preservation strategies, such as storage media, hardware, software, and governance. Health facilities need to make decisions on the types of storage media to use for their records, depending on the types of records, and human and financial resources available (Hoke 2012). Storage media such as servers

and computers need significant investments in financial resources and technical expertise to maintain, compared to the use of CDs and Floppy Disks (Hoke 2012). The type of storage medium to be used for preserving records requires a modest investment in hardware and software. CDs, DVDs, and Hard drives require computer hardware and software to maintain records. Lastly, preservation strategies also need commitment from the management of health facilities concerning financial and human resources (Hoke 2012). As such, health facilities should properly plan and budget for investment in financial and human resources to properly implement preservation strategies. Types of preservation strategies commonly used for preserving physical and electronic records will be discussed in the next section.

3.5.1 Migration

The history of digital storage is marred by outdated technologies designed to preserve digital records and information using devices such as drives, cartridges, and tapes (Louisiana State Archives 2020). To counter the challenges of obsolete technologies, digital records have to be moved to newer systems and storage devices such as hard drives, flash disks, servers, and cloud computing (Louisiana State Archives 2020). This change in technologies has called for the transfer of data or systems from one device to the other in the process called migration. Migration is the transfer of records from an old system to a newly adopted system for recordkeeping (Lowry & Nduna 2015; Magama 2018). Louisiana State Archives (2020:1) focuses on data (records) migration as the process of moving data(records) from one information system or storage device to another. Franks (2018) and The National Archives (2017) categorise migration into two, namely data migration and system migration. Data migration, according to Franks (2018:159-160), is the movement or transfer of data from one storage device to the next, while system migration is upgrading or replacing the old systems to achieve maximum security of data, increased productivity and decreased costs. Franks (2018) outlines several issues that need to be addressed when moving data from one device or system to the next, as follows:

1. Data identification – identify all data that will be transferred from one device to the next, including gaps.
2. Unique identifiers – symbols used to identify consolidated data need to be isolated to avoid conflicts in data identification and use.
3. Data quality assessment – data is examined and value assessed. This process involves removing duplicates and valueless data for disposal.
4. Metadata identification – identify useful metadata from non-useful metadata and document the entire process.
5. Explicit metadata fields – metadata that is used to identify documents must be maintained to enhance the retrieval of records (Franks 2018).

Equally, Franks (2018) identifies the following system migration issues:

1. Metadata mapping – metadata about the types of objects, description of the object, and roles of users assigned to the digital objects, such as access, view, and download, must be mapped to the current system.
2. Records management metadata – metadata such as disposal, automation, and aggregation of documents into files must be maintained.
3. Consider the alternative – migration is time-consuming and costly. As such, the decision has to be made to use the new system and maintain the old system as a backup option.

4. Keep abreast of new systems and standards – new systems and standards may simply be the process of migration of data, such as MoReq 2010 (Franks 2018).

The process of moving data from one device to the next can be complex and time-consuming. Franks (2018:160) argues that a cost-benefit analysis should be done to determine the value of the entire migration process. To be successful, The National Archives (2017) argues that the process of data and system migration should follow a project management approach with a series of steps for implementation. Franks (2018) identifies three major steps for performing migration: pre-migration testing, post-migration testing, and creating records of the migration. A similar process is highlighted by the Louisiana State Archives (2020) with the planning, processing and testing phase. Pre-migration or planning phase involves evaluating the quality of data for migration, disposing of substandard data, preserving relationships in the data through metadata, identifying hardware, software and format requirements of the records requiring migration, and lastly, identifying and preserving any metadata essential to the records' integrity and authenticity (Franks 2018; Louisiana State Archives 2020). The processing phase involves implementing the activities at the planning or pre-migration phase. Lastly, post-migration testing and creating records of the migration expounded by Franks (2018) are spanned into a single testing phase proposed by the Louisiana State Archives (2020). This process involves testing to ensure that all records migrated to the new system or device have been properly done, including essential functionality and characteristics have been captured (Franks 2018; Louisiana State Archives 2020). According to the Louisiana State Archives (2020), documentation is also key at this stage, as it helps to correct any data corruption issues and source records are maintained for a suitable period after migration for testing purposes.

However, the National Archives (2017) elaborate on the steps for conducting migration and adopts a four-step process: action plan, define your digital continuity requirements, assess and address risks to digital continuity, and lastly, maintain digital continuity. Project planning involves activities such as defining the objectives of the project, defining success criteria, identifying project governance, identifying resources, and identifying risks and issues (The National Archives 2017). Some of the activities in the project requirements include defining the information needed, considering whether migration is the best option, identifying what information to migrate, stating the functionality needed for the new EDRMS, agreeing on ownership of requirements and test criteria, and identifying risks and issues to the migration (The National Archives 2017). According to The National Archives (2017), some of the risks to digital content include assessing the export capabilities of the source system, assessing the import capabilities of the destination system, assessing the compatibility of the export and import systems, identifying data transformations, defining the migration process, defining the deletion process, and identifying risks and issues. The process of migration ends with testing the maintenance of digital continuity (The National Archives 2017). Digital continuity involves testing the migrated information, evaluating test results and assessing whether migration information meets requirements (The National Archives 2017).

In a contrasting scenario, public healthcare facilities in developing countries continue to face challenges in the migration of data or records and systems. A qualitative study by Adu and Ngulube (2017) that focused on threats and challenges to the preservation of digital records of public institutions in Ghana revealed that public institutions, including hospitals in Ghana, faced

challenges in preserving medical records due to a lack of migration of records. It was recommended that public institutions in Ghana, including hospitals, should implement migration procedures.

3.5.2 Backup

The business environment has been engulfed by so many risks and uncertainties. One of the risks and uncertainties is the occurrence of disasters. One of the strategies for protecting the data and records of institutions is to implement backup procedures (Upward *et al* 2019). Other strategies for protecting data and records include data archiving and insurance. According to Magama (2018), backup is the process of creating multiple copies and storing them in different locations, far apart from each other. Equally, Crockett (2017) also defines a backup as the process of periodically moving data from one type of medium to a secondary storage medium for potential retrieval at a later date (short-term, usually within a few days to a couple of months). Backup entails the creation of primary storage and secondary storage of data or records. There are several reasons for creating a backup of records. According to Hofman (2021), the backup of records saves time and money and increases the productivity of an organisation in the case of a disaster. Backup of records also helps the organisation to prepare for disaster, eliminate the threats of accidental deletion of records (Crockett 2017), mitigate the negative impact of software bugs and hardware failures on the organisation and ability to reproduce results of the past for the continuity of business of the organisation (Yeo 2021). Millar (2017) has also argued that backup systems support access to records and respond to data requests from clients. A backup system also limits the liability of the organisation from disruptions in business due to the occurrence of disasters.

Backup of records can be stored on various media according to the needs of the organisation and financial capacity. The media for backup can be categorised into two, namely traditional and modern media (Saffady 2021). According to Saffady (2021), traditional media for backup include floppy diskettes, tape drives, and removable cartridges. Floppy diskette drives are becoming less standard with most computers, and these drives have a low storage capacity and are slow (Franks, 2018). Besides Floppy diskettes, tape drives are an option for a high-capacity backup but are not common in modern desktop computers (Franks 2018). Tape drives require a third-party backup application or backup capabilities in the operating system (Touray 2021). Touray (2021) argues that tape media is relatively low-cost, although not commonly used in modern organisations. Another storage medium is removable cartridges, which are used as a backup solution as a portable or external device. Common brands of removable cartilage, such as Iomega Zip® and Jaz® storage drives, are more expensive than floppy diskettes (Franks 2018). Besides the high cost of purchasing the storage media, Franks (2018) posits that removable cartilage is fast, and its portability allows for flexibility. In terms of operation, removable cartilages operate through built-in special drivers and applications to facilitate the backup of data or records (Franks 2018).

Besides the traditional media, several modern storage media are used for the backup of records. Saffady (2021) outline five common modern media for the backup of records namely CD, DVD, flash disk, HDD, SSD, cloud storage, Deoxyribonucleic acid (DNA) storage (Hofman 2021); however, not all desktop computers are equipped with read-only memory (CD-ROM) drives or writable CD drives (Touray 2021). The advantages of CDs are low-cost storage media and a higher storage capacity compared to floppy diskettes (Brown 2017; Smallwood 2019). Similar to the technology of CDs is the DVD. DVD is an optical disc technology with a gigabyte storage capacity and can facilitate video, audio or other information storage (Smallwood 2019). Digital Versatile

Discs offer several advantages compared to CDs, such as higher capacity (Smallwood 2019); however, it is more expensive compared to CDs (Franks 2018). In addition, flash disks and hard drives offer alternative means of storing records. A flash drive is a storage device that includes flash memory and a USB interface (Touray 2021:36). Flash drives are portable and have varying storage capacities ranging from 8 to 256 gigabytes (GB) (Zhang & Zhang 2021).

The recent advancement in technology has further improved the storage of records with the development of HDDs and SSDs. HDDs rely on spinning magnetic disks to store and retrieve data. Access to data depends on the speed of rotation of the magnetic disks. Although HDDs are a proven and reliable technology, Hepisuthar (2021) argues that it has limitations such as breakdowns caused by shocks, vibrations, or just simple wear and tear due to continuous use. Lerner and Bonnet (2021) posit that the limitations of HDDs are one of the reasons behind the development of SSDs. According to Lerner and Bonnet (2021:45), SSDs are a type of non-volatile memory that does not require a continuous power supply to retain data or code. SSDs use flash memory chips, or flash storage invented by an engineer at Toshiba in 1984 (Hepisuthar 2021; Lerner & Bonnet 2021). SSDs offer speed of access to data (Lerner & Bonnet 2021), with better throughput in performance (Hepisuthar 2021).

Besides HDDs and SSDs, cloud storage offers another dimension to the storage of data and records. Cloud storage is an off-site storage system whose service provider is responsible for hosting, securing, and maintaining the concerned servers (Prajapati & Shah 2022). Cloud storage is one of the services of cloud computing technology offered by service providers such as Google, Microsoft, and Amazon (Rashid & Chaturvedi 2019). Franks (2018) and Rashid and Chaturvedi (2019) posit that cloud storage offers secure storage, accessibility of data and programs, and IT costs of purchasing and operating IT infrastructure at an institutional level. DNA provides an attractive alternative for data storage due to its high physical density, reproducibility, and excellent durability, which have been tested by nature (Hao *et al* 2021). Data is stored by encoding with nucleic acid sequences, creating different forms of data storage strategies using DNA nanostructures (Sun, He, Luo & Coy 2019).

Despite significant investments in technologies, developing countries such as Australia also lack file-back procedures for medical records. A literature review study by Smith and Macdonald (2006) on managing health information during disasters in Australian hospitals revealed that hospitals faced challenges in implementing backup procedures. It was recommended that hospitals need to embrace backup of computer files to enhance access and use over a long period.

Similar findings in West African countries have also reported several challenges of a lack of backup procedures for medical records. For example, a quantitative study by Anyira (2020) on the preservation of medical information in healthcare facilities in Delta State, Nigeria, revealed that health facilities do not have backup records in the event of disaster, damage, or loss. It was further noted that the non-existence of backup medical records puts healthcare facilities and patients at great risk in the case of an eventuality. The reasons for the lack of backup procedures were that backup was not a priority by healthcare facilities, the casual attitude of staff towards preservation, poor funding of healthcare facilities, lack of records storage space, lack of modern records storage equipment, lack of skilled manpower, lack of records of preservation policy, lack of ICT deployment, insecurity and Erratic power supply (Anyira 2020). A similar study in West Africa

by Adu and Ngulube (2017) on threats and challenges to the preservation of digital records of public institutions in Ghana also revealed that public institutions, such as hospitals, lacked backup procedures for medical records. Similarly, a study by Mensah and Adams (2014) on the nexus between corporate governance and records management in private and public hospitals in Ghana revealed that the surveyed private and public hospitals in Ghana lacked metadata. The study recommended that public institutions in Ghana should improve the implementation of preservation strategies through the establishment of backup procedures.

In South Africa, the challenges of a lack of backup procedures for medical records have been reported by different studies, which impact access and use of medical records by healthcare personnel. Although South Africa is advanced in ICTs, the findings have revealed that public healthcare facilities in the country also face challenges in backing up medical records. A quantitative study by Marutha and Ngoepe (2018) on the medical records management framework in public healthcare services in the Limpopo province of South Africa revealed that the medical records management framework implemented in Limpopo healthcare institutions lacked functionality for backing up and tracking records. Consequently, medical records were at risk of loss due to theft or damage due to a lack of backup and tracking systems. Studies by Marutha (2021) and Marutha (2019) in South Africa also revealed that the surveyed hospitals experienced a lack of backup record systems, which worsened the problem of access and use of medical records by healthcare staff.

3.5.3 File formats

The recent development in ICTs poses a threat to the long-term preservation of records. To ensure access and long-term preservation of records, organisations need to adopt reliable file formats. However, there seems to be a challenge in the adoption and use of file formats for the long-term preservation of records (McLellan 2007; Pham *et al* 2019). Partly, the problem lies in the lack of a commonly accepted definition of file format. McLellan (2007) argued that the concept of file format is not completely settled. The author distinguishes between tagged textual formats, wrapper formats, and “true” file formats (McLellan 2007). For the sake of this discussion, three definitions for the concept have been drawn from different sources and presented below:

1. The file format is a class of digitally encoded assets defined by a set of semantic, syntactic and serialisation encoding rules for converting from abstract information to tangible byte streams (Abrams 2007:51);
2. The file format is a specific, pre-established structure for the organisation of a digital file or byte stream (PREMIS 2008:195);
3. File format is the organisation of data within files, usually designed to facilitate the storage, retrieval, processing, presentation, and/or transmission of the data by software (InterPARES2 n.d.).

The study adopted the third definition because of its relevance to the concept of preservation of medical records and research objectives. There are a lot of file formats in circulation, and the decision has to be made on the right file format for the requirements of the organisation (Drago 2019). To aid in decision-making, Drago (2019), the Library of Congress (2017) and Universitat Wien (2024) have proposed a simplified format selection criteria as follows:

1. Openness – available to the general public, which makes it possible to decode.

2. Portability – ease in the use of the format on different platforms, both hardware and software.
3. Quality and functionality – availability of the features that ensure quality and richness of data, including metadata.
4. Development support – this entails the availability of resources needed to maintain and develop the format.
5. Diffusion – measures the degree of diffusion of the format in the world. Diffusion has implications for the probability of support of the file format over time.
6. Transparency – refers to the degree to which the digital representation is open to direct analysis with basic tools. Transparency operates in standard encodings and not with encryption and compression.
7. Self-documentation – digital objects that are self-documenting are more suitable and less vulnerable in the long run than objects stored separately from the metadata needed to make them usable (Drago 2019).

As alluded to, different file formats exist for long-term preservation of records. The file formats have been categorised into recommended and not recommended for different types of records or files (Library of Congress 2017; Universitat Wien 2024). The records in document format, the recommended file formats are PDF (Portable Document Format) and DOC, PPT (PowerPoint Point Presentation), QXD (QuarkXPress Document), and INDD (InDesign Document) are not recommended. However, Drago (2019) and Han and Wan (2018) recommend the use of PDF/A ISO-standardised version of the PDF, for archiving and long-term preservation of electronic documents. According to Han and Wan (2018), a PDF/A file is a self-contained and self-described container which accommodates all the data from the digitisation of textual materials, including page-level metadata. For Video files, Universitat Wien (2024) recommends file formats such as AVI (Audio Video Interleave), MPEG-2 (Moving Pictures Expert Group 2), MKV (Matroska Video files) and MP4. Other formats such as WMV (Windows Media Video File), FLV (Flash Video File), MOV and 3GPP (Third Generation Partnership Project File) are not recommended (Library of Congress 2017, Franks 2018). Audio files recommended file formats are WAV (Waveform Audio File Format), FLAC (Free Lossless Audio Codec), MPS (Mathematic Programming System), and OGG, while WMA (Windows Media Audio), AAC (Advanced Audio Coding) are not recommended (Franks 2018). Lastly, picture files recommended file formats include TIFF (Tag Image File Format), JPG (Joint Photographic Experts Group) and PNG (Portable Network Graphic), while BMP (Bitmap Image File) and GIF (Graphics Interchange Format) are not recommended file formats (Pham *et al* 2019).

Despite tremendous advancements in ICTs, it has been revealed that some developed countries, such as Australia, cannot properly implement file formats for preserving medical records. A study by Smith and Macdonald (2006) on managing health information during disasters in Australian hospitals revealed that hospitals faced challenges in implementing file formats such as PDFs and pictures for preserving medical records despite the proliferation of electronic records in various formats. As such, hospitals need to embrace preservation strategies for health records, such as converting paper-based records to electronic ones and backing up computer files to enhance access and use over a long period.

In sharp contrast, some developing countries in Asia, such as Singapore and Kuwait, have demonstrated sophistication and advancement in the use of file formats for preserving medical records. A review paper by Edmund, Ramaiah and Gulla (2009) on electronic medical records management systems in developing countries with a case study of the Singapore National Eye Centre revealed the significant application of file formats such as PDF for plain text or XML documents, SQL for spreadsheets, SQL for databases, and TIFF for pictures for preserving medical records. The use of the file formats could be attributed to recent developments in ICT in the health system in the country, which has given rise to electronic records in various formats such as PDF, XML and pictures. Another study by Alnashmi *et al* (2022) on the health information management system of Kuwait revealed that hospitals use file formats such as PDF, XML, SQL, and TIFF for Word documents, spreadsheets, databases and pictures, besides filing strategies such as terminal digit filing system, serial numeric filing, and ID number.

3.5.4 Metadata

One of the most important features for ensuring long-term preservation of records is metadata. Metadata supports all the functions in the preservation of records, such as access, storage, retrieval and disposal. Miller (2022) argues that good-quality metadata is vital for providing intellectual access to the digital collection. Several definitions exist in the literature, and three will be outlined in this discussion. One of the earliest and most simplified definitions of metadata is “data about data” (Crocket 2017:20; Miller 2022:1). Crocket (2017:44) further defines metadata as descriptive information about records and archives. Metadata is a set of data that describes and provides information about other data (Millar, 2017:300). A similar definition is provided by Miller (2022), who considers metadata as data or information that is about other data or information resources, such as books, an audio file, a scientific data set, or a digital image. The term metadata is a combination of the Greek suffix meta and the Latin word data (Miller 2022). The Greek word meta means after, before, relating to, based on, an abstraction level than the current, that which is about something else (Miller 2022). On the other hand, data is bits of information processed by computers. The concept of metadata trended in 1995, closely following the World Wide Web and the Internet in 1994 (DCMI 2020). Metadata is very useful in the preservation of records. Firstly, metadata supports access to digital content with embedded descriptive information such as title, creator or author, date of publication, and subject matter (Crocket 2017; Miller 2022; Yeo 2021). Another function is that metadata supports safe disposal of disposal (Crocket 2017).

Broadly, the literature categorises metadata into three, namely descriptive metadata, administrative metadata and structural metadata (Allen 2020; Miller 2022; Riley 2017). Descriptive metadata provides intellectual access to the digital collection through elements such as title, author, date of publication, subject, publisher and description (Franks 2018). Similarly, Miller (2022) further argues that descriptive metadata serves two major functions, namely identification and retrieval. Descriptive metadata allows users to identify the content, context and meaning of digital objects, which supports the retrieval of the resources (Crocket 2017). Administrative metadata serves a different purpose than descriptive metadata. Allen (2020) argues that administrative metadata facilitates the management of data or records and describes elements such as permissions, rights, preservation, usage, resolution, bit depth, colour space, file format, and compression. Lastly, structural metadata includes the organisation of the file. Structural metadata is mostly used by computers and describes the relationship among the parts of the digital object (Allen 2020; Crocket 2018; Franks 2018). Miller (2022) relates structural metadata to technical metadata. For the preservation of digital records, Brown (2014) recommends the following metadata standards:

PREMIS (Preservation Metadata Implementation Strategies), Metadata Object Description Schema (MODS), and Metadata Encoding and Transmission Standard (METS).

Studies in developed countries such as the United States, Germany, Spain, the United Kingdom, Canada and South Korea have indicated the tremendous use of metadata for preserving medical records. A study by Shahrul Asari, Hussin and Samsudin (2017) focusing on record-keeping metadata standardization of electronic health records system integration in developed and developing countries such as the United States, Germany, Spain, the United Kingdom, Canada and South Korea, and Malaysia revealed that the developed countries were advanced in the use of metadata for preserving medical records compared to the local context of Malaysia which was lagging in the use of metadata for preserving medical record. The study methods were literature review analysis and Scopus analysis tools. The study speculated that some of the contributing factors to this situation were the availability of funding and developments in ICTs for the preservation of medical records in countries such as the USA, Germany and Spain compared to Malaysia. However, other developing countries, such as Singapore, demonstrated the effective use of metadata for preserving medical records. A review paper by Edmund, Ramaiah and Gulla (2009) on electronic medical records management systems in developing countries, with a case study of the Singapore National Eye Centre, revealed several preservation strategies for preserving medical records through metadata for authentication.

In sharp contrast, some countries in East Africa have highlighted major challenges in the use of metadata for preserving medical records. A qualitative study by Gisemba, Ng'eno and Bosire (2022) on medical records management to support evidence-based medical practice at Kisii Teaching and Referral Hospital in Kenya established that medical records at the hospital were not preserved using documented, implemented, or circulated metadata at different stages of records management, such as creation and maintenance. Some of the compelling reasons for the findings were a lack of documentation for metadata and the allocation of explicit metadata for medical records. Consequently, the hospital had challenges in accessing records and the timely disposal of inactive records. In West Africa, similar findings were also reported in a study by Mensah and Adams (2014) on the nexus between corporate governance and records management in private and public hospitals in Ghana, which revealed that the surveyed private and public hospitals in the country lacked metadata for preserving medical records.

3.5.5 Dehumidification

Humidity is one of the contributing factors to the high rate of deterioration of physical records. The higher the humidity, the greater the risk to records (Miller 2022). High humidity promotes the growth of mould and causes records to absorb moisture, swelling them and deforming their shape permanently (Miller 2022). According to Saffady (2021), low humidity equally causes havoc to paper records because it promotes dryness and leaves them brittle. Besides promoting air circulation in the storage area for records by installing air vents, Miller (2022) and Yeo (2021) proposed a dehumidification process to reduce humidity in the records storage area. According to Dehghani, Date and Akbarzadeh (2018:89), dehumidification is the removal of water from the air. Dehumidification controls the temperature levels in the storage area for records, thereby shielding records from abnormal humidity levels (Crocket 2018; Miller 2022; Yeo 2017). However, Miller (2017) argues that the process of dehumidification should be accompanied by a strict monitoring regime of temperature and humidity of the storage area for records. Dehghani, Date and Akbarzadeh (2018) also argue that an investment in an alternative power supply if the existing

main power supply is intermittent is a wise decision in dehumidification. Several methods exist for dehumidifying the storage place for records such as storing records from outside walls to encourage air circulation, keeping records out of basements or attics, good ventilation, packing records in archival containers made of polyester, storing fragile records in one location for monitoring (Miller 2022), use of dehumidifier equipment (Dehghani, Date & Akbarzadeh 2018), solar thermal-driven dehumidification (Ge, Wang, Xu, Pan, Du, Chen & Chen 2018), space heaters, chilling, open coil duct heaters, energy recovery ventilators, and desiccators (Purushothama 2024).

3.5.6 Damage repair

One of the ways of preserving records is to conserve and restore them. Conservation includes repairing records, which prolongs their life span for continuous use (Crocket 2017). According to Miller (2022:147), conservation is defined as the active protection of paper and analogue records, often by using physical and chemical treatments to repair damaged or deteriorating items to minimise further deterioration. Restoration involves the repair of an item, either to return it to its original appearance or to improve its aesthetic qualities (Miller 2022:149). Upward *et al* (2019) argued that restoration requires a significant investment of time and financial resources. However, Saffady (2021) emphasise that restoration should be undertaken when the look of an item is important or when the item is in a dire condition of complete deterioration. Therefore, this priority for restoration should be for items such as maps or photographs rather than paper-based records (Miller 2022). Miller (2022) further argues that if stabilising an item is the goal, the focus should be on conservation, such as removing staples and tape, storing items in archival-quality containers or removing dust and debris from the items. In the words of Miller (2022), paper-based records should be recommended for conservation rather than restoration.

Several factors have been noted to cause the deterioration of physical or analogue records. The most significant one is the acidic nature of physical records, which renders them fragile and prone to degradation over time (Crocket 2017; Ligterink & Di Pietro 2018; Miller 2022). Other sources of acidity which contribute to the deterioration of records include inks and adhesives (Ligterink & Di Pietro 2018). Other contributing factors to the deterioration of records include fluctuations in or excessive levels of temperature and relative humidity, excessive exposure to light (Miller 2022), air pollution (Ligterink & Di Pietro 2018), destruction from biological agents such as mould or insects, and abuse and mishandling (Myo 2016).

The recommended temperature for storing records is 18-20 Degrees Celsius with a relative humidity of 35-40% (Crocket 2017). Miller (2022) argues that every increase in temperature of 5 Degrees Celsius doubles the rate of reaction, which deterioration. The damage to records due to acidity can be controlled by using mass deacidification, encapsulation, archival-quality envelopes, folders and boxes (Miller 2022) and following acceptable standards for storage conditions for mixed media enshrined in the ISO 18934:2011: Imaging Materials – Multiple Media Archives – Storage Environment (Saffady 2021). The damage to records due to excessive exposure to light can be repaired by using incandescent lights rather than fluorescent lights (Miller 2022), controlling photocopying and scanning of records by creating a master physical or digital copy (Saffady 2021), and using curtains and blinds in the storage area for records (IRMT 2011). The recommended light level for storing records is 50 lux units (IRMT 2018). According to Ligterink and Di Pietro (2018), air pollution can be controlled by the installation of air filtration systems. Other ways of repairing damaged records due to pollution include treating the wood shelving with

acrylic paint to keep acidic words from further damaging records or storage boxes (IMRT 2018; Ligterink & Di Pietro 2018; Myo 2016). Biological agents are also one of the major contributors to the damage of paper-based records. It is recommended that records be stored at optimal temperature and relative humidity (Crocket 2017). Records infected with moulds can be repaired by drying them and then vacuuming off the moulds using a low-suction vacuum, which prevents spores from being dispersed (IMRT 2018). Alternatively, a soft brush can be used to remove the dried mould from the records (Miller 2022; Touray 2021).

In West Africa, contrasting findings have been revealed on the status of cleaning and handling of medical records. In some instances, medical records are carefully cleaned and handled, and in other cases, not. A review paper by Popoola (2021) on modern methods of preservation and conservation of mutilated health records in Nigeria revealed that most health facilities in the country lack basic preservation strategies such as cleaning, careful handling of records and effective storage of records. It was recommended that healthcare facilities in Nigeria implement proper preservation of medical records such as cleaning of records, careful handling, photocopying, using air filter systems to control air pollution, sun shields, use of energy saving lights, air-conditioners for controlling temperature and relative humidity, using papers with low acidity, fumigation against insects and rodents attack, fire extinguishers and sand buckets, microfilming of records, ensuring adequate security of records to prevent unauthorized access to records. Contrasting findings were reported in a study by Yaya *et al* (2015) on the challenges of record management in two health institutions in Lagos State, Nigeria which revealed that health institutions in the state utilised several strategies for preserving medical records such as good handling care of records, instant filing and indexing of generated records, physical security of records, and digitisation. This was due to the exposure of staff to computer and ICT skill training, computerisation, refreshing, and regular training of manpower in records management and microfilming (Yaya *et al* 2015). Similar findings were reported in a quantitative study by Asunmo and Yaya (2016) on the management and preservation of health records in some selected hospitals in Lagos state, Nigeria, which revealed that the surveyed hospitals utilised several strategies for repairing damaged medical records, such as computerisation, binding, lamination, microfilming, encapsulation and de-acidification. The implementation of preservation strategies improved access and security of records over a period, hence improving service delivery to patients.

In Southern Africa, it has been revealed that healthcare facilities face challenges in properly handling records, which compromise the integrity of medical records. A study by Marutha (2021) on medical records preservation strategies in improving healthcare service providers' access to patients' medical histories in South Africa revealed a lack of structure for medical records (indexing and folio numbering) for easy monitoring, detection and control of missing records; lack of control of temperature in the filing storages; water leak detectors and carbon dioxide fire extinguishers. The situation compromised the originality of records and access to quality medical care by patients in South Africa.

3.5.7 Privacy and security

Security and privacy are some of the significant functions of a preservation programme for medical records. The adoption of electronic health records was suggested to be the solution to the problem of lack of security and privacy (Keshta & Odeh 2021). However, the implementation of electronic health records systems has been halted due to privacy and security concerns (Keshta & Odeh 2021). Privacy is regarded as the right of the individual to keep information about themselves from

being disclosed to others (Office of the Australian Information Commissioner, 2014). It is justified that the information of a patient should be released to others with the patient's permission or allowed by law (Ozair, Jamshed, Sharma & Aggarwal 2015). The decision about the disclosure of the patient's information may be made by a legal representative or legal guardian if the patient is unable to do so due to age or mental incapacity. However, healthcare institutions, insurance companies and researchers need access to the data in health records for administrative, economic or academic purposes. Therefore, the key to preserving confidentiality is to allow only authorised individuals access to information. This process begins with authorisation by the relevant authority responsible for the medical records. Consequently, relevant privileges are assigned to the user. American Health Information Management Association (2016) argues that user privilege is one of the major aspects of the security of medical records. Part of the condition to access is the acceptance of accountability for the use and misuse of the information in their possession. Ozair *et al* (2015) further argue that additional security steps are required, such as strong privacy and security policies, to secure patient information.

Security is defined as the level at which accessing someone's personal information is restricted and allowed only for those authorised (Gupta 2018; Sittig & Singh 2015). In electronic health records, Dehling and Sunyaev (2014) suggested three basic security requirements, namely confidentiality, integrity and availability. Confidentiality entails restricting information to persons who are not authorised to access data during either storage or transmission, or when they are being treated (Keshta & Odeh 2021:178). Confidentiality can be achieved through data encryption, controlling access to electronic health records systems (Keshta & Odeh 2021), and the integrity of records professionals (Gupta 2018). However, the use of encryption has been towards health data sent through networks and less to health data stored in storage media such as computers (Dehling & Sunyaev 2014). Confidentiality protects records from unauthorised access, unauthorised deletion and unwarranted modification. Data also needed to be available. Availability means the system can be accessed and is fully operational (Crocket 2017; Saffady 2021). This entails that any authorised person can use the system.

Regardless of the huge security measures implemented to secure medical records, security lapses are likely to happen. One of the security lapses is security breaches. According to Ozair *et al* (2015), security breaches threaten patient privacy when confidential health information is accessed without the owner's consent or authorisation. One of the known cases of a security breach was reported at Howard University Hospital in Washington, USA, in 2013. A medical technician of the hospital was found guilty of violating the HIPA Act. The accused used her position to access hospital records and retrieve patients' names, addresses and medicare numbers for selling the information. A few weeks later, more than 34,000 patients' medical records were also compromised. A contractor engaged by the hospital gained access to the servers and downloaded the patient's files onto a laptop, which was stolen from his car. The data were password-protected but without encryption. Consequently, the hospital paid a penalty of \$275,000 to the victims of alleged violation of their privacy.

Keeping medical records secure is a challenging task for health personnel and regulators. Several security measures can be implemented to safeguard medical records, such as using cloud storage, password protection and encryption. The adoption of extra security features, such as a two-factor authentication system with security tokens and passwords, can assist in securing medical records.

A survey conducted in the USA in 2011 found that 73% of physicians text other physicians about work (Green 2011). Mobile devices have peripheral security features and are easily misplaced, damaged or stolen. Ozair *et al* (2015) emphasise that mobile devices used for transmitting confidential information must be encrypted.

Other security measures such as firewalls, antivirus software, and intrusion detection software must be included to protect data integrity. These measures must be implemented within the framework of policies and procedures to maintain patient privacy and confidentiality. For example, employees must not share their ID with anyone, always log off when leaving a terminal and use their ID to access patient digital records. A security officer must be designated by the organisation to work with a team of health IT experts. The health facility must conduct regular random audits to ensure compliance with security policies and procedures by all health personnel. A system may be implemented to assist with auditing, such as listing of content accessed, duration and the user, data and time and logs of modifications to medical records (American Health Information Management Association 2016). The system can generate a report of any inappropriate access to a medical record, including the name, the time, date, pages accessed and duration of the review (Ozair *et al* 2016). According to Ozair *et al* (2016), the information is useful in determining the reason for access, such as system error or intentional/unauthorised.

The security requirements for physical records are different from those of electronic records. For physical records, Crocket (2017) argues that the storage area for records should be restricted from unauthorised access. This implies that only authorised users should have access to records in the storage area. Therefore, all the doors and windows of the records storage area and filing cabinets should be kept securely locked (United Nations 2024). Unauthorised personnel, such as maintenance, should be accompanied at all times (United Nations 2024). Other security measures for physical records include labelling files, folders, boxes and contents clearly; equipping offices and storage areas with fire and security alarms and test alarms regularly, regular security and facility inspections for all workspaces or records storage areas, destroy obsolete and superseded records securely as soon as they are no longer needed (United Nations 2024).

Some countries in West Africa, such as Nigeria, have well-implemented physical security systems, such as alarm systems, security systems, and perimeter security. A study by Yaya *et al* (2015) on challenges of record management in two health institutions in Lagos State, Nigeria, revealed that health institutions in the state properly preserved medical records with the installation of physical security measures such as security personnel, emergency preparedness, surveillance, perimeter security, alarm systems and locking records. Similar and contrasting findings were reported in a study by Mensah and Adams (2014) on the nexus between corporate governance and records management in private and public hospitals in Ghana. The study revealed that both private and public hospitals had fire extinguishers, smoke detectors and fire detectors for the safety and security of medical records. The study further revealed contrasting findings between private and public hospitals in Ghana. The findings revealed that, unlike private hospitals, the disaster management equipment available in public hospitals was not in good condition (Mensah & Adams 2014).

In Southern Africa, it has been revealed that healthcare facilities face a myriad of security lapses for medical records. A study by Masuku and Ngulube (2020) on managing health records in the

Bulawayo and Matabeleland South provinces hospitals, Zimbabwe, revealed limited security measures for medical records through the use of passwords. The reason could be attributed to a lack of security measures and funding to implement other strict security measures such as encryption, redaction, CCTV cameras and security locks at entrance to the records storeroom. Studies by Marutha (2020) and Marutha (2019) in South Africa also revealed that the surveyed hospitals had a shortage of records security measures such as burglar-proofing equipment; firefighting equipment was stored in the corridors, water taps and pipes crossed the records storage areas, there was a lack of smoke and water detectors, nonfunctional ventilation control equipment, air-conditioners and irregular fumigation. It was further revealed that inadequate safety and security measures in the health facilities worsened the problem of access and use of medical records by healthcare staff.

3.5.8 Disposal

The retention of unnecessary paper and electronic records wastes staff time, organisational resources, space, and equipment. Therefore, disposal is the appropriate action for eliminating such types of records from the system. According to the University of Aberdeen (2024:1), disposition is the appropriate destruction or transfer of records to the archives at the end of their retention periods. Retention periods and appropriate disposal actions are outlined in the records retention and disposal policy or disposal policy. The retention and disposal dates are not fixed and may be extended due to factors such as pending lawsuits, audits, and changes in law and regulations (Franks 2018; University of Aberdeen 2024). The definition implies two major ways of disposing of records, namely destruction and transfer to a records centre or archives (Franks 2018; University of Aberdeen 2024). Franks (2018) outlines four major destruction methods for paper records, such as shredding, recycling, maceration, and pulping. Nevertheless, Franks (2018) argues that the destruction of records must be irreversible to safeguard the exposure of the contents to unauthorised personnel. Different destruction methods apply to electronic records. The most common destruction methods for electronic records include deleting the contents of the storage media for records and formatting (Franks 2018; Upward *et al* 2019). One of the disadvantages of deletion is that the method does not eradicate data or information hidden in hard drives or servers (Franks 2018). To address this problem, Upward *et al* (2019) suggest the use of formatting rather than deletion. Formatting permanently removes data and system information from the hard drive or server.

In Southern Africa, it has been revealed that most healthcare facilities follow procedures for disposing of medical records. Studies by Marutha (2021) on medical records preservation strategies in improving healthcare service providers' access to patients' medical histories in South Africa revealed that healthcare institutions in Limpopo were compliant in disposing of records according to established procedures. Similar findings were reported in a study by Pyrene (2015) on the management of medical records for health care services delivery at the Victoria Public Hospital in the Eastern Cape Province, South Africa which revealed that the hospital disposed of obsolete medical records after preserving them for a specified period according to the requirements of the HPCSA due to the availability of policies and procedures that govern medical records management in the hospital. Similarly, a study by Masuku and Ngulube (2020) on managing health records in the Bulawayo and Matabeleland South provinces hospitals in Zimbabwe also revealed that obsolete paper-based records were disposed of and deposited with the National Archives of Zimbabwe (NAZ) according to established policies and procedures. The present study agrees with the studies by Marutha (2021), Masuku and Ngulube (2020) and Pyrene (2015) on the importance

of preservation strategies for medical records. The discussion implies that preservation is achieved by implementing relevant preservation strategies such as migration, metadata, and dehumidification within a preservation framework. The quality of preservation strategies implemented on medical records is further influenced by existing policies and standards, storage mechanisms, and the knowledge and skills of staff involved in preservation activities in healthcare facilities. It is for this reason that the present study intends to establish preservation strategies currently in place at selected public healthcare facilities in Malawi.

3.6 Policies and standards

The cornerstone of efficient and effective records management is a framework of preservation policies and standards (Adjei & Mensah 2016). A preservation policy is a framework/mandate for conducting preservation activities in an institution (Shepherd & Yeo 2003:56). The policies, procedures, and standards stipulate and guide record officers on all the activities related to preservation, including the implementation of preservation strategies. The policies, standards and procedures are a commitment from management and the entire health system that the preservation of medical records is serious and obligatory (Crockett 2017). It is argued that countries should develop and implement policies, standards, procedures and legislative frameworks that will assist in guiding the archiving and management of medical records (Cullinan 2006; Katuu 2015). Legislative frameworks are significant in helping organisations such as healthcare facilities achieve their goals and objectives (Marutha 2018). An improvement in records management needs to consider the national and international legislative and regulatory framework (Katu & Van der Walt 2016).

3.6.1 Legal and regulatory frameworks

Globally, countries have developed legislative frameworks that guide the preservation of medical records. In the USA, several legislation exist that guide the preservation of medical records. Some of the legislation are the HIPA Act of 1996, Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, Electronic Health Record Systems (HER) Regulation, Medical Record Service (MRS) Regulation, Clinical Laboratory Improvement Amendments (CLIA), Occupational Safety and Health Administration (OSHA) Regulation and Food and Drug Administration (FDA) Regulation (Coventry & Branley 2018; Rose, Kumar & Kass 2023). In the USA, other legislation are state-specific, such as the California Medical Record Law of 2019. Besides these, other legislation have jurisdictions in the USA in terms of the preservation of medical records, such as the ISO 15189 2012: Medical Laboratories, WHO Guidelines, General Data Protection Regulation (GDPR) of 2016 (Hoofnagle, Van Der Sloot & Borgesius 2019; ISO 2016; WHO 2018). The legislation and guidelines address preservation issues such as retention and storage of medical records, access and disclosure of medical records, confidentiality and privacy of patient information, security and integrity of medical records, data breach notification and reporting and patient rights and consent.

In the United Kingdom, the Data Protection Act 2018 is the overarching Act that functions with the GDPR of 2016. The Act protects personal data, including records. It also includes provisions for the retention and secure handling of medical records to enhance the privacy and security of patients' data and records (Hoofnagle, Van Der Sloot & Borgesius, 2019). Other international legislation and guidelines, such as the ISO 15189 2012: Medical Laboratories and WHO Guidelines, apply to the preservation of medical records in the UK (ISO 2016; WHO 2018).

The Personal Health Information Protection Act (PHIPA) of 2004 in Canada governs the collection, use, and disclosure of personal health information and records (Baron & Lemmens 2023). The act applies to personnel handling medical information and records, such as healthcare providers and records staff (Baron & Lemmens 2023; Sarabdeen, Chikhaoui & Ishak 2022). The legislation has guidelines for the retention and security of medical records (Sarabdeen, Chikhaoui & Ishak 2022). The goal of the Act is to protect patient privacy and confidentiality. A similar Act exists in Australia called the Privacy Act 1988. Even though it is a general piece of legislation and old, the Privacy Act 1988 regulates the handling of personal information by the Australian government and private sector organisations (Aljerais, Barati, Rana & Perera 2021). Although not directly applicable to medical records, it includes principles for the protection of personal information which apply to healthcare professionals and the preservation of medical records (Aljerais *et al* 2021; Australia 2018).

In Singapore, the Personal Data Protection Act 2012 (PDPA) regulates the collection, use, and disclosure of personal data and records (Ong 2020; Setiawati 2020). The legislation includes requirements for the retention and protection of medical records to ensure the privacy and confidentiality of patients' data and information (Ong 2020). Similarly, China has several laws and guidelines for the management of medical records, including preservation of medical records. The country has Cybersecurity Law and the Personal Information Protection Law of 2021 (Allam & Jones 2020). The legislation guide the collection, use, and transfer of personal information and health data. These laws may include provisions for obtaining patient consent, ensuring data security, and imposing penalties for unauthorised disclosure or misuse of medical records. Besides the legislative frameworks, China has several regulations such as Regulations on the Management of Medical Records in Medical and Health Institutions issued by the National Health Commission of China, Administrative Measures for the Protection of Medical Information issued by local health authorities, Regulations on Electronic Medical Records (EMR) and Health Information Security Standards (Allam & Jones 2020). The regulations and standards specify the requirements for records creation, retention periods, and data security measures such as access control, encryption, audit trails and patient privacy.

In Africa, some countries have made strides in enacting laws that govern the preservation of medical records. However, it has been revealed that most of the legal and regulatory frameworks are outdated (Asogwa 2012; Ndenje-Sichalwe, Ngulube & Stilwell 2011). For example, South Africa has an outstanding legal and regulatory framework for the management of medical records. The most common legislation relevant to preservation of medical records are the National Archives and Records Service of South Africa Act (No. 43 of 1996), Limpopo Provincial Archives Act (No. 5 of 2001), the National Health Act (No. 61 of 2003), Promotion of Access to Information Act (No. 2 of 2000) (PAIA), Electronic Communication and Transaction Act (No. 25 of 2002), Electronic Records (Evidence Act) (2009), Public Finance Management Act (Act No.1 of 1999), Protection of Personal Information Act (Act No.4 of 2013), Copyright Act (Act No.98 of 1978), Protection of State Information Bill (2010) and the Constitution (Act 108 of 1996) (Makeleni & Cilliers 2021; Marutha 2019; Ngwenya 2020). The National Archives and Records Service of South Africa Act (No. 43 of 1996) governs the management and care of records of government agencies, which includes the preservation of medical records (Chaterera, Ngulube & Rodrigues 2014; Katuu 2015). The national archivist is mandated by law to manage all public sector records, including medical records (Chaterera, Ngulube & Rodrigues 2014; Ngoepe 2014). Despite the

existence of the legislation, Ngoepe (2017) argued that some pieces of legislation, such as the Electronic Records (Evidence Act) of 2009 lack guidance, which renders it ineffective.

In Zimbabwe, some legislation frameworks exist, such as the Public Health Act (Chapter 15:17) (2018), Public Health Act Chapter 15:09 (2002), Medical Services Act Chapter 15:13 (2001), and National Aids Council of Zimbabwe Chapter 15:14 (2000) (Magama 2018; Masuku & Ngulube 2020). The legislation regulate the management of medical records, including preservation (Magama 2018; Mutsagondo & Ngulube 2018). Despite the existence of legislation related to the management of medical records, Mutsagondo (2021) lamented a lapse in legal policy and procedural frameworks in Zimbabwe, which negatively impacts the effective management of digital records.

Other countries, such as Nigeria and Uganda, lack specific legislation for the preservation of medical records. However, general legislation exist such as the National Health Act, Data Protection Act, Access to Information Act and National Archives Act. However, general regulations and guidelines exist, issued by bodies such as the Medical and Dental Council of Nigeria (MDCN), the National Health Act in Nigeria and the Ministry of Health in Uganda (Anyira 2020). The guidelines guide the management of medical records and the protection of patient information. In Kenya, the Health Act of 2017 governs the management of health information and preservation of medical records. The Act also outlines standards for the access, use, storage and maintenance of medical records to safeguard the confidentiality and data security of patients' data and information. Likewise, in Ghana, the Health Institutions and Facilities Act of 2011, and the Health Professions Regulatory Bodies Act of 2013 provide guidelines for the management of medical records, including preservation (Adjei & Mensah 2016; Mensah & Adams 2014). The legislation also stipulate retention periods, security, privacy and confidentiality of patients' records.

Like other African countries, Malawi also lacks specific legislation on the preservation of medical records. However, generic legislation have been enacted to safeguard patients' data and information. Some of the legislation are the National Archives Act, Access to Information Act of 2017, Public Health Act of 2021, Medical Services Act of 2018, and Data Protection Act of 2024 (Ministry of Health 2018; Tough & Lihoma 2018). Legislation such as the Medical Services Act (2018) regulates medical services in Malawi, including the standards of care, licensing of healthcare providers and management of health facilities (Ministry of Health 2018). Although not relevant to the preservation of medical records, the Act includes guidelines for maintaining accurate and complete patient records (Tough & Lihoma 2018). Furthermore, the Data Protection Act (2024) protect the privacy of individuals, including patients. The Act also regulates the preservation of medical records, besides the protection of data of individuals. Besides the legislation, health bodies such as the Ministry of Health have developed specific policies and guidelines related to health information management, such as the Health Information Management Policy and Guidelines and Regulations by the Ministry of Health (Ministry of Health 2020). The policies and guidelines stipulate best practices for managing health information, including preservation such as storage and access, records retention periods, records disposal practices and data security measures (Ministry of Health 2020).

3.6.2 Standardisation and best practices

Several standards and best practices exist that may guide the preservation of medical records. Most of the standards are developed by the ISO. The most widely adopted standard in the field of records management is the ISO 15489:2016. ISO 15489:2016 Information and documentation-Records management is a useful standard for defining the roles, processes and methods for a digital preservation implementation where the focus is the long-term management of records (ISO 2016). ISO 15489 is both a standard and a set of best practices for managing business records to ensure that they are curated and documented throughout their lifecycle while remaining authoritative and accessible (ISO 2016).

Another significant standard developed by ISO and relevant to digital preservation is ISO 20652. ISO 20652: Space Data and Information Transfer Systems - Producer-Archive Interface - Methodology Abstract Standard is an international standard that provides a methodological framework for developing procedures for the formal transfer of digital materials from the creator into the digital preservation environment (ISO 2006). The standard outlines four phases involved in the transfer of digital materials, namely the preliminary phase, formal definition phase, transfer phase and validation phase (ISO 2006). The preliminary phase involves negotiations with the creators of digital content for transfer into a digital repository. The formal definition phase involves defining requirements for digital materials. After the formal definition, the digital materials are transferred to the digital preservation environment in the Transfer Phase. Digital materials and relevant metadata are validated during the Validation Phase to ensure they conform to a set of requirements.

Another important standard for preserving digital materials is ISO 14721:2012 Space Data and Information Transfer Systems - Open Archival Information System (OAIS) Reference Model (ISO 2012). The standard is popularly known as the OAIS reference model. It was developed by the Consultative Committee for Space Data Systems (CCSDS) and first published in 1999 (Lavoie 2014). The Standard has been adopted for guidance in many digital preservation developments since 2000. Overall, ISO 14721: 2012 standard provides a systematic framework for understanding and implementing the archival concepts needed for long-term digital information preservation and access, and for describing and comparing architectures and operations of existing and future archives (ISO 2012). It describes roles, processes and methods for long-term preservation. A useful introductory guide to the standard is available as a DPC Technology Watch Report (Lavoie 2014).

An OAIS Model is an archive that consists of people and systems responsible for preserving information and making it available to users defined as a Designated Community. To accomplish this task, the standard defines specific responsibilities: receive information from information producers, implement sufficient control measures on the information, determine the scope of the archive's user community and follow documented policies and procedures for preserving information (Lavoie 2014). In addition, the standard also defines metadata and representation information for managing digital materials (Lavoie 2014). The standard also defines a broad range of digital preservation functions, including ingest, access, archival storage, preservation planning, data management and administration (Lavoie 2014).

Another standard for preserving digital materials is the ISO/TR 18492:2005 Long-term preservation of electronic document-based information (ISO/TR 2005). The standard is a practical

methodology for the preservation and retrieval of authentic electronic documents. The standard is a set of requirements which guides media renewal, migration, quality, security and environmental control (ISO/TR 2005). The set of requirements is developed to ensure the authenticity of records beyond the lifetime of original information-keeping systems (ISO/TR 2005). Besides the ISO/TR 18492 standard, the ISO 16175 standard is also relevant to the concept of digital preservation. Although not directly related to digital preservation, ISO 16175:2011 Principles and functional requirements for records in electronic office environments relates to electronic document and records management systems and enterprise content management systems (ISO 2011). Despite the fact that the standard does not outline specific requirements for digital preservation, it acknowledges the need to maintain records over time and that format obsolescence issues need to be considered in the specification of these electronic systems (ISO 2011).

Other generic international standards exist that may also be relevant in the digital preservation domain such as ISO 9001 Quality management systems which demonstrate an organisation's ability to provide and improve consistent products and services (ISO 2015), ISO/IEC 27001 Information technology -- Security techniques -- Information security management systems demonstrates that digital materials are securely managed to ensure their authenticity, reliability and usability (ISO/IEC 2013) and ISO/IEC 15408. The Common Criteria for Information Technology Security Evaluation provides a standardised framework for specifying functional and assurance requirements for IT security and a rigorous evaluation of these (ISO/IEC 2009).

Other standards relevant to digital preservation are Moreq (Model Requirements for the Management of Electronic Records) and HL7 (Health Level Seven International). Moreq is a records management specification developed by the European Union in 2011 and is widely used by public and private institutions in Europe (Moreq 2024). The current version of the standard is Moreq2010, while the old one was Moreq2, published in 2008. The standard focuses on digital preservation and long-term preservation of electronic records (Faria, Guimarães & Ferreira 2022). The standard provides guidance and specifications for creation and capture, metadata, classification, retention and disposition, preservation and access, audit and compliance (Faria, Guimarães & Ferreira 2022). The strength of Moreq2 is that it is easy to implement the specifications, as it is very practical in its specifications (Moreq 2024). In addition, the standard is applicable in different jurisdictions, markets and industry sectors (Corujo & Revez 2021). This implies that the standard can be modified according to the needs and requirements of an organisation. Consequently, the standard can assist an organisation to comply with legal and regulatory requirements within the business sector.

A similar standard to Moreq2010 is HL7 (Health Level Seven International). HL7 is a set of standards developed by a Standards Development Organization (SDO) (Duda, Kennedy, Conway, Cheng, Nguyen, Zayas-Cabán & Harris 2022). The organisation focuses on developing standards, protocols and frameworks for the exchange, integration, sharing, and retrieval of electronic health information (Duda *et al* 2022). The standards, protocols and frameworks are widely used in healthcare facilities globally (Hussain, Langer & Kohli 2018). Some of the versions of HL7 standards are HL7 Version 2 (V2), HL7 Clinical Document Architecture (CDA), HL7 Fast Healthcare Interoperability Resources (FHIR), HL7 Version 3 (V3) and HL7 Consolidated CDA (C-CDA) (Hussain, Langer & Kohli 2018; Duda *et al* 2022). HL7 Version 2 (V2) and HL7 Version 3 (V3) focus on message-based interoperability, while HL7 Clinical Document Architecture

(CDA) is an XML-based standard for the exchange of clinical documents (Saripalle, Runyan & Russell 2019). Furthermore, HL7 Fast Healthcare Interoperability Resources (FHIR) is similar to HL7 Version 2 (V2) but focuses on web-based interoperability (Hussain, Langer & Kohli 2018). The HL7 Consolidated CDA (C-CDA) provide a set of templates, constraints, and guidelines for creating interoperable clinical documents (Monsen, Heermann & Dunn-Lopez 2023).

Besides generic standards discussed in the preceding sections, there are technical standards that guide the development of metadata and the choice of file formats for digital materials. The common descriptive metadata standards, namely PREMIS, METS and Dublin Core (DC), are de facto standards for developing descriptive metadata for digital materials (Library of Congress 2015). PREMIS (Preservation Metadata: Implementation Strategies) is a standard hosted by the Library of Congress and first published in 2005 (Library of Congress 2015). The data dictionary and supporting tools of PREMIS have been specifically developed to support the preservation of digital material (Digital Preservation Coalition 2024). Besides PREMIS, METS (Metadata Encoding and Transmission Standard) is an Extensible Markup Language (XML) encoding standard which enables digital materials to be packaged with archival information (Lovoie 2014). METS provides a format for encoding metadata necessary for the management of digital objects within a repository and the exchange of such objects between repositories and their users (Digital Preservation Coalition 2024).

Besides PREMIS and METS, the DC standard is also one of the most common international standards for describing digital materials in the Web environment. Dublin Core was formally known as the Dublin Core Metadata Element Set. The Dublin Core standard was developed in 1995 in a city called Dublin in the USA (Arakaki, Alves & da Costa 2018). According to Arakaki, Alves and da Costa (2018), the 13 principles of the Dublin Core standard were developed based on the report by Stuart L. Weibel, Carol Jean Godby, Eric Miller and Ron Daniel. Currently, Dublin Core is developed and maintained by the Dublin Core Metadata Initiative (DCMI). DCMI is an independent, public and non-profit organisation that specialises in the design of metadata standards for web and physical resources (Santana, Cordeiro & Oliveira Jr 2023). The organisation is a project of the Association for Information Science and Technology (ASIS&T). Dublin Core standard comprises 15 metadata terms for describing resources and improving searching (Zavalina & Burke 2021). The 15 metadata elements are title, creator, subject, description, publisher, contributor, date, type, format, identifier, source, language, relation, coverage, and relation (Zavalina & Burke 2021). According to Evans (2019), Dublin Core terms are machine-readable and can be used on the semantic web. In addition, the terms are compatible with other metadata terms such as Extensible Markup Language (XML), JavaScript Object Notation (JSON) and Unified Modelling Language UML) (Evans, 2019; Zavalina & Burke 2021).

Another metadata standard relevant to the archival community but applicable to the preservation of medical records is the Encoded Archival Description (EAD). EAD is based on an XML document type definition (DTD) (Duff & Pitti 2024). DTD defines the structure of an XML document and lists the elements and attributes that can be found in the document (Upward *et al* 2019). The metadata standard is used by archivists to describe collections such as photographs, maps, scrapbooks, diaries, and newspaper clippings (Duff & Pitti 2024). Encoded Archival Description provides a three-level description of the archival collection (Crocket 2016). The first level is the overview of the entire collection, such as type of materials, provenance, scope and

content notes. The second level is the grouping of the materials in the collection, while the third level is the description of each file or item.

A similar standard to EAD is Describing Archives: A Content Standard (DACS). DACS is a set of rules for describing archives, personal papers, and manuscript collections (Society of American Archivists 2022). However, the standard is also applicable to all types of materials at all levels of description (Duff & Pitti 2024). The rules are designed to be compatible with other standards such as Machine-Readable Cataloguing version 21 (MARC 21), Encoded Archival Description (EAD), and Encoded Archival Context (EAC) (Society of American Archivists 2022). DACS was developed based on international standards such as the International Standard for Archival Description (General) and International Standard Archival Authority Record for Corporate Bodies, Persons and Families (ISAAR[CPF]) (Society of American Archivists 2022).

There are also standards relating to file formats. Most of the file formats are non-proprietary and open format standards (ISO/IEC 2015). One of the advantages of adopting non-proprietary and open format standards is that it gives an organisation a good basis for developing a sustainable digital preservation programme. ISO/IEC 26300-1:2015 Open Document Format for Office Applications provides an XML schema for the preservation of widely used documents such as text documents, spreadsheets, and presentations (ISO/IEC 2015). In addition, ISO 19005 Electronic document file format for long-term preservation prescribes elements of valid PDF/A, which ensures that they are self-contained and display consistently across different devices (ISO 2005). Other file formats, such as JPEG-2000 and TIFF, are also defined by the ISO standards (ISO/IEC 2015; ISO 2005).

Standards are very important in digital preservation. However, several factors inhibit their use. One of the barriers is the rapid change of technology, which has superseded the pace of development of standards (Lavoie 2014). The standards development process takes years of development, which renders them ineffective during their implementation. Standards development and implementation are a huge business potential for standards organisations (Digital Preservation Coalition 2024). According to the Digital Preservation Coalition (2024), the competition among standards organisations can encourage the development and implementation of standards which lack consistency and are interoperable for preservation. Standards can be difficult to read for implementing institutions, due to the technical terms used and expensive to implement (Digital Preservation Coalition 2024).

In Europe, contrasting findings have been revealed on the level of adoption or implementation of policies and standards for the preservation of medical records. A descriptive study by Cowan and Haslam (2006) investigated the management of NHS records in public healthcare facilities in the United Kingdom. The findings of the study revealed that healthcare facilities are guided by the NHS Code of Practice guidelines in the preservation of medical records. It was revealed that the guidelines are useful in revising legislation on medical records management and the development and implementation of retention schedules. A related review study by Carpenter, Ram, Croft and Williams (2007) on medical records and record-keeping standards in the United Kingdom also reported on the existence of standards for the preservation of medical records, such as notes and content of admission, handover and discharge records for the Royal College of Physicians. Carpenter *et al* (2007) argued that the standards improved medical practices such as enhancing the

validity and utility of patient data, improving the structure of medical records for inclusion into electronic records, and enabling the sharing of data with other healthcare providers. Contrasting findings were revealed in a study by Heart, O'Reilly, Sammon, and O'Donoghue (2009) on Electronic Health Record (EHR) diffusion in Ireland and Israel. The study adopted a multi-case study design, and data was collected using interviews. The stakeholder/actor framework was used as the theoretical framework. It was revealed that the lack of legal and regulatory frameworks was one of the factors that negatively impacted electronic health records adoption and diffusion in the two countries. The study recommended implementing relevant policies and standards to enhance the diffusion of EHR across the healthcare systems in the two countries.

In the USA, studies have revealed a lack of policies and standards for preserving medical records in healthcare facilities. A study by Cockcroft (2009) on national health information infrastructure revealed a lack of common standards to enhance the interoperability of health data across systems in Australia, Canada and the USA. The study adopted formal content analysis using an established evaluation framework. The situation created a challenge to the interoperability of systems managing medical records in the countries, and failure to share medical records to improve service delivery to patients (Cockcroft 2009). Similar findings were reported in a descriptive study by Smith and Macdonald (2006) in Australia that hospitals lacked preservation standards and policies, which negatively impacted on adoption of preservation strategies. Contrasting findings were reported in a study by Tavakoli, Saghaiannejad and Habibi (2012) on laws and procedures in medical records retention in the USA, England, Australia and Iran. The study adopted a comparative-descriptive research approach, and data was collected using note-taking (library note cards). The findings revealed that the USA, England, and Australia had well-stipulated policies and procedures governing the retention of medical records. However, an interesting finding was that Iran lacked relevant policies and standards, such as a complete, clear and up-to-date schedule for the retention of health records. This situation contributed to the lack of space in health facilities due to the accumulation of destructible records and premature destruction of records (Tavakoli, Saghaiannejad & Habibi 2012).

In Asia, studies have revealed that preservation in healthcare facilities is guided by policies and standards. A quantitative study by Amin *et al* (2020) on medical records management practice in a University Hospital in Malaysia revealed that the hospital had a records management programme that outlined how records were created, captured, used, maintained, preserved and disposed of. Furthermore, the study revealed that the University Hospital was guided by guidelines and procedural manuals designed by the Ministry of Health and the National Archives of Malaysia in the management of records. The study was guided by the Records Lifecycle model, and data was collected using a structured questionnaire. The study purposively selected 90 health staff and a records staff. Similar findings were reported in a study by Alnashmi *et al* (2022) on health information management systems in Kuwait. The study adopted mixed methods. Regional directors of 38 hospitals were targeted, and a self-developed questionnaire was used for data collection. The findings revealed that medical records policies and procedures were present and updated, though staff displayed negligence regarding the awareness of these policies and procedures. The study recommended that health facilities should standardise medical records, train the hospital staff on standards through workshops and seminars, and that records management guidelines should be widely circulated to health staff.

In East Africa, it has been revealed that healthcare facilities lacked policies and standards for preserving medical records. A qualitative study by Gisemba, Ng'eno and Bosire (2022) on medical records management at Kisii Teaching and Referral Hospital (KTRH) in Kenya revealed the absence of a comprehensive internal policy framework to anchor medical records management and preservation activities in different sections of the hospital. The study further revealed that staff were not aware of a written medical records management policy, and the policy had not been adopted by the top management. Consequently, procedures for titling, indexing, classifying, and describing medical records were lacking at the hospital. A case study approach was used, and the target population comprised hospital staff who create, generate, use, and manage medical records, such as HRIM officers, system administrators, admission clerks, doctors, clinical officers, and nurses. Purposive sampling was used to select the samples, and data was collected through a triangulation of interviews, observation, and documentary reviews.

In West Africa, it has also been revealed that healthcare facilities lacked policies and standards for preserving medical records. A study by Mensah and Adams (2014) on corporate governance and records management revealed that public and private hospitals in Ghana had no written and approved policies, such as retention and disposal schedules, which directed them on how to manage the hospital's records. Consequently, the private hospitals never destroyed or transferred their records to the records centre, while the public hospitals transferred some of their records to the national archives based on need. The study was informed by Upward's (1980) Records Continuum theory and Freeman's (1984) stakeholders' theory. The target population was health staff responsible for records management, and questionnaires and personal observations were used for data collection. Similar findings were reported in a mixed methods study by Adjei and Mensah (2016) on total quality management to enhance service delivery in medical records at Korle-Bu Teaching Hospital (KBTH) in Ghana. The study was guided by total quality management (TQM) standards. The study employed a survey and case study designs with a population comprising staff of the KBTH medical records department, the head of the records department and the deputy. Data was collected through questionnaires complemented with personal observations. The study revealed that Korle-Bu Teaching Hospital lacked comprehensive policies and guidelines for medical records management with a focus on the security and confidentiality of records, records retention and destruction, access, the cataloguing of records and circulation of records within and outside the facility. Therefore, the study recommended the adoption of ISO 15489 standards for the creation and management of authentic, reliable, complete and usable records capable of supporting patient care; and the development of standards for measuring performance through the adoption of the TQM principles by the hospital's records department to deliver quality services.

Similar findings to those reported in Ghana were reported in several studies in Nigeria. A study by Asunmo and Yaya (2016) on the management and preservation of health records revealed that the surveyed hospitals in Lagos State in Nigeria, lack records management policies and standards. The study adopted the ex post facto design. The targeted population was doctors, nurses, health record keepers, specialists, administration officers, clerks, personal assistants, accountants and cleaners. Data was collected using a questionnaire. The study recommended that hospitals should incorporate preservation in the hospital through the formulation of record management policies, infrastructural development, proper funding, computer skill training, and staff training and re-training, as these will help to address the challenge of poor record preservation practices in the hospital. Similar findings were reported in the studies by Anyira (2020) and Yaya *et al* (2015) in

Nigeria. The findings of the studies revealed some challenges in preserving medical records due to a lack of preservation and conservation policies.

In Southern Africa, studies have also revealed a lack of policies, legislation and standards for preserving medical records. A qualitative study by Makeleni and Cilliers (2021) on electronic medical records in public healthcare institutions revealed a lack of legislation and regulation in the field of electronic medical records in South Africa. It was argued that records management policies, regulations and standards will eliminate preservation errors such as duplication of data, capturing incorrect spellings and using inaccurate formats and ensure that medical records are of good quality and that they are consistent across healthcare departments or institutions (Makeleni & Cilliers, 2021). The study was guided by a data quality framework (DQF), and data was collected through interviews. The targeted population of this study worked in public healthcare institutions in Klerksdorp, in the North West province of South Africa. Participants were selected using purposive sampling. Similar findings were reported in the study by Luthuli and Kalusopa (2020) on the integration of medical records management requirements in ICTs in Private and Public Hospitals in the Umhlathuze Area, KwaZulu-Natal Province, South Africa. The study was guided by the ISO 15489 framework and IRMT good practice indicators. The study adopted a survey research design and used multiple forms of data collection techniques such as structured questionnaires, observations and document analysis. The targeted population were nurses, doctors, clerks or receptionists and management responsible for records in both the public and private hospitals. The findings of the study revealed that private and public hospitals lacked institutional procedures for filing, arranging and disposition of electronic documents generated by desktop computers or records management software. The reasons for the findings from the studies were due to financial constraints and trained records management personnel to manage medical records in South African public health care institutions.

Similar findings were reported by Luthuli and Kalusopa (2017) on the management of medical records in KwaZulu-Natal, South Africa. The study was guided by the Records Lifecycle model, ISO 15489-1 (2016), and Batho Pele principles. The study adopted a case study design with triangulation of a semi-structured questionnaire, semi-structured interviews and observations. Convenience sampling was used to select patients, twenty-two medical records clerks and a manager for interviews. It was revealed that Ngwelezana Hospital lacked an updated medical records management policy, procedures and tools. The current records management tools and procedures did not contribute to health service delivery, and the use of a manual records management system was time-consuming and laborious. Similar findings were reported in the studies by Luthuli (2017), Marutha (2019), Marutha and Ngulube (2012) and Ngwenya (2020) that healthcare facilities lacked legislative frameworks, policies and procedures, and the majority of records officials did not understand the contents of the legislative framework governing records management. Some of the policies that were lacking were records retention and disposal policy (Marutha & Ngulube, 2012). Some of the evidence for the lack of policies, legislation and standards were a lack of awareness and existence of the records management policies and procedures manual; lack of adherence to records management standards; lack of security measures, with rampant cases of missing files, folios and torn folders; delays in access and use of records; lack of an elaborate electronic records management programme and low levels of skill and training opportunities in records management (Luthuli (2017). Consequently, training and awareness were required for records officials to improve their level of understanding and adoption of records

management legislative frameworks, policies and procedures (Marutha, 2019; Marutha & Ngulube, 2012).

Contrasting findings were reported in a mixed methods study by Pyrene (2015) on the management of medical records for healthcare services delivery at the Victoria Public Hospital in the Eastern Cape Province, South Africa. The study adopted the Records Continuum model. Questionnaires, interviews and observation were used to collect data. This study established that Victoria Hospital operates within recognised policies and procedures for filing, storage and retrieval of medical records. The study further revealed that the hospital was guided by some of the procedures such as the White Paper on the Transformation of Public Service Delivery, South Africa 1997; the Guidelines by HPCSA, 2008; the Constitution of South Africa (1996); the Promotion of Administrative Justice Act, no.3 of 2000; Promotion of Access to Information Act no. of 2000; and the National Health Act, no 61 of 2003.

In Botswana, the findings have revealed the existence of management procedures, policies and standards for preserving medical records. A case study by Mampe and Kalusopa (2012) on records management in the Ministry of Health revealed that records users and records management personnel were not aware of the records management procedures, policies and standards set by Botswana National Archives and Records Services (BNARS). Data were obtained through questionnaires, interviews, observations and documentary review. One of the contributing factors to the lack of awareness of records management standards, policies and procedures was the attitude among records officers. The findings imply that records management procedures, policies and standards in the Ministry of Health in Botswana.

In Zimbabwe, it was revealed that healthcare facilities lacked documented policies and standards for preserving medical records. A qualitative study by Masuku and Ngulube (2020) revealed that public hospitals in Bulawayo and Matabeleland South Provinces lacked documented health records management policies and standards. The study was guided by the lifecycle model. A case study design was employed, and data was collected through questionnaires, interviews, observation and document analysis. Similar findings were reported in a study by Masuku (2019) on the framework for electronic health records and electronic medical records standards in the health sector of Zimbabwe. The study adopted a qualitative research approach with a case study design. Data was collected using interviews and questionnaires. The findings revealed that healthcare facilities in Zimbabwe lacked specific policies and legislation for preserving medical records. Consequently, general policies were adopted for records management, such as the Patient Charter, the Constitution of Zimbabwe, and the ICT Policy for Zimbabwe. Conspicuously, standards of electronic health records (EHRs) and electronic medical records (EMRs) were missing. Similar findings were also reported in a study by Chikuni and Mnjama (2010) on the management of medical records at Gwanda Provincial Hospital in Zimbabwe. The findings revealed that the hospital lacked a policy for the retention or disposal of records. Consequently, the disposal and storage of medical records did not support the environmental conditions for the conservation and preservation of paper records due to the lack of a policy. In addition, the findings of the study revealed that the hospital does not have any preservation and conservation plans in place for managing patient records. In this regard, the current study examined the preservation policies and standards of the selected public healthcare facilities in Malawi. This entails that the effective

implementation of preservation strategies, storage mechanisms, and training is informed by policies and standards within the preservation framework.

3.7 Storage mechanisms

One of the major functions of preservation is to ensure proper storage of records for access, security and proper disposal. Storage or storing is the placement of records onto a shelf or into a file drawer, according to a plan (Read & Ginn 2015:118). Storage also means saving a record into an electronic medium that is readable by a computer. Due to the nature of records, records can be stored in both physical and electronic media using various equipment such as folders, shelves, drawers, and computers (Read & Ginn 2015). The storage rooms for records should meet certain conditions or requirements, such as recommended temperature and humidity, pest-free, dust-free, and free from mould (Crocket 2017). Medical records should also be properly packaged to avoid the deterioration or decomposition of records through the use of cartons, folders and airtight containers for storing records (Crocket 2017). Records should also be properly handled to avoid damage and enhance access while maintaining their original condition/format (Millar 2017).

Storage mechanisms for medical records can be categorised into two, namely storage mechanisms for storing physical records and electronic records. Examples of storage mechanisms for physical records are shelves, medicine cupboards, folders, file cabinets, cartons, and airtight containers (Chenthara, Ahmed, Wang, Whittaker & Chen 2020; Gisemba, Ng'eno & Bosire 2022; Luthuli & Kalusopa 2020; Kumar, Bharti & Amin 2021; Kumar, Kumar & Sodhi 2022; Smith & Macdonald 2006). For electronic records, storage mechanisms mostly in use include computers, external hard drives, servers, cloud, blockchain technology, Compact Discs, Flash Disks, and Floppy Disks (Ahmed, Wang, Whittaker & Chen 2020; Decman 2011; Verma 2022). The storage area for records should be securely locked, while computers and other electronic devices containing electronic records should be password protected (Read & Ginn 2015). All doors and windows should be closed while ensuring airflow in the storage or office space for records (Read & Ginn 2015). Only authorised staff should have access to records. Records officers should maintain a register of any security lapses so that decisions can be made to arrest the situation. Properly storing records has major benefits such as enhancing access to records, ensuring the security and safety of records and equipment, timely disposal of records and reduction of storage costs. Ultimately, properly kept records support prompt medical decision-making by healthcare staff and the timely provision of treatment to the patients (Marutha 2019; Marutha & Ngoepe 2018).

3.7.1 Cloud storage

The concept of cloud-based storage emerged towards the end of 2007 to ensure the protection of data and information while achieving a reduction of costs in infrastructure, business processes, and other applications (Franks 2018). This has created a major interest from academics as well as practitioners (Sunyaev & Sunyaev 2020). It has been predicted that the projected market value of cloud services will likely reach \$2,432.87 billion by 2030 from \$569.31 billion in 2022 and \$677.95 billion in 2023 (Fortune Business Insights 2024:1). The statistics imply the growth in the use of cloud computing in all sectors, including health. However, cloud storage and cloud computing are not synonymous. Cloud storage is regarded as a service within the business of cloud computing. To bring clarity to the two terms, the following definitions have been adopted. Cloud computing, in simple terms, means storing and accessing data and programs over the Internet instead of our computer's hard drive (Rashid & Chaturvedi 2019:421). Rashid and Chaturvedi (2019:421) also define cloud computing as the use of hardware and software to deliver a service

over a network, usually the Internet. Cloud computing is a model for providing IT infrastructure, components and applications to clients from a centralised location (Benlian *et al* 2018). Cloud (2011:25) also defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources, such as networks, servers, storage, applications, and services, that can be rapidly provisioned and released with minimal management effort or service provider interaction. The concept of the cloud is a 'hypothetical' or 'metaphor' to represent the Internet (Rashid & Chaturvedi 2019).

One of the distinguishing features of the cloud computing model is the cloud service providers and deployment models (Cloud 2011). One of the service models is called the cloud service provider, such as Google, Microsoft and Amazon. These cloud service providers operate like vendors and offer customer-demand cloud computing resources and services such as Office 365, OneDrive, Google Docs, and Google Drive (Franks 2018). In this particular model, customers are provided with online services and are accessible via the internet using a web browser and login details, while the data, software and hardware are located in the data centres (Rashid & Chaturvedi 2019). Cloud computing has four major deployment models, such as private cloud, public cloud, community cloud and hybrid cloud (Jamsa 2022). Private cloud is defined for organisations or businesses, while public cloud is available to the general public and offered by different vendors such as Google, Amazon and Microsoft (Jamsa 2022:6). Public cloud constitutes the infrastructure and services and is open to thousands of people at a fee (Rashid & Chaturvedi 2019). Community cloud provides services and infrastructure to organisations with similar interests, while a hybrid is a mixture of private and public cloud (Jamsa 2022).

Several advantages exist for adopting cloud computing such as accessing IT services on demand, from any device, and at any time (Sunyaev & Sunyaev 2020), broad network accessibility, resource pooling, multitenancy, reliability and scalability, economies of scale (Rashid & Chaturvedi 2019), lower IT costs of purchasing and operating IT infrastructure at an institutional level (Franks 2018), and customisation and measured services (Jamsa 2022). However, the adoption of cloud computing is not a panacea for all IT and records storage-related challenges in organisations. Critical decision-making has to be made in adopting cloud computing guided by issues such as the location of the data in the cloud, backup procedures, security standards, network requirements, uninterrupted access to the organisation's data, and flexibility in withdrawing services and data from the service providers (Franks 2018).

Despite the glowing influence of cloud computing services, concerns regarding the service remain an issue. Franks (2018) and Sunyaev and Sunyaev (2020) have voiced concerns with cloud services, such as a lack of data security and privacy, cost management, performance challenges, interoperability, high demand on the network, and lack of knowledge and expertise in the use of the service. Franks (2018) further argued that organisations should be clear enough on the storage and disaster preparedness services offered by cloud service providers. Equally, Sunyaev and Sunyaev (2020) also highlighted the challenges of data recovery and availability, regulatory and compliance capabilities, and management capabilities. Nevertheless, the use of cloud computing offers many opportunities for cloud storage of medical records in public healthcare facilities in developing countries in the midst of dwindling health budgetary allocation, obsolete ICT infrastructure, lack of trained ICT personnel, and ineffective disaster recovery procedures (Masuku & Ngulube 2020; Marutha 2021).

In Europe, contrasting findings have been revealed on the status of the use of cloud storage for storing medical records. A study by Verma (2022) on a blockchain-based privacy preservation framework for healthcare data in the cloud environment revealed that the majority of European countries have adopted mobile devices integrated with cloud computing to store medical records to enhance data privacy and network security amidst security concerns in the use of the technologies in the healthcare system. The study proposed the use of blockchain technology to store and access records in the cloud through mobile devices to ensure the security, authenticity and integrity of medical records. The reasons for the findings could be attributed to security concerns with the use of storage mechanisms for records, such as mobile devices and the cloud (Google Drive and OneDrive). Contrasting findings were reported in a study by Decman (2011) on electronic health records management and preservation in Slovenia. The findings of the study revealed that the country lacked the use of cloud storage for medical records despite advancements in the use of computer hardware and networking in the healthcare system. The reasons for the findings could be attributed to the lack of policies to motivate the use of computer hardware and networking to store medical records in Slovenia.

In Asia, healthcare facilities have yet to adopt cloud computing for the preservation of medical records. A study by Li, Shih and Wang (2018) proposed cloud technology for authentication and privacy of medical data for telecare medical information systems. The study proposed a more secure cloud-assisted system for the privacy of medical data. Similar findings to those of Li, Shih and Wang (2018) were reported in the study by Zala and Shukla (2022) in Singapore. The study revealed challenges with the storage of medical records and proposed the adoption of a more secure cloud-based medical e-health record system. Contrasting findings were reported in the study by Wang, Zhang, Zhang and Wang (2019). The findings of the study revealed that a cloud-based electronic medical records system is convenient, but challenges exist with the centralisation of the system, such as threats to data security and privacy protection. The study proposed the adoption of a consortium blockchain on the Ethereum platform for the preservation of medical records due to its decentralisation, which offers advanced data security, privacy preservation, and access control.

3.7.2 Blockchain technology

Before the dawn of modern technology, medical records were stored using paper-based records. Evidence exists that such systems have been marred by difficulties in accessing records and security lapses. Shahnaz, Qamar and Khalid (2019) have argued that the challenges with paper-based systems can be resolved through the adoption of blockchain technology. The adoption of this technology is critical in the era where medical records are increasingly being created in electronic format. Blockchain technology was first introduced by Nakamoto in 2009 (Nakamoto, 2008). Originally, the technology was invented to solve the problem of double spending of bitcoin, but later it has been adopted in other applications. Blockchain technology comprises a series of blocks that are connected and are continuously growing by storing data on the blocks (Shahnaz, Qamar & Khalid 2019:147783). It utilises a decentralised approach that allows the information to be distributed and each piece of data to have shared ownership. In addition, the technology uses a harsh system of providing security to a batch of data available in a peer-to-peer network. The architecture of blockchain eliminates third-party intervention or centralised control of data.

Several researchers have recommended the use of blockchain technology for the storage of medical records (Boonstra, Versluis & Vos 2014; Gordon & Catalini 2018; Gunter & Terry 2005; Li *et al*

2018; Shahnaz, Qamar & Khalid 2019). Blockchain technology offers several benefits, including security, anonymity, data transparency, integrity and a tamperproof platform for storing medical records (Shahnaz, Qamar & Khalid 2019). As with any other technology, blockchain technology is associated with several challenges. The major challenges are scalability and storage capacity, threats of malicious attacks, lack of social skills, and lack of universally defined standards for using the technology (Kuo *et al* 2017; Shahnaz, Qamar & Khalid 2019; Zhang *et al* 2018). It is assumed that these challenges may negatively affect the speedy adoption of blockchain technology in the healthcare system (Shahnaz, Qamar & Khalid 2019). The problem of storage and scalability, and threats of malicious attacks can be addressed by using off-chain storage of data (Eberhardt & Tai 2017), a scalable framework of blockchain using Hadoop database, encryption of data to ensure confidentiality, and use of VPNs (Virtual Private Networks) to ensure safety from malicious attacks (Kuo *et al* 2017). Being a relatively new technology, it has been noted that many users lack the knowledge and skills to use blockchain (Shahnaz, Qamar & Khalid 2019). Lack of knowledge and skills may be resolved by continuous professional development on the part of the records managers and ICT specialists (Shahnaz, Qamar & Khalid 2019). On standards, Shahnaz, Qamar and Khalid (2019) argued that the development of standards and principles for blockchain technology is non-existent and would take some time for certified international standards authorities to develop them.

In Europe, healthcare facilities are lagging in adopting blockchain technology for storing medical records. A study by Verma (2022) on a blockchain-based privacy preservation framework for healthcare data in the cloud environment revealed that most European countries have not adopted blockchain technology for storing medical records. Healthcare facilities use mobile devices integrated with cloud computing to enhance data privacy and network security amidst security concerns. The study recommended the use of blockchain technology to ensure the security, authenticity and integrity of medical records. Similar findings were reported in a study by Chen *et al* (2019) in the UK revealed that healthcare facilities lack a secure system for storing and sharing medical records in healthcare settings and mobile applications, and remote monitoring systems. The study proposed blockchain technology because of its security, which allows patients to retain ownership over their records while allowing hospitals to have easy access to the records. As an extension, a systematic survey by Nowrozy, Ahmed, Kayes, Wang and McIntosh (2024) also proposed a liberal adoption of techniques for preserving medical records to ensure data privacy. The study revealed that no single technique, such as cloud computing, Ethereum-based blockchain, and cryptography, is sufficient to ensure data privacy in a storage system for records. The study recommended the use of different techniques for the storage and privacy of medical records.

In the US, it has been revealed that healthcare facilities have not adopted blockchain technology for storing records. As such, healthcare facilities are facing security challenges in storing records. A descriptive study by Ivan (2016) on blockchain-based methods for the secure storage of patient records in health facilities in the USA revealed that health facilities in the USA faced a myriad of security concerns in the storage of medical records using traditional methods such as computers, hard drives, and CDs. The study recommended the use of blockchain technology to improve the storage of medical records, to improve access and control over health data. Similar findings were reported in a study by Stafford and Treiblmaier (2020) on a blockchain ecosystem for secure and sharable electronic medical records, which revealed that the current medical records storage and transmission methods are proprietary and have interoperability and security problems. The study

proposed the use of a secure and interoperable system for medical records storage, such as blockchain, to resolve this challenge.

In Asia, the use of blockchain has been inconsistent with other countries adopting the technology in storing medical records, while others do not. A study by Chenthara *et al* (2020) on the Health Chain framework for privacy preservation of electronic health records using blockchain technology in China revealed the use of a Health Chain framework which ensures data integrity, data privacy, data scalability, and secure storage of medical records through encryption. Similar studies by Li, Shih and Wang (2018), Li, Zhu, Shen, Gao, Tao and Liu (2018) and Tan, Yu, Shi, Yang, Wei and Lu (2021), Xia, Sifah, Smahi, Amofa and Zhang (2017) in China proposed a blockchain-based data preservation system for medical data that offers a reliable storage solution for security and verifiability of stored data while preserving the privacy of users. The user privacy system is guaranteed through a variety of cryptographic algorithms. In addition, a similar study by Sun, Ren, Wang and Yao (2020) on blockchain-based systems for electronic medical records in China revealed the use of cloud storage for storing medical records in healthcare facilities which had flaws such as lack of control as medical records are centrally stored and high probability of loss of medical data due to system failure. The study proposed the use of blockchain technology that offers more control and security to medical records in a decentralised model. Similar findings were reported in a study by Haddad *et al* (2023) in Malaysia on a generic Patient-Centred Blockchain-Based EHR Management System. The study was done at the IoT and Wireless Communication Protocols Laboratory at the ECE department at International Islamic University Malaysia (IIUM). The findings of the study revealed that the use of a Patient-Centred Blockchain-Based EHR Management (PCEHRM) system appeared to be efficient and secure in storing medical records with decentralised storage of medical metadata.

Contrasting findings were reported in a study by Kumar, Bharti and Amin (2021) on Blockchain and Inter-Planetary File Systems (IPFS) in India. The findings revealed that blockchain technology was not used for the storage of medical records. Consequently, healthcare facilities in the country encountered several challenges in storing medical records using traditional methods, such as attacks by ransomware and misplacing or mixing the patient's data. The study recommended the use of IPFS and blockchain technology to improve the storage of medical records. Similar findings to those of Kumar, Bharti and Amin (2021) were reported in the studies by Benifa, Mini and Krishnan (2021), Kumar, Kumar and Sodhi (2022) and Singh, Rathore, Alfarraj, Tolba and Yoon (2022) on a blockchain-based secure storage framework for electronic medical records in India. The studies revealed the non-adoption of blockchain technology and proposed the use of technology such as blockchain, Federated Learning, Inter-Planetary File System, and key management for secure electronic medical records storage, sharing and access to the patient's records. However, the use of the Internet of Things for secure storage of medical records has been identified in countries such as China. A study by Zhan and Xuan (2021) on a medical record encryption storage system based on the Internet of Things in China recommended the use of Internet of Things technology to reduce the cost of storing paper-based records, unify and standardise records and guarantee the safety of medical records through encryption.

3.7.3 Computers

The advent of computers has revolutionised the creation, capture, storage, processing, and transfer of information in organisations. Thus, the use of computers has spread in every sector of the economy, including health. According to Encyclopaedia Britannica (2023), a computer is a device

for processing, storing, and displaying information. In healthcare, computers are increasingly being used to assist in the provision of quality care (Joos, Wolf & Nelson 2019). Computers and information systems are being used in assessing, planning, documenting, and evaluating care in healthcare facilities (Joos, Wolf & Nelson 2019). One of the major functions of computers is the storage of medical records (Abdekhoda, Dehnad & Zarei 2019; Yaya *et al* 2015). Computers provide a means of storing medical records for access and use by healthcare practitioners at a later stage. Mostly, information in a computer is stored offline and in organised folders. If connected to other devices, records may be accessible to other healthcare providers remotely. The advantages of storing medical records on a computer are enhanced security and confidentiality of records (Hepisuthar 2021). This is achieved by implementing security features such as passwords, encryption, and positioning a computer in a secure room. However, the probability of loss of medical records due to hard drive malfunction or failure is very high in computers (Hepisuthar 2021). In addition, the challenge of computers for storing medical records is technological obsolescence. This implies that records held in computers may be inaccessible over time if not promptly migrated to new hardware or software. The problem of intermittent power supply can also affect the operations of computers, especially in developing countries (Yaya *et al* 2015).

In Europe, the use of computers has been widespread in storing medical records in healthcare facilities. A study by Decman (2011) on electronic health records management and preservation in Slovenia revealed that the country is advanced in the use of computer hardware and networking in the healthcare system, though electronic storage of patients' medical records is low. The study adopted a quantitative research method with a survey design. A web survey (questionnaire) was used for data collection, and the study targeted one healthcare unit, for example, the outpatient department, hospital department, and dispensary, in all public and private organisations in the healthcare sector in the Republic of Slovenia. The targeted population were doctors, nurses, heads of departments, dental offices, and specialist practices.

In Asia, the use of computers for storage and access to medical records has been inconsistent. Other countries have adopted computers and electronic medical records in the provision of care to patients, while others are lagging. A study by Edmund, Ramaiah and Gulla (2009) on electronic medical records management systems in Singapore revealed that the use of computers and electronic medical records has helped save the physical housing space of the hospitals and security by allowing authorised personnel access to records. It was argued that the technology helped to improve access to records and reduction in storage costs (Edmund, Ramaiah & Gulla 2009). Similar findings were reported in a study by Alnashmi *et al* (2022) on the health information management system in Kuwait. The study adopted a mixed-methods approach with descriptive and explanatory designs. The study targeted regional directors of hospitals and used a self-developed questionnaire for data collection. The findings revealed that most hospitals surveyed adopted computers and Health Information Systems (HIS) for storing medical records. Contrasting findings were reported in a quantitative study by Amin *et al* (2020) on medical records management practice in decision-making at a University Hospital in Malaysia. The study was guided by the Records Lifecycle model, and a structured questionnaire was used for data collection. Cluster and purposive sampling techniques were adopted to select participants for the study. The findings of the study revealed that the University Hospital lacked computers, which contributed to missing files, damaged files, inadequate filing space and inadequate hardware. One

of the contributing factors was the lack of a policy framework to guide the storage of medical records in the University Hospital in Malaysia.

In West Africa, computers for the preservation of medical records are lacking in healthcare facilities. This compromises access and use of records in the provision of care to patients. A study by Yaya *et al* (2015) on record management in health institutions in Lagos State, Nigeria, revealed several challenges to records management in health institutions, such as the inadequate supply of computers and other ICT devices for record preservation, and outdated or non-existent hardware, software and network connectivity. The study adopted an ex post facto research design, and the target population was doctors, nurses, records officers, administrative officers, clerks, personal assistants, accountants and cleaners. Similar findings were reported in a study by Asunmo and Yaya (2016) in Nigeria, which revealed a low deployment of ICT, such as computers, in the health facilities in Delta State compared to Lagos State in Nigeria.

In South Africa, computers were used for the storage of medical records in healthcare facilities. A study by Marutha and Ngulube (2012) on electronic records management in the public health sector of the Limpopo province in South Africa revealed that computers were in use for the storage of medical records. Similar findings were reported in a qualitative study by Masuku and Ngulube (2020) on managing health records in the Bulawayo and Matabeleland South provinces hospitals, in Zimbabwe. The study was guided by the Records Lifecycle model, and data was gathered through questionnaires, interviews, observation and document analysis. Purposive sampling was used to select the respondents for the study. The study focused on all public and private hospitals in the Bulawayo and Matabeleland South Provinces and NAZ, with a total of 16 hospitals. The study revealed that records in the hospitals were kept in computer databases for capturing and storing patient information, among others.

3.7.4 Portable storage media

The developments in ICTs have given rise to a series of portable storage media for records such as floppy diskette, tape drive, removable cartridge, CD, DVD, flash disk, HDD, and SSD. Others can be categorised as traditional, such as floppy diskettes, tape drives, and removable cartridges, while CD, DVD, flash disk, HDD, and SSD can be considered as amongst the modern storage media (Saffady 2021).

Floppy diskette drives are becoming less standard with most computers, and these drives have a low storage capacity and are slow (Franks 2018). Besides Floppy Diskettes, tape drives are an option for a high-capacity backup but are not common in modern desktop computers (Franks 2018). Tape drives require a third-party backup application or backup capabilities in the operating system (Touray 2021). Touray (2021) argues that tape media is relatively low-cost although not commonly used in modern organisations. Another storage medium is removable cartridges, which are used as a backup solution as a portable or external device. Common brands of removable cartilage, such as Iomega Zip® and Jaz® storage drives, are more expensive than floppy diskettes (Franks 2018). Besides the high cost of purchasing the storage media, Franks (2018) posits that removable cartilage is fast, and its portability allows for flexibility. In terms of operation, removable cartilages operate through built-in special drivers and applications to facilitate the backup of data or records (Franks 2018).

Most desktop computers are equipped with read-only memory (CD-ROM) drives or writable CD drives (Touray, 2021). The advantages of CDs are low-cost storage media and a higher storage capacity compared to floppy diskettes (Brown 2017; Smallwood 2019). The DVD is another tool that is similar to the technology of CDs. DVD is an optical disc technology with a gigabyte storage capacity and can facilitate video, audio or other information storage (Smallwood 2019). Digital Versatile Discs offer several advantages compared to CDs, such as higher capacity (Smallwood 2019); however, it is more expensive compared to CDs (Franks, 2018). In addition, flash disks and hard drives offer alternative means of storing records. A flash drive is a storage device that includes flash memory and a USB interface (Touray 2021:36). Flash drives are portable and have varying storage capacities ranging from 8 to 256 gigabytes (GB) (Zhang & Zhang 2021).

The recent advancement in technology has further improved the storage of records with the development of HDD and SSD. HDDs rely on spinning magnetic disks to store and retrieve data. Access to data depends on the speed of rotation of the magnetic disks. Although HDDs are a proven and reliable technology, Hepisuthar (2021) argues that it has limitations such as breakdowns caused by shocks, vibrations, or just simple wear and tear due to continuous use. Lerner and Bonnet (2021) posit that the limitations of HDDs are one of the reasons behind the development of SSDs. According to Lerner and Bonnet (2021:45), SSDs are a type of nonvolatile memory and do not require a continuous power supply to retain data or code. SSDs use flash memory chips, or flash storage invented by an engineer at Toshiba in 1984 (Hepisuthar 2021; Lerner & Bonnet 2021). SSDs offer speed of access to data (Lerner & Bonnet, 2021), with better throughput in performance (Hepisuthar 2021).

In Nigeria, public healthcare facilities use a variety of media for storing medical records, such as video discs, magnetic tape, and floppy disks. A study by Asunmo and Yaya (2016) on the management and preservation of health records in Nigeria revealed that the surveyed hospitals stored through vinyl discs, video discs, lamination, microgroove discs, shellac discs, mylar, floppy discs, magnetic tape, cellulose acetate, and microfilming. The study adopted the ex post facto design. The reason for the findings was a low deployment of ICT in the health facilities in Delta State (Asunmo & Yaya 2016).

In South Africa, several storage equipment items are used for the storage of medical records in healthcare facilities. A study by Marutha and Ngulube (2012) on electronic records management in the public health sector of the Limpopo province in South Africa revealed that microfilm, cassettes, and compact disks were used for the storage of medical records. The study adopted qualitative and quantitative methods. Purposive and stratified random sampling techniques were applied, and data was collected using questionnaires, observation and interviews. The study used the Raosoft sample size calculator to calculate the sample size.

3.7.5 Storage rooms

Storage rooms are among the most common storage areas for records. The storage rooms protect records from environmental factors, pests, human carelessness and mould. These factors can cause damage to physical media and speed up the rate of deterioration. Storage rooms should always be cleaned without chemicals or water, using a vacuum cleaner where possible (Read & Ginn 2015). Vacuum cleaners should always be cleaned to avoid spreading dust around the storage room (Read & Ginn 2015; Saffady 2021). In addition, uncontrollable access to storage rooms risks damage and theft of records (Crockett 2017; Miller 2022). To protect records from these threats, Crockett

(2017) argues that storage space should be in a brick, stone or concrete building and kept dark, cool, dry, well-ventilated, pest-free and secure. Windows and doors should be locked all the time (Crocket 2017; Franks 2018; Saffady 2021). If possible, the storage rooms should be installed with air conditioning, heating, and ventilation to regulate the temperature and relative humidity (Franks 2018; Saffady 2021). Electrical wires and water pipes should be installed far from the storage area (Franks 2018; Saffady 2021). In sharp contrast, a study by Marutha (2021) on medical records preservation strategies in Limpopo hospitals, in South Africa, revealed that storage space for records was close to water pipes and basins due to a lack of a purpose-built building for preserving records. Furthermore, records should not be kept in basements and attics because they are vulnerable to dampness and the roof to heat (Miller 2022). Due to costs in storage space, some organisations opt to use off-site storage areas outside the organisation to minimise costs (Franks 2018). Another option is outsourcing the storage space from another organisation for free or at a cost (Franks 2018).

The size of the space selected for storing records should be based on the estimated volume of the records (Saffady 2021). Floor space and height of the ceiling must be considered commensurate with the dimensions of the storage equipment, such as shelves (Franks 2018; Saffady 2021; Upward *et al* 2019). One recommended rule for estimating states that one-third of all records are active and can be found in offices, one-third are inactive and should be stored in a records centre, and one-third (or more) have no value and should be destroyed (Franks 2018). The purpose of the rule is to create additional space for new records by eliminating valueless records while maintaining records of significance to the organisation (Saffady 2021).

In the Middle East, storage rooms were used for the storage of medical records. A study by Alnashmi *et al* (2022) on health information management systems in Kuwait revealed that most hospitals surveyed adopted on-site and off-site storage rooms through outsourcing. The adoption of off-site storage was a feasible and less costly option due to the lack of adequate storage space for the storage of medical records. A mixed-method approach was adopted with descriptive and explanatory designs. A self-developed questionnaire was used for data collection.

In West Africa, storage rooms are used for the storage of medical records in healthcare facilities. A study by Anyira (2020) on the preservation of medical information in healthcare facilities in Delta State, Nigeria revealed that medical records were stored in storage rooms with air conditioners, equipped with fire extinguishers and sand buckets, a CCTV Security system was installed, and an electronic record management system was available. The reasons for the findings were a lack of modern records storage equipment, a lack of skilled staff, and a lack of ICT deployment. The survey method was used, and data was collected using the questionnaire administered by hand, social media and e-mail. Contrasting findings were revealed in a study by Mensah and Adams (2014) in Ghana. The study revealed that the preservation of records was given very little attention by the hospitals, characterised by a lack of adequate storage facilities, with some records kept on the floor and others in metal containers, which were sited far from the records units in the public hospitals. This negatively impacted on timely retrieval or loss of records and the lack of space for keeping records. The study was informed by Upward's (1980) Records Continuum theory and Freeman's (1984) stakeholders' theory. Data was collected using questionnaires and personal observations.

In East Africa, storage rooms were also used for the storage of records despite the challenge of inadequate space. A qualitative study by Gisemba, Ng'eno and Bosire (2022) on medical records management at Kisii Teaching and Referral Hospital in Kenya revealed that medical records were stored in the main repository equipped with closed-circuit television (CCTV) cameras and lockable doors to the main storage area. It was also revealed that the challenge of lack of space in the main repository is consistent with the volume of records at the hospital.

In Southern Africa, storage rooms are in use for the storage of medical records in healthcare facilities, though the challenges of space were noticeable. A study by Luthuli (2017) on medical records management practices in public and private hospitals in the Umhlathuze Area, South Africa revealed that public hospital uses a centralised storage room for records, while private hospitals' system is decentralised. The study was guided by the Records Life Cycle, Records Continuum, and Integrated Records Management Model. The study was largely quantitative with a survey research design. Multiple data collection instruments were used, such as structured questionnaires, observations and document analysis. Similar findings were reported in a study by Luthuli and Kalusopa (2017) and Masuku and Ngulube (2020) in South Africa and Zimbabwe, respectively. The studies were guided by the Records Lifecycle theory and ISO 15489-1 (2016). Data was collected using a semi-structured questionnaire, semi-structured interviews and observations, and document analysis. Convenience and purposive sampling techniques were adopted to select the participants for the study. The study revealed that internal storage facilities and records rooms were used for the storage of medical records. It was further revealed that the hospital was using an outside container called *khulukuthu* ('dumping area') due to a lack of storage space. Some records were kept at the OPD, referred to by some as the 'front desk'. A similar challenge of lack of storage space was also reported in a study by Ngwenya (2020) in South Africa, where medical records with torn boxes were placed on the floor supported with planks and bricks. Files were also stacked up in open cabinets due to a shortage of storage room and equipment (Ngwenya 2020). According to Ngwenya (2020), the contributing factor was a lack of standard, regulated equipment for the storage of medical records. Consequently, records staff could climb on top of piles of files to access records, which made it difficult to access them promptly (Ngwenya 2020). The other challenge, as posed by Marutha (2021), was that water pipes passing through and basins were located inside the storage facility due to a lack of a purpose-built building for preserving records.

3.7.6 Physical storage equipment

Physical storage equipment offers convenient storage while supporting access to records. The common storage equipment for records includes shelves, storage boxes, vaults, and filing cabinets (Franks 2018; Millar 2017; Saffady 2021). Shelves are amongst the oldest storage equipment for physical records (Smallwood 2019). Cognisant of the different types of shelves, Smallwood (2019) argues that shelves for records should be open metal or wooden racking secured to the floor and ceiling. Shelves should be positioned away from the outside walls to avoid dampness (Franks 2018; IRMT 2004; Millar 2017). Wooden shelving or cabinets sealed and treated with fire-resistant solvent-free paint or water-based varnish is acceptable for boxed material or bound volumes (IRMT 2004). However, metal shelves are highly recommended for loose volumes of records (Saffady 2021). The standard shelf should not be more than 200cm for easy shelving and accessibility to the records (Saffady 2021). Chikuni and Mnjama (2010) also argued that static wooden open-racking type of shelving, which is up to 2 metres high, is recommended for the storage of medical records.

Franks (2018:251) further argues that steel shelving 41 inches high and 31 inches deep is recommended to accommodate standard storage boxes (10 inches X 12 inches X 15 inches high). In addition, vaults have been used for housing vital records and records stored on different media such as microfilm and computer tapes (Franks 2018). A vault offers high security to records as access is restricted to authorised personnel (Saffady 2021; Touray 2021; Yeo 2021). Besides a vault, the filing cabinet is also a common equipment for storing records (Saffady 2021). Steel filing cabinets are the most common for storing records, although wooden cabinets are in use (Franks 2018). Some of the advantages of steel filing cabinets are that they are portable, lockable and fire-resistant (Franks 2018; Saffady 2021).

In West Africa, healthcare facilities adopted storage equipment such as filing cabinets and cupboards for preserving medical records. A qualitative Gisemba, Ng'eno and Bosire (2022) on medical records management at Kisii Teaching and Referral Hospital in Kenya revealed that medical records were preserved using different equipment such as shelves, medicine cupboards, the floor, and lockable steel cabinets. Although this is the case, it was also revealed that the hospital lacked adequate storage equipment for the storage of medical records, such as shelves, filing cabinets, and vaults. A case study approach was used as the research design. Purposive sampling was adopted, and interviews, observation, and documentary reviews were used for data collection. The validity and reliability of the results were assured through peer debriefing, piloting, and triangulating data sources. Similar findings were reported in a study by Awogbami, Opele and Awe (2020) in Nigeria that healthcare facilities use filing equipment for the storage and retrieval of medical records. In addition, the study lamented the lack of storage equipment, such as shelves, cupboards, and filing equipment, for the preservation of medical records. The study employed a descriptive survey design. A self-developed questionnaire was used to collect data, where validity and reliability were tested using Cronbach's alpha test, which yielded 0.83%. Similar findings were reported in a study by Anyira (2020) that storage equipment such as shelves, cabinets and drawers were used for the storage of medical records in Nigeria. The reasons for the findings were attributed to a lack of modern records storage equipment, a lack of skilled staff, and a lack of ICT deployment.

In Southern Africa, different storage equipment items have been adopted for the storage of medical records in healthcare facilities. The most common ones are shelves, filing cabinets, cupboards, and folders. A mixed methods study by Pyrene (2015) on the management of medical records at the Victoria Public Hospital in the Eastern Cape Province, South Africa, revealed that medical records were stored using equipment such as folders, shelves and filing cabinets. The study adopted the Records Continuum model. Questionnaires, interviews and observation were used to collect data. Similar findings were reported in a qualitative study by Ngwenya (2020) on the management of medical records at Diepsloot clinics in Gauteng Province of South Africa. The findings of the study revealed that health facilities store records using file covers, boxes, storage rooms, and file cabinets. The study unveiled the challenges of a lack of standard, regulated equipment for the storage of medical records, with torn boxes placed on the floor supported with planks and bricks. It was also noticeable that some files were stacked up in open cabinets due to a shortage of storage room and equipment for records. Consequently, records staff could climb on top of piles of files to access records, which made it difficult to access them promptly. The study was guided by the life cycle model and the continuum model. A case study design was guided by the interpretive paradigm. Interviews, focus groups, and observations were used to collect data. A purposive

sampling method was adopted. Similar findings were reported in the studies by Chikuni and Mnjama (2010), Luthuli and Kalusopa (2020), Mampe and Kalusopa (2012), Marutha (2019) and Marutha (2021), where medical records were stored using steel and wooden open racking-type shelves which are up to 2 metres high, cupboards, static and mobile filing cabinets, corridors, storage rooms, storerooms, duty rooms, boxes, and folders/covers. The major challenges faced in the preservation of medical records were the shortage of preservation space, boxes, file covers, and markers due to limited budget allocation for medical records management (Luthuli & Kalusopa 2020; Mampe & Kalusopa 2012; Marutha 2019). As a result, patient case files were dormant and stored on the floor in the central medical records room (Chikuni & Mnjama 2010; Luthuli & Kalusopa 2020; Marutha 2019). Some records were kept on the floor, dirty and dusty and no folders for the files (Chikuni & Mnjama 2010; Luthuli & Kalusopa 2020; Mampe & Kalusopa 2012; Marutha 2019). Temperatures in this facility were high, which led to the brittleness of paper that resulted in crumbling (Chikuni & Mnjama 2010). The studies adopted ISO 15489 (2016), IRMT good practice indicators (Luthuli & Kalusopa 2020), and Records Continuum and Records Lifecycle model (Marutha, 2019; Marutha, 2021). Due to challenges in the storage mechanism for records in developing countries (Malawi included), coupled with recent advancements in ICTs as posited by the previous studies (Luthuli & Kalusopa 2020; Mampe & Kalusopa 2012; Marutha 2019), the present study intends to identify the storage mechanisms for medical records at the selected public healthcare facilities in Malawi. Therefore, storage mechanisms are one of the foci of preservation of records in a preservation framework. As such, implementation of preservation strategies, dissemination of policies and standards, and establishment of best practices apply to records in storage.

3.8 Knowledge and skills

Healthcare facilities need staff who have the requisite knowledge and skills to properly preserve medical records that have been created in the course of providing care to patients (Mensah 2011). Staff with the required skills, knowledge and competencies can properly manage medical records based on the best practices for records management (Amin *et al* 2020). National Records of Australia (2020) recommends that the records manager should possess the following professional skills and competencies:

1. Sound knowledge of records management theory and practice, including standards and best practices;
2. An ability to apply and adapt records management standards and best practices effectively in the organisation's context;
3. An understanding and ability to establish various records management tools and techniques;
4. A good knowledge of records management software applications and their use;
5. Experience or knowledge of other organisations' records management systems, obtained through regular liaison with peers;
6. An ability to interpret best practice standards, apply them locally and provide accurate and effective advice and guidance to colleagues (National Records of Australia 2020).

Besides skills and competencies, the records manager is expected to have the following personal skills and competencies:

1. Clear, confident and effective communication skills, both verbally and in writing;

2. An ability to communicate and get on well with colleagues at all levels;
3. Enthusiasm and is proactive;
4. A positive “can-do” attitude;
5. Completes tasks through to their conclusion;
6. Works effectively in a team environment, including in a leadership role;
7. Flexibility and an adaptable outlook, including the ability to respond to changing needs and different situations;
8. Effective advisory and influencing skills;
9. Can deliver effective presentations and training to an audience;
10. Share knowledge and experience;
11. Good analytical skills;
12. Marketing and promotional awareness, skills and abilities;
13. Personal and professional integrity;
14. Ability to develop and maintain a wide network of professional contacts;
15. Keeps up to date with professional developments and actively participates within the professional community (National Records of Scotland 2020; Amin *et al* 2020).

Surprisingly, most healthcare facilities in developing countries are manned by staff who have very limited experience or skills in records management, including preservation (Abore, Debiso, Birhanu, Bua & Negeri 2022; Gisemba, Ng’eno & Bosire 2022; Makeleni & Cilliers 2021). The majority of staff handling records in these countries have qualifications in Information Technology, nursing and other health-related fields besides records management (Masuku & Ngulube 2020). This lack of knowledge and skills negatively impacts the records personnel’s ability to execute their tasks with due diligence and support the health service delivery to patients (Park, Lee & Boo 2018). In addition, Tough and Lihoma (2018) have also argued that a lack of staff with the necessary skills and knowledge in medical records management could lead to data loss, data errors, missing records, lawsuits and other records-related challenges. To bridge this knowledge gap, Park, Lee and Boo (2018) have posited that records managers from developing countries need additional competencies such as analysis of big data, artificial intelligence, statistics, data processing, disease classification, cancer registration, security and personal information protection analysis to operate in the modern technological world.

In Asia, medical records are managed by qualified records management personnel with qualifications in records management. Although this is the case, training gaps exist that need to be addressed for the records manager to function fully in a technologically enabled healthcare setting. A quantitative study by Park, Lee and Boo (2018) on education and licensing examinations for medical record administrators in Korea revealed that the career path for medical records personnel should be revised to reflect emerging fields in medical records management, such as public policy and research, medical information management, and information processing and data analysis. The findings further suggested additional competencies such as analysis of big data, use of artificial intelligence, statistics, data processing, disease classification, cancer registration, security and personal information protection analysis (Park, Lee & Boo 2018). The study adopted a questionnaire and interviews for data collection. Similar findings were reported in a study by Amin *et al* (2020) on medical records management practice at the University Hospital in Malaysia. The findings of the study revealed that medical records officers had the right level of skills and

competencies in medical records management, such as communication, enthusiasm, pro-active, positive attitude, teamwork, leadership, flexibility, adaptability, networking, good analytics skills, and marketing and promotional awareness. Despite this positive development, the study revealed that the University Hospital had inadequate records professionals to handle medical records management functions. The study was guided by the Records Lifecycle model. The study applied a quantitative method approach with the use of a structured questionnaire.

However, some studies in India and Singapore revealed that records officers lacked the knowledge and skills in critical functions of preservation, such as receiving and filing medical records. A study by Bhat, Gijo and Jnanesh (2016) on productivity and performance improvement in the medical records department of a hospital in India revealed a lack of knowledge and skills among medical records handlers in receiving, assembling, coding, entry, and filing. The study recommended the recruitment of qualified personnel to handle the records management functions. The study applied the case study design and an interview for data collection. One of the contributing factors is the lack of time and human resources to retrain the staff to switch to electronic records management (Edmund, Ramaiah & Gulla 2009). Similar findings were reported in a descriptive study by Pourasghar, Malekafzali, Kazemi, Ellenius and Fors (2008) on medical records at the Women's Hospital in Iran. Data was collected using checklists and interviews. The findings of the study revealed that physicians and nurses lacked knowledge and skills in preserving medical records. The study recommended that physicians and nurses should attend workshops or courses after graduation to get more training and information on medical records (Pourasghar *et al* 2008).

In Africa, it has been noted that records officers and staff in healthcare facilities did not have the required level of knowledge and skills in the preservation of medical records. A study by Gisemba, Ng'eno and Bosire (2022) revealed that clinicians, admission clerks, and other staff handling and using medical records did not possess adequate knowledge and skills in medical records management. The findings further revealed that staff handling records acquired some medical records management skills on the job, but never attended workshops, conferences, or seminars. The study established that some staff took the initiative to train themselves in medical records management due to a lack of capacity-building opportunities at the hospital. Similar findings were reported in the studies by Adjei and Mensah (2016), Adu and Ngulube (2017) and Mensah and Adams (2014) in Ghana. The studies revealed that the majority of staff, especially "support staff", had a low level of education with no formal training in the management of medical records. The qualifications for the staff were a diploma, General Certificate of Education, Basic Education Certificate Examination, Senior Secondary School Certificate of Education, Middle School Leavers Certificate, degrees and other qualifications. In addition, the staff responsible for records lacked training in digital preservation despite possessing adequate organisational and technical expertise in digital preservation (Adu & Ngulube 2017). It was recommended that staff should be exposed to seminars and internships in areas such as preservation strategies and tools, digitisation, copyright issues and metadata, digital records security, digital repositories, standard formats and preservation strategies (Adu & Ngulube 2017). The studies were guided by the Records Lifecycle and Records Continuum models (Adu & Ngulube 2017; Mensah & Adams 2014).

In Nigeria, it has also been noted that records officers lack the formal training to preserve medical records. A study by Awogbami, Opele and Awe (2020) on health records management practices

and patients' satisfaction in South-West Nigeria revealed that health information management officers lacked formal records management training to manage medical records. A descriptive survey design was adopted with a random sampling technique. Data was collected using a self-developed questionnaire, which was tested for validity and reliability using Cronbach's alpha test, which yielded 0.83%. Similar findings were reported in the studies by Adeleke *et al* (2019), Adegboyega and Saâ (2019), Anyira (2020), Asunmo and Yaya (2016), Awogbami, Opele and Awe (2020) and Yaya *et al* (2015) in Nigeria. The studies revealed that hospital staff lacked knowledge and skills in records management and preservation, and as such, they should be incorporated through training and re-training, formulation of record management policies, infrastructural development, proper funding, and computer skill training. It was also noted that the majority of health facilities in Nigeria recruit unqualified personnel to handle records management functions (Adeleke *et al* 2019). Consequently, the Health Records Officers' Registration Board of Nigeria (HRORBN), which is the Federal Government Agency that regulates health records training and practice in the country released an official statement denouncing the employment of unqualified personnel to perform the work of qualified health records who have led to poor quality of health data in the country (HRORBN, 2017). Some of the reasons were the lack of funding (Yaya *et al* 2015) and the lack of professional standards and regulations on the management of health records and information (Adeleke *et al* 2019).

In Ethiopia, it was also observed that staff in healthcare facilities lacked training in electronic medical records and computer-related skills. A study by Abore *et al* (2022) on electronic medical recording systems in public general hospitals of Sidama region, Ethiopia, revealed that most of the staff predominantly lacked training in electronic medical records and computer-related skills. The contributing factors were a lack of continuous on-the-job orientations, monitoring, and follow-up to improve their skills and knowledge in medical records management (Abore *et al* 2022). Data was collected using a pretested self-administered questionnaire and in-depth interviews. The sample size was determined using Epi Info version 7, and stratified random sampling was adopted.

In Southern Africa, it has also been revealed that healthcare staff lacked knowledge and skills in the preservation of medical records. A qualitative study by Makeleni and Cilliers (2021) on data quality of electronic medical records in public healthcare institutions in the North Western province of South Africa revealed that staff lacked knowledge and skills in electronic records management. The study recommended training for healthcare staff on medical records management and preservation to avoid mistakes such as typing errors and incomplete records. The study utilised a data quality framework (DQF), and interviews were conducted with seven nurses and one information technology specialist chosen through purposive sampling. Similar findings were reported in the studies by Katuu (2015), Luthuli and Kalusopa (2020), Luthuli (2017), Marutha (2019), Marutha and Ngulube (2012) and Ngwenya (2020) that healthcare staff lacked expertise in the management of records. It was also established that the staff employed to manage medical records had qualifications in an administration certificate (Ngwenya, 2020) and a diploma not related to records management (Luthuli, 2017). The reasons for the findings are attributed to a lack of education and training among staff directly responsible for a records management function in health institutions (Katu 2015; Ngwenya 2020). It was recommended that healthcare staff managing records should undergo training in medical records management (Marutha 2019). Besides the lack of skills among healthcare staff, Marutha and Ngulube (2012) reported on the problem of understaffing in the records management unit.

In Zimbabwe, staff in healthcare facilities lacked skills and knowledge on the preservation of medical records. A study by Khumalo, Dube and Mnjama (2017) on records management in hospitals in Bulawayo, Zimbabwe, revealed a lack of skills and knowledge on preservation among healthcare staff. This was attributed to the failure of the National Archives of Zimbabwe (NAZ) to oversee the management of medical records because of a lack of adequate resources. The findings also revealed a lack of e-records capacity-building programmes by NAZ aimed at capacitating employees to manage e-records. Similar findings were reported in the study by Masuku and Ngulube (2020) on managing health records in the Bulawayo and Matabeleland South provinces hospitals, in Zimbabwe. The study revealed that the majority of the records management personnel did not have qualifications in records management but rather qualifications in National Diplomas in Records and Information Science Management, Health Information Management Certificates, National Diplomas in Information Technology, Diplomas in Nursing, Advanced Level Certificate, and Ordinary Level Certificate.

In Botswana, it has also been revealed that healthcare staff lack the knowledge and skills to preserve medical records. A study by Mampe and Kalusopa (2012) on medical records management in Botswana revealed that most of the records management personnel were inadequately skilled. The majority of staff handling records held certificates and diplomas in records management without professional training.

In Tanzania, healthcare facilities were locked with a lack of shortage of staff with e-records management competencies. A mixed methods study by Newa and Mwantimwa (2019) on e-records management in the Tanzanian public service. The findings of the study revealed that the healthcare facilities had a shortage of staff with e-records management competencies. The reason for the findings was due to the inadequacy of staff's competencies needed for e-records management (Kamatula 2018; Newa & Mwantimwa 2019). A descriptive research design was utilised to collect, process, and analyse data in this study, in which a total of 38 respondents were involved. Data were collected through questionnaires, interviews and documentary review.

In Malawi, a shortage of clerical staff with skills and knowledge in the preservation of medical records has been observed. A qualitative study by Tough and Lihoma (2018) on medical record-keeping systems in Malawi revealed a lack of adequate and appropriate training for data clerks and other record-keeping specialists. Consequently, frontline health care staff, ward maids, cleaners, security personnel and volunteers from village health committees have to undertake routine clerical or data capture work, resulting in uncaptured data and data errors. The situation was associated with data loss and data errors (Msiska, Kumitawa & Kumwenda 2017; Tough & Lihoma 2018). The reasons for the findings were a lack of training, accreditation, and career progression prospects for clerical staff, and training was mainly through short courses, and the adequacy of these was questioned (Tough & Lihoma 2018). According to Tough and Lihoma (2018), the focus of the training was on competence in ICT rather than ICD – the International Classification of Diseases – and the latter would be of greater benefit. Similar findings were reported in a study by Msiska, Kumitawa and Kumwenda (2017) on electronic medical records systems in Malawian central hospitals. The study revealed that the majority of healthcare staff did not receive any training in medical records management. The study was guided by the Performance of the Routine Information System Management (PRISM) framework. The study population was data clerks, nurses, clinicians, laboratory technicians, and HIV counsellors from 5 departments: the

Department of Medicine, the ART Clinic, the Department of Paediatrics, the Adult Emergency and Trauma Centre (AETC), and the Laboratory Department. Data was collected using a semi-structured questionnaire and focus group discussions. A significant gap exists in healthcare in preserving medical records. This argument is supported by previous scholars from developing countries such as Dube and Mnjama (2017), Luthuli and Kalusopa (2020), Luthuli (2017), Marutha (2021, 2019), Ngwenya (2020), Newa and Mwantimwa (2019) and Tough and Lihoma (2018). Preservation knowledge and skills of staff support the implementation of preservation strategies, dissemination of policies and standards, and establishment of best practices for preserving records in a preservation framework. For this reason, the present study endeavours to assess the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi.

3.9 Framework for the preservation of medical records

The preservation of records in public healthcare facilities needs to be guided by established standards and procedures in a preservation program within a preservation framework (Marutha, 2020). The framework recognises that preservation and enduring access to the health facilities' records must be fully supported by a preservation program that includes the implementation of preservation strategies, dissemination of policies and standards, and establishment of best practices, and these activities must be perpetual (University of Minnesota 2022).

Globally, several studies have adopted generic frameworks for the preservation of medical records. Studies by Adu and Ngulube (2017), Amin *et al* (2020), Masuku and Ngulube (2020) and Ngwenya (2020) adopted the Records Lifecycle model for the study of the preservation of medical records. Other studies adopted frameworks such as the Records Continuum (Adu & Ngulube 2017; Luthuli 2017; Ngwenya 2020), International Records Management Trust (IRMT) E-records Readiness Tool (Moatlhodi & Kalusopa 2016), ISO 15489 framework (Luthuli & Kalusopa 2020; Luthuli & Kalusopa 2017), International Records Management Trust (IRMT) good practice indicators (Luthuli & Kalusopa 2020), and Performance of the Routine Information System Management (PRISM) framework (Msiska, Kunitawa & Kumwenda 2017). However, a study by Marutha (2021) proposed a framework for the preservation of medical records in Limpopo hospitals in South Africa. The framework was meant to be localised as a centre of benchmark for healthcare institutions to suit their own environmental needs (Marutha 2021). The proposed framework focused on the safety and security of medical records through the implementation of policies and procedures, storage, and strategies for the preservation of medical records. The framework aimed at ensuring that the medical records created by one healthcare institution can be accessed by other healthcare institutions without duplicating records. In a nutshell, the literature has demonstrated a lack of a framework for the preservation of medical records. The current study suggests that healthcare facilities need to be guided by a specialised framework for the preservation of medical records. To achieve this aim, the current study intends to develop a new framework to promote best practices for preserving medical records at selected public healthcare facilities in Malawi.

3.10 Gaps in scholarship: empirical, theoretical and methodological shortcomings

In doctoral research, reference to related empirical studies is essential to avoid duplication, inform on the theory and methodology used by researchers investigating similar phenomena, maximise innovation and attain professional standards in research (Maggio, Sewell & Artino 2016:298). The researcher examined previous studies to identify gaps in existing literature and position the present study in the context of extant literature. This section presents a critical discussion of related

empirical studies from a global, regional and local perspective. Selection of the studies was based on their relevance to the themes of the study as highlighted in the literature review map, to identify empirical, theoretical and methodological gaps.

Globally, Zhan and Xuan (2021) undertook a study titled “Medical Record Encryption Storage System Based on Internet of Things.” The study sought to establish how the Internet of Things technology can be applied to the management of medical records. They utilised an experimental approach by modelling the business process management of doctors, nurses and patients and constructing a medical record encryption management system. The key findings of the study included: the cost of paper is significantly reduced, and the related forms of medical records are more unified and standard; medical record inquiry and reading are more convenient and controllable; and the safety of medical records is well guaranteed. The major conclusion from the study is that the encrypted medical record storage system based on Internet of Things technology can effectively solve the collection, statistics, and integration of patient treatment information, which can be summarized into a unified, shared, and interconnected electronic medical record management system to realize the collection of patient treatment information in the whole process. The study by Zhan and Xuan (2021) relates to the present study in that both studies examined medical records in public healthcare facilities. However, the two studies used different methodological approaches based on divergent philosophical viewpoints to achieve their objectives.

Alnashmi *et al* (2022), in a study titled “Exploring the Health Information Management System of Kuwait: Lessons and Opportunities,” sought to assess the medical records system in multiple healthcare settings in Kuwait, comprising government, private, and oil sectors. The study adopted a mixed-methods, descriptive, and explanatory approach and was conducted between May 2019 and July 2020. Regional directors of 38 hospitals were targeted, and a self-developed questionnaire was used for data collection. A total of 98 participants responded to the survey. The key findings of the study included: hospitals were using paper-based medical records, as compared to both paper-based and electronic media; hospitals in Kuwait did not adhere to the Ministry of Health policies regarding medical records disposition; instead, they developed their hospital-based disposition policy; there were clear discrepancies in record retention policies among the participating hospitals, and the duration of record retention varied from 2 years, 5 years, 10 years, and more than 20 years across hospitals in Kuwait. In conclusion, national policies and guidelines need to be established to monitor the medical record systems in Kuwaiti hospitals to further enable better patient care and improve healthcare facilities. Furthermore, it has become indispensable to develop and maintain electronic health records as they constitute an integral part of modern healthcare. The study recommended that health facilities should standardise medical records and train the hospital staff on standards through workshops and seminars, and records management guidelines should be widely circulated to health staff. The study by Alnashmi *et al.* (2022) relates to the present study in that both studies examined medical records in public healthcare facilities. Coincidentally, the two studies used similar methodological approaches to achieve their objectives. However, the study by Alnashmi *et al* (2022) focused on records management with little emphasis on preservation, while the present study focused on the preservation of medical records. In addition, the overall aim of the study by Alnashmi *et al* (2022) was to propose guidelines for records management, while the present study was geared towards developing a full-fledged

framework for the preservation of medical records. The framework was meant to guide preservation activities by healthcare staff in public healthcare facilities in Malawi and beyond.

A study carried out by Amin et al (2020) titled “Role of Medical Records Management Practice in Improving Decision Making in University Hospitals” explored the role of medical records practices in improving decision-making in University Hospital in Malaysia. The specific objectives of the study were to: identify medical record management in university hospitals associated with good practice in managing records, assess the staff's skill in managing medical records appropriately, and see how medical record management programs contribute to quality decision-making. The study was guided by the Records Lifecycle model. The study applied a quantitative method approach with the use of a structured questionnaire. A cluster sampling technique was used to classify the whole hospital into nine departments (clusters) and 90 health staff, and a records staff were purposively selected to participate in the study. The key findings of the study included: the completeness of physical notes and nursing notes of patients, and also that use and archive lifecycle are not associated with good practice in managing medical records. Most of the medical record officers have insight into personal skills and competencies about medical records; medical record officers have the right level of staff skill to manage medical records appropriately; misfiling and missing files, shortage of records staff and poor staff knowledge are the three main problems that affect the hospital in their quest to managing records effectively and making decisions. The major conclusion from the study was that the hospital has a records management programme that outlines how records are created, captured, used, maintained, preserved and disposed of. The study recommended that to make adoption of an integrated Electronic Records Management System, more training for records staff, conducive storage and enlarged storage location, adequate records staff and more alertness about security issues. The study by Amin *et al* (2020) relates to the present study in that both studies examined medical records in public healthcare facilities. In addition, both studies examined knowledge and skills in managing medical records. Furthermore, both studies adopted the Records Lifecycle framework as a lens for discussing the findings of the study based on the objectives. However, the two studies used different methodological approaches based on divergent philosophical viewpoints to achieve their objectives.

In Africa, Anyira (2020) investigated the preservation of medical information in healthcare facilities in Delta State, Nigeria, in a study titled “Preservation of Medical Information in Healthcare Facilities in Delta State, Nigeria.” The study was guided by the following objectives: to discover the major threats to medical records, to examine the strategies and methods of preserving medical information, and to examine the challenges militating against the effective preservation of medical records in Delta State. The survey method was used for the study. Medical staff members who are involved in handling health records in selected health facilities in Delta State were the target of this study. The questionnaire was the instrument used for data collection. The instrument was administered to respondents by hand, social media and e-mail. 300 questionnaires were administered to healthcare officials in 150 healthcare facilities in Delta State. Two questionnaires were administered to two officials of each facility. The healthcare facilities surveyed include public and private hospitals 84, dental and eye clinics 15, pharmacies 21, and medical laboratory test centres 30 with a total of 150 health facilities. Data was analysed using graphical charts. The key findings of the study included: the major threats to medical records in healthcare facilities include Rodents and pests, tampering, physical damage, lack of skilled staff,

dust, wear and tear, misplacement, poor power supply, lack of ICT deployment; the strategies and methods of preserving medical records in healthcare facilities included adherence to records preservation strategies, shelving of records, using cabinets and drawers to store records, use of air conditioners to control temperature, providing alternative source of power supply, and installation of CCTV Security system; challenges militating against effective preservation of medical records included nonchalant attitude towards preservation, poor funding of healthcare facility, lack of records storage space, lack of modern records storage equipment, lack of skilled manpower, lack of records management and preservation policy, excessive heat, harsh climatic conditions, pests and rodents attack, lack of ICT deployment, lack of temperature and humidity control equipment, insecurity, and erratic power supply. The study recommended that libraries/archives should be established in all healthcare facilities in Delta State, while librarians or archivists should be responsible for managing medical records. Also, healthcare facilities should deploy electronic health record systems, while regulators of health facilities should create a comprehensive policy and regulations that guide the management and preservation of medical records. The study by Anyira (2020) relates to the present study in that both studies examined the preservation of medical records in public healthcare facilities in developing countries such as Nigeria and Malawi. In addition, both studies examined strategies and methods of preserving medical information and challenges militating against the effective preservation of medical records. However, the two studies used different methodological approaches based on divergent philosophical viewpoints to achieve their objectives.

Gisemba, Ng'eno and Bosire's (2022) study titled "Medical Records Management to Support Evidence-Based Medical Practice at Kisii Teaching and Referral Hospital in Kenya," assessed medical records management (MRM) in support of evidence-based medical practices at Kisii Teaching and Referral Hospital (KTRH) to propose strategies to improve MRM in the hospital. A qualitative approach was adopted with a case study design. The study population comprised 500 workers, while the target population comprised 291 KTRH staff from four departments that create, generate, use, and manage medical records, namely: clinical, admissions, HRIM, and ICT departments. The study population included 3 HRIM officers, a system administrator, 10 admission clerks, 7 doctors, 8 clinical officers, and 23 nurses. Purposive sampling was used, and interviews, observation, and documentary reviews were used for data collection. The validity and reliability of the results were assured through peer debriefing, piloting, and triangulating data sources. The key findings of the study were that medical records at KTRH were fragmentary and the hospital was grappling with the issue of space in the main repository as records were sometimes filed on top of shelves, impeding ease of retrieval; storage mechanisms for records were medicine cupboards and floors; and some of the challenges related to the storage of medical records included a lack of storage equipment. The study concluded that the general status of MRM at KTRH was inadequately positioned to manage medical records as a strategic evidence resource in a continuum from creation to disposition, and therefore requires urgent attention. The study recommended that the integration of MRM functional, structural and infrastructural aspects into the hospital's health information system (HIS) and business process, and continuously manage these MRs in line with the Records Continuum model and best-practice strategies; the hospital should also develop operational policies and procedural frameworks for MRM, build MRM capacity and provide MRM knowledge and skill to staff; and improve its ICT infrastructure and integration of MRM functionalities. The study by Gisemba, Ng'eno and Bosire (2022) relates to the present study in that both studies examined medical records in public healthcare facilities in developing countries

such as Nigeria and Malawi. In addition, both studies examined storage methods for preserving medical records. However, the two studies used different methodological approaches based on divergent philosophical viewpoints to achieve their objectives. Furthermore, the focus of the two studies was different in that the study by Gisemba, Ng'eno and Bosire (2022) was meant to assess medical records management (MRM) practices in the healthcare system, while the present study was to develop and recommend a framework for preserving medical records.

Lastly, Marutha (2021) undertook a study titled “Medical Records Preservation Strategies in Improving Healthcare Service Providers’ Access to Patients’ Medical Histories in the Limpopo Hospitals, South Africa.” The purpose of the study was to investigate strategies for the preservation of medical records and to recommend a framework that healthcare institutions may use to ensure that they have their patients’ medical records/histories at their fingertips (readily available). The study adopted a multi-method approach with a survey research design and stratified random sampling. A questionnaire, observation, system analysis and document analysis were used to collect data from records management officials and heads of clinical, nursing and records management units at 40 state hospitals in the province of Limpopo in South Africa. Other data collection tools were observation, system analysis and document analysis. The key findings of the study were that the healthcare facilities lacked a structure for medical records (indexing and folio numbering) for easy monitoring, detection and control of missing records; weak security measures; lack of control of temperature in the filing storage; medical records were not backed up with electronic records system for any disaster recovery; water leak detectors and carbon dioxide fire extinguishers. The study also revealed that healthcare institutions in Limpopo revealed compliance with records metadata requirements, air-conditioners were functional, the presence of designated officials as custodians of the medical records and the filing system. The major conclusion drawn from the study was that the preservation of medical records in public healthcare institutions in Limpopo was very chaotic, to the extent that access to patients’ medical histories was not always a possibility. The study recommended that healthcare institutions need a framework for medical records preservation throughout the process of healthcare service delivery, to avoid chaotic healthcare services that eventually hamper the health of the patients. Consequently, the study provided a generic framework that may be localised as a centre of benchmark for healthcare institutions to suit their own environmental needs. The study by Marutha (2021) relates to the present study in that both studies examined the preservation of medical records in public healthcare facilities in developing countries such as South Africa and Malawi. In addition, both studies focused on the need for a framework to guide the preservation of medical records by healthcare staff. However, the two studies used different methodological approaches based on divergent philosophical viewpoints to achieve their objectives. The present study was guided by mixed methods approaches, while that of Marutha (2021) adopted a multi-method approach with a predominantly survey design. Furthermore, the focus of the present study by Marutha (2021) was narrow in that it meant to investigate strategies for the preservation of medical records while the focus of the present study was broader in that it focused on additional aspects of the preservation of medical records such as storage mechanisms, policies and standards, and knowledge and skills besides preservation strategies.

In a study titled “Managing Health Records in the Bulawayo and Matabeleland South Provinces Hospitals, Zimbabwe,” Masuku and Ngulube (2020) investigated the management of health records in the Bulawayo and Matabeleland South provinces in Zimbabwe. The objectives of the

study were to: understand how health records were being managed in the two hospitals, establish the availability of, and analyse standard procedures and guidelines that informed both the National Archives of Zimbabwe (NAZ) and hospitals in managing health records, and establish the level of professional training for health records management staff in hospitals under study. The study was guided by the Records Lifecycle model. A qualitative case study design was employed, and data was gathered through questionnaires, interviews, observation and document analysis. Data were analysed thematically based on the objectives of the study. Purposive sampling was used to select the respondents for the study. The study focused on all public and private hospitals in the Bulawayo and Matabeleland South Provinces and NAZ. The key findings of the study were that the strategies for the management of health records in hospitals were inadequate, there were no documented health records management standards to guide the management of these records in hospitals, and most health records personnel in hospitals did not possess records management qualifications. The study recommended that hospitals and NAZ should draft and implement health records management standards to guide the management of health records, and hospitals should employ staff with the requisite records management qualifications and offer them continuous training. The study by Masuku and Ngulube (2020) relates to the present study in that both studies examined medical records in public healthcare facilities in developing countries such as Zimbabwe and Malawi. In addition, both studies examined policies and standards, and the knowledge and skills of staff on the management of medical records. Also, both studies adopted the lifecycle model as a theoretical lens. However, the two studies used different methodological approaches based on divergent philosophical viewpoints to achieve their objectives. The study by Masuku and Ngulube (2020) was qualitative, while the present study adopted a mixed methods approach. The study by Masuku and Ngulube (2020) was broader since it focused on records management in general rather than preservation to be specific. Also, the study setting included public and private hospitals in the Bulawayo and Matabeleland South Provinces and NAZ for the study by Masuku and Ngulube (2020), while the present study focused on public healthcare facilities in Malawi.

3.11 Summary

This chapter provided a descriptive and empirical review of extant literature and discussed the previous related works in the area of preservation of medical records from a global, regional and local perspective. The literature was organised along themes identified from the literature review map, synthesised and summarised into key issues pertinent to the present study. The literature revealed that African countries, including Malawi, are lagging in implementing preservation strategies such as artificial intelligence, DNA storage, cloud storage, and backup due to a lack of funding, staff and technical infrastructure. In addition, the problem of lack of policies and standards in Africa (Malawi included) was highlighted, with the literature suggesting that training and awareness were required for records officials to improve their level of understanding and adoption of legislative frameworks, policies and procedures (Marutha 2019; Marutha & Ngulube 2012). Furthermore, the literature shows that developing countries such as Ghana, Nigeria, Kenya, South Africa, Zimbabwe and Botswana are not as exposed and have delays in the implementation of electronic systems for storing medical records. On skills and knowledge, the literature suggests that many records handlers in developing countries lack basic knowledge and skills in preserving medical records. The literature has also demonstrated a lack of a tailor-made framework for the preservation of medical records in Malawi, except for a study by Marutha (2021), which developed a framework for the preservation of medical records in Limpopo hospitals in South Africa.

In conclusion, the literature about the preservation of medical records revealed a lack of coordination of preservation activities as a result of the lack of a framework for the preservation of medical records in public healthcare facilities in African countries. Furthermore, the previous literature did not fully discuss the phenomenon of preservation of medical records, nor did they incorporate different perspectives on the problem. Instead, most of the studies mainly focused on one aspect (for example, 'preservation strategies'), as opposed to the present study, which strived to incorporate various pertinent issues in preservation, such as preservation strategies, storage mechanisms, policies and standards, knowledge and skills, and a preservation framework. Additionally, these studies fell short of utilising mixed methodologies that yield findings with wider degrees of generalisation as demanded by the present study. This study, therefore, intervenes in the need to address these gaps by developing a framework for the preservation of medical records based on empirical findings that will generate new knowledge on the subject of preservation.

The next chapter discusses the methodology adopted in conducting the study. The research paradigms, research approaches, research design, choice of sampling procedures and data collection methods will be discussed in the next chapter.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

The credibility of research depends on sound methodology and the methods it is based on. Over the years, there has been a major debate over the consensus on the terms of research methodology and research approaches (Abou Samra 2024). Johnson and Onwuegbuzie (2009) further argued that the methodology debate is not new. The concepts of research methodology and research approaches have been used interchangeably. However, some scholars have drawn the differences between the two concepts. Gray (2021:45) defines research methodology as “overall strategies, processes or techniques utilised in the collection of data for analysis to uncover new information or create a better understanding of the topic.” Abou Samra (2024:6) defines methodology as a process that produces science. Neuman (2019:25) considers research methodology as the entire research process, such as contextual setting, ethical principles, philosophical assumptions and the impact of the research. Kumar (2019:96) also considers research methodology as a composition of techniques and procedures for identifying and analysing data concerning a specific research topic. Furthermore, Kothari (2019:7) also attempts to define the concept of research methodology by stating that it is a way to systematically solve the research problem. In other words, it may be understood as a science of studying how research is done scientifically (Kothari 2019:7). In other words, research methodology is a process or plan for conducting a study based on specific research objectives or hypotheses to achieve the aim of the study (Neuman 2019).

Besides, research approaches are procedures or techniques used for data collection, analysis, and interpretation that researchers use for their studies (Creswell & Creswell 2022:334; Walliman 2021:121). The procedures and techniques are broadly categorised into qualitative, quantitative and mixed methods (Babbie 2020). The distinction is further made between research approaches and research design. According to Neuman (2019:59), research approach is a plan for conducting a study involving one or several approaches (for example, qualitative, quantitative and mixed methods) while a design is a plan for conducting a study based on a specific approach. This entails that a research design is within the research approaches. Furthermore, Kothari (2019:7) also attempts to provide a vivid distinction between research approaches and research methodology by stating that the former comprises methods/techniques that are used for the conduction of research, while the latter is a way to systematically solve the research problem. Consequently, research approaches and research design are part of the broader concept of research methodology as an overall strategy for conducting a study to find answers to a research problem.

The significance of research methodology cannot be underrated in a modern scientific research endeavour. Research methodology is one of the criteria for evaluating the reliability of the study (Kothari 2019:7). In the words of Gray, research methodology aims to help the researcher gather new information and create a new interpretation of the problem under study (Gray 2021). Therefore, it is imperative that the researcher carefully select the methodological aspects that concisely address the research problem. In other words, a “best fit” between the research problem and the methodology for addressing it. The main aim of the study was to develop a framework for the preservation of medical records in selected public healthcare facilities in Malawi. The study was guided by the methodological map (Figure 4.1) adapted from Ngulube (2015:128). Therefore, the chapter discusses the philosophical underpinnings and methodology of the study.

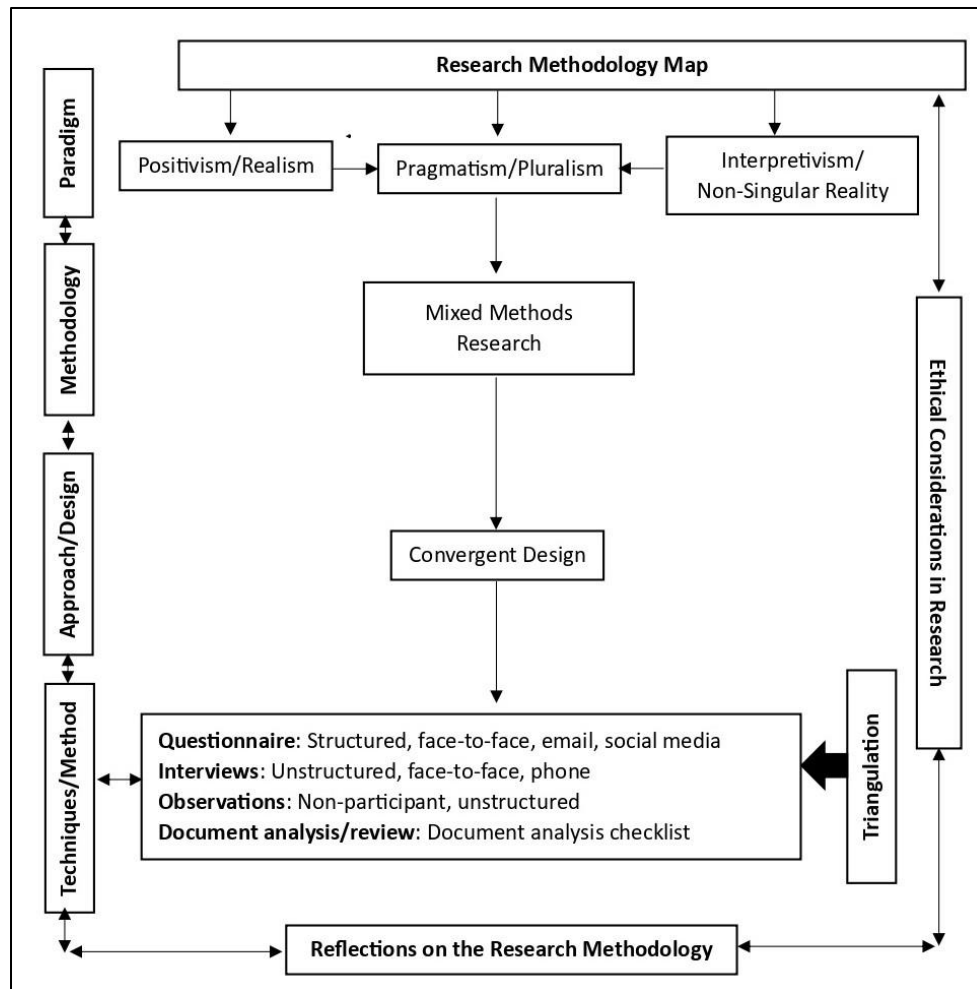


Figure 4.1: Research Methodology Map (Source: Adapted from Ngulube 2015:128)

4.2 Research paradigms

In planning for research, researchers must align the philosophical assumptions that they bring to the study with the research approaches and designs. Supporting this argument, Creswell and Creswell (2022) and Okesina (2020) argue that the philosophical assumptions of the researcher need to be identified as they influence the practice of research. Philosophical assumptions can be defined as a system of assumptions and beliefs about knowledge development (Saunders, Lewis & Thornhill 2019:130). Creswell and Creswell (2022:5) use the term philosophical worldview instead to mean a basic set of beliefs that guide action. However, the term paradigm has been synonymous with philosophical assumptions (Babbie 2020; Kumar 2019). The current study adopted the term paradigm rather than philosophical assumptions based on trends in the literature. Evidence suggests that the term paradigm was first introduced by Kuhn in 1970 (Kuhn 1970). Originally, Kuhn defined a paradigm as “an integrated cluster of substantive concepts, variables and problems associated with the corresponding methodological approaches and tools (Kuhn 1970:10). Using the term paradigms rather than philosophical assumptions, Kivunja and Kuyini (2017:26) further argue that paradigms constitute the abstract beliefs and principles that shape how a researcher sees the world, and how s/he interprets and acts within that world. Paradigms are also defined as the researcher’s thinking or philosophical orientation or perspective that influences what

should be studied, how it should be studied, and how the results of the study should be interpreted (Okesina 2020). In agreement with the discussion on paradigms, Leavy (2022:12) also argued that paradigms are lenses through which research is conceived and executed. In a practical and realistic analogy, Leavy (2022:12) postulated that paradigms are like sunglasses with differently shaped frames and differently coloured lenses. However, the terms qualitative and quantitative research approaches have been synonymous with paradigms in the literature (Wilkes, Anderson, Johnson & Bedell 2021). Biesta (2010), Morgan (2007), and Shannon-Baker (2015) have argued that the terms “quantitative” and “qualitative” are not synonymous with paradigms, but refer to different approaches to data and methods in social science. The researcher agrees with the opinion of scholars such as Creswell (2019), Biesta (2010), Morgan (2007), and Shannon-Baker (2015) that quantitative and qualitative research approaches are dissimilar to the concept of paradigms. Rather, quantitative and qualitative research are approaches of inquiry guided by a specific paradigm.

In an attempt to bring clarity to the discussion on paradigms, Morgan (2007) suggested the following ways to explain the concept of paradigms:

1. Paradigms as world views (all-encompassing perspectives on the world);
2. Paradigms as epistemological stances (ontology, epistemology and methodology from the philosophy of knowledge);
3. Paradigms as shared beliefs among members of a speciality area (about the nature of questions and answers in a field of research; and
4. Paradigms as model examples of research (depend on existing typical examples of best solutions to problems).

Generally, research paradigms have basic assumptions in ontological, epistemological, methodological and axiological (Rehman & Alharthi 2016). The four assumptions of research paradigms have been discussed below.

1. Ontology, according to Saunders, Lewis and Thornhill (2019:133), is the researchers’ assumptions about the nature of social reality. Researchers have assumptions, implicit and explicit, about reality, how it exists and what can be known about it (Rehman & Alharthi 2016). The researcher set out to inquire about what kind of reality exists: “a singular verifiable reality and truth or a socially constructed multiple realities” (Patton 2015:134). The current study conformed to multiple realities to investigate the framework for the preservation of medical records in selected public healthcare facilities in Malawi.
2. Epistemology originated from a Greek word which means knowledge (Kivunja & Kuyini 2017). Epistemology is used to describe how we come to know something; how we know the truth (Kivunja & Kuyini 2017:27). In other words, epistemology addresses key questions such as: is knowledge something which can be acquired on the one hand, or is it something which has to be personally experienced? What is the nature of knowledge and the relationship between the knower and the would-be known? What is the relationship between me, as the inquirer, and what is known (Kivunja & Kuyini 2017:27). The current forms to two forms of knowledge: authoritative and empirical knowledge. Knowledge will be acquired and experienced through interaction with people in the know and documents on the preservation of medical records and observations on conditions for the preservation of medical records in healthcare facilities.

3. Methodology is a broad concept that refers to the overall strategies, processes or techniques utilised in the collection of data for analysis to uncover new information or create a better understanding of the topic (Gary 2021:45). A mixed methods approach was adopted to find out about reality with a pragmatic paradigm.
4. Axiology refers to the ethical issues that need to be considered when planning a research proposal (Kivunja & Kuyini 2017:28). The study was done in conformity with the UNISA Ethics Policy document of 2016.

All research conforms to different philosophical assumptions which inform the nature of knowledge to be acquired and enhance the credibility of the study. Babbie (2020) argued that paradigms help researchers to better understand other researchers' bizarre views and actions, and experience new ways of seeing and explaining things, which brings credibility to the study. Considering the importance of paradigms in the research process, Okesina (2020) posits that paradigms inform the choice of research methodology, design and method for the study. For this reason, it is very important that the researchers clearly state the paradigm underpinning the study during the research process (Ugwu, Ekere & Onoh 2021). The choice of paradigms is an issue of ongoing debate among researchers (Hall 2020). The differences in the ontological and epistemological stances of researchers influence them to choose different research approaches to address a similar research problem (Creswell 2015). The factors that influence the choice of a paradigm are illustrated in Figure 4.2, adopted from Chilisa and Kawulich (2012). This entails that there is no right or wrong paradigm for a particular study (Kumar 2019). Consequently, a large number of paradigms have been proposed by researchers. However, Creswell (2019) suggests three main taxonomies, namely Positivism, Interpretivism, and Pragmatism.

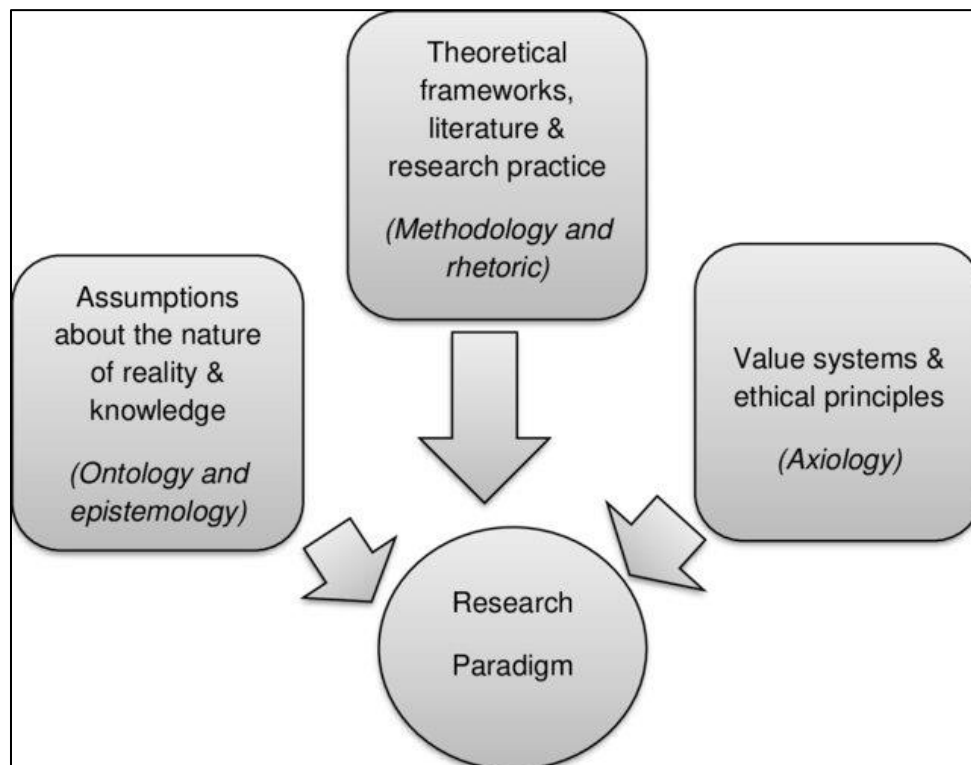


Figure 4.2: Considerations when Choosing Research Paradigms (Source: Chilisa & Kawulich 2012:3)

4.2.1 Positivism paradigm

The term positivism originates from the branch of philosophy that rose to prominence during the early nineteenth century because of the works of the French Philosopher Auguste Conte (Richards 2003). Positivists are of the view that reality exists independently of humans without the influence of our senses (Kumar 2019). The ontological position of positivists is that of realism (Babbie 2020). Positivists strive to understand the social world like the natural world. In nature, there is a cause-and-effect relationship between phenomena, and once established, they can be predicted with certainty in the future (Kivunja & Kuyini 2017). For positivists, the same applies to the social world. Since reality is free, researchers can arrive at the same conclusion about the phenomenon regardless of the differences in context (Rehman & Alharthi 2016). The epistemological position of positivists is that of objectivism without the influence of our social world (Babbie 2020). Researchers play the role of observers to study the phenomenon that exists independently of them (Creswell 2019). Language and symbols are used to describe the phenomena in their real form without any interference (Gray 2021). Positivism has been successful in studying natural objects, but they are not successful when applied to social phenomena (Rehman & Alharthi 2016). Complexities exist in the natural world, such as social laws and relationships, which are different from the laws governing the natural world (Rehman & Alharthi 2016). The positivism paradigm is aligned with the quantitative research approach (Kumar 2019). Quantitative data is collected through experiments or surveys using a closed-ended questionnaire. Numeric data originating from the methods are analysed through descriptive and inferential statistics (Rehman & Alharthi 2016). Similar studies by Amin *et al* (2020) in Malaysia, Anyira (2020) in Nigeria, and Marutha (2021) in South Africa have used the paradigm in studying the preservation of medical records.

4.2.2 Interpretivism paradigm

Interpretivism holds contrary views to those of positivists and believes that reality and truth are socially constructed and not discovered (Babbie 2020). This means that reality cannot be separated from the social world. The interpretivism paradigm is also called the anti-positivist, naturalistic or humanistic paradigm (Creswell & Creswell 2022). The ontological perspective of interpretivism is relativism or relativist ontology (Nguyen 2019; Ugwu, Ekere & Onoh 2021). Relativism assumes that knowledge can be gained or generated from the point of view of the individual who is directly involved (Ugwu, Ekere & Onoh 2021). Because of individual differences, realities about the phenomena under study have multiple realities (Kivunja & Kuyini 2017; Rehman & Alharthi 2016). The epistemology of interpretivism is subjectivism, which recognises the influence of the researcher and research participants in the creation and interpretation of reality or knowledge (Nguyen 2019). In other words, the interpretivism paradigm requires that social phenomena be understood “through the eyes of the participants rather than the researcher” (Martin 2018:21). The Interpretivism paradigm is aligned with qualitative research approaches such as ethnography and case studies (Babbie 2020). Examples of data collection methods that yield qualitative data are open-ended interviews, observations, field notes, personal notes, and documents (Babbie 2020; Creswell & Creswell 2022). Qualitative data is analysed thematically to generate themes and sub-themes as major findings of the study (Creswell & Creswell 2019). Similar studies by Gisemba (2022), Masuku and Ngulube (2020) and Zhan and Xuan (2021) in Kenya, Zimbabwe and China, respectively, used the paradigm in studying the preservation of medical records.

4.2.3 Pragmatism paradigm

The pragmatic paradigm was introduced to end what was known as the “paradigm war” between the positivists and the interpretivists (Ugwu, Ekere & Onoh 2021:121). Most of the assumptions behind the pragmatism paradigm emanate from earlier works of Peirce, James, Mead and Dewey (Cherryholmes 1992; Murphy & O’Leary 1994; Patton 2015). The pragmatism paradigm rose among the philosophers who argued that the “truth” can only be understood from both perspectives of positivist and interpretivist paradigms and not one (Kivunja & Kuyini 2017). The pragmatism paradigm believes in the strength of the two paradigms, which is not aligned with any of the two assumptions (Creswell 2019). The ontological position of pragmatism is a non-singular reality, which means that there is no single reality, and all individuals have the power to interpret reality (Ugwu, Ekere & Onoh 2021). The epistemological perspective is relational in that researchers have the power to interpret knowledge according to a given context (Ugwu, Ekere & Onoh 2021). The proponents of the pragmatism paradigm further advocated for a worldview with corresponding multiple research approaches for understanding the actual behaviour of participants (Ugwu, Ekere & Onoh 2021). Research designs aligned to pragmatism are mixed methods designs, namely convergent, explanatory sequential, and exploratory sequential (Creswell 2019). Data collection instruments are drawn from both quantitative and qualitative research approaches, such as questionnaires and interviews (Kumar 2019). As a result, data is analysed through statistical (descriptive and inferential statistics) and thematic analyses. A previous study by Alnashmi *et al* (2022) on the health information management system in Kuwait adopted the pragmatism paradigm as a philosophical assumption. Drawing on the works by Creswell (2019), the following are the philosophical assumptions of research located within the pragmatism paradigm:

1. Pragmatism is not committed to any one system of philosophy and reality, which applies to mixed methods research, which draws from both qualitative and quantitative assumptions during research.
2. The pragmatism paradigm accords the researchers the freedom to choose methods, techniques, and procedures of research that best meet their needs and purposes.
3. Pragmatists do not see the world as an absolute entity. Similarly, mixed methods researchers consider many approaches for collecting and analysing data rather than confining to one (for example, qualitative or quantitative).
4. Pragmatists believe that truth is relative and context-specific. Therefore, mixed methods researchers use both qualitative and quantitative data to provide the best understanding of the research problem.
5. The pragmatists attempt to address the *what* and *who* research questions based on the purpose of the study.
6. Pragmatists agree that research occurs in different contexts, such as social, historical, and political. Mixed methods research may include a theoretical lens that is reflective of the social, historical and political arms.
7. Pragmatists argue that the question of reality and laws of nature is irrelevant. Both the external and internal worlds are relevant to the study of a phenomenon.
8. The pragmatism paradigm offers an opportunity for researchers to study a phenomenon using different methods, different assumptions, and different data collection and analysis methods.

The study was underpinned by the pragmatism paradigm. This entails that both qualitative and quantitative approaches were adopted for the study. The researcher adopted the pragmatism paradigm for three reasons. Firstly, the methodological flexibility and ability to benefit from the strengths of either qualitative or quantitative approaches. Secondly, the researcher was able to look at both the “what” and “who” of the research problem and exhaustively address the research questions of the study. Lastly, the researcher was able to consider the multidimensional contexts of the study, such as the social, historical, and political nature of the topic of preservation of medical records in healthcare facilities in Malawi. Consequently, the researcher’s choice of pragmatic research paradigm led to the adoption of both qualitative and quantitative research approaches to investigate the framework for the preservation of medical records in selected public healthcare facilities in Malawi. The decision by the researcher affirms the generally accepted view that the choice of a paradigm influences the methodological decisions for a study (Creswell & Creswell 2022; Chilisa & Kawulich 2012; Okesina 2020).

4.3 Research approach

Creswell (2019:45) defined research approaches as strategies, processes or techniques for conducting a research study. In addition, Neuman (2019:59) also defines research approaches as a process of collecting, analysing data and presenting the results. Lastly, Kothari (2019:7) also attempts to describe research approaches by stating that they comprise methods/techniques that are used for the conduction of research. This entails that research approaches include research designs, data collection instruments, and sampling strategies, among others, relevant to the study. Ngulube (2020) ably recommends that Information Science researchers should strengthen the methodology and conceptual framework to increase the likelihood of such studies making positive contributions to the existing body of knowledge and discipline. Therefore, describing the approaches used in a study is essential because it enables researchers to test the approaches used (Ngulube 2015) and to replicate the study in different settings (Awinja 2022). According to this understanding, Creswell and Creswell (2019) and Kumar (2019) outline three types of research approaches, namely quantitative, qualitative and mixed methods.

Creswell and Creswell (2022) summarise the three research approaches as follows:

1. The qualitative research approach is supported by the interpretivism paradigm. The common research designs are ethnographies, grounded theory, narratives, phenomenology, and case studies. Data is collected using data collection instruments such as open-ended interviews, observations, field notes, personal notes, and documents. Data is analysed thematically to generate themes and sub-themes as major findings of the study.
2. The quantitative research approach is grounded in a positivist worldview. The research designs in quantitative methods are surveys and experiments. Quantitative data is collected through experiments or surveys using a closed-ended questionnaire. Numeric data originating from the methods are analysed through descriptive and inferential statistics.
3. The mixed methods research approach is grounded in the pragmatism knowledge claims. Examples of research designs in mixed methods are convergent, explanatory sequential, and exploratory sequential. Data is collected using both quantitative and qualitative data collection instruments, such as open-ended interviews, observations, field notes, personal notes, documents, and closed-ended questionnaires. Similarly, numeric data is analysed through descriptive and inferential statistics, and text or image data is analysed using thematic analysis.

4.3.1 Qualitative research

The notion of the true meaning of qualitative research is a highly contentious one among social scientists. Partly, this is due to the broad range of techniques and philosophies enshrined in qualitative research (Hennink, Hutter & Bailey 2020). However, there seems to be consensus in the literature on the definition of qualitative research. According to Hennink, Hutter and Bailey (2020:10), qualitative research is an approach that allows the researcher to examine people's experiences in detail by using a specific set of research approaches. Qualitative research is an approach to exploring and understanding the meaning individuals or groups ascribe to a social or human problem (Creswell & Creswell 2022:180). Qualitative research is commonly abbreviated as QUAL. Qualitative researchers tend to collect data in the field at the site where participants experience the issue or problem under study (Creswell & Creswell 2022; Hennink, Hutter & Bailey 2020). Data is collected using in-depth interviews, focus group discussions, observation, content analysis, visual methods, and life histories or biographies (Hennink, Hutter & Bailey 2020). Generally, qualitative data is in the form of text, images and audio (Hammarberg, Kirkman & de Lacey 2016; Hennink, Hutter & Bailey 2020). Qualitative data is analysed thematically to generate themes and sub-themes. The integrity of qualitative research is achieved through trustworthiness, credibility, applicability, and consistency are the evaluative criteria (Hammarberg, Kirkman & de Lacey 2016). Previous studies by Gisemba (2022), Masuku and Ngulube (2020) and Zhan and Xuan (2021) in Kenya, Zimbabwe and China, respectively, used the qualitative approach in studying the preservation of medical records.

4.3.2 Quantitative research

Quantitative research is the dominant and preferred research approach in the social sciences (Mohajan 2020). A qualitative approach is commonly abbreviated as QUAN. According to Ahmad, Wasim, Irfan, Gogoi, Srivastava and Farheen (2019:2828), quantitative research refers to a set of strategies, techniques and assumptions used to study psychological, social and economic processes through the exploration of numeric patterns. Equally, Kumar (2019) also argues that quantitative research deals with the quantification or measurement of results and is concerned with the generalisation of results to the entire population. The purpose of quantitative research is to generate knowledge and create an understanding of the social world through scientific inquiry (Ahmad *et al* 2019). Using scientific inquiry, quantitative researchers rely on observable data to examine questions about the sample population (Bloomfield & Fisher 2019). Quantitative research yields a wide range of numeric data (Babbie 2020:26). Quantitative data is collected through surveys or questionnaires, structured interviews, structured observations, experiments, and reviews of records or documents for numeric or quantifiable information (Creswell & Creswell 2022; Kumar 2019; Ahmad *et al* 2019:2831). Numeric data originating from the approaches are analysed through descriptive and inferential statistics (Babbie 2020:422-426). Previous studies by Amin *et al* (2020) in Malaysia, Anyira (2020) in Nigeria, and Marutha (2021) in South Africa have used the approach to studying the preservation of medical records.

4.3.3 Mixed methods research

Diverging from the assumptions of the two parallel research approaches (for example, qualitative and quantitative) is the research approach called mixed methods research, commonly abbreviated as MMR. The historical developments of mixed methods date back to the late 1980s and early 1990s, based on the work of different individuals from fields such as education, evaluation, management, sociology and health sciences (Creswell & Creswell 2022). However, Creswell and

Creswell (2022) further argued that the origin of the methodology dates back to 1959 when Campbell and Fisk used it to study psychological traits, despite that quantitative measures were only used. This prompted other scholars to collect different forms of data for addressing the research problems (Creswell & Creswell 2022). Since then, several authors have written on mixed methods (Bryman 2021; Creswell & Creswell 2022; Johnson & Onwuegbuzie 2009; Maxwell 2016; Morgan 2014; Tashakkori & Teddlie 2009), demonstrating the breadth and depth of the literature on the methodology (Dawadi, Shrestha & Giri 2021). On definitions, Creswell and Creswell (2022:19) offer several definitions of mixed methods research as follows:

1. Mixed methods research involves the collection of both qualitative (open-ended) and quantitative (closed-ended) data in response to research questions.
2. The methodology includes rigorous methods of data collection, data analysis, and interpretation of both quantitative and qualitative data.
3. The two forms of data are integrated into the design analysis by merging the data, explaining the data, building from one database to another, or embedding the data within the larger framework.
4. These procedures are incorporated into a distinct mixed methods design that indicates the procedures to be used in the study.
5. Lastly, these procedures are often informed by a philosophy and a theory.

However, several terminologies are used for this approach in the literature, such as integrating, synthesis, quantitative and qualitative methods, multi-method, mixed method, or mixed methodology (Anguera, Blanco-Villasen, Luis Losada, Sa´nchez-Algarra and Onwuegbuzie 2018). However, some scholars such as Babbie (2020), Bryman (2021), Creswell and Creswell (2022), Johnson and Onwuegbuzie (2009), Maxwell (2016), Morgan (2014), Tashakkori and Teddlie (2010) and the present study have adopted the term mixed methods research or MMR. Nevertheless, it has been argued that the two major methodological concepts of mixed methods and multi-method or multimethod are different. This has been discussed in the proceeding paragraphs below.

The turn of a decade has witnessed the growth of the methodological concepts of multimethod and mixed methods. However, the clear distinction between the two has been blurred. In some instances, the two terms have been used interchangeably, implying that the terms mean the same (Anguera *et al* 2018; Burns, Bellows, Eigenseher, Jackson, Gallivan & Rees 2014; Stange, Crabtree & Miller 2006). For example, Stange, Crabtree and Miller (2006:292) state that “mixed methods (also known as multimethod) research involves integrating quantitative and qualitative approaches to generating new knowledge.” Borkan (2004:4) says, “two articles in a special issue on multimethod studies in the Annals of Family Medicine focus on mixed methods or multimethod techniques, offering a tantalising glimpse of the potential of such investigations for primary care.” The International Journal of Multiple Research Approaches, according to its name, is expected to publish not only studies on multimethod but also mixed methods studies (Burns *et al* 2014). The three case studies above highlight chaos, confusion and lack of methodological understanding by scholars on multimethod and mixed methods.

To aid in bringing a distinction between multimethod and mixed methods, the study has isolated some key descriptions that have attempted to vividly describe the concepts. The earliest

explanation of multimethod is provided by Johnson, Onwuegbuzie and Turner (2007:119), who argue that “multimethod research is when different approaches or methods are used in parallel or sequence but are not integrated until inferences are being made.” The above view of multimethod is supported by explanations given in the renowned Sage Handbook of Mixed Methods in Social & Behavioral Research (Tashakkori & Teddie 2010), which describes multimethod studies as studies involving multiple types of qualitative research (for example, case studies and ethnographic studies) or multiple types of quantitative research (for example, surveys and experiments) while mixed methods involve the mixing of both types of data (Morse 2016). In adding value to the explanations above, Creswell (2015) offers a distinctive difference between multimethod and mixed methods.

Mixed methods are not simply the collection of multiple forms of qualitative data (e.g., interviews and observations), nor the collection of multiple types of quantitative data (e.g., survey data, experimental data). It involves the collection, analysis and integration of quantitative and qualitative data. In this way, the value of the different research approaches (e.g., the trends as well as the stories and personal experiences) can contribute more to understanding a research problem than one form of data collection (quantitative or qualitative) could on its own. When multiple forms of qualitative data (or multiple forms of quantitative data) are collected, the term is ‘multimethod’ (Creswell 2015:2–3).

The researcher concurs with Creswell (2015), Johnson, Onwuegbuzie and Turner (2007), Morse (2016), Taskakkori and Teddie (2010) and others that the key difference between multimethod and mixed methods is the integration of quantitative and qualitative data, which is not the case in multimethod. In multimethod research, different methods such as interviews and observations are used in qualitative research, while surveys and experiments are adopted in quantitative research (Anguera *et al* 2014).

There are several benefits to adopting MMR in a research study. Dawadi, Shrestha and Giri (2021) outline six major justifications for MMR in research as follows:

1. The first reason for employing the MMR approach is the expansion of the study. This entails that the use of MMR brings depth and breadth to the study through a collection of both closed-ended quantitative data and open-ended qualitative data to support understanding of a research problem (Creswell & Creswell 2022). This enables the researcher to generalise the findings to a larger population.
2. Secondly, the belief that combining the two methods is complementary and a value addition to the study. The researchers use both data sets to answer the same research question, which can produce greater certainty and wider implications in the conclusion (Maxwell 2016).
3. Thirdly, an MMR approach helps “to overcome the epistemological differences between quantitative and qualitative paradigms and to provide a royal road to true knowledge” (Bergman 2008:4). Indeed, a principled combination of the two methods supports researchers in developing an in-depth and comprehensive understanding of a research phenomenon (Lund 2012).
4. Fourthly, an MMR approach helps to obtain more rigorous conclusions by employing two methods in such a way that the strengths of the qualitative methods offset the weaknesses

of the quantitative methods and vice versa (Plano Clark & Ivankova 2016). This implies that a qualitative method can be strong in those areas where a quantitative method is weak and vice versa. Creswell and Creswell (2022) agree with this argument by stating that MMR can strengthen the study methodologically by minimising the weaknesses of either qualitative or quantitative approaches. In practice, a quantitative approach may be more suitable for addressing one question, and a qualitative approach is more suitable for addressing another question.

5. Fifthly, triangulation is one of the values of adopting an MMR in a study. Triangulation of data in a mixed methods study is considered a strategy for validating the results obtained from either of the approaches (Creswell & Creswell 2022). This entails that multiple data sets from both qualitative and quantitative offer insights on a phenomenon and provide stronger inferences on the study population (Teddlie & Tashakori 2009).
6. Lastly, the rationale for an MMR approach is to develop more effective conclusions through the results from one method (qualitative or quantitative) to shape or inform the use of another method (qualitative or quantitative) (Plano Clark & Ivankova 2016). This entails that the development and use of an emerging or new method based on the previous method is achieved only in a mixed methods approach.

There are several ways of mixing qualitative and quantitative approaches in mixed methods research. Different scholars in various disciplines such as Nursing (Morse 2016; Sandelowski 2000), Public Health Education (Steckler, McLeroy, Goodman, Bird & McCormick 1992), Health Research (Morgan 1998), Education Research (Creswell 2015; Tashakkori & Teddlie 2010), and Human and Social Sciences (Creswell & Creswell 2022) have suggested different typologies of mixed methods designs. However, the core typologies for mixed methods research in human and social sciences outlined by Creswell and Creswell (2022:15) are as follows:

1. Convergent mixed methods is a design in mixed methods research in which the researcher merges quantitative and qualitative data to provide a more comprehensive understanding of the research problem. Creswell and Creswell (2022:218) refer to this design as One-Phase Design. In this typology, the researcher collects both forms of data at the same time and merges them at the interpretation of the results stage.
2. Explanatory sequential mixed methods is another form of mixed methods design in which the researcher collects quantitative data initially, analyses the results and builds on the results to explain them in more detail in qualitative research. Creswell and Creswell (2022:218) call this design a Two-Phase Design. It is called explanatory because qualitative data is used to explain quantitative data, which was collected and analysed in the initial phase of data collection and analysis. In addition, it is called sequential because quantitative data collection and analysis are followed by qualitative data collection and analysis.
3. Exploratory sequential mixed methods is the direct opposite of the explanatory sequential mixed methods. In this design, qualitative data is collected and analysed in the initial phase and builds on the results to explain in more detail in the quantitative phase. Creswell and Creswell (2022:218) refer to this design as a Three-Phase Design. The qualitative data may be used to inform the development of the data collection instrument that may be used to collect quantitative data in the second phase.

The present study adopted a mixed methods approach (MMR). The adoption of the quantitative and qualitative approaches in a mixed methods approach supported the researcher in developing an in-depth and comprehensive understanding of a research phenomenon (Lund 2012). In addition, the use of the approach coupled with a triangulation of data generated new insights in a multidimensional context (social, historical, and political) on the status of the preservation of medical records in public health facilities in Malawi. Quantitative approach was useful to obtain numeric data on attitudes and opinions captured through a questionnaire that was administered to healthcare staff and data entry clerks. A qualitative approach was used to capture the perceptions of participants using an interview guide from hospital directors, hospital administrators and records officers. Observations and document analysis tools collected both qualitative and quantitative data and complemented the two instruments discussed earlier. A previous study by Alnashmi *et al* (2022) in Kuwait also adopted a mixed methods approach in the study of the preservation of medical records in health facilities.

4.4 Research design

Research designs are an important aspect of a research study. Therefore, researchers need to exercise caution in choosing the right research design for addressing the problem under study. According to Creswell and Creswell (2022:11), research designs are types of inquiry within qualitative, quantitative, and mixed methods approaches that provide specific direction for procedures in a research design. In addition, Babbie (2020:119) consider research designs as a set of decisions regarding what topic to study, among what population, and with what research approaches, for that purpose. Furthermore, Kumar (2019:95) defines a research design as a plan, structure and strategy of investigation that is aimed at obtaining answers to the research problem. In other words, a research design acts as a framework for the collection and analysis of data (Bryman & Bell 2021:98). In general, a research design is a plan of inquiry for addressing the research objectives and research problem. Broadly, research designs are aligned with the philosophical assumptions of the study and resultant research approaches. Therefore, the positivism paradigm is aligned with the quantitative research approach and associated research designs such as surveys and experiments, while the interpretivism paradigm is aligned with the qualitative research approach and associated research designs such as case study, ethnography and phenomenological research designs. The pragmatism paradigm is aligned with mixed methods approaches and associated research designs such as convergent, explanatory sequential and exploratory sequential. Creswell and Creswell (2022) further discuss the core typologies for mixed methods research as follows:

1. Convergent mixed methods is a design in mixed methods research in which the researcher merges quantitative and qualitative data to provide a more comprehensive understanding of the research problem. Creswell and Creswell (2022:218) refer to this design as One-Phase Design. In this typology, the researcher collects both forms of data at the same time and merges them at the interpretation of the results stage.
2. Explanatory sequential mixed methods is another form of mixed methods design in which the researcher collects quantitative data initially, analyses the results and builds on the results to explain them in more detail in qualitative research. Creswell and Creswell (2022:218) call this design a Two-Phase Design. It is called explanatory because qualitative data is used to explain quantitative data, which was collected and analysed in the initial phase of data collection and analysis. In addition, it is called sequential because quantitative data collection and analysis are followed by qualitative data collection and analysis.

3. Exploratory sequential mixed methods is the direct opposite of the explanatory sequential mixed methods. In this design, qualitative data is collected and analysed in the initial phase and builds on the results to explain in more detail in the quantitative phase. Creswell and Creswell (2022:218) refer to this design as a Three-Phase Design. The qualitative data may be used to inform the development of the data collection instrument that may be used to collect quantitative data in the second phase.

The present study adopted the convergent mixed methods design to provide a more comprehensive understanding of the current problem of the lack of a framework for the preservation of medical records in selected public healthcare facilities in Malawi (Figure 4.3). The weighting was more quantitative data and less qualitative data as stipulated by the design configuration symbolised by QUAN+qual (Creswell & Creswell 2022). Quantitative and qualitative data were collected roughly at the same time and eventually merged during the interpretation phase. Inconsistencies in the data were highlighted and explained during the interpretation of the results. The rationale for choosing the design was that neither of the approaches (quantitative nor qualitative) was adequate to address the research problem (Plano Clark & Ivankova 2016). A previous study by Alnashmi *et al* (2022) in Kuwait adopted the convergent mixed methods design in the study of the preservation of medical records in health facilities.

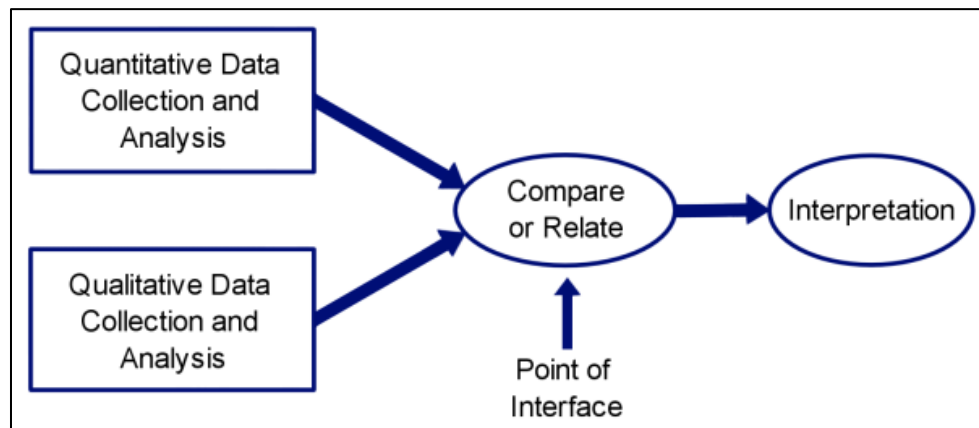


Figure 4.3: Convergent Mixed Methods Design (Source: Creswell & Creswell 2019:218)

4.4.1 Convergent mixed methods design

The convergent mixed methods design is one of the common core mixed methods approaches. According to Creswell and Creswell (2022:217), a convergent mixed methods design involves the collection and analysis of quantitative and qualitative data at the same time. This is the reason the design is called One-Phase (Creswell & Creswell 2022:218). However, analysis for the two data sets is done separately. Finally, the two data sets are merged to compare the results at the interpretation stage, usually during the discussion of the findings. The key assumption of this design is that both quantitative and qualitative approaches yield different data and information, but together they yield the same results. This design originates from the concept of a multimethod and multitrait idea from Campbell and Fiske (1959), where they argued that psychological traits could be best understood by gathering different forms of data. As a result, different scholars have adopted the use of different datasets to address their research problems.

Data collection through the convergent mixed methods design is achieved in a two-fold manner. Firstly, the collection of quantitative data through questionnaires that yield numeric data for statistical analysis. Secondly, qualitative data analysis uses instruments such as interviews, observations, documents, and records for thematic analysis. Nevertheless, there are two major debatable issues concerning data collection in the convergent mixed methods design, namely the choice of variables and sampling. Firstly, the idea behind data collection in this design is to collect both sets of data using the same or parallel variables or constructs. This is important to achieve the goal of successfully comparing the quantitative and qualitative findings during the interpretation or discussion stage. However, researchers who decide to use slightly or overall different variables in data collection in the quantitative and qualitative phases might have challenges in comparing the findings. The current study adopted the method of collecting quantitative and qualitative data using similar variables to achieve complementarity and comparison of the data. Secondly, the design allows for differences in the variation in the sample size for quantitative and qualitative data collection. Creswell and Creswell (2022) also argue that the norm is to have a large sample size for the quantitative phase and a smaller sample size for the qualitative phase. This is in line with the traditions of both approaches, where quantity (size) is key in achieving validity of the findings in quantitative research, while quality (depth) is key in qualitative research (Creswell & Creswell 2022). In instances where the sample size is the same for the two approaches, Creswell and Creswell (2022) argue that the depth of qualitative data collected is compromised or limited to meet the number of participants. The study adopted a larger sample size for the quantitative section compared to the qualitative section. As regards sampling, the same individuals can also be involved in both quantitative and qualitative data collection phases (Creswell & Creswell 2022). Creswell and Creswell (2022) argue that this arrangement enhances the comparison of the findings from the two samples.

Data analysis and integration are another key feature of the convergent mixed methods design. It is argued that data analysis in this design consists of three phases. The first is an analysis of quantitative data, while the second is an analysis of qualitative data. The third involves mixed methods data analysis, which involves integrating the two databases. On integration, Creswell and Creswell (2022) propose three approaches such as side-by-side comparison, data transformation, and joint display. Jones (2015) proposes a fourth approach called visualisation. The integration is achieved in the discussion section of the research report. Side-by-side involves reporting the quantitative results followed by a discussion of qualitative findings or vice versa (Creswell & Creswell 2022:220). The side-by-side approach is also called narrative (Moseholm & Feters 2017; Polit & Beck 2020). Furthermore, data transformation involves changing the qualitative data to numerical data represented in quantitative research (Moseholm & Feters 2017:3; Creswell & Creswell 2022:220). The two data sets are combined to provide meaning to a variable being studied. Lastly, joint display involves using a single table or figure to display the quantitative and qualitative data (Creswell & Creswell 2022). Panda, Das and Maruf (2015) provide a generalised description of joint display as a way of bringing together data using visual means such as tables, figures and others. Creswell and Creswell (2022) posit that quantitative variables may be displayed using one or more columns, while qualitative data is displayed in the rows in a joint display. Lastly, visualisation uses GIS mapping for the analysis of spatial information with local quantitative or qualitative findings (Jones 2015). The methods of data integration are practical depending on the type of research. The current study adopted a side-by-side comparison or narrative approach in merging the quantitative and qualitative data due to its simplicity and wide use in previous studies.

Interpretation of data in the convergent mixed methods design is done in the discussion section, while the results section reports the results of the analysis of the data from the two approaches (Creswell & Creswell 2022). During interpretation, the findings from the two databases are compared, which may result in slight divergence or differences in the results (Creswell & Creswell 2022; Moseholm & Feters 2017). Creswell and Creswell (2019) argued that the researcher needs to acknowledge this limitation, and further steps should be taken to explain the findings. This is achieved through consulting the databases to seek explanations or insights on the data to normalise the divergence or differences (Creswell & Creswell 2022). Quantitative and qualitative data for the current study were interpreted in the discussion section. Divergence in the data was resolved by referring to the databases for more explanation, and any limitations were acknowledged in the report.

Validity in a convergent mixed methods design is achieved through construct validity (quantitative validity) and triangulation (qualitative validity) for each data set (Palinkas, Mendon & Hamilton 2019). However, there seems to be a lack of methods tailor-made for achieving validity in a mixed methods approach (Creswell & Creswell 2022). Nevertheless, Creswell and Creswell (2022) posit that mixed methods researchers can adopt the traditional methods for achieving validity concerning quantitative and qualitative research. Both construct and triangulation methods were adopted to achieve the validity of the findings in the current study.

4.5 Target population

The study population “refers to individuals, groups and communities from whom the information for the study will be collected” (Kumar 2019:58). According to Saunders, Lewis and Thornhill (2019:295), the target population is the entire group in whom the researcher is interested and that meets the sample requirements is referred to as the target population. An example of a study population can be a person, a group, an organisation, and written documents or messages (Babbie 2020). This implies that a study population comprises both people and documents, among others. The entities for the population must.

The study’s population comprised five (5) public healthcare facilities, namely Mzuzu Central Hospital (MCH) located in Mzuzu City, Kamuzu Central Hospital (KCH) located in Lilongwe City, Queen Elizabeth Central Hospital (QECH) in Blantyre City, Zomba Central Hospital (ZCH) and Zomba Mental Hospital (ZMH) in Zomba City. The public healthcare facilities were selected because the preservation of medical records exists with infrastructure and staff complement. Other public healthcare facilities were excluded because medical records are rarely preserved and frequently transferred to central hospitals for proper maintenance.

The study population was drawn from four (5) units of the public health facilities, such as the administration unit, records management unit, ICT unit, nursing services unit and clinical services unit. The hospital directors and hospital administrators were drawn from the hospital administration unit, records officers and data entry clerks were drawn from the records management unit, the ICT unit comprised of ICT officers, and nurses were drawn from the nursing unit; and mental health clinicians, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, paediatricians, dieticians, and physiotherapists were drawn from the clinical unit. Other categories of staff, such as librarians, drivers, receptionists, and cleaners, were not targeted as they were not heavily involved in the

preservation of medical records. The population of the study is highlighted in Table 4.1 with relative sizes of the population in each of the case study sites.

Table 4.1: Population (N= 415)

Population	Health Facility				
	Mzuzu Central Hospital	Kamuzu Central Hospital	Zomba Central Hospital	Zomba Mental Hospital	Queen Elizabeth Central Hospital
Hospital Directors	1	1	1	1	1
Hospital Administrators	1	1	1	1	1
Nurses	22	33	17	22	64
Mental Health Clinicians	0	0	0	15	0
Laboratory Technicians	3	5	3	3	4
Ophthalmologists	2	3	2	0	3
Pharmacists	2	3	2	2	3
Dieticians	2	3	1	1	3
Physiotherapists	3	4	2	3	4
Dermatologists	2	2	2	0	3
Radiologists	3	3	2	1	4
Dentists	3	4	2	0	4
Oncologists	2	4	2	0	5
Gynaecologists	3	3	2	0	4
Paediatricians	3	4	4	0	6
Counsellors	2	3	1	5	3
Records Officers	1	2	1	1	4
Data Entry Clerks	7	15	5	4	18
ICT Officers	3	5	2	2	5
Total	65	98	52	61	139

(Source: Ministry of Health 2020)

The above statistics were obtained from the Ministry of Health through email communication. Due to constraints such as time and finances, it was practically impossible to conduct a census including the entire population in the study. Below is a brief profile of each of the respondents, outlining their relevance to the present study:

4.5.1 Hospital administrators

The hospital directors and hospital administrators comprise the senior management level and are part of the hospital administration unit in the public healthcare facilities in Malawi. They were selected for the study because they are responsible for policy making, budgeting and general administrative duties of the healthcare facilities. Policies and budgeting relate to the preservation of medical records. Apart from policy making, hospital administrators also create and use (consume) medical records daily.

4.5.2 Nursing staff

Nurses comprise the largest population of staff responsible for the provision of healthcare to patients. Nurses belong to the nursing unit department. This category of the population was selected because they are involved in all activities of records management across the lifecycle of records from records creation, use and disposal.

4.5.3 Clinical staff

Likewise, clinicians constitute the largest population of staff responsible for the provision of care to patients. The specific roles of clinicians in healthcare facilities include mental health clinicians, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, paediatricians, dieticians, and physiotherapists. Clinical staff were also selected because they create, distribute, use, maintain, and dispose of medical records.

4.5.4 Records management staff

Records officers and data entry clerks were drawn from the records management unit. Records officers (including assistant records officers) were selected because of their expertise in records and archives management. This category of staff is charged with the responsibility of managing records from creation to disposition in the entire healthcare facility. Records management staff are also responsible for implementing preservation actions, preservation policies and standards, storage mechanisms, and the safety and security of medical records. This category of staff is also responsible for the training of staff on the preservation of medical records. Thus, they were able to respond to all questions related to the preservation of medical records in the context of healthcare facilities.

4.5.5 ICT staff

ICT staff include ICT officers who are responsible for the management of the hardware and software installations of the healthcare facilities. Part of the software is the database system, such as HMIS, EMR Systems, LDI Systems, and MSI Systems (Ministry of Health 2019). It is assumed that ICT staff are directly responsible for the management of digital records, hence being able to respond to questions on the preservation of digital records in healthcare facilities.

4.6 Sampling methods/techniques

Sampling is the process of selecting the population with the desired characteristics for the study (Bell, Bryman & Harley 2018:89). According to Kumar (2019:177), sampling is the process of selecting a few (a sample) from a larger group (the sampling population) to become the basis for estimating or predicting the prevalence of an unknown piece of information, situation or outcome regarding the larger group. A sample is a subgroup of the population you are interested in (Kumar 2019:177). There are advantages and disadvantages to sampling. One of the advantages is that it saves time and money as the population for the study is reduced, while the disadvantage is the possibility of error in estimating the characteristics of the population in a sample (Kumar 2019). Neuman (2019) adds that the purpose of sampling is to generalise the findings from a few representative individuals to the entire population. However, the purpose of sampling in quantitative and qualitative research may be different. The purpose of sampling in quantitative research is to draw inferences about the group through a representative sample, while in qualitative research, it is meant to gain in-depth knowledge about a situation or event and will provide insights about the group (Kumar 2019). In other words, a larger sample is important in quantitative research, while a small sample is considered adequate in qualitative research.

Generally, the literature categorises sampling techniques into two, namely probability and non-probability sampling techniques (Babbie 2020; Kumar 2019; Neuman 2019). Probability sampling employs random sampling techniques so that each unit in the population has a known chance of being selected (Bell, Bryman & Harley 2018). Examples of probability sampling techniques are simple random sampling, systematic sampling, stratified sampling, and cluster/area sampling. Probability sampling techniques have been largely associated with quantitative research approaches (Onwuegbuzie & Collins 2007). Non-probability sampling techniques employ non-random techniques for selecting the units in the study, which entails that some members of the population are eliminated based on the choice or decision of the researcher (Kumar 2019:177). Examples of non-probability techniques are convenience sampling, snowball sampling, quota sampling and purposive or judgment sampling (Babbie 2020). Non-probability sampling techniques have been largely associated with qualitative research approaches (Onwuegbuzie & Collins 2007).

For mixed methods research, the tradition has been the adoption of sampling techniques from both probability and non-probability sampling techniques (Onwuegbuzie & Collins 2007). In practice, Onwuegbuzie and Leech (2005) have argued that sampling techniques have been widely adopted in quantitative, qualitative or mixed methods regardless of the traditional dichotomy that probability sampling techniques fall within quantitative research and non-probability fall within qualitative research. According to Onwuegbuzie and Collins (2007), some of the major sampling strategies in mixed methods research are simple, stratified, stratified-purposive, cluster, systematic, multi-stage random, maximum variation, homogeneous and critical case.

Stratified sampling was used to select respondents for the quantitative section of the study. Healthcare staff responsible for the preservation of medical records were first divided into subgroups called strata based on common characteristics they share, such as positions, roles and responsibilities, and knowledge of preservation of medical records. The researcher draws the motivation from Kumar (2019), who argues that purposive sampling is extremely useful to describe a phenomenon if little is known about it, as is the case with the current study on the preservation of medical records in public healthcare facilities. Stratified purposive sampling involves dividing the larger population into sub-categories and purposively selecting the units based on a predefined criterion (Onwuegbuzie & Collins 2007).

For the qualitative section of the study, participants were selected through a purposive sampling technique from the same population. This method is supported by Creswell and Creswell (2019), who argue that the process of drawing the sample from the same sample size for the quantitative and qualitative data collection enhances comparison of the findings from the two samples. Participants with rich information on the preservation of medical records in public healthcare facilities were purposively selected. Previous studies by Marutha (2021) and Anyira (2020) used stratified and purposive sampling strategies in the study of the preservation of medical records in South Africa and Nigeria, respectively.

4.7 Sample size

Kumar (2019:58) defines a sample size as the number of units from which the required information for the study is obtained and is usually denoted by the letter *n*. Several methods exist for determining a sample size, such as a sample size table, a sample size formula, a sample size calculator, and an established sample size from previous studies (Kumar 2019).

The sample size for the study was calculated using a Raosoft sample size calculator, which recommends a sample size of 200 out of the total population of 415 based on a margin of error of 5% and a confidence level of 95% (Raosoft 2004). Therefore, the sample size for the quantitative section of the study was 181 (200 minus 19 sample size of the hospital directors, hospital administrators and records officers) as highlighted in Table 4.2. For the qualitative section, the sample size was determined by data saturation, whereby the researcher waited until data saturation occurred during the data collection phase (Kumar 2019). Creswell and Creswell (2022) recommended that a sample size of 5 to 25 participants is enough to reach data saturation. Therefore, the sample size of the qualitative section of the study was 19, as displayed in Table 4.3. This arrangement is supported by Creswell and Creswell (2022), who argue that a larger representative sample size is key to achieving validity of the findings in quantitative research, while quality (depth) or a smaller sample size is adequate in achieving validity in qualitative research.

Table 4.2: Sample Size (n=181)

Population	Health Facility				
	Mzuzu Central Hospital	Kamuzu Central Hospital	Zomba Central Hospital	Zomba Mental Hospital	Queen Elizabeth Central Hospital
Nurses	7	8	4	4	10
Mental Health Clinicians	0	0	0	9	0
Laboratory Technicians	1	3	2	2	2
Ophthalmologists	1	2	1	0	2
Pharmacists	1	2	1	1	3
Dieticians	1	2	1	1	3
Physiotherapists	2	3	1	2	4
Dermatologists	1	1	1	0	4
Radiologists	2	2	1	1	4
Dentists	2	2	1	0	4
Oncologists	1	2	1	0	3
Gynaecologists	1	2	1	0	3
Paediatricians	1	1	2	0	3
Counsellors	1	1	1	2	3
Data Entry Clerks	3	7	3	2	8
ICT Officers	3	5	2	2	5
Total	28	43	23	26	61

Table 4.3: Sample Size (n=19)

Population	Health Facility				
	Mzuzu Central Hospital	Kamuzu Central Hospital	Zomba Central Hospital	Zomba Mental Hospital	Queen Elizabeth Central Hospital
Hospital Directors	1	1	1	1	1
Hospital Administrators	1	1	1	1	1
Records Officers	1	2	1	1	4
Total	3	4	3	3	6

The eligibility criteria for the samples were based on the designation and employment status of healthcare staff. The study targeted staff in the following departments with overall responsibility for preserving medical records: administration, inpatient and outpatient, laboratory, ophthalmology, pharmacy, physiotherapy, dermatology, radiology, dental, oncology, gynaecology, paediatrics, and counselling. In addition, the study targeted staff mostly on permanent employment and long-term contracts, such as two (2) years and above, with knowledge and experience in the preservation of medical records. The recruitment process involved accessing employment details for eligible staff, such as names, departments, phone numbers, and emails. The researcher used the details to contact the staff concerned through phone, email, social media, and personal contacts about their participation in the study.

4.8 Research instruments

Data collection is defined as the process of gathering, evaluating and analysing precise understandings for research using typical authenticated methods (Mazhar, Anjum, Anwar & Khan 2021:6). The data collection process is achieved using tools called data collection instruments or research instruments (Babbie 2020). Research instruments are tools used to collect data for a research project (Kumar 2019:58). Research instruments are important because the data collected assist in addressing the research objectives or assessing the hypotheses of the study (Mazhar *et al* 2021). Creswell and Creswell (2022) also argue that data collection is the most significant step for research, regardless of the field of study. Generally, research instruments are categorised into two, namely those that collect quantitative data and those that collect qualitative data (Creswell & Creswell 2022). An example of a research instrument that yields quantitative data is a questionnaire, while open-ended interviews, observations, field notes, personal notes, and documents yield qualitative data (Kumar 2019). However, another categorisation exists, such as research instruments that collect primary data and secondary data (Kothari 2018; Kumar 2019). Examples of research instruments that collect primary data include observations, interviews, questionnaires, and document analysis (Kothari 2018; Kumar 2019). Secondary data is collected through research instruments such as government publications, journals, books, magazines, newspapers, reports, public records, statistical and historical documents, diaries, manuscripts, data from unpublished studies, autobiographies and biographies (Kothari 2018; Kumar 2019). The study adopted a questionnaire, interviews, observations, and document analysis as tools for data collection. The justifications for the use of the tools are discussed in the sections below.

4.8.1 Questionnaire

The questionnaire is one of the most common research instruments for collecting numeric data in survey research from a large population. According to Kumar (2019:60), a questionnaire is a written list of questions, the answers to which are recorded by respondents. A questionnaire is a predetermined set of questions given to several respondents (Mazhar *et al* 2021:6). Babbie (2020:257) further adds that a questionnaire is a document containing questions and other types of items designed to solicit information appropriate for analysis. Although the term questionnaire implies a set of questions, statements are also included in the document (Babbie 2020). A questionnaire is administered to a select group of people with the ability to respond to questions and return the questionnaire within a specified period (Kumar 2019). In a questionnaire, respondents read the questions, interpret what is expected and then write down the answers (Kumar, 2019). Another key feature of a questionnaire is that respondents can provide the answers to the questions with little interference from the researchers (Kumar 2019). According to Creswell and Creswell (2022), a questionnaire can take many forms, such as printed sheets with questions or in digital format.

Questionnaires take two main forms, depending on the types of questions, such as open-ended and closed-ended questions. The open-ended questionnaire is also called an unstructured questionnaire, while the closed-ended questionnaire is also called a structured questionnaire (Dalati & Gomez 2018; Wellman 2019). In the open-ended questionnaire, the respondent is asked to provide his or her answer to the question. In other words, there is no restriction on the way the questions are supposed to be answered by the respondents. Usually, the type of question commences with the word “what”. The crafting of the questions provides a space for recording responses in the questionnaire. Closed-ended questions are a different type from open-ended questions. In closed-ended questions, the respondent is asked to select an answer from among a list provided by the researcher. Babbie (2020) argues that closed-ended questions are popular in survey research because they provide uniformity in the responses and are easy to process compared to open-ended questions. Scholars like Kumar (2019), Neuman (2019) and Walliman (2021) have argued that an open-ended questionnaire is a form of interview and is common in qualitative research approaches.

In terms of administration, Babbie (2020) outline four types of questionnaires. The first is a self-administered questionnaire in which the respondents respond to questions themselves without interference from the researcher. The second is an interviewer-administered questionnaire in which questions are asked to respondents in a face-to-face mode. Responses are manually or digitally recorded by the researcher. The third questionnaire was administered by telephone, in which the researcher asked the questionnaires and respondents responded to them over the phone. The last questionnaire was administered online. This method takes the form of sending electronic questionnaires to respondents through email or social media, and respondents respond to the questions and return them within the agreed period.

A good questionnaire has several qualities. According to Kothari (2018), Kumar (2019) and Babbie (2020), some of the qualities of a good questionnaire are as follows:

1. Questions should be smaller and to the point.
2. Questions should be in sequence.

3. Questions should proceed in a logical sequence, moving from easy to more difficult questions.
4. Personal and intimate questions should be left to the end.
5. Technical terms should not be used in questionnaires.
6. Questions may be dichotomous, multiple-choice or open-ended.
7. Questions that can affect the answers of the respondents should be avoided.
8. Questions must include all aspects of the problem (Babbie, 2020; Kothari, 2018; Kumar, 2019).

The adoption of the questionnaire in a research study has several benefits. Creswell and Creswell (2022), Dalati and Gomez (2018), Kothari (2018) and Mazhar *et al* (2021), Wellman (2019), and the present study have outlined the following benefits of adopting a questionnaire:

1. The use of questionnaires for data collection requires low costs in the sense that the forms can be sent electronically to respondents, compared to interviews, which have to be done face-to-face or by phone.
2. The questionnaire reduces bias error since respondents can respond to the questions without interference from the researcher.
3. The absence of a researcher increases anonymity, especially in dealing with sensitive questions.
4. A questionnaire is that it can be administered physically through a printed form or mailed electronically. This is important for respondents who have preferences on the type of questionnaire to use based on their convenience.
5. Through electronic means, a questionnaire can be used to solicit feedback from people who are spread over a wide area and are not easy to contact face-to-face.
6. Questionnaires are also convenient to the respondents in the sense that they can respond to the questions in their own free time and speed.
7. Questionnaires also allow wide coverage of the subject area represented by questions. All important issues can be included, and respondents can respond to all of them at once.

However, the use of a questionnaire is not without limitations, as highlighted by Bryman and Bell (2021) as follows:

1. The questionnaire poses a highlight probability of a non-response rate due to a lack of understanding of the questions by the respondents and no opportunity to probe the respondents to elaborate on their responses. This is particularly true for self-administered questionnaires and those sent by email.
2. There is also a possibility of missing data as respondents fail to respond to all the questions. The researcher may have no opportunity to follow up with the concerned respondents for additional data.
3. Questionnaires also pose a risk of a high non-return rate due to a lack of commitment from the respondents to respond to the questions, busy schedules of respondents, or questionnaires being lost in transit.
4. The ambiguity of the identity of the respondents who participated in the study can be a major disadvantage in using a questionnaire. This is more prevalent with postal or emailed questionnaires, and the researcher cannot be sure who responded to the questions.

The closed-ended questionnaire was administered to the respondents physically (face-to-face), via social media and via email. Questionnaires through email and social media were preferred due to challenges with distance and the absence of respondents due to their busy schedules. Physical questionnaires were used when respondents were reachable face-to-face in healthcare facilities. The researcher recruited five research assistants to assist with the administration of the instrument. The five research assistants were drawn from each of the health facilities. The research assistants held the positions of HMIS officers and Data Entry Clerks. The in-house research assistants were opted for because they were conversant with the subject of the preservation of medical records and were conversant with the health system of their respective healthcare facilities. The research assistants were trained on data collection for one day. The questionnaire had closed-ended questions, which were used to obtain quantitative data from 181 respondents. The closed-ended questions sought to obtain quantitative data on preservation strategies, policies and standards, storage and mechanisms, and knowledge and skills. The closed-ended questionnaires were administered to nurses, and clinical staff (mental health clinicians, dermatologists, laboratory technicians, radiologists, dentists, oncologists, ophthalmologists, gynaecologists, pharmacists, paediatricians, dieticians, physiotherapists, counsellors), data entry clerks and ICT officers. Previous studies by Alnashmi *et al* (2022), Amin *et al* (2020), Anyira (2020), Gisemba (2022) and Marutha (2021) have used the questionnaire to collect data on the preservation of medical records in Kuwait, Malaysia, Nigeria, Kenya, and South Africa, respectively.

4.8.2 Interviews

Interviews have become the dominant instrument for data collection in the social sciences. An interview is a process whereby the researcher interviews the target population either by phone or in a face-to-face situation (Creswell & Creswell 2022:59). According to Babbie (2020:273) and Mazhar *et al* (2021:7), the interview is a data collection encounter in which one person (an interviewer) asks questions of another (an interviewee). Interviews are done at the convenience of the respondents (Mazhar *et al* 2021:7). Mostly, interviews are done in a face-to-face encounter, though telephone interviews are also common (Babbie 2020; Mazhar *et al* 2021). Several considerations have to be made when adopting an interview method for data collection. Mazhar *et al* (2021) argue that interviewers have to be sensibly nominated, skilled, updated, authentic, genuine, diligent, unbiased and ethically sound.

Interviews are categorised differently according to the structure of questions and mode of delivery. Concerning structure, Kumar (2019) and Mazhar *et al* (2021) categorise interviews as structured, semi-structured and unstructured. Structured interviews follow a rigid procedure in that predetermined questions are asked in a specific order (Babbie 2020). In other words, all respondents are asked the same questions. Structured interviews are used when the interviewer has a very clear understanding of the question (Baumbusch 2010; Langley & Meziani 2020; Magaldi & Berler 2020). Semi-structured interviews use both closed and open-ended questions and are accompanied by questions of why or how (Adams 2015). Due to their flexibility and ability to gather more details, Magaldi and Berler (2020) call semi-structured interviews an exploratory interview. In semi-structured interviews, the interviewer has a framework of themes to be explored (Ruslin, Mashuri, Rasak, Alhabsyi & Syam 2022). In line with the themes, the interviewer has the liberty to introduce new questions based on responses from the interviewee (Ruslin *et al* 2022; Megaldi & Berler 2020). Semi-structured interviews are used when the researcher needs flexibility and intends to examine cases presented by the interviewee (Ruslin *et al* 2022). As the name implies, unstructured interviews do not follow a system of predetermined questions and

standardised techniques for recording information (Mazhar *et al* 2021). Unstructured interviews are applicable when the question or topic is relatively new and the interviewer has no clear understanding of it (Baumbusch 2010; Langley & Meziani 2020; Magaldi & Berler 2020). According to the mode of delivery, interviews are done face-to-face or by phone. Factors such as time, resources and availability of respondents determine the method to use (Babbie 2020; Bryman 2021; Kumar 2019; Walliman 2021).

Babbie (2020) discusses several guidelines which the researcher has to follow to have a successful interview.

1. It is argued that interviewers should dress similarly to the people being interviewed. A well-dressed interviewer will have difficulty getting good cooperation and responses from poorer respondents, and vice versa.
2. Besides dressing, the interviewer should be familiar with the questions. Lack of familiarity with the questions creates an unfair burden on the interviewees and consumes a lot of time in the process.
3. The interviewers should be strict in following the wording of the questions, as slight changes might invite a different unintended response from the interviewees.
4. In addition, the interviewees must be competent in recording the responses word for word (verbatim). For this purpose, a digital recorder should be used with approval from the interviewees to supplement recorded notes.
5. Probing is an important technique in conducting interviews. In the case of unclear or wrong responses, the interviewer can probe or request elaboration on the issue.

There are several advantages to adopting interviews compared to other data collection instruments. Babbie (2020) outlines the following benefits of interviews:

1. Interviews attain higher response rates compared to questionnaires. It is argued that a well-designed interview ought to achieve a higher response rate of at least 80-85 per cent. Partly, the reason is that respondents feel obliged to accept interviews rather than questionnaires.
2. Interviews also provide an opportunity to probe responses or answers provided by respondents. This process reduces the number of “don’t knows” and “no answers”.
3. Interviews also provide an avenue to clarify misunderstandings of questions, thereby obtaining relevant responses.
4. The interviewer can reduce the time spent asking questions by skipping obvious questions through observations such as gender, quality of English and others (Babbie 2020).

Like any other data collection instrument, interviews have several disadvantages. Neuman (2019) and Walliman (2021) outline several disadvantages of interviews, which the researcher strived to overcome as follows:

1. During the interview process, the interviewee might feel that their responses are not being respected or manipulated. Consequently, the interviewee might not be willing to reveal more information about the aspect or issue.

2. The interviewers might be quick to judge the responses of the respondents. This may create bias in the questions being asked by the interviewer. Eventually, the data might be biased and not original.
3. Responses from the interviewees may offer more insights or details on the issue being discussed. However, it may be difficult to verify the truth about the responses.
4. The interviewees may feel disappointed or withdrawn if asked about sensitive issues or topics not related to the study. Interviewees may hide other information or fake the responses.
5. The interview process is costly as it consumes time and financial resources to conduct face-to-face or phone interviews (Neuman 2019; Walliman 2021).

Semi-structured interviews were administered to the participants face-to-face and by phone. Interviews by phone were preferred due to challenges with distance and the absence of participants due to their busy schedules. Face-to-face interviews were opted for when participants were reachable physically in healthcare facilities. The interviews had open-ended questions, which were used to obtain qualitative data from 19 participants. The open-ended questions sought to obtain qualitative data on preservation strategies, policies and standards, storage mechanisms, and knowledge and skills. Semi-structured interviews were administered to hospital directors, hospital administrators and records officers. Previous studies by Gisemba (2022), Masuku and Ngulube (2020) and Zhan and Xuan (2021) in Kenya, Zimbabwe and China, respectively, adopted the interviews for data collection in studying the preservation of medical records.

4.8.3 Observations

Observation is one of the basic tools for collecting data in behavioural sciences. Observation is a purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place (Kumar 2019:125). According to Bryman (2021:269), observation is a way of collecting data through observation. In simpler terms, observation involves ‘seeing’ things – such as objects, processes, relationships and events – and formally recording and analysing what is seen (Garbutt, Napier, Scholz & Simister 2018:1). Observation is used both as a stand-alone data collection tool and triangulated with other tools such as interviews and questionnaire (Bryman 2021; Garbutt *et al* 2018; Kumar 2019).

Different types of observations exist, such as structured, unstructured, participant and non-participant observations. Structured observation, also called direct or systematic observation, is a technique in which the researcher employs explicitly formulated rules for the observation and recording of behaviour (Bryman 2021:272). In structured observation, the aspects to be observed are specified, and the means of collecting data are predetermined (Bryman 2021). This process ensures standardisation and easier to compare and analyse data (Kumar 2019). Thus, structured observation is applicable in quantitative research (Bryman 2021). Structured observation is applicable in large-scale studies and testing hypotheses (Walliman 2021). However, unstructured observations do not follow any rules or procedures for observing behaviour and are done haphazardly (Garbutt *et al* 2018; Kumar 2019). This approach is flexible and open-ended in the sense that the observer focuses on a wide range of issues and notes the ones relevant to the study (Garbutt *et al* 2018). It also allows a comprehensive and in-depth understanding of the topic, which entails that the approach is applicable in qualitative research.

Besides structured and unstructured observations, participant and non-participant observations are another category of observation methods. Participant observation involves developing close relationships with the members of a group or living in the situation which is being studied (Kumar 2019). In this approach, the researcher can take part in the activities of the group with consent, keenly observe and take notes of a phenomenon or case (Sileyew 2019). Depending on the type of data collected, participant observation applies to both qualitative and quantitative research approaches (Kumar 2019). This means that both numeric and narrative data can be collected using observations (Ahmad *et al* 2019). In addition, the approach is flexible in triangulating with other instruments such as interviews, questionnaires, and document analysis (Garbutt *et al* 2018). Triangulation of instruments enhances the richness of the data collected through participant observation (Bryman 2021; Creswell & Creswell 2019; Kumar 2019). One of the limitations of participant observation is the probability of introducing the researcher's bias in the process of data collection (Khakimova 2019). Nevertheless, Garbutt *et al* (2018) argue that participant observation is appropriate for studying social phenomena related to beliefs, rituals, symbolic systems, and values. Non-participant observation is the direct opposite of participant observation. In this approach, the researcher observes a case or phenomenon from a distance without getting involved in the affairs of the group being observed (Kumar 2019). In this case, the researcher assumes the role of a passive observer watching and listening to the activities and drawing conclusions. In most cases, the participants are not aware that they are being observed.

The observation method has several benefits as supported by Garbutt *et al* (2018), Khakimova (2019), Kumar (2019) and the present study as follows:

1. The observation method addresses the inherent problem in interviews and questions of inaccurate responses due to a lack of accurate memory of past events by respondents. Through observation, the researcher can capture the accurate rendering of behaviour demonstrated by the group.
2. The observation method is relevant in situations where interviews and questionnaires are not practical due to differences in languages or disability of the people being observed.
3. The observation method allows the triangulation of data collection instruments, which enhances the richness of the data collected.
4. The observation method can collect both qualitative and quantitative data, which adds value to the data collected through other means (Garbutt *et al* 2018; Khakimova 2019; Kumar 2019).

Despite several benefits of the observation method, some challenges need to be identified and addressed (Garbutt *et al* 2018; Kumar 2019; Ross & Bibler Zaidi 2019). The following are some of the challenges of the observation method which the researcher strived to address:

1. The observation method may lead to a collection of wrong data if individuals or groups are aware that they are being observed and, as a result, change their behaviour. In social science research, this situation is called the Hawthorne effect.
2. An observer may introduce bias if he/she is not impartial, and it is difficult to verify the observations and inferences drawn from them.
3. The inferences or interpretations drawn from observation may vary from one observer to another. This is dependent on the observational and writing skills of the observer.

4. In observation, it is always difficult to balance between observation and/or recording. Either way, the researcher might miss important details and, as a result, draw wrong inferences or conclusions from the data collected.
5. The observation method may focus primarily on observable behaviour, but does not always explain the motivations for that behaviour. This means that observation may only provide one part of the picture while the other part remains unexplored or unanswered (Garbutt *et al* 2018; Kumar 2019; Ross & Bibler Zaidi 2019).

Unstructured and non-participant observations were conducted in public healthcare facilities. The questions were open-ended and closed-ended, which were used to obtain qualitative and quantitative data. To aid in data collection, an observation checklist was used to collect data on the condition of storage rooms for records such as ventilation, air filter systems, sun shield, use of energy-saving light, air-conditioners, condition of electrical wires and plumbing pipes, and cleanliness), and storage equipment such as computers, servers, internet and intranet devices, reprographic machines, fire extinguishers, fire alarms and sand buckets, security of records. The observation method was adopted to complement data collected from questionnaires, interviews, and document analysis, commonly referred to as triangulation. This is supported by scholars such as Bryman (2021), Garbutt *et al* (2018) and Kumar (2019) who argue that observation is flexible in triangulating with other instruments such as interviews, questionnaires, and document analysis. Triangulation of instruments enhances the richness of the data collected through observation (Creswell & Creswell 2022). In addition, previous studies by Mensah and Adams (2014) and Masuku and Ngulube (2020) in Ghana and Zimbabwe, respectively, adopted observations for data collection in studying the preservation of medical records in the two countries.

4.8.4 Document analysis

Documents have been a valuable source of information for research for many years. However, the preference for document analysis for collecting research data has been minimal compared to interviews and questionnaires (Morgan 2022; Tight 2019). This has been demonstrated by the lack of literature on document analysis compared to other data collection tools (Tight 2019). Document analysis consists of analysing various types of documents, including books, newspaper articles, academic journal articles, and institutional reports (Morgan 2022). Document is a generic term for a wide range of materials, including visual sources, such as books, policies and procedures manuals, photographs, video, and film (Merriam & Tisdell 2016; Muchaonyerwa 2015). Therefore, documents cannot be underrated as a source of good information for research.

One of the strengths of document analysis is that it yields both qualitative and quantitative data (Morgan 2022). Depending on the type of analysis, numbers and statistics can be used to interpret the data (Tight 2019). According to Morgan (2022), this process is called content analysis. Therefore, quantitative research facilitates comparison and statistical aggregation of data (Patton 2015). Qualitative research focuses on how people interpret their own experiences and is designed to explore latent and explicit meaning in the data. Explicit data extracts or verbatim are used as evidence for the arguments in the data.

The validity of the data collected through document analysis is also dependent on the selection procedures for the documents. Figure 4.4 outlines the selection criteria for documents adopted from Kridel (2015). Flick (2018), Kridel (2015) and the present study considered four factors to use when selecting the documents for inclusion in the study.

1. Authenticity involves the extent to which a document is genuine (Dunne, Pettigrew & Robinson 2016). In a similar manner that the interviewer selects the appropriate people for the interview, the same applies to the selection of documents which are original and not forged. A document with inconsistent content, such as changes in typography, handwriting, and style of language, could be a sign that a document is not original and needs verification before use in the study (Dunne, Pettigrew & Robinson 2016).
2. Credibility relates to the extent to which the source is free from error and distortion (Dunne, Pettigrew & Robinson, 2016). Credibility is checked by verifying whether the producers or authors of the documents are reliable sources or not (Flick 2018).
3. Representativeness deals with a reflection of the content of the document with a collection of other documents about the same topic (Kridel 2015). However, researchers may lack control over the documents to access as organisations make decisions on content for investigation (Flick 2018).
4. Meaning pertains to evidence of clarity and understandability of the content of a document (Dunne, Pettigrew & Robinson 2016). Documents contain both literal and interpretive meanings. Literary meaning pertains to the face value of a document, while interpretive meaning relates to the contextual understanding of the content of a document. However, the researcher needs to relate the two meanings to assess the meaning of the entire document (Morgan 2022).

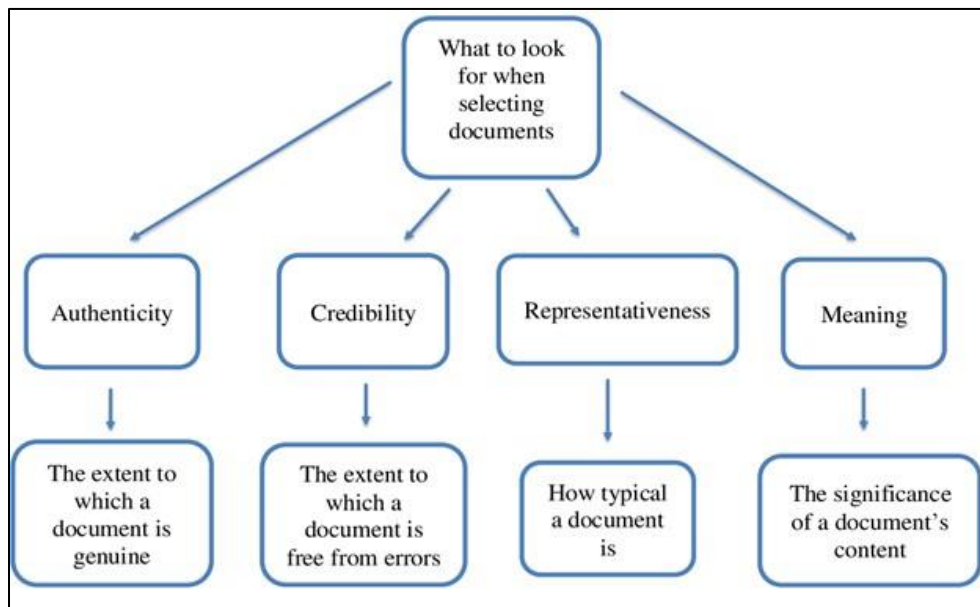


Figure 4.4: Criteria for Selecting Documents (Source: Kridel 2015)

The use of document analysis has many advantages in research. Blackstone (2019), Morgan (2022), Patton (2015), Tight (2019) and the present study argued that document analysis offers several advantages as follows:

1. The document analysis method can be used both as a sole data collection method or triangulated with other methods such as interviews and questionnaires. In all, documents provide the best source of data for researchers.

2. Analysis of documents helps reduce risks to researchers involved in sensitive research projects, such as terrorism. Therefore, analysing documents on the topic is deemed a safer approach compared to collecting the primary data from the terrorists.
3. Analysis of data from documents eliminates the inherent weaknesses of questionnaires and interviews, such as influence from researchers due to sex, age, and social class (Waterfield, 2018), and distrust from respondents because of a fear that the research findings may be useless or harmful to their communities (Ellard-Gray, Jeffrey, Choubak & Crann 2015).
4. Document analysis provides an opportunity for researchers to acquire an accurate interpretation and understanding of the facts of the phenomenon. This is not possible through interviews or observations, as researchers do not see everything in a setting and determine what is crucial to observe (Bailey 2018). For novice researchers, the use of observations to gain information can be a challenge due to a lack of observation and writing skills (Creswell 2015; Ross & Bibler Zaidi 2019).
5. Using documents as a form of data raises fewer ethical concerns than other methods. For example, public records are available for access and use by anyone and are often anonymous. Authors of books and articles in newspapers and journals are generally aware that their intellectual work is available to the public. However, Merriam and Tisdell (2016) argue that researchers need to deal with instances of ethical issues resident in documents such as evidence of misappropriation of funds or corruption.
6. It is a fact that document analysis is more appropriate for novice researchers because of the elimination of fieldwork such as getting permission letters from gatekeepers, travelling to a site to collect data, and transcribing or coding the collected data. This set of activities is not necessary for document analysis except in circumstances when the data is in audiovisual format (Braun, Clarke & Weate 2016).

Document analysis, like any other data collection method, is marred with limitations. Blackstone (2019), Creswell and Creswell (2022), Merriam and Tisdell (2016) and Morgan (2022) have outlined some of the limitations of document analysis, which the researcher strived to overcome as follows:

1. Validity of information through document analysis is only possible with accurate sampling and representation of documents that cover a balanced view of the topic of study. In some instances, organisations may not be willing to release documents with contrary views and not align with the ambitions of the current management. This raises serious questions about the validity of the information from documents in such circumstances.
2. Another potential bias could result from the system of recording documents. If the personnel involved were biased in recording events, this might result in bias in the information in the records and compromise the validity of the findings of the study.
3. Another limitation of document analysis is the lack of data on a certain subject. This might force researchers to align their research questions based on the available data. In addition, the use of information in the documents may not provide an accurate representation of facts because of unrepresentative samples. Partly, the reason is that the documents were not originally produced for research purposes.

Document analysis checklist collected both quantitative and qualitative data on policies and standards for preserving records, backup procedures, budget documents, programmes for

preserving records, and analysis of documents for workshops, seminars, and training on the preservation of records. The document analysis guide was developed, whose sections were policies, standards, procedure manuals, handbooks, information reports, procedure manuals, posters, notices, and memos. Previous studies by Marutha (2021) and Masuku and Ngulube (2020) in South Africa and Zimbabwe, respectively, adopted document analysis for data collection in studying the preservation of medical records. Table 4.4 maps research questions to respondents, data sources, and data analysis strategies.

Table 4.4: Mapping Research Questions to Respondents, Data Sources and Data Analysis Strategies

Research question	Respondents	Data sources	Data analysis strategy
Establish the preservation strategies currently in place at selected public healthcare facilities in Malawi.	• Nursing staff • Clinical staff • Data entry clerk • ICT Officers	• Questionnaire	• Statistical Analysis (SPSS)
	• Records Officers	• Interviews	• Thematic Analysis (ATLAS.ti)
Examine the preservation policies and standards of the selected public healthcare facilities in Malawi.	• Hospital administrators • Records Officers	• Interviews • Document analysis	• Thematic Analysis (ATLAS.ti)
	• Nursing staff • Clinical staff • ICT Officers	• Questionnaire	• Statistical Analysis (SPSS)
Examine the storage mechanisms for medical records at the selected public healthcare facilities in Malawi.	• Nursing staff • Clinical staff • ICT Officers • Data entry clerk	• Questionnaire • Observations	• Statistical Analysis (SPSS)
	• Hospital administrators • Records Officers	• Interviews	• Thematic Analysis (ATLAS.ti)
Assess the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi.	• Hospital administrators • Records Officers	• Interviews • Document analysis	• Thematic Analysis (ATLAS.ti)
	• Nursing staff • Clinical staff • ICT Officers • Data entry clerk	• Questionnaire	• Statistical Analysis (SPSS)
Develop a new framework to promote best practices for preserving medical records at selected public healthcare facilities in Malawi.	• Nursing staff • Clinical staff • Hospital administrators • Records Officers • Data entry clerk • ICT Officers	• Questionnaire • Interviews • Document analysis	• Statistical Analysis (SPSS) • Thematic Analysis (ATLAS.ti)

4.9 Data collection procedures

Data collection procedures are defined as techniques or procedures followed in administering instruments and collecting data from subjects under study (Kothari 2019:19). Before the visit to the healthcare facilities, the researcher formally informed the Chairperson of the Research Ethics Committee of the planned dates for the data collection exercise. Upon arrival at each healthcare facility, the researcher reported for the data collection exercise at the office of the Chairperson of the Research Ethics Committee. Thereafter, verbal approval for data collection was also obtained from the staff in charge of each department/section. The researcher recruited five research assistants and trained them on research processes to ensure the rigour of the data. The training took one day in each healthcare facility. The research assistants signed confidentiality forms. The five research assistants were drawn from each of the healthcare facilities and held the positions of HMIS officers and Data Entry Clerks. The in-house research assistants were opted for because they were conversant with the subject of the preservation of medical records and the health system of their respective healthcare facilities. Respondents were encouraged to sign the consent forms. The forms stipulated that participation is voluntary and respondents are free to deny participation at any time. The researcher and research assistants administered the questionnaire to the respondents through face-to-face, email and social media. Filled questionnaires were collected by the researcher and research assistants within four weeks of data collection. Appointments were made with the hospital directors, hospital administrators, and records officers for interviews. Interviews were done at the health facilities in private and confidential rooms. Virtual interviews through the phone were conducted with staff on a tight work schedule. Interviews lasted for 30 minutes per participant. Permission was sought from the participants to record their responses through a digital recorder, and additional notes were written to supplement the recordings. Qualitative data was collected for four days from each of the health facilities. Observations and document analysis were conducted within the same period of data collection. The data collection exercise ran from 1 to 31 July 2024.

4.10 Pilot study

One of the challenges with data collection is the high probability of a non-response rate emanating from a lack of understanding of the items in the data collection instruments by respondents. One of the ways of resolving this challenge is through implementing a pilot study (Bryman, 2021). A pilot study or feasibility study is conducted on a small-scale basis to ascertain the feasibility of the proposed larger study. This study is conducted on a population with similar characteristics to the real study (Bryman 2021; Kumar 2019). A pilot study is important in that it establishes the content validity of scores of the instrument; provides an initial consistency of the items; and improves questions, format and instructions (Creswell & Creswell 2022). In addition, Creswell and Creswell (2022) also argue that a pilot study reveals the time the study will take, which is vital in planning for data collection.

A pilot study was conducted on one clinical department staff, one nursing department staff, one records officer, one data entry clerk, and one ICT staff at Saint John's Hospital in Mzuzu in the northern region of Malawi in March 2024. Based on the results of the pilot study, necessary amendments were made to the instruments before the onset of the actual data collection exercise. Conducting a pilot study helped to ensure the reliability and validity of data collection instruments. The site was selected because it shares similar features with the study settings, such as the

preservation of medical records. Feedback obtained during the pilot study helped to revise the data collection instruments by eliminating incorrect wording and ambiguity.

4.11 Ensuring rigour

The quality of a research study can be judged by the choice and implementation of research approaches and techniques. The concept of rigour has been defined variably in the literature. According to Merriam-Webster Dictionary (2020:26), rigour is the quality or state of being very exact, careful, or with strict precision. In other words, rigour is the quality of being thorough and accurate (Oxford English Dictionary 2021:68). Liu (2017:125) is a set of standards investigators use to evaluate the quality, trustworthiness, and value of research. This means that rigour is the ability to carefully follow the procedures of the research process, which positively impacts the quality of the research. In other words, rigour means generating results or findings that reflect the reality of the phenomenon being studied. The goal of rigour is to ensure that the research design, method, and conclusions are explicit, public, replicable, open to critique, and free of bias (Johnson, Adkins & Chauvin 2020). Rigour in research is achieved differently according to the research approaches. Rigour in quantitative research is achieved through validity and reliability, while rigour in qualitative research is achieved through the criteria for trustworthiness such as dependability, credibility, confirmability and transferability (Babbie 2020; Johnson, Adkins & Chauvin 2020; Kumar 2019).

Validity and reliability for the quantitative section of the study were achieved through the triangulation of data collected through questionnaires, interviews, document analysis and observations at the interpretation stage of the results of the study. The method helped to observe the consistency in responses from the respondents to the questions in the data collection instruments. Concerning reliability, this study used Cronbach's alpha (a coefficient of reliability or consistency) to measure how well a set of items measures a single unidimensional latent construct. According to Taber (2018), Cronbach's alpha provides a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1. A score value of between 0.7 and 1.0 denotes the reliability of the data, and a low alpha is considered the opposite. A score value of 0.8 was reached, which demonstrated the reliability of the data collection instruments.

For the qualitative section, criteria for trustworthiness such as dependability, credibility, confirmability and transferability were achieved by spending more time in the field, maintaining rigorous documentation of the activities in the field, and exposing the data collection tools such as interviews, observation guides, and document analysis to the scrutiny of peers, academics, and researchers. The researcher spent one week at each health facility under study during the data collection process to familiarise himself with the values of the institutions. In addition, the researcher maintained rigorous documentation of the activities in the field by recording them in the field diary or journal. This ensured that every field encounter was accurately recorded and formed part of the research data analysis, interpretation, and results. Interview and observation guides were subjected to the scrutiny of peers, academics, and researchers. The researcher presented the research proposal to peers, academics, and researchers through seminars and conferences at Mzuzu University and the five public healthcare facilities in Malawi and deemed it appropriate. The diverse perspectives of peers, colleagues and academics assisted the researcher in revising the instruments.

The research proposal was submitted for ethical clearance at the UNISA Research Ethics Committee and MZUNIREC. The ethical approval reference number for the research proposal from the UNISA Ethical Clearance Committee was 16672313_CRECHS_2023. The MZUNIREC research approval reference number was MZUNIREC/DOR/23/120. This process enabled the proposal to be scrutinised for wording, methodology and instruments adopted for the study. Any inconsistencies in the proposal were resolved and resubmitted for ethical clearance. Eventually, the proposal was approved by both research ethics bodies, which implies that the research conformed to the language and methodological issues.

4.12 Data analysis

The correct interpretation of the data collected depends on the application of the appropriate data analysis procedures according to the research approach(s) adopted for the study. Data analysis involves procedures or methods that can be applied to data that has been collected to obtain meaningful information from the data that has been collected (Babbie 2020:52). Kumar (2019:110) added that data analysis also involves summarising and organising collected data in such a manner that they answer the research questions. The common data analysis methods are statistical analysis for quantitative data and thematic analysis for qualitative data (Babbie 2020; Creswell & Creswell 2022; Walliman 2021).

Statistical analyses involve investigating trends, patterns, and relationships using quantitative data (Babbie 2020). Quantitative data was cleaned, coded and analysed using IBM SPSS version 20.0 to produce descriptive and inferential statistics such as frequencies, percentages, and crosstabulations. Also, previous studies by Alnashmi *et al* (2022), Amin *et al* (2020), Anyira (2020), Gisemba (2022) and Marutha (2021) in Kuwait, Malaysia, Nigeria, Kenya, and South Africa respectively used the statistical analysis in analysing quantitative research data on their studies in the preservation of medical records.

Thematic analysis is a method of identifying, analysing, organising, describing and reporting themes found within the data set (Kumar 2019:115). In the words of Neuman (2019), the key process of analysing qualitative data is through coding in the form of classifying and categorising various sets of data and using the software to manage the entire process. Qualitative data was coded, transcribed and analysed thematically with the aid of a software package called ATLAS.ti to produce themes and sub-themes which formed the major findings of the study. Similar studies by Gisemba (2022), Masuku and Ngulube (2020) and Zhan and Xuan (2021) in Kenya, Zimbabwe and China, respectively, adopted thematic analysis for analysing qualitative research data in the study of the preservation of medical records.

4.13 Ethical considerations

Regardless of the field of study, all professions need to be guided by a code of conduct that governs the entire research process. This is particularly important in the era where most research projects involve people as subjects who have rights and deserve respect. Kumar (2019:17) defines ethics as a “set of actions that are considered correct, especially those of a given profession or group”. The study adhered to moral and general ethical principles of informed consent, anonymity, confidentiality, autonomy, beneficence, nonmaleficence, and justice as stipulated in the UNISA Ethics Policy document of 2016. Ethical clearance to conduct the study was sought from the UNISA Ethical Clearance Committee in South Africa and the MZUNIREC in Malawi to conduct the study in the health facilities in the northern region of Malawi. The ethical approval reference

number for the research proposal from the UNISA Ethical Clearance Committee was 16672313_CRECH_CHS_2023. The MZUNIREC research approval reference number was MZUNIREC/DOR/23/120. Permission letters to collect data were obtained from the research ethics committees in the public healthcare facilities in Malawi. The permission letters were submitted together with the research proposal for ethical clearance. Among the requirements for postgraduate research at the institution, the researcher submitted a Turnitin report demonstrating not more than a 35% similarity index as a safeguard against plagiarism. In addition, the researcher acknowledged all sources used in the report and signed the declaration on the title page.

The anonymity and confidentiality of respondents were maintained during data collection and reporting of the results (Babbie 2020). Codes were used to represent responses from respondents instead of names during data collection and reporting of results. Respondents were free and secure to participate in the study and offer responses to the questionnaire and interview items. Respondents were informed that they were free to withdraw from the study if they so wished without any sanctions.

Autonomy demands that the decisions made by the research participants are recognised and respected without imposing decisions on them (Babbie 2020). The study enforced the autonomy of participants by informing them of their rights to voluntary participation. This was done by verbally informing the participants and through the consent forms. Informed consent forms were distributed to all the participants for the study to collect qualitative and quantitative data. The study participants were provided with consent forms for signing purposes. The researcher ensured that participants freely signed the forms without being forced or coerced with money or otherwise.

The principles of beneficence and nonmaleficence demand that research participants should not be harmed through the conduct of the study (Babbie 2020). The study ensured that research participants and/or people involved in the study were not exposed to any harm. This was achieved by avoiding bias, using the appropriate methodology, correct reporting, and appropriate use of information. The findings from the study were accurately reported without any form of bias regarding gender, religion, and educational status. The entire research proposal was exposed to external review through research supervision and ethical clearance before approval and, consequently, data collection.

Justice aims to ensure that the benefits and burdens are shared equitably and that no groups are being exploited (Babbie 2020). To achieve justice, the study participants were selected based on research needs rather than convenience based on explicit inclusion and exclusion criteria discussed in the section on the scope and limitations of the study.

4.14 Summary

The research process involves making critical decisions and justifications about the methods adopted (Walliman 2021:13). The chapter presented different methods and techniques adopted to investigate the preservation of medical records in selected healthcare facilities and develop a framework for preservation. The initial sections of the chapter were dedicated to discussing the concept of research methodology. This culminated in an illustrative presentation of a research methodology map. The choice of the methodology was outlined, and justifications were made. The chapter also presented the three major research designs in social science research literature. Sufficient justification for the choice of a pragmatism paradigm in comparison to positivist and

interpretivist paradigms was ably provided in the chapter. This discussion on paradigms informed the decision to adopt a mixed methods approach for the study and exclude other approaches, such as qualitative and quantitative. The chapter also provided sufficient details on the research designs with a focus on mixed methods designs. As a result, a decision for the choice of a convergent mixed methods design was made, which was followed by a justification. Other mixed methods designs, such as exploratory and explanatory, were not considered as appropriate for addressing the research objectives of the study.

The chapter discussed and justified the choice of the five study sites, namely Mzuzu Central Hospital (MCH), Kamuzu Central Hospital (KCH), Queen Elizabeth Central Hospital (QECH), Zomba Central Hospital (ZCH) and Zomba Mental Hospital (ZMH). The chapter also expounded on the target population, sampling techniques, sample size, and research instruments for collecting data from the study participants. A discussion on the pilot to pre-test the research instruments at Saint John's Hospital in Mzuzu was made. The issue of rigour of data collection instruments was also discussed in the chapter. The discussion of rigour was split into two, namely validity and reliability in quantitative research, and trustworthiness in qualitative research, and how this was achieved was exposed in the chapter. The chapter also provided insights into the two data analysis techniques for qualitative and quantitative data. The third data analysis technique was achieved and exemplified during the interpretation or discussion of the findings chapter. Finally, the chapter highlighted the ethical issues in general and disclosed ethical considerations upheld in the entire study.

The next chapter presents the study findings emanating from the data collected using questionnaires, interviews, observations, and document analysis techniques. Quantitative and qualitative data were analysed and presented separately in the form of tables, graphs, and narratives. The data was triangulated or merged during the interpretation of the discussion phase.

CHAPTER FIVE

DATA ANALYSIS AND PRESENTATION OF FINDINGS

5.1 Introduction

The previous chapter described the methodology followed in applying mixed methods research to address the research objective and questions pertinent to this study. This chapter analyses and presents the raw data gathered through quantitative and qualitative methods from the target population of five public healthcare facilities in Malawi using questionnaires, interviews, observations and document review. Questionnaires were administered to data entry clerks and ICT staff (Appendix 1) and clinical and nursing staff (Appendix 2). Interview schedules were used to collect data from hospital administrators (Appendix 3) and Records Officers (Appendix 4) in each of the five healthcare facilities in Malawi. Observations and document reviews were carried out to supplement the data collected through questionnaires and interviews (Appendices 5 and 6).

In such empirical studies, data analysis involves summarising and organising collected data in such a manner that they answer the research questions (Kumar 2019). The purpose of conducting data analysis is to obtain meaningful information from the data that has been collected (Babbie 2020). Hence, the focus of this chapter was to present the study findings duly analysed in a comprehensible and interpretable form to identify relations and trends in response to the research questions to meet the study objective. The objective of the study was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records. In this study, data analysis and presentation of findings have been undertaken according to the themes derived from the study's research questions outlined in Section 1.6 of Chapter One.

This chapter has been organised into two sections along the themes derived from the research questions. First, quantitative data was obtained through questionnaires with clinical staff, nursing staff and data entry clerks. This was followed by the presentation and analysis of qualitative data obtained from hospital directors, hospital administrators and records officers. Quantitative data is presented in the form of frequencies, percentages, tables and cross-tabulations, while qualitative data is presented in the form of a descriptive narrative using texts appearing as phrases and direct quotes from participants. Data from observations and document reviews complemented quantitative and qualitative data.

5.1.1 Mixed methods research data presentation and analysis

Data analysis and presentation are another key feature of the convergent mixed methods design. Analysis of data in this design is achieved in three phases. Firstly, there is an analysis of quantitative data, and secondly, there is an analysis of qualitative data. Quantitative data is analysed using statistical analysis with the aid of software packages such as SPSS and STATA (Babbie 2020; Walliman 2021). For this study, IBM SPSS version 20.0 was adopted to produce descriptive statistics. Qualitative data is analysed through thematic analysis with the aid of software packages such as NVivo and ATLAS.ti (Creswell & Creswell 2022). The qualitative data for the study was transcribed and analysed using ATLAS.ti.

On data presentation, Creswell and Creswell (2022) propose three approaches such as side-by-side comparison, data transformation, and joint display. Jones (2015) proposes a fourth approach called visualisation. The four approaches have been outlined below.

1. Side-by-side, also called narrative, involves reporting the quantitative results followed by a discussion of qualitative findings or vice versa (Creswell & Creswell 2022; Moseholm & Fetters 2017).
2. Data transformation involves changing the qualitative data to numerical data represented in quantitative research (Moseholm & Fetters 2017; Creswell & Creswell 2022). The two data sets are combined to provide meaning to a variable being studied.
3. Joint display involves using a single table or figure to display the quantitative and qualitative data (Creswell 2022). The purpose of the joint display is to bring together data using tables, figures and others (Panda, Das & Maruf 2015). For example, quantitative variables may be displayed using one or more columns, while qualitative data is displayed in the rows in a joint display (Creswell & Creswell 2022).
4. Lastly, visualisation uses Geographic Information System (GIS) mapping for the analysis of spatial information with local quantitative or qualitative findings (Jones 2015).

The current study adopted a side-by-side comparison or narrative approach in merging the quantitative and qualitative data due to its simplicity and wide use in previous studies. In the process of data analysis and presentation, a reference to relevant theories and literature has been made in this chapter.

5.2 Response rate and respondents' profile

The question that new researchers are grappling with is the appropriate percentage return rate or response rate of questionnaires or interviews. However, there seems to be a lack of consensus on the recommended response rate for a study (Babbie 2020). Overall, determining the response for a study is important as it provides a picture of the representativeness of the sample respondents. A high response rate may represent a significant reduction of nonresponse rate, which adds validity to the study findings. Conversely, a low response rate shows a low response rate from respondents, which is a danger signal to a lack of validity of the study findings. Response rate is defined as the number of complete interviews or questionnaires with reporting units divided by the number of eligible reporting units in the sample (Babbie 2020:270). Therefore, the response rate is calculated by dividing the total number of questionnaires or interviews filled by the total sample size and is expressed as a percentage.

Researchers must increase the response rate, which increases the validity of the findings. This can be achieved by pre-testing the instruments, which reduces non-response bias. Another solution to reducing non-response bias is the adoption of mixed-methods research. Creswell and Creswell (2022) argue that the use of a mixed methods approach has the potential to minimise error margins for non-responses, which increases the validity of the findings. Considering these views, the present study targeted five public healthcare facilities in Malawi. The sample size was 200 respondents, where 31 were from Mzuzu Central Hospital (MCH), 47 were from Kamuzu Central Hospital (KCH), 26 were from Zomba Central Hospital (ZMH), 29 were from Zomba Mental Hospital (ZMH), and 67 were from Queen Elizabeth Central Hospital (QECH). All five institutions granted the researcher permission to carry out the study as demonstrated by the letters of

authorisation (Appendices 9-13), representing a 100% response rate as displayed in Table 5.1. The names of the public healthcare facilities have been coded to ensure the anonymity of the respondents.

Table 5.1: Number of Respondents in the Hospitals (N=200)

Name of healthcare facility	Number of respondents	Percentage
MCH (Hospital A)	31	16
KCH (Hospital B)	47	24
ZCH (Hospital C)	26	13
ZMH (Hospital D)	29	15
QECH (Hospital E)	67	34
Total	200	100

(Source: Field Data 2024)

The study targeted 181 respondents in public healthcare facilities for the questionnaires, comprising 129 (71%) clinical and nursing staff and 52 (29%) data entry clerks and ICT officers. Out of this number, 181 respondents comprising 129 (71%) clinical and nursing staff and 52 (29%) data entry clerks and ICT officers responded, representing a 100% response rate for quantitative data as shown in Table 5.2.

Table 5.2: Response Rate for Questionnaire (n=181)

Target group	Targeted number	Actual number of respondents	Response rate (%)
Clinical and nursing staff	129	129	100
Data entry clerks and ICT officers	52	52	100
Total	181	181	100

(Source: Field Data 2024)

The total number of interviews targeted was 19, constituting interviews with hospital directors, hospital administrators, and records officers. As displayed in Table 5.3, interviews were successfully conducted, representing a response rate of 68%. The non-response rate of 32% was due to the tight schedule of hospital directors, hospital administrators and records officers owing to the nature of work in the healthcare facility. This made it difficult for the participants to honour the interview appointments and collect data.

Table 5.3: Response Rate for Interviews (n=19)

Target group	Targeted number	Actual number of respondents	Response rate (%)
Hospital Directors	5	2	40
Hospital Administrators	5	5	100
Records Officers	9	6	67
Total	19	13	68

(Source: Field Data 2024)

Prominent research scholars have reported on recommended response rates. For example, Babbie (2020) rates response rates as follows: 50% is considered adequate, 60% is good, and 70% is very good. In agreement, Bryman (2021:230) supported a response rate of 60-69% and cautioned against analysing study findings with a 50% response rate. In the context of Babbie (2020), the researcher considered the response rate of the study of 97% to be very good and which would lead to successful data analysis and obtaining accurate conclusions. Table 5.4 displays the response rate for the entire study.

Table 5.4: Response Rate for the Study (N=200)

Target group	Targeted number	Actual number of respondents	Response rate (%)
Quantitative data	181	181	100
Qualitative data	19	13	68
Total	200	194	97

(Source: Field Data 2024)

5.3 Presentation of quantitative data

This section presents quantitative data collected through questionnaires with data entry clerks, ICT officers and clinical and nursing staff based on the themes of the study derived from the research objectives. The next section of 5.4 will present qualitative data gathered through interviews with hospital directors, hospital administrators and records officers. Data collected from observations and document reviews will be presented to complement the data in the two sections.

5.3.1 Demographic characteristics of the respondents

Demographic data provides useful information about the respondents, which is important in determining the representativeness of the sample with the target population and the ability to generalise the findings. Examples of demographic characteristics relevant to the study were healthcare facility, department/section, gender, qualification, work position and age group. These demographic characteristics have been discussed in the proceeding sections.

5.3.1.1 Respondent's healthcare facility

The study sought to establish the healthcare facilities of the respondents. The study found that 58 (30%) respondents were from Hospital E, 49 (25%) respondents from Hospital B, 32 (16%) respondents from Hospital C, 28 (14%) respondents from Hospital A and 27 (14%) respondents from Hospital D. The findings are displayed in Table 5.5. The findings imply that majority of respondents were from Hospital B, while the least number of respondents were from Hospital D.

Table 5.5: Respondent's Healthcare Facility (n=194)

Name of healthcare facility	Frequency (f)	Percentage (%)
Hospital A	28	14
Hospital B	49	25
Hospital C	32	16
Hospital D	27	14
Hospital E	58	30
Total	194	100

(Source: Field Data 2024)

5.3.1.2 Respondent's department/section

The study also sought to find out the departments/sections of the respondents. The study found that respondents belonged to different departments, with the majority belonging to the medical department (30, 15%) and the outpatient department (26, 13%). The least number of respondents (1, 1%) belonged to departments such as rehabilitation, trauma and tuberculosis. The findings are illustrated in Table 5.6.

Table 5.6: Respondent's Department/Section (n=194)

Department/section	Frequency (f)	Percentage (%)
Medical	30	15
Out-Patient	26	13
Administration	18	9
Paediatric	16	8
Surgical	16	8
Obstetrics and Gynaecology	15	8
Acute	9	5
Clinical	9	5
General paying	7	4
Dermatology	6	3
Ophthalmology	6	3
Laboratory	4	2
Mental health	4	2
Emergency	4	2
Postnatal	4	2
Anaesthesia	3	2
Dental	3	2
Epilepsy	3	2
Oncology	3	2
Oncology	3	2
Urology	2	1
Rehabilitation	1	1
Trauma	1	1
Tuberculosis	1	1
Total	194	100

(Source: Field Data 2024)

5.3.1.3 Respondent's gender

Respondents were asked about their gender, and the findings are highlighted in Table 5.7. The findings revealed that most respondents were female (112, 58%), and the least number of respondents were male (82, 42%).

Table 5.7: Respondent's Gender (n=194)

Gender	Frequency (f)	Percentage (%)
Male	82	42
Female	112	58
Total	194	100

(Source: Field Data 2024)

5.3.1.4 Respondent's qualifications

The study sought to determine the academic qualifications of respondents. As illustrated in Table 5.8, the findings indicated that most respondents were holders of diplomas (64, 33%) and bachelor's degrees (53, 27%), indicating that they were mainly middle-level staff.

Table 5.8: Respondent's Qualifications (n=194)

Qualifications	Frequency (f)	Percentage (%)
Masters	17	9
Honours Degree	4	2
Bachelors	53	27
Postgraduate Diploma	3	2
Diploma	64	33
Certificate	2	1
Malawi School Certificate of Education (MSCE)	44	23
Junior Certificate of Examination (JCE)	6	3
Primary School Leaving Certificate of Examination (PSLCE)	1	1
Total	194	100

(Source: Field Data 2024)

5.3.1.5 Respondent's work position

The study also sought to determine the work position of clinical and nursing staff, ICT and data entry staff, hospital directors, hospital administrators and records officers. As indicated in Table 5.9, 48 (25%) respondents were ward clerks, 37 (19%) were nurses, 27 (14%) were clinicians, 23 (12%) were nurse and midwife technicians, and 21 (11%) were nursing officers. The least number of respondents, 2 (1%), were hospital directors, health information management system clerks, lab technicians, and psychiatric nurses. The findings imply that most respondents were ward clerks, while the least were hospital directors, health information management system clerks, lab technicians, and psychiatric nurses.

Table 5.9: Respondent's Work Position (n=194)

Work position	Frequency (f)	Percentage (%)
Ward Clerk	48	25
Nurse	37	19
Clinician	27	14
Nurse and Midwife Technician	23	12
Nursing Officer	21	11
Records Officer	6	3
Hospital Administrator	5	3
Laboratory Data Clerk	5	3
Mental Health Clinical Officer	5	3
Dermatology Officer	3	2
Lab Manager	3	2
Doctor	3	2
Hospital Director	2	1
Health Information Management System Clerk	2	1
Lab Technician	2	1
Psychiatric Nurse	2	1
Total	194	100

(Source: Field Data 2024)**5.3.1.6 Respondent's age group**

The respondents were asked to indicate their age groups on a predetermined scale to ascertain their age. The findings of the study revealed the following: 4 (2%) respondents were aged between 18-24, 46 (24%) were aged between 25-30, 44 (23%) were aged between 31-35, 37 (19%) were aged between 36-40, 17 (9%) were aged between 41-45, 24 (12%) were aged between 46-50, 12 (6%) were aged between 51-55, 9 (5%) were aged between 56-60 and 1 (1%) was aged between 60-65. The findings are displayed in Table 5.10. The results imply that most respondents were in the age range of 25-40. The least number of respondents were in the age range of 60-65.

Table 5.10: Respondent's Age Group (n=194)

Age group	Frequency (f)	Percentage (%)
18-24	4	2
25-30	46	24
31-35	44	23
36-40	37	19
41-45	17	9
46-50	24	12
51-55	12	6
56-60	9	5
60-65	1	1
Total	194	100

(Source: Field Data 2024)

5.3.1.7 Types of medical records created/received

The purpose of this question was to ascertain the types of medical records created/received by respondents. The question solicited multiple responses from respondents on different types of medical records created/received in the five public healthcare facilities in Malawi. The findings of the study, as summarised in Table 5.11, revealed that the types of records created/received by respondents were health passports (159, 82%), case files (152, 78%), registers (147, 76%), laboratory results (142, 73%), nurses' patients reports (140, 72%), doctors' clinical reports (122, 63%), radiology notes (110, 57%), personal notes (100, 52%), death certificates (67, 35%), birth certificates (45, 23%) and others (30, 15%). The findings entail that the majority of records created/received by the healthcare facilities were health passports, case files, registers, laboratory results and nurses' patients' reports.

Table 5.11: Types of Records Created/Received (n=194)

Types of records	Frequency (f)	Percentage (%)
Health passports	159	82
Case files	152	78
Registers	147	76
Laboratory results	142	73
Nurses' patient reports	140	72
Doctors' clinical reports	122	63
Radiology reports	110	57
Personal notes	100	52
Death certificates	67	35
Birth certificates	45	23
Others (specify)	30	15

(Source: Field Data 2024)

5.3.2 Preservation strategies

One of the critical components in the preservation of medical records is the implementation of good preservation strategies. Implementation of good preservation strategies can improve access, security and timely disposal of records (Marutha 2021; Masuku & Ngulube 2020). However, poor preservation strategies can cripple a health facility, halting efficiency, sucking up precious time, and causing unnecessary stress for employees (Anyira 2020). Despite a lack of consistency in the definition of preservation strategies, previous scholars (Magama 2018; Marutha 2021; Masuku & Ngulube 2020; Millar 2017) have unanimously used the concept of preservation strategies as an umbrella term to refer to all activities undertaken to ensure long-term preservation and retention of the authoritative nature of data to ensure data remains authentic, reliable and usable while maintaining its integrity. Some of the examples of preservation strategies recorded in the literature are migration, refreshing, emulation, byte replication, conversion, backup, cloud computing, preservation metadata, file formats, fire extinguishers, smoke detectors and fire detectors (Adetunji 2021; Gisemba, Ng'eno & Bosire 2022; Magama 2018; Marutha 2021; Masuku & Ngulube 2020; Shahrul Asari, Hussin & Samsudin 2017).

The first research question of this study was to establish the preservation strategies currently in place at selected public healthcare facilities in Malawi. As discussed in Chapter Two, the

preservation actions enshrined in the Records Lifecycle, Data Curation Centre model and OAIS Model are important in understanding the preservation strategies for records. The research question was addressed in the questionnaires and interview guide to data entry clerks and ICT officers, clinical and nursing staff, and records officers in the following sections: questions 1-27 of the questionnaires for data entry clerks and ICT officers (Appendix 1), questions 1-6 of the questionnaire for clinical and nursing staff (Appendix 2), and questions 8-9 of the interview guide for records officers (Appendix 4). In the present study, the following themes were adopted:

1. Migration
2. Backup procedures
3. File formats
4. Dehumidification
5. Metadata
6. Damage repair
7. Privacy and security
8. Disposal of records

5.3.2.1 Migration

Migration is one of the most important strategies for transferring and preserving digital content across different media as technology becomes obsolete. To counter the challenges of obsolete technologies, digital records must be moved to newer systems and storage devices such as hard drives, flash disks, servers, and cloud computing (Louisiana State Archives 2020). Given this, the study investigated the migration of medical records in the five public healthcare facilities in Malawi. A question was posed to data entry clerks and ICT officers on the ways of migrating medical records in the public healthcare facilities in Malawi. The question was designed on a five-point scale of 1 to 5, where 1 represents strongly disagree, 2 disagree, 3 neither disagree nor agree, 4 agree, and 5 strongly agree. The question solicited multiple responses from respondents on migration issues such as migration equipment, migration procedures and skills and knowledge of staff on migration. The findings revealed that 33 (64%) respondents agreed that physical records are migrated to an electronic format, and 31 (59%) respondents agreed on the availability of migration equipment. In addition, 26 (52%) respondents also agreed on the existence of documentation for migration procedures, and 24 (48%) agreed that staff have the knowledge and skills to migrate records. The findings are displayed in Table 5.12. Overall, the findings imply that migration is done in the five public healthcare facilities in Malawi, with evidence of migration methods and equipment, availability of documentation for migration procedures and knowledge and skills of staff on migration.

Table 5.12: Migration (n=52)

Migration	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Physical records are migrated to electronic format through scanning and other means.	2	4	12	23	4	8	26	50	7	13
Migration equipment and software, such as scanners, computers, servers and databases, are available.	3	6	12	23	6	12	21	40	10	19
Documentation for migration procedures has been developed and is used by staff.	4	8	15	29	5	10	24	46	2	4
Staff have the knowledge and skills to migrate records.	3	6	13	25	10	19	18	35	6	12

(Source: Field Data 2024)

5.3.2.2 Backup procedures

The business environment, including healthcare facilities, is faced with numerous risks and uncertainties which negatively impact their daily business operations. In this context, backup procedures for records are important to ensure data protection and guarantee business continuity (Upward *et al* 2019). Other benefits of backup are that it saves time and money (Hofman 2021), and helps the organisation to prepare for disaster and eliminate the threats of accidental deletion of records (Crocket 2017). Consequently, respondents were asked about different aspects of backup procedures such as frequency of backup, backup equipment, power supply to conduct backup, backup procedures manuals and knowledge and skills of staff on backup. A question with multiple response options was posed to data entry clerks and ICT officers on backup procedures of medical records in the public healthcare facilities in Malawi. The question was designed on a five-point scale of 1 to 5, where 1 represents strongly disagree, 2 disagree, 3 neither disagree nor agree, 4 agree, and 5 strongly agree. As illustrated in Table 5.13, most of the respondents agreed that backup procedures for records were conducted in the five public healthcare facilities in Malawi. Some of the backup procedures agreed upon by the respondents were regular backup of physical and electronic records (25, 52%), availability of backup equipment such as Google Drive and servers (24, 51%), the existence of reliable power supply for conducting backup procedures (25, 51%), development of backup manuals (23, 47%) and knowledge and skills of staff on backup procedures (23, 41%). The findings imply that backup procedures for records are conducted in the five public healthcare facilities in Malawi. However, there is room for improvement in such practices in the five public healthcare facilities in Malawi.

Table 5.13: Backup Procedures (n=52)

Backup procedures	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Physical and electronic records are regularly backed up.	0	0	12	23	15	29	17	33	8	15
Backup equipment is available, such as computers, Google Drive, and servers.	4	8	8	15	16	31	16	31	8	15
A reliable power supply exists to support backup procedures for records such as the ESCOM line, solar power, and a generator set.	2	4	16	31	8	15	21	40	5	10
Back-up procedure manuals have been developed for use by staff.	4	8	21	40	4	8	17	33	6	12
Staff handling records have the knowledge and skills to back up records.	2	4	17	33	10	19	17	33	6	12

(Source: Field Data 2024)

In addition, the findings gathered through observations in all five healthcare facilities have revealed that a reliable power supply through ESCOM line, generator set, and solar was installed. A reliable power supply is important in implementing backup procedures for records.

5.3.2.3 File formats

The recent development in ICTs poses a threat to the long-term preservation of records. To ensure access and long-term preservation of records, organisations need to adopt reliable file formats. Against this backdrop, the study sought to establish the file formats being implemented for various types of medical records in the five public healthcare facilities in Malawi. A question with multiple response options was posed to data entry clerks and ICT officers regarding the file formats used to preserve medical records in the five public healthcare facilities in Malawi. The question was designed on a five-point scale of 1 to 5, where 1 represents strongly disagree, 2 disagree, 3 neither disagree nor agree, 4 agree, and 5 strongly agree. As displayed in Table 5.14, a total of 19 (37%) and 14 (27%) agreed on the use of file formats and that necessary equipment and software are available to preserve records, respectively. However, a cumulative number of 23 (45%) and 20 (39%) disagreed that file formats, equipment and software exist for preserving medical records in the five public healthcare facilities in Malawi. The findings imply that file formats are being used, but most staff are not aware or knowledgeable about them.

Table 5.14: File Formats (n=52)

File formats	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
File formats are used to preserve records such as PDF, SQL and TIFF.	4	8	19	37	10	19	13	25	6	12
Necessary equipment and software are available to manage records in various formats such as PDF, SQL, and TIFF.	4	8	16	31	18	35	12	23	2	4

(Source: Field Data 2024)

5.3.2.4 Dehumidification

Humidity is one of the contributing factors to the high rate of deterioration of physical records. Miller notes that the higher the humidity, the greater the risk to records (2022). High humidity promotes the growth of mould and causes records to absorb moisture, swelling them and deforming their shape permanently (Miller 2022). As proposed by Miller (2022) and Yeo (2021), the negative impact of humidity on records can be reduced by implementing a dehumidification process. Dehumidification is the removal of water from the air (Dehghani, Date & Akbarzadeh 2018:89). It is for this reason that the study endeavoured to determine the mechanisms for conducting dehumidification in the five public healthcare facilities in Malawi. Therefore, a multiple-response question was posed to data entry clerks and ICT officers on the ways of conducting the dehumidification process in their respective healthcare facilities. The question was tagged on a five-point scale of 1 to 5, where 1 represents strongly disagree, 2 disagree, 3 neither disagree nor agree, 4 agree, and 5 strongly agree. The findings are presented in Table 5.15. The findings revealed that the majority of the respondents (33, 63%) disagreed that dehumidification equipment, such as space heaters and energy recovery ventilators, is available in the five public healthcare facilities. In addition, the majority of the respondents (27, 52%) also disagreed that best practices are followed for dehumidifying storage places, such as good ventilation, storing records away from outside walls, keeping records out of the basement and packaging records in archival containers. The findings imply that the dehumidification process is rarely conducted in the five public healthcare facilities in Malawi.

Table 5.15: Dehumidification (n=52)

Dehumidification	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Dehumidification equipment is available, such as space heaters and energy recovery ventilators.	8	15	25	48	6	12	9	17	4	8
Best practices are followed for dehumidifying storage places, such as good ventilation, storing records away from outside walls, keeping records out of the basement and packaging records in archival containers.	2	4	25	48	7	13	15	29	3	6

(Source: Field Data 2024)

The researcher also made observations on the existence of equipment for dehumidifying storage areas for records. It was noted that all five healthcare facilities lacked such equipment. However, some hospitals have implemented mechanisms for improving air circulation in the records storage areas, such as air vents, fans and air conditioners.

5.3.2.5 Metadata

One of the most important features for ensuring long-term preservation of records is metadata. Metadata supports all the functions in the preservation of records, such as access, storage, retrieval and disposal. This fact is supported by Miller (2022), who argues that good-quality metadata is vital for providing intellectual access to digital collections. Simply defined, metadata is “data about data” (Crocket 2017:20; Miller 2022:1). Therefore, a multiple-response question was posed to data entry clerks and ICT officers on metadata in the public healthcare facilities in Malawi. The question was tagged on a five-point scale of 1 to 5, where 1 represents strongly disagree, 2 disagree, 3 neither disagree nor agree, 4 agree, and 5 strongly agree. The findings as summarised in Table 5.16 revealed that the majority of respondents disagreed that metadata activities such as metadata creation (26, 50%), adoption of metadata standards (32, 62%), metadata documentation (27, 52%) and knowledge and skills of staff to create and assign metadata to records (25, 48%) were done. The findings imply that metadata activities are rarely done in the five public healthcare facilities in Malawi.

Table 5.16: Metadata (n=52)

Metadata	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Metadata has been created to identify and locate physical and electronic records.	6	12	20	38	11	21	11	21	4	8
Appropriate metadata standards have been adopted, such as PREMIS, METS and DC.	6	12	26	50	16	31	3	6	1	6
Metadata documentation is available for use by staff.	5	10	22	42	10	19	8	15	1	5
Data entry clerks and ICT officers have the knowledge and skills to create and assign metadata to records.	4	8	21	40	9	17	13	25	5	4

(Source: Field Data 2024)**5.3.2.6 Damage repair**

Damage repair is one of the ways of preserving and restoring records. The purpose of damage repair is to normalise the media for records and prolong its lifespan for continuous use. As such, a multiple-response question was posed to data entry clerks and ICT officers on damage repair for medical records in the public healthcare facilities in Malawi. The responses were tagged on a five-point scale from strongly disagree to strongly agree. The findings, as displayed in Table 5.17, slightly indicated that damaged records are not regularly repaired (22, 43%) and equipment for repairing records is not available (19, 37%). Slightly, the findings imply that damaged records were not repaired, and equipment for repairing does not exist in the healthcare facilities.

Table 5.17: Damage Repair (n=52)

Damage repair	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Damaged records are regularly repaired by straightening folded edges and pages, etc.	4	8	18	35	15	29	11	21	4	8
Equipment for repairing records is available.	3	6	16	31	14	27	16	31	3	6

(Source: Field Data 2024)

5.3.2.7 Privacy and security

Security and privacy are some of the significant functions of a preservation programme for medical records. The implementation of records systems was suggested as the solution to the challenges of access and preservation of records in organisations. However, the implementation of electronic health records systems has been halted due to privacy and security concerns (Keshta & Odeh 2021). Therefore, a question was posed to respondents on privacy and security measures for medical records in the five public healthcare facilities in Malawi. As such, a multiple-response question was posed to clinical and nursing staff, data entry clerks and ICT officers on privacy and security measures for medical records in the public healthcare facilities in Malawi. The responses were tagged on a five-point scale from strongly disagree to strongly agree. The findings are outlined in Table 5.18 and reveal that privacy and security measures have been implemented at the five public healthcare facilities in Malawi. Some of the privacy and security measures as revealed by the study were only authorised users accessing records (150, 83%), doors and windows of the records storage area and filing cabinets are securely locked (126, 70%), security measures such as firewalls, passwords, encryption, and redaction are used to protect electronic records (84, 47%), and regular security and facility inspections take place in the records storage area, offices etc. (85, 47%). However, the findings also revealed that CCTV cameras were not installed in offices, records storage areas, etc (144, 80%). Roughly, the findings imply that privacy and security measures have been implemented in the five public healthcare facilities in Malawi.

Table 5.18: Privacy and Security (n=181)

Privacy and security	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Only authorised users have access to records	10	6	12	7	9	5	88	49	62	34
Doors and windows of the records storage area and filing cabinets are securely locked.	11	6	31	17	13	7	76	42	50	28
CCTV cameras have been installed in offices, records storage areas, etc.	72	40	72	40	14	8	10	6	12	7
Security measures such as firewalls, passwords, encryption, and redaction are used to protect electronic records.	35	19	31	17	31	17	61	34	23	13
Regular security and facility inspections take place in the records storage area, offices, etc.	32	18	31	17	33	18	58	32	27	15

(Source: Field Data 2024)

Observations made on the security and privacy of records revealed that all five public healthcare facilities lacked CCTV cameras. However, a few departments at Hospital E were installed with CCTV cameras for security monitoring of records. In addition, it was observed that other security measures were implemented in the healthcare facilities, such as burglar bars and locking the doors to the offices and records storage rooms.

5.3.2.8 Disposal of records

The retention of unnecessary paper and electronic records wastes staff time, organisational resources, space, and equipment. Therefore, disposal is the appropriate action for eliminating such types of records from the system. In this regard, a question was posed to respondents on whether disposal mechanisms for medical records exist in the five public healthcare facilities in Malawi. As such, a multiple-response question was posed to clinical and nursing staff, data entry clerks and ICT officers on disposal mechanisms for medical records in the public healthcare facilities in Malawi. The responses were tagged on a five-point scale from strongly disagree to strongly agree. As displayed in Table 5.19, the findings entail that the disposal of records is being implemented at the five public healthcare facilities in Malawi. Some of the disposal mechanisms for records include properly disposing of records according to the retention and disposal policy (108, 60%), disposal methods have been established such as transferring records to a records centre, burning, and shredding (94, 52%) and a disposal manual exists that guides staff in properly disposing of records (79, 44%).

Table 5.19: Disposal of Records (n=181)

Disposal of records	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Records are properly disposed of according to the retention and disposal policy.	11	6	21	12	41	23	72	40	36	20
Disposal methods have been established, such as transferring records to a records centre, burning, and shredding.	16	9	22	12	49	27	64	35	30	17
A disposal manual exists that guides staff in properly disposing of records	17	9	17	9	58	32	52	29	27	15

(Source: Field Data 2024)

The study computed a crosstabulation of preservation strategies and types of medical records. The purpose was to establish the preservation strategies that apply to specific categories of medical records to improve the overall preservation of medical records. The findings presented in Table 5.20 have revealed that migration and backup were mostly applicable to registers, while file formats and dehumidification were done on health formats. It is also evident that case files and registers were the majority of records formatted with metadata. The findings further indicated that

the majority of records repaired were health passports and case files. Security measures are applied to all types of records. However, the findings indicated that registers and health passports were the most secure types of records. The study also revealed that disposal methods applied to all types of records, with the majority of them being registers and health passports.

Table 5.20: Crosstabulation of Preservation Strategies and Types of Records (n=181)

Preservation strategies	Types of records																			
	Health passports		Case files		Registers		Personal notes		Laboratory results		Radiology reports		Doctors' clinical reports		Nurses' patient reports		Birth certificates		Death certificates	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Migration	31	60	26	50	34	65	7	13	15	29	15	29	19	37	21	40	11	21	14	27
Backup	24	46	19	37	23	44	6	12	11	21	10	19	14	27	16	31	7	13	9	17
File formats	16	31	12	23	14	27	3	6	8	15	5	10	8	15	10	19	3	6	5	10
Dehumidification	16	31	13	25	14	27	4	8	11	21	8	15	11	21	12	23	6	12	8	15
Metadata	17	33	18	35	18	35	7	13	12	23	10	19	14	27	13	25	6	12	9	17
Records repair	24	46	23	44	27	52	5	10	15	29	13	15	15	29	16	31	6	12	10	19
Security measures	38	73	29	56	43	83	4	8	21	40	17	33	16	31	19	37	9	17	13	25
Disposal methods	21	40	15	29	24	46	2	4	11	21	8	15	7	13	8	15	4	8	6	12

(Source: Field Data 2024)

Observations made in the healthcare facilities revealed a lack of equipment for disposing of records, such as incinerators and shredders. However, it was observed that all medical records were transferred to the National Records and Archives Services of Malawi for destruction or permanent preservation.

5.3.3 Preservation policies and standards

Preservation policies and standards are a cornerstone of efficient and effective records management (Adjei & Mensah 2016). Policies and standards provide a mandate to records officers and staff handling the preservation of records in an institution (Shepherd & Yeo 2003). As such, the policies, procedures, and standards stipulate and guide record officers on all the activities related to preservation, including the implementation of preservation strategies. In addition, the policies, standards and procedures are a commitment from management and the entire health system that the preservation of medical records is serious and obligatory (Crocket 2017). Therefore, public healthcare facilities in Malawi must develop and implement policies, standards, procedures and legislative frameworks that will assist in guiding the preservation of medical records and achieve their goals and objectives (Katuu 2015; Marutha 2018).

The models guiding this study, discussed in Chapter Two, such as the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model, have all emphasised the significance of implementing policies, procedures, and standards in preserving medical records. For example, the DCC Curation Lifecycle Model is flexible in complementing other standards, policies, and reference frameworks at the implementation level of preservation activities such as OAIS and ISO

15489 (ISO 2016). Furthermore, Section 3.6 of Chapter Three of this study discussed two major aspects of policies and standards, such as legal and regulatory frameworks and standardisation and best practices. Guided by the models and literature, the study examined the types of preservation policies and standards currently implemented in the five public healthcare facilities in Malawi. The research question was addressed in the questionnaires, interview guide and document checklist to data entry clerks and ICT officers, clinical and nursing staff, records officers, hospital directors and hospital administrators in the following sections: questions 28-38 of the questionnaires for data entry clerks and ICT officers (Appendix 1), questions 7-10 of the questionnaire for clinical and nursing staff (Appendix 2), questions 7-11 of the interview guide for hospital directors and administrators (Appendix 3), questions 11-15 of the interview guide for records officers (Appendix 4), and questions 2 (a-d) of the document review checklist (Appendix 6). The themes under this research question were the following:

1. Policies
2. Standards
3. Guidelines and procedures
4. Legislation

5.3.3.1 Policies

Policies are a cornerstone of an effective preservation programme for medical records. Policies are significant because they provide a mandate to records officers and staff handling the preservation of records in an institution. As such, policies guide the conduct of all preservation activities in institutions such as healthcare facilities. Therefore, the respondents were asked whether there was the existence of policies that guide the preservation of medical records in the five public healthcare facilities in Malawi. As such, a multiple-response question was posed to clinical and nursing staff, data entry clerks and ICT officers on the existence of the policies that guide the preservation of medical records in the public healthcare facilities in Malawi. The responses were tagged on a five-point scale from strongly disagree to strongly agree. As displayed in Table 5.21, the findings imply that the majority of respondents agreed that the five public healthcare facilities had written and approved policies such as records management policy, retention and disposal policy, health information management (116, 64%) and data entry clerks and ICT officers were aware of the policies through sensitising/awareness campaigns, and meetings (87, 48%).

Table 5.21: Policies (n=181)

Policies	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Written and approved policies are available, such as records management policy, retention and disposal policy, health information management policy, guidelines and regulations.	9	5	21	12	35	19	93	51	23	13
Data entry clerks and ICT officers are aware of the policies through sensitising/awareness campaigns and meetings.	9	5	42	23	41	23	66	36	21	12

(Source: Field Data 2024)

Furthermore, the document reviews made by the researcher in the five healthcare facilities in Malawi revealed that policies for preserving records do not exist. Specifically, Hospital B was in the process of drafting the policy, and Hospitals C and E adopted the HMIS policy for the preservation of records.

5.3.3.2 Standards

Standards are important instruments that ensure consistency in the preservation of medical records across geographical boundaries. Standards also act as a guide and best practices for the preservation of medical records. To investigate standards currently existing in the five public healthcare facilities in Malawi, a question was posed to respondents on the adoption and level of awareness of staff on the standards for preserving medical records. As such, a multiple-response question was posed to clinical and nursing staff, data entry clerks and ICT officers on the adoption and their level of awareness of the standards for preserving medical records. The responses were tagged on a five-point scale from strongly disagree to strongly agree. The findings are displayed in Table 5.22. The findings indicated that standards have been adopted for managing medical records, such as ISO 15489, ISO 20652, ISO 9001, Moreq, and HL7 (101, 56%), and Data entry clerks and ICT officers were aware of the standards through awareness campaigns, meetings, seminars and workshops (83, 55%). The findings indicate that the healthcare facilities have adopted standards for preserving records, and staff are aware of them.

Table 5.22: Standards (n=181)

Standards	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Standards have been adopted for managing medical records, such as ISO 15489, ISO 20652, ISO 9001, Moreq, and HL7.	10	6	31	17	39	22	80	44	21	12
Data entry clerks and ICT officers are aware of the standards through awareness campaigns, meetings, seminars and workshops.	15	8	42	23	39	22	63	35	20	11

(Source: Field Data 2024)

However, findings gathered through document review also revealed that all five healthcare facilities lack standards for preserving records. The use of the HMIS policy for records management was noted in Hospital E.

5.3.3.3 Guidelines and procedures

Besides standards, guidelines and procedures are very important in the preservation of medical records. Guidelines and procedures are a framework that provides practical steps in implementing records management policies, standards and legislation. Therefore, a question was posed to the respondents on the guidelines and procedures for preserving medical records in the five public healthcare facilities in Malawi. The purpose was to investigate the procedures for disposing of records, filing, backup, and accessing/retrieving records in the five public healthcare facilities in Malawi. A multiple-response question was posed to clinical and nursing staff, data entry clerks and ICT officers on guidelines and procedures for preserving medical records. The responses were tagged on a five-point scale from strongly disagree to strongly agree. As displayed in Table 5.23, the findings indicated that the five public healthcare facilities in Malawi have guidelines and procedures for disposing of records (111, 62%), procedures for filing, titling, indexing, classifying, and describing records (51, 28), guidelines and procedures for backup of records (89, 50%), and guidelines and procedures for accessing/retrieving records (96, 53%). The findings entail that guidelines and procedures exist for preserving medical records in healthcare facilities.

Table 5.23: Guidelines and Procedures (n=181)

Guidelines and procedures	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Procedures for disposing of records have been developed at the facility.	8	4	22	12	40	22	90	50	21	12
Filing procedures for titling, indexing, classifying, and describing records are available.	8	4	35	19	41	23	33	18	18	10
Guidelines and procedures for the backup of records are available to staff.	12	7	38	21	37	20	68	38	21	12
Guidelines and procedures for accessing/retrieving records are available to staff.	10	6	35	19	39	22	70	39	26	14

(Source: Field Data 2024)

The data from the document review also revealed that all five healthcare facilities lack guidelines and procedures for preserving records. It was clear from the review process that healthcare facilities such as Hospital E adopted the standard operating procedures (SOPs) to guide the management of medical records by all staff at the hospital.

In addition, findings through document review also revealed that all healthcare facilities lacked a programme/schedule for the preservation of records. This implies that healthcare facilities are not systematic in preserving medical records.

5.3.3.4 Legislation

Legislation formalises the commitment of countries to properly preserve medical records. Legislation provides a useful platform and link with institutional policies, guidelines and procedures concerning the preservation of medical records. Several legislation exist that govern the preservation of medical records. Some legislation are country-specific and applicable within the boundary of that country, such as the HIPA Act of 1996 in the USA and the Data Protection Act 2018 of the UK. Other legislation apply to different jurisdictions, such as the GDPR of 2016 in the European Union. A multiple-response question was posed to clinical and nursing staff, data entry clerks and ICT officers on legislation that govern the preservation of medical records in the five public healthcare facilities in Malawi. The responses were tagged on a five-point scale from strongly disagree to strongly agree. The findings as illustrated in Table 5.24 revealed that the five public healthcare facilities in Malawi adhere to laws such as the National Archives Act, Access to Information Act of 2017, Public Health Act of 2021, Medical Services Act of 2018, Data Protection Act of 2024 (121, 67%) and that the pieces of legislation exist in the health facilities (86, 47%). Furthermore, the study also revealed that staff were aware of these laws for preserving records through awareness campaigns, meetings, seminars and workshops (84, 46%). The findings

indicate that legislation exist that guides preservation activities in the healthcare facilities in Malawi.

Table 5.24: Legislation (n=181)

Legislation	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
The facility adheres to laws such as the National Archives Act, Access to Information Act of 2017, Public Health Act of 2021, Medical Services Act of 2018, Data Protection Act of 2024, etc.	7	4	15	8	38	21	97	54	24	13
The pieces of legislation exist in the health facility	10	6	30	17	50	28	64	35	22	12
Staff are aware of these laws for preserving records through awareness campaigns, meetings, seminars and workshops	12	7	39	22	45	25	64	35	20	11

(Source: Field Data 2024)

The document review also revealed that all five healthcare facilities were not aware of legislation for preserving records. Due to a lack of legislation, Hospital C adopted the use of the Health Sector Strategic Plan III as legislation that guides preservation activities for records.

5.3.4 Storage mechanisms

One of the major functions of preservation is to ensure proper storage of records for access, security and proper disposal. Storage or storing is the placement of records onto a shelf or into a file drawer, according to a plan (Read & Ginn 2015:118). Storage also means saving a record into an electronic medium that is readable by a computer. Due to the nature of records, records can be stored in both physical and electronic media using various equipment such as folders, shelves, drawers, and computers (Read & Ginn 2015). Proper storage of records has major benefits such as enhancing access to records, ensuring the security and safety of records and equipment, timely disposal of records and reduction of storage costs. Ultimately, properly kept records support prompt medical decision-making by healthcare staff and the timely provision of treatment to the patients (Marutha & Ngoepe 2018; Marutha 2019).

The Records Lifecycle model adopted for this study argues that records are not static but have a lifespan resembling that of a living organism. As such, management of records needs to consider the entire lifespan, popularly known as the “lifecycle” of a record. The five phases in the lifecycle of a record include creation, distribution, use, maintenance and final disposition (Marutha 2011). In the lifecycle of a record, the model argues that records need to be properly managed, including

storage from the point of creation to final disposition. However, the aspect of storage of records is emphasised in the maintenance stage, which includes storage methods, storage equipment, storage environment, and safety and security. Likewise, the DCC Curation Lifecycle Model supports the implementation of storage methods for records according to relevant standards such as OAIS and ISO 15489 (ISO 2016) (Higgins 2008:138). Lastly, the OAIS Model emphasises the importance of storage, maintenance and retrieval of records. The model discusses specific functions of archival storage such as migration, error checking, implementing disaster recovery strategies, and retrieval. Furthermore, Section 3.7 of Chapter Three of this study discusses storage mechanisms for medical records.

The third research question sought to examine the storage mechanisms for medical records at the selected public healthcare facilities in Malawi. The research question was addressed in the questionnaires, interview guide and document checklist to data entry clerks and ICT officers, clinical and nursing staff, records officers, hospital directors and hospital administrators in the following sections: questions 39-63 of the questionnaires for data entry clerks and ICT officers (Appendix 1), questions 11-27 of the questionnaire for clinical and nursing staff (Appendix 2), question 12 of the interview guide for hospital directors and administrators (Appendix 3), questions 16-19 of the interview guide for records officers (Appendix 4), and questions 1-3 of the observation checklist (Appendix 5). The themes under this research question were the following:

1. Cloud storage
2. Blockchain technology
3. Artificial intelligence
4. DNA storage
5. Computers
6. Portable storage media
7. Storage rooms
8. Physical storage equipment

5.3.4.1 Cloud storage

The challenges with offline storage of records have given rise to cloud storage. It is argued that cloud-based storage offers numerous benefits such as protection of data and information while achieving a reduction of costs in infrastructure, business processes, and other applications (Franks 2018:217). This growth has also prompted healthcare facilities to adopt the model of preserving medical records. Therefore, a multiple-response question was posed to respondents to investigate the use of cloud storage in the preservation of medical records. The responses were tagged on a five-point scale from strongly disagree to strongly agree. The findings have been presented in Table 5.25. The findings have revealed that healthcare facilities do not use cloud storage to store records (76, 42%), ICT infrastructure does not exist that supports the use of cloud storage services for records (75, 41%) and Data entry clerks, ICT officers, clinical and nursing staff lack the knowledge and skills to store records in the cloud (86, 48%). The findings indicate that cloud storage is not used for the storage of medical records in healthcare facilities.

Table 5.25: Cloud Storage (n=181)

Cloud storage	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
A healthcare facility uses cloud storage to store records.	33	18	43	24	54	30	39	22	12	7
An ICT infrastructure exists that supports the use of cloud storage services for records.	33	18	42	23	51	28	12	7	18	10
Data entry clerks, ICT officers and clinical and nursing staff have the knowledge and skills to store records in the cloud.	38	21	48	27	41	23	40	22	14	8

(Source: Field Data 2024)**5.3.4.2 Blockchain technology**

Evidence exists that systems for preserving medical records are characterised by challenges such as security lapses and a lack of access to records. Shahnaz, Qamar and Khalid (2019) have argued that the challenges with paper-based systems can be resolved through the adoption of blockchain technology. The adoption of blockchain technology is critical in the era where medical records are increasingly being created in electronic format. Therefore, a multiple-response question was posed to respondents to investigate the use of blockchain technology in preserving medical records. The responses were tagged on a five-point scale from strongly disagree to strongly agree. As illustrated in Table 5.26, the findings revealed that the five public healthcare facilities do not use blockchain technology to store electronic records (72, 46%), ICT lack of existence of infrastructure that supports the use of blockchain technology (69, 38%), and data entry clerks, ICT officers, clinical and nursing staff lack the knowledge and skills to store records using blockchain technology (90, 50%). The findings imply that blockchain technology is not used to store medical records in healthcare facilities.

Table 5.26: Blockchain Technology (n=181)

Blockchain technology	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
The facility uses blockchain technology to store electronic records.	34	19	48	27	57	31	32	18	10	6
An ICT infrastructure exists that supports the use of blockchain technology.	18	10	51	28	51	28	24	13	12	7
Data entry clerks, ICT officers and clinical and nursing staff have the knowledge and skills to store records using blockchain technology.	39	22	51	28	55	30	27	15	9	5

(Source: Field Data 2024)**5.3.4.3 Artificial intelligence**

The dawn of the 21st century has given rise to new and innovative technologies such as Artificial Intelligence (AI). AI has huge potential and is projected to impact every part of society and business, including healthcare. Milana and Ashta (2021) further argued that healthcare will benefit from AI and improve service delivery. This is partly due to the huge amount of data being created in health, which surpasses the human's capacity to process and use (Khalid *et al* 2023). Because of the foregoing, a multiple-response question was posed to respondents to assess the use of AI in the five public healthcare facilities in Malawi. The responses were tagged on a five-point scale from strongly disagree to strongly agree, and the findings are displayed in Table 5.27. The findings indicated that AI is rarely used for the preservation of medical records in the public healthcare facilities in Malawi. Specifically, the findings revealed that the facility does not use Artificial Intelligence to store records (92, 52%) and that AI has not improved the storage and retrieval of medical records (69, 38%). Concerning knowledge and skills on AI, the study revealed that data entry clerks, ICT officers and clinical and nursing staff lack the knowledge and skills in Artificial Intelligence (98, 54%). The findings indicate that AI is not used for the storage and retrieval of medical records in healthcare facilities.

Table 5.27: Artificial Intelligence (n=181)

Artificial intelligence	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
The facility uses Artificial Intelligence to store records	38	21	57	31	40	22	32	18	14	8
Artificial Intelligence has improved the storage and retrieval of medical records	9	5	60	33	57	31	21	12	9	5
Data entry clerks, ICT officers and clinical and nursing staff have the knowledge and skills in Artificial Intelligence.	4	2	57	31	45	25	33	18	4	2

(Source: Field Data 2024)**5.3.4.4 DNA storage**

The recent advancements in technology have resulted in an exponential increase in data. As such, the demand for data and long-term storage devices is expected to grow. Therefore, innovative methods are required for long-term preservation of data with reduced labour and storage costs, energy consumption and insufficient data density (Hilbert & López 2011). Deoxyribonucleic acid (DNA) storage is one of the innovative solutions that offer long-term preservation of data at a reduced cost (Doricchi *et al* 2022). A question was posed to respondents to examine the ways of using DNA storage for preserving medical records in the five public healthcare facilities in Malawi. The findings displayed in Table 28 confirmed that the five public healthcare facilities in Malawi do not use DNA to store records (69, 38%) and that data entry clerks, ICT officers and clinical and nursing staff lack the knowledge and skills in DNA technology (87, 48%). The findings confirm that DNA storage is not used to store medical records in healthcare facilities.

Table 5.28: DNA Storage (n=181)

DNA storage	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
The facility uses DNA to store records	15	8	54	30	72	40	9	5	6	3
Data entry clerks and ICT officers have the knowledge and skills in DNA technology	15	8	72	40	51	28	12	7	6	3

(Source: Field Data 2024)

5.3.4.5 Computers

The use of computers in healthcare has improved the creation, capture, storage, processing, and transfer of information. Computers provide a means of storing medical records for access and use by healthcare practitioners at a later stage. In addition, computers enhance the security and confidentiality of records (Hepisuthar 2021). As such, computers have the potential to improve the provision of quality care to patients (Joos, Wolf & Nelson 2019). Data entry clerks, ICT officers, and clinical and nursing staff were asked about the use of computers in preserving medical records in the five public healthcare facilities in Malawi. The findings illustrated in Table 5.29 revealed that an adequate number of computers are available for storing records (93, 51%), computers have improved the security of stored records (102, 56%), and computers have reduced the storage costs for records in the five public healthcare facilities in Malawi (103, 58%). The findings imply that computers are heavily used for preserving medical records in the five public healthcare facilities in Malawi.

Table 5.29: Computers (n=181)

Computers	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
An adequate number of computers is available for storing records.	6	3	42	23	15	8	66	36	27	15
Computers have improved the security of stored records in the facility.	6	3	24	13	24	13	87	48	15	8
Computers have reduced the storage costs for records in the facility.	6	3	24	13	21	12	72	40	33	18

(Source: Field Data 2024)

The findings obtained through observations in all five healthcare facilities revealed that computers, servers, internet, and databases (i.e. EMR for outpatient, Offline MS Access for backup of register records) are used for preserving records. It was also observed in all the hospitals that special computers such as J2 were funded by organisations such as the Elizabeth Grazer Pediatric Aids Foundation (EGPAF) and the World Bank for outpatient and inpatient services.

5.3.4.6 Portable storage media

The developments in ICTs have given rise to a series of portable storage media for records such as floppy diskette, tape drive, removable cartridge, CD, DVD, flash disks, HDD, and SSD. Portable storage media has enabled the preservation of medical records in electronic format. A question was posed to data entry clerks, ICT officers, clinical staff and nursing staff about the use of portable storage media for preserving medical records in healthcare facilities. The findings have been highlighted in Table 5.30. The findings exposed that modern media such as CDs, DVDs, flash disks, hard disk drives, and solid-state drives are used for storing records (69, 38%). Furthermore, the respondents disagreed that traditional media such as microfilm, cassettes, and floppy disks are used for storing records (100, 55%). The findings imply that traditional media are

rarely used to store records because they are not supported by modern technologies such as computers.

Table 5.30: Portable Storage Media (n=181)

Portable storage media	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Traditional media such as microfilm, cassettes, and floppy disks are used for storing records.	45	25	55	30	46	25	33	18	2	1
Modern media such as CDs, DVDs, flash disks, hard disk drives, and solid-state drives are used for storing records.	37	20	41	23	33	18	58	32	11	6

(Source: Field Data 2024)

Furthermore, observations were made in all five public healthcare facilities to ascertain the storage media used for preserving records. Some of the portable storage media for preserving records include tablets, flash disks and hard disks.

5.3.4.7 Storage rooms

Storage rooms are among the most common storage areas for records. Despite the growth in technologies, storage rooms remain a feasible option for preserving physical records. The storage rooms also protect records from environmental factors, pests, human carelessness and mould. Storage rooms also support disaster preparedness and recovery for records. Therefore, a multiple-response question was posed to respondents to investigate the use of storage rooms for preserving medical records in the five public healthcare facilities in Malawi. Respondents were provided with the option to rate their responses on a five-point scale from strongly disagree to strongly agree. The findings of the study have been highlighted in Table 5.31. The findings revealed that storage rooms are regularly cleaned and dusted (121, 66%), storage rooms are well ventilated (128, 71%), adequate lighting has been installed in the rooms (119, 66%), and blinds and thick curtains have been installed in the rooms to insulate records from the sun (88, 48%). However, the study revealed that air conditioners were not installed to regulate temperature in the rooms (102, 57%), and rooms were rarely equipped with equipment such as fire extinguishers and fire alarms for disaster preparedness (78, 44%). The findings imply that the five public healthcare facilities used storage rooms for preserving medical records.

Table 5.31: Storage Rooms (n=181)

Storage rooms	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Storage rooms are regularly cleaned and dusted.	10	6	24	13	25	14	93	51	28	15
Storage rooms are well-ventilated.	12	7	18	10	21	12	97	54	31	17
Air conditioners have been installed to regulate the temperature in the rooms.	48	27	54	30	20	11	41	23	18	10
Adequate lighting has been installed in the rooms.	14	8	29	16	19	10	81	45	38	21
Blinds and thick curtains have been installed in the rooms to insulate records from the sun.	26	14	36	20	31	17	66	36	22	12
The rooms are equipped with equipment such as fire extinguishers and fire alarms for disaster preparedness.	30	17	48	27	35	19	49	27	19	10

(Source: Field Data 2024)

Observations made in the healthcare facilities also revealed the condition of storage rooms for records. The findings revealed that storage rooms were clean and dust-free despite the few instances of dust in some departments handling records. The storage rooms had no sign of dampness, cracks, damage or deterioration, though spots of leakage exist, which show that they were recently maintained. Despite the condition of the rooms, it was observed that records were not kept at a recommended temperature of 18 to 21 Degrees Celsius. It was also observed that the records storage rooms were equipped with blinds and thick curtains to insulate the room from direct sunlight. However, some storage rooms in the healthcare facilities lacked blinds, thick curtains and adequate lighting.

It was also observed that the healthcare facilities had inadequate space to maintain record storage equipment. The existing space in some healthcare facilities was improvised and was originally designed for patient wards, healthcare staff offices, and restrooms for healthcare staff on night duty.

Furthermore, it was also observed that most of the storage rooms had air vents installed for air ventilation. Some departments at Hospital E had air conditioners installed in the storage rooms for records. However, it was observed that some records storage rooms in Hospital C and Hospital E were positioned in the patient's wards, which resulted in poor air ventilation.

On disaster preparedness, the observations made in the five healthcare facilities indicated that fire extinguishers were in use, but not in all records storage areas. This is even though the fire extinguishers were positioned far from the records storage rooms. Other disaster preparedness equipment, such as smoke detectors, was observed in Hospital E in a donor-funded building.

5.3.4.8 Physical storage equipment

Like storage rooms, physical storage equipment is the common and traditional way of storing records. Physical storage equipment, such as shelves, storage boxes, vaults, and filing cabinets, offers convenient storage and an affordable means of preserving records while supporting access. Data entry clerks, ICT officers, clinical staff, and nursing staff were asked about the physical storage equipment for records in the five public healthcare facilities in Malawi. The purpose of the question was to investigate the extent of the use of physical storage equipment in preserving medical records. The findings have been displayed in Table 5.32. The findings imply that physical storage equipment, such as shelves, cupboards, folders, file cabinets, boxes, and airtight containers, exists and is adequate for storing records (109, 60%) and that shelves, cupboards, folders, file cabinets, boxes, and airtight containers are in good working condition (90, 50%). However, the study revealed a lack of adequate space to maintain file cabinets, boxes and airtight containers for storing records (85, 47%).

Table 5.32: Physical Storage Equipment (n=181)

Physical storage equipment	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Equipment such as shelves, cupboards, folders, file cabinets, boxes, and airtight containers exists and is adequate for storing records.	13	7	30	17	29	16	84	46	25	14
Shelves, cupboards, folders, file cabinets, boxes, and airtight containers are in good working condition.	15	8	42	23	33	18	67	37	23	13
There is adequate space to maintain file cabinets, boxes and airtight containers for storing records.	21	12	64	35	30	17	44	24	22	12

(Source: Field Data 2024)

The study sought to ascertain a relationship between storage mechanisms and types of records in the five healthcare facilities in Malawi. A crosstabulation was computed to ascertain the relationship between storage methods and types of records. The findings presented in Table 5.33 have revealed that different types of storage media are used for the preservation of medical records in healthcare facilities. It is clear from the findings that cloud storage, blockchain and artificial

intelligence were mostly used for preserving health passports and case files. The use of DNA storage was even across all types of records, and computers were mostly adopted for preserving health passports, case files and registers. Traditional and portable storage media were used for preserving all types of records in healthcare facilities. Furthermore, storage rooms and storage equipment were also used for preserving all types of records.

Table 5.33: Crosstabulation of Storage Mechanisms and Types of Records (n=181)

Storage mechanisms	Types of records																			
	Health passports		Case files		Registers		Personal notes		Laboratory results		Radiology reports		Doctors' clinical reports		Nurses' patient reports		Birth certificates		Death certificates	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Cloud storage	62	34	61	34	57	31	39	22	54	30	42	23	42	23	48	27	34	19	34	19
Blockchain	44	24	42	23	34	19	32	18	34	19	28	15	35	19	34	19	24	13	23	13
Artificial Intelligence	44	24	47	26	40	22	28	15	35	19	28	15	35	19	41	23	24	13	26	14
DNA storage	18	10	18	10	18	10	9	5	9	5	12	7	9	5	9	5	10	6	10	6
Computers	60	33	57	31	72	40	15	8	39	22	30	17	36	20	42	23	33	18	31	17
Traditional Portable media	39	22	32	18	28	15	25	14	35	19	29	16	29	16	35	19	22	12	18	10
Modern Portable media	79	44	82	45	75	41	44	24	71	39	54	30	63	35	78	43	44	24	45	25
Storage rooms	140	77	138	76	138	76	68	38	123	68	91	50	104	57	119	66	77	43	76	42
Storage equipment	124	69	121	67	129	71	66	36	96	53	72	40	83	46	99	55	69	38	67	37

(Source: Field Data 2024)

The findings through observations made in all five public healthcare facilities also confirmed that storage equipment such as storage rooms, folders, shelves, cartons, archival boxes, steel cabinets, and registers (admission books) is used for preserving records.

5.3.5 Preservation knowledge and skills

The fourth research question sought to assess the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi. The findings for this research question were derived from questionnaires, interview guides, observation checklist and document review checklist as follows: questions 64-74 of the questionnaires for data entry clerks and ICT officers (Appendix 1), questions 28-34 of the questionnaires for clinical and nursing staff (Appendix 2), questions 13-18 of the interview guide for hospital directors and administrators (Appendix 3), questions 20-27 of the interview guide for records officers (Appendix 4), question 5 of the observation checklist (Appendix 5), and questions 2(e) and 4 of the document review checklist (Appendix 6). The themes under this research question included the following:

1. Knowledge and skills
2. Competencies

3. Ethical considerations

5.3.5.1 Knowledge and skills

Healthcare facilities need staff who have the requisite knowledge and skills to properly preserve medical records that have been created in the course of providing care to patients (Mensah 2011). Staff with the required skills, knowledge and competencies can properly manage medical records based on the best practices for records management (Amin *et al* 2020). National Records of Australia (2020) recommends that the records manager should possess the following professional skills and competencies:

1. Sound knowledge of records management theory and practice, including standards and best practices;
2. An ability to apply and adapt records management standards and best practices effectively in the organisation's context;
3. An understanding and ability to establish various records management tools and techniques;
4. A good knowledge of records management software applications and their use;
5. Experience or knowledge of other organisations' records management systems, obtained through regular liaison with peers;
6. An ability to interpret best practice standards, apply them locally and provide accurate and effective advice and guidance to colleagues (National Records of Australia 2020).

Therefore, the study sought to find out from the respondents the level of knowledge and skills in the preservation of medical records. A question was posed to data entry clerks, ICT officers, clinical officers, nursing officers, hospital directors, hospital administrators and records officers. The findings presented in Table 5.34 revealed that staff responsible for preserving records have the necessary qualifications (72, 40%), on-job orientations, monitoring, and follow-up are available to staff responsible for preservation (79, 44%), and staff have the knowledge and skills to work with hardware and software such as computers, scanners, printers, photocopiers, databases etc (78, 43%). However, the study also revealed a lack of an adequate number of staff for preserving records (63, 35%), a lack of knowledge and skills in receiving, assembling, coding, titling, entering and filing records (74, 41%), staff have not been exposed to workshops, short courses, seminars, and internships on preservation (103, 57%), and staff are not supported by the institution to attend workshops, short courses, seminars, and internships on preservation (98, 54%). The findings imply that despite the existence of knowledge and skills among staff on the preservation of records, more needs to be done to improve their knowledge and skills.

Table 5.34: Knowledge and Skills (n=181)

Knowledge and skills	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Staff responsible for preserving records have the necessary qualifications.	12	7	36	20	36	20	60	33	12	7
An adequate number of staff are available for preserving records.	12	7	51	28	30	17	54	30	9	5
Staff have knowledge and skills in receiving, assembling, coding, titling, entry and filing records.	24	13	50	28	37	20	55	30	15	8
Staff have been exposed to workshops, short courses, seminars, and internships on preservation.	40	22	63	35	30	17	41	23	7	4
Staff are supported by the institution to attend workshops, short courses, seminars, and internships on preservation.	41	23	57	31	30	17	45	25	8	4
On-the-job orientations, monitoring, and follow-up are available to staff responsible for preservation.	28	15	47	26	27	15	69	38	10	6
Staff have the knowledge and skills to work with hardware and software such as computers, scanners, printers, photocopiers, databases, etc.	3	2	51	28	24	13	60	33	18	10

(Source: Field Data 2024)

The researcher observed that no staff in all healthcare facilities have attended continuous professional development activities on records management, such as workshops, short courses, seminars, and internships. The findings from the document review also revealed a lack of short courses, workshops, and seminars on the preservation of records. This is evidenced by a lack of documentation on continuous professional development in public healthcare facilities. The findings obtained through document review also revealed that healthcare staff lack written and approved continuous professional development guidelines.

Furthermore, observations made in the healthcare facilities also revealed that staff were knowledgeable and skilled in assembling, coding, titling, entry and filing records. On the filing system, it was observed that all healthcare facilities adopted the system of filing according to section, month and year of records.

5.3.5.2 Competencies

Besides knowledge and skills, the staff responsible for preserving records needs to possess the required competencies. According to National Records of Scotland (2020) and Amin *et al* (2020), some of the critical competencies for staff handling records include communication skills, enthusiasm, positive attitude, teamwork, flexibility, effective advisory and influencing skills, sharing knowledge and experience, good analytical skills, integrity, and networking. Having identified the knowledge and skills, it was necessary to investigate the competencies of staff responsible for preserving medical records. A question was posed to data entry clerks, ICT officers, clinical officers, nursing officers, hospital directors, hospital administrators and records officers on the competencies of staff responsible for preserving records. The findings have been presented in Table 5.35. The findings revealed that staff have competencies in areas such as communication, positive attitude, teamwork, leadership, flexibility and networking (93, 52%). However, the study found that staff were not competent in areas such as artificial intelligence, data processing, disease classification and cancer registration (88, 48%). The findings imply healthcare staff are incompetent in areas such as artificial intelligence, data processing, disease classification and cancer registration.

Table 5.35: Competencies (n=181)

Competencies	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Staff have the competencies in areas such as communication, positive attitude, teamwork, leadership, flexibility and networking.	3	2	27	15	33	18	81	45	12	7
Staff are competent in areas such as artificial intelligence, data processing, disease classification and cancer registration.	42	23	46	25	40	22	40	22	13	7

(Source: Field Data 2024)

5.3.5.3 Ethical considerations

Medical records contain sensitive and confidential data about patients, and they need to be protected through ethical considerations. In addition, ethical consideration in the preservation of medical records is important in the era of technologies which have compromised the security and privacy of patient information. Some of the ethical principles relevant to medical records are

autonomy, beneficence/non-maleficence, privacy and confidentiality, justice and fidelity. Therefore, a question was posed to respondents on the ethical considerations related to the preservation of medical records in the five public healthcare facilities in Malawi. A question was posed to data entry clerks, ICT officers, hospital directors, hospital administrators and records officers on ethical considerations in preserving medical records. The findings have been displayed in Table 5.36. The findings revealed that ethical considerations such as privacy, confidentiality, justice and fidelity were adhered to when handling medical records (120, 72%), and staff were aware of ethical considerations such as privacy, confidentiality, justice and fidelity (126, 70%). The findings imply that staff responsible for preserving records are aware of and adhere to ethical considerations in their work.

Table 5.36: Ethical Considerations (n=181)

Ethical considerations	Strongly disagree		Disagree		Neither disagree nor agree		Agree		Strongly agree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Ethical considerations such as privacy, confidentiality, justice and fidelity are adhered to when handling medical records	6	3	12	7	9	5	99	55	30	17
Staff are aware of ethical considerations such as privacy, confidentiality, justice and fidelity.	6	3	12	7	12	7	90	50	36	20

(Source: Field Data 2024)

5.4 Presentation of qualitative data

This section presents qualitative data collected through interviews with hospital directors, hospital administrators and records officers. A total of 13 participants participated in the interviews, comprising 2 hospital directors, 5 hospital administrators, and 6 records officers (Table 5.4). Codes were used to represent the participants involved in the interviews. Hospital directors were assigned codes of Participant 1 and Participant 2, while hospital administrators were assigned codes of Participant 3, Participant 4, Participant 5, Participant 6, and Participant 7. Records officers were assigned codes of Participant 8, Participant 9, Participant 10, Participant 11, Participant 12, and Participant 13.

5.4.1 Preservation strategies

The first research question of the study was posed to participants to establish preservation strategies being implemented at the five public healthcare facilities in Malawi. The research question was addressed in the interview guide to records officers in the following sections: questions 8-10 of the interview guide for records officers (Appendix 4). In the present study, the following themes were adopted:

1. Strategies for preserving records
2. Measures to ensure the privacy and security of records

3. Methods for disposing of records

5.4.1.1 Strategies for preserving records

A question was posed to participants on the strategies for preserving records in the five public healthcare facilities in Malawi. A question was posed to records officers on the strategies for preserving records. The general responses provided by records officers in the five public healthcare facilities indicated that medical records were preserved using strategies such as backup, disposal, migration and archiving. On backup, some participants had this to say:

Mostly, our records are backed up through an online system using MS Access database and also transferred to the National Archives for permanent storage (Participant 8).

Our records are backed up through DHIS III at CHISU in Lilongwe 3 (Participant 10).

The active records are kept at the medical records library here at the HMIS office. Some electronic records are backed up on the computers and archived as well. We also conduct backup, etc (Participant 13).

Another participant had this to say on the disposal of records:

Here at Kamuzu Central Hospital, the strategies that we are using in preserving medical records are backup, migration, and transfer to the National Archives (Participant 9).

On migration, one participant said that:

Here at Kamuzu Central Hospital, the strategies that we are using in preserving medical records are backup, migration, and transfer to the National Archives (Participant 10).

Other participants also commented on migration and archiving as follows:

Here at Kamuzu Central Hospital, the strategies that we are using in preserving medical records are backup, migration, and transfer to the National Archives (Participant 9).

Mostly, we use backup and archiving strategies here at the hospital (Participant 12).

The active records are kept at the medical records library here at the HMIS office. Some electronic records are backed up on the computers and archived as well. We also conduct backup, etc (Participant 13).

5.4.1.2 Measures to ensure privacy and security of records

A question was posed to records officers on the measures to ensure the privacy and security of records in the five public healthcare facilities in Malawi. The general responses provided by records officers in the five public healthcare facilities revealed that several measures are being implemented to ensure the privacy and security of records, such as restricting access to records, locking records officers, use of passwords on computers and obtaining authorisation letters for entry to records storage areas. The participants commented as follows on the question:

As a facility, we have implemented several privacy and security measures for records, such as restricting access to records, the locks to the records offices and storage, and computers locked with a password. This process prevents tampering with records (Participant 8).

Some of the measures that we have implemented in ensuring the privacy and security of medical records are that access to records is done by obtaining an authorisation letter, and the storage rooms and records offices are always locked (Participant 10).

The records offices and rooms are always locked, and some records are kept in a lockable container (Participant 11).

Here, we have installed the barriers to the records office/medical library, we implemented restrictions on staff entry, and only authorised staff have access to the medical records. In addition, all staff sign off the records (Participant 13).

The health facility has also implemented security measures such as locking records offices and records storage areas and restricting access to medical records. The goal is to ensure records are safe and protected all the time (Participant 12).

5.4.1.3 Methods for disposal of records

Question 10 in the interview guide for records officers sought to examine the methods for disposing of records in the five public healthcare facilities in Malawi. Responses from records officers in the five public healthcare facilities revealed that medical records are not destroyed at the hospital level but are transferred to the national archives for permanent preservation. Some of the participants said the following:

Our records are never destroyed here at the hospital level but are transferred to the National Archives for permanent storage (Participant 8).

Considering the sensitivity and significance of medical records, records are not destroyed at the facility but are usually transferred to the National Records and Archives Services of Malawi for permanent preservation (Participant 10).

5.4.2 Policies and standards

The second research question of the study was posed to participants to examine the policies and standards on preservation at the five public healthcare facilities in Malawi. The research question was addressed in the interview guide to records officers in the following sections: questions 11-15 of the interview guide for records officers (Appendix 4) and questions 7-11 of the interview guide for hospital directors and administrators (Appendix 3). In the present study, the following themes were adopted:

1. Written and approved policies for preserving records
2. Standards for preserving records
3. Adhere to relevant legislation for preserving records
4. Awareness of the policies and standards for preserving records
5. Methods for raising the level of awareness of staff on policies, standards, and legislation.

5.4.2.1 Written and approved policies for preserving records

A question was posed to records officers, hospital directors and administrators on written and approved policies for preserving records in the five public healthcare facilities in Malawi. The findings revealed that healthcare facilities lack the written and approved policies for preserving records, as highlighted by the records officers. The national policies, guidelines and regulations, such as the HMIS policy, may not substitute institutional policies for preserving records. In terms of updating the policies, the response from the participants was that the policies are updated at the national level. Some participants had this to say:

Currently, the hospital is using national policies, guidelines and regulations for preserving medical records (Participant 1).

Mostly used policies are those developed at the national level (Participant 2).

The health facility has developed different policies related to the preservation of medical records, and these are printed and distributed to all staff responsible for the preservation of records (Participant 4).

The facility does not have written and approved policies for preserving records (Participant 3).

At the moment, the facility does not have policies for the preservation of records, but they are in draft form (Participant 4).

The hospital has an HMIS policy which caters for all medical records-related issues (Participant 12).

The facility does not have written and approved policies for preserving medical records (Participant 13).

5.4.2.2 Standards for preserving records

A question was posed to records officers on standards for preserving records. The findings revealed that healthcare facilities lack the standards for preserving records, as highlighted by the records officers. The HMIS policy is not a relevant standard for preserving records, but rather a general framework for managing health information in healthcare facilities in Malawi. Some participants had this to say:

The hospital does not have standards for preserving records (Participant 8).

At the current time, the hospital does not have any standard for preserving records (Participant 9).

None are available at the hospital, but HMIS policy acts as a standard for preserving records (Participant 13).

We mostly use the HSSP III as a standard for preserving medical records (Participant 11).

5.4.2.3 Adherence to relevant legislation for the preservation of records

Participants were asked about the healthcare facilities' adherence to legislation for preserving records. A question was posed to records officers, hospital administrators and hospital directors on adherence to legislation for preserving records. The overall response from the records officers was that the healthcare facilities do not adhere to relevant legislation for the preservation of medical records. Some participants had this to say:

Yes, the facility is obliged to adhere to all laws for records management and preservation of medical records (Participant 3).

Yes, the facility adheres to relevant policies such as the National Archives Act, etc. (Participant 1).

As far as I am concerned at the moment, the hospital does not adhere to any relevant legislation for preserving records (Participant 8).

The facility does not adhere to any relevant legislation for preserving records (Participant 10).

I am not aware of the facility's adherence to legislation for preserving medical records (Participant 11).

The facility does not adhere to relevant legislation for preserving records (Participant 13).

5.4.2.4 Awareness of the policies and standards for preserving records

A question was posed to records officers, hospital administrators and hospital directors on awareness of staff on policies and standards for preserving records. The overall response from the records officers was that the healthcare staff were not aware of the policies and standards for the preservation of medical records. Some participants commented as follows:

Staff are aware of the policies, standards and legislation through orientation, etc (Participant 3).

Yes, staff are aware of the policies, standards and legislation (Participant 4).

Some staff are aware of the policies, standards and legislation, but not all (Participant 5).

As I have mentioned on policies and standards regarding the non-existence of these instruments, staff are not aware of the policies and standards for the preservation of medical records (Participant 8).

Since the policies and standards are available at the facility, the staff are not aware of them (Participant 9).

Staff handling records, especially data entry clerks, may not be aware of the standards and policies for preserving medical records. A section is shared by statistical clerks (Participant 11).

5.4.2.5 Methods for raising the level of awareness of staff on policies, standards and legislation

A question was posed to records officers, hospital administrators and hospital directors on methods for raising the level of awareness of staff on policies, standards, and legislation. The responses from hospital directors and hospital administrators have outlined several methods for raising the level of awareness of staff on policies, standards, and legislation, such as orientations, training, mentoring, and meetings. However, responses from the records officers in all five healthcare facilities have confirmed that methods for raising the level of awareness of staff on policies, standards, and legislation do not exist. The following are the comments from the participants:

There are no methods currently implemented at the health facility to raise awareness of staff on the policies, standards and legislation because these instruments do not exist at the health facility (Participant 8).

As I have said already, we have not thought of coming up with methods for raising awareness on policies and legislation for preserving medical records among staff, and I am sure once we have these instruments, the facility will raise the awareness of staff of their existence (Participant 10).

Mostly, we use meetings, trainings, etc for sensitising staff about policies, standards and legislation (Participant 13).

The methods for raising awareness among staff of the policies, standards and legislation do not exist here at the hospital (Participant 12).

5.4.3 Storage mechanisms

The third research question of the study was posed to participants to assess the storage mechanisms for records at the five public healthcare facilities in Malawi. The research question was addressed in the interview guide to records officers in the following sections: questions 16-19 of the interview guide for records officers (Appendix 4) and question 12 of the interview guide for hospital directors and administrators (Appendix 3). The following themes were adopted:

1. Storage mechanisms for physical and electronic records
2. Condition of the storage equipment and rooms
3. Budget for purchasing storage equipment and other records preservation-related activities
4. Disaster preparedness measures.

5.4.3.1 Storage mechanisms for physical and electronic records

A question was posed to records officers on storage mechanisms for physical and electronic records. The findings indicated that healthcare facilities use different types of storage mechanisms for physical and electronic records, such as shelves, archival boxes and folders, computers, and DHIS III database. The following are the responses from the participants:

We normally use shelves, boxes and folders for storing physical records, while computers are used to store electronic records (Participant 8).

Mostly, we use different mechanisms for storing records, such as storage rooms, shelves, archival boxes, folders, and computers (Participant 9).

We use shelves, cartons, archival boxes, folders and computers for storing physical and electronic records (Participant 13).

Physically, records are stored using cabinets, shelves and boxes and electronically using DHIS III (Participant 11).

We normally use shelves, boxes, and folders for storing physical records, while some electronic records are kept in the computers, hard drives and flash disks here at the records office (Participant 12).

5.4.3.2 Condition of the storage equipment and rooms

Records officers were asked about the condition of the storage equipment and rooms in terms of cleanliness, ventilation, temperature and lighting. Responses from the participants hinted that the storage rooms for records were in a good state, but could be improved. The following were the responses from the participants:

The storage equipment and rooms are in good condition, but they can be improved by daily cleaning them and installing air conditioners since the rooms are small and ventilation is a problem (Participant 8).

I have to be honest with you on this aspect, the condition of storage equipment and storage rooms is very poor, and there is a leakage in the roof that needs fixing, etc (Participant 10).

The condition of storage equipment and rooms is very good (Participant 13).

The condition of storage equipment and rooms is very poor in terms of cleanliness, ventilation, temperature, etc (Participant 11).

The condition is not so good and needs improvement (Participant 12).

5.4.3.3 Budget for purchasing storage equipment and other records preservation-related activities

Concerning the budget, a question was posed to records officers, hospital administrators and hospital directors in the five public healthcare facilities in Malawi. The responses from the participants have revealed that healthcare facilities have varying budget figures for records management activities. The inadequate nature of the budget for records management functions is very clear from the responses. The following were the general responses from the participants:

The facility has a budget for purchasing records storage equipment pegged at K11 million as of the current financial year (2024-2025) (Participant 1).

Yes, the budget exists for purchasing storage equipment, but it is very limited to a tune of K1.8 million per year as of 2024 (Participant 8).

Yes, we have a budget of K11 million per year, and mostly this money is rarely utilised for its intended purposes because it is just a planning figure that never materialises (Participant 9).

Yes, the budget exists, but access to it is a problem for us here at the HMIS office/records office. HMIS is part of the budget formulation team for the Ministry of Health (Participant 13).

5.4.3.4 Disaster preparedness measures

The study also sought to establish the disaster preparedness measures existing in the five healthcare facilities in Malawi. A question was posed to records officers on the disaster preparedness measures implemented in the healthcare facilities. The findings revealed that the five public healthcare facilities have implemented disaster preparedness measures such as fire extinguishers and the use of PVA water-based paint for records storage rooms. Zomba Central Hospital is anticipating recruiting a disaster preparedness specialist through the World Bank Oxygen Plant Project. The following are the responses from the participants:

Fire extinguishers were installed in the wards and office, although far from the records storage facilities. In addition, PVA water paint is being used to paint the premises, which helps to repel fire (Participant 8).

We mostly have fire extinguishers in storage rooms and the records office for disaster preparedness here at Kamuzu Central Hospital (Participant 10).

Mostly, we have fire extinguishers, which we use for disaster preparedness. We are anticipating that the World Bank will fund the oxygen plant at the facility, and part of the project may be the installation of fire extinguishers and the recruitment of a disaster preparedness specialist (Participant 11).

5.4.4 Knowledge and skills

The fourth research question of the study was posed to participants to assess their level of knowledge and skills in the preservation of medical records at the five public healthcare facilities in Malawi. The research question was addressed in the interview guide to records officers in the following sections: questions 20-27 of the interview guide for records officers (Appendix 4) and questions 13-18 of the interview guide for hospital directors and administrators (Appendix 3). The following themes were adopted:

1. Qualifications of staff responsible for preserving records
2. Level of knowledge and skills of staff on the preservation of records
3. Number of staff responsible for preserving records
4. Staff adherence to ethical considerations
5. Provision of on-the-job orientations, monitoring, and follow-up for staff handling records
6. Support for staff for continuous professional development

5.4.4.1 Qualifications of staff responsible for preserving records

A question was posed to records officers, hospital administrators and hospital directors on the qualifications of staff handling records in the five public healthcare facilities in Malawi. The findings indicated that the qualification of most staff responsible for preserving records was the MSCE. A small number of staff had diplomas in fields such as ICT. The following were some of the comments made by the participants:

The qualification of the staff responsible for records is MSCE (Participant 3).

The qualification of staff responsible for records is MSCE, which is an entry grade for the cadres (Participant 4).

The qualification for staff responsible for records is MSCE, and this can be improved through seminars, training and orientations (Participant 8).

For our staff responsible for records management, it is mostly MSCE, and of course, we have a few members of staff in this category with degrees (Participant 10).

Here, the qualifications of staff handling medical records are a Diploma in ICT and MSCE (Participant 13).

5.4.4.2 Level of knowledge and skills of staff on preservation of records

On the level of knowledge, a question was posed to records officers in the five healthcare facilities in Malawi. Responses from the records officers indicated that their level of knowledge and skills in the preservation of records was low. Some participants made the following comments:

I must say that the level of knowledge and skills of staff responsible for preserving medical records is low since most of these are MSCE holders with little exposure to records management (Participant 8).

The level of knowledge and skills of staff responsible for the preservation of records is low and this can be attributed to a lack of training (Participant 9).

The level of knowledge and skills is low, and there is a need for further training on records management/HMIS among staff handling the preservation of medical records (Participant 13).

The level of knowledge and skills of staff on the preservation of records is very good (Participant 12).

5.4.4.3 Number of staff responsible for preserving records

The study also revealed the number of staff responsible for preserving records in the five public healthcare facilities in Malawi. As such, a question was posed to records officers in the healthcare facilities in Malawi on the number of staff responsible for preserving records. Responses from the participants revealed that all healthcare facilities had an inadequate number of staff responsible for preserving records. This implies that the number of staff responsible for the preservation of records

was inconsistent with the size of the healthcare facilities. Some of the participants' answers were as follows:

The staff we have here are not adequate, and we definitely need more, considering the amount of work we have at this hospital (Participant 8).

I strongly feel that the number of staff handling records against the size of the facility and workload is inadequate, and we need more staff (Participant 9).

The numbers are on the lower side, and we would have preferred more because we have 25 official data entry clerks and 55 improvised ones. The required number for us is 80 (Participant 13).

It is mostly inadequate as there are just 3 of us handling all records-related issues at the hospital, and 5 staff would have been better for us and our work (Participant 12).

5.4.4.4 Staff adherence to ethical considerations

Records officers were asked about the staff's adherence to ethics in preserving medical records. Participants responded by stating that staff are always professional and adhere to professional ethics when preserving medical records. These sentiments were shared by all records officers in the five healthcare facilities in Malawi. Some of the views of the records officers concerning adherence to ethics were as follows:

Yes, the staff is always professional and adheres to professional ethics (Participant 8).

On this issue of professionalism, our staff are very good and adhere to all principles of professionalism, and a general code of conduct for all staff exists here at the hospital (Participant 9).

They always adhere to ethics as staff handling medical records (Participant 13).

Staff always adhere to ethics, and the facility improvises by recruiting hospital attendants for data entry/records work (Participant 8).

5.4.4.5 Provision of on-the-job orientations, monitoring, and follow-up for staff handling records

The interviews with the records officers also revealed the extent to which healthcare facilities provide on-the-job orientations, monitoring, and follow-up to staff handling records. The responses from the records officers revealed that the five healthcare facilities provide on-the-job orientations, monitoring, and follow-up to staff handling records. The following are some of the comments from the participants:

Yes, it is the duty of the HMIS office to conduct the on-the-job orientations, monitoring and follow-ups for staff handling records (Participant 8).

Yes, the hospital and records office conduct these orientations, monitoring, etc for staff handling records (Participant 10).

These on-the-job orientations, monitoring, and follow-up are done here at the hospital (Participant 13).

These are done and staff are taken through on-job orientations, monitoring, and follow-up on the preservation of medical records (Participant 12).

5.4.4.6 Support for staff for continuous professional development

Records officers, hospital directors and hospital administrators were asked to mention the continuous professional development support provided to staff handling records. The responses from the hospital administrators and hospital directors revealed that healthcare facilities plan for continuous professional development activities. However, the views of records officers indicated that staff handling records rarely attend continuous professional development activities such as short courses, seminars and internships. The following were some of the comments from the participants:

Due to financial constraints, short courses are not supported, but seminars only (Participant 1).

Yes, it is planned once a year (Participant 4).

The hospital does not support staff to attend short courses or seminars, but only orientations (Participant 8).

At the moment, the hospital is not doing enough to support staff attending short courses, seminars and internships, especially in the preservation of medical, partly due to funding issues, but indeed there is a need for these opportunities for staff (Participant 10).

Staff are not supported by the hospital at the moment to attend a short course in the preservation of medical records (Participant 13).

Yes, the hospital supports staff with refresher courses, but not short courses and seminars. Training plans are made every year, and it appears the hospital prioritises health staff (Participant 11).

Staff are not supported to attend short courses, seminars, or internships on the preservation of medical records (Participant 12).

Considering the significance of funding in implementing continuous professional development activities for staff, a follow-up question was posed to hospital directors, hospital administrators and records officers. The responses from the participants revealed that healthcare facilities lack funding to support staff attending short courses, seminars, and internships on the preservation of medical records. The following were some of the responses from the participants:

For continuous professional development activities here at the hospital, no funding is available for staff handling records (Participant 3).

Funding exists for continuous professional development activities, and not from the hospital budget, but mostly funded by donors/partners such as Lighthouse (Participant 4).

No funding is available for staff to participate in continuous professional development activities (Participant 8).

There is inadequate funding for such activities as continuous professional development for staff responsible for medical records, but we are lucky to have partners such as EGPAF, and Lighthouse who support us with lunch allowances, etc, for staff to attend refresher courses, etc. (Participant 9).

Budgeting is done but not allocated, and mostly the funds are relocated to other priority areas (Participant 13).

No funding exists for staff for continuous professional development activities on the preservation of medical records (Participant 12).

Findings through document review on funding revealed that healthcare facilities budget for the preservation of records. It was further noted that the budget through government subvention ranged from K1.4 million to K11 million, despite some healthcare facilities reserving their right to disclose the figures. However, it was noted that the budget for the preservation of records was never utilised.

A follow-up question was posed to records officers, hospital directors and hospital administrators on the existence of continuous professional development guidelines for staff handling records. The responses from the participants indicated that all healthcare facilities lack continuous professional development guidelines. The question ignited the following responses from the participants in line with the above finding:

Currently, there are no continuous professional development guidelines for staff responsible for records at the health facility (Participant 1).

The facility does not have continuous professional development guidelines (Participant 4).

The hospital does not have continuous professional development guidelines for records staff, but maybe in the near future (Participant 8).

In the meantime, the facility does not have any guidelines for continuous professional development (Participant 10).

None of the continuous professional development guidelines do not exist at the hospital (Participant 13).

These continuous professional development guidelines for staff responsible for records do not exist here at the hospital (Participant 12).

5.5 Summary

The chapter has analysed and presented the findings of the study on the framework for the preservation of medical records in selected public healthcare facilities in Malawi. Data for the study was gathered through triangulation of data collection instruments, namely questionnaires, interviews, observations and document reviews. Analysis and presentation of data followed a systematic approach based on the research questions derived from the research objectives. Based on the convergent design adopted for the study, the analysis and presentation of quantitative and qualitative data were done in different sections. Data gathered through observations and document analysis complemented the quantitative and qualitative data. Quantitative data was presented using tables, percentages and crosstabulations, while qualitative data was presented through verbatim extracts from participants and indented.

The next Chapter (Six) discusses the findings using extant literature and theory. The interpretation and discussions is organised according to the themes derived from the research objectives.

CHAPTER SIX

INTERPRETATION AND DISCUSSION OF FINDINGS

6.1 Introduction

While interpretation is the process of making meaning of data produced in the research study (Neuman 2019:102), a discussion is a process of interpreting and describing the significance of the research findings in light of what is known about the research problem being investigated and explaining any new insights about the problem (Kumar 2019:52). This chapter interprets and discusses the research results presented and analysed in Chapter Five. Based on the mixed methods perspective for the study, data was obtained through questionnaires, interviews, observations, and document analysis. Interpretation and discussion of research findings are significant in drawing meaningful conclusions from the findings and enhancing the readers' understanding of the major issues that arise from the study.

In the study, interpretation and discussion were done based on the literature presented in Chapter Three and the results presented in Chapter Four. The entire process of interpretation and discussion was guided by the main purpose of this study, which was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records. The findings are interpreted and discussed concerning the research questions outlined in Section 1.6 of Chapter One following the pragmatism paradigm equivalent to the mixed methods research approach adopted for this study.

6.2 Preservation strategies

Despite a lack of consistency in the definition of preservation strategies, previous scholars (Magama 2018; Marutha 2021; Masuku & Ngulube 2020; Millar 2017) have unanimously used the concept of preservation strategies as an umbrella term to refer to all activities undertaken to ensure long-term preservation and retention of the authoritative nature of data to ensure data remains authentic, reliable and usable while maintaining its integrity. Some examples of preservation strategies recorded in the literature are migration, refreshing, emulation, byte replication, conversion, backup, cloud computing, preservation metadata, file formats, fire extinguishers, smoke detectors and fire detectors (Adetunji 2021; Gisemba, Ng'eno & Bosire 2022; Magama 2018; Marutha 2021; Masuku & Ngulube 2020; Shahrul Asari, Hussin & Samsudin 2017).

The first research question of the study was to establish the preservation strategies currently in place at selected public healthcare facilities in Malawi. As discussed in Chapter Two, the Records Lifecycle model, DCC Curation Lifecycle Model and OAIS Model were adopted to understand the preservation strategies for medical records in public healthcare facilities in Malawi under the following themes:

1. Migration
2. Backup procedures
3. File formats
4. Dehumidification
5. Metadata
6. Damage repair

7. Privacy and security
8. Disposal of records

6.2.1 Migration

Public healthcare facilities generate a large number of records that need to be consistently managed to enable access and use. This process has been worsened by technological obsolescence (Louisiana State Archives 2020). To counter the challenges of obsolete technologies, digital records should be moved to newer systems and storage devices such as hard drives, flash disks, servers, and cloud computing (Louisiana State Archives 2020). Migration is the transfer of records from an old system to a newly adopted system for recordkeeping (Lowry & Nduna 2015; Magama 2017). Therefore, migration is one of the most important strategies for transferring and preserving digital content across different media as technology becomes obsolete.

The study was determined to investigate the migration of medical records in the five public healthcare facilities in Malawi. The present study found that migration is done in the five public healthcare facilities in Malawi, with evidence of migration methods and equipment, availability of documentation for migration procedures and knowledge and skills of staff on migration. Similar findings obtained through interviews with records officers also revealed that all five public healthcare facilities in Malawi were equipped with equipment for the migration of data and records, such as computers. Other medical records were also migrated to centralised servers for permanent storage. The present findings are significant in two major ways. Firstly, the implementation of migration activities is a sign that public healthcare facilities in Malawi recognise the value of records in healthcare service delivery. Secondly, migration also ensures that records are accessible over a long time despite technological changes. However, there is room for improvement, and future research should focus on policies and standards on the migration of records.

However, Franks (2013) warned that migration is a complex and time-consuming process. As such, a cost-benefit analysis should be done to determine the value of the entire migration process (Franks 2013). For effective implementation, the National Archives (2017) suggested that migration should follow a project management approach with a series of steps for implementation. Similar sentiments are expressed by the theoretical frameworks guiding the study, namely the Records Lifecycle model, DCC Curation Lifecycle Model and OAIS Model, that preservation strategies, including migration, need to follow a lifecycle approach for effective implementation (Consultative Committee for Space Data Systems 2002; Higgins 2008; Read & Ginn 2015). The findings of the present study disagree with those of Adu and Ngulube (2017) that public institutions, including hospitals in Ghana, faced challenges in preserving medical records due to a lack of migration of records.

The present study also aimed to determine which categories of medical records were most affected by migration. The findings in Table 5.20 of Chapter Five indicate that migration primarily applies to registers. This finding was unexpected and suggested that migration is prioritised for a single type of record rather than being applied broadly. This focus may stem from the large volume of registers generated by public healthcare facilities in Malawi. This state necessitates frequent migration of other types of records, such as case files, to enhance access to patient data and to support healthcare personnel in delivering effective services.

6.2.2 Backup procedures

Public healthcare facilities are faced with a myriad of risks and uncertainties, such as disasters, which threaten the existence and use of medical records. Therefore, the implementation of backup procedures enables the protection of data and records (Upward *et al* 2019). According to Magama (2017), backup is the process of making multiple copies and storing them in different locations, far apart from each other. Backup entails the creation of primary storage and secondary storage of data or records. Several benefits exist for implementing backup such as saving time and money, increasing the productivity of an organisation in the case of a disaster (Hofman 2021), preparing for disaster, eliminating the threats of accidental deletion of records (Crocket 2017), mitigating the negative impact of software bugs and hardware failures on the organisation, and ability to reproduce results of the past for the continuity of business of the organisation (Yeo 2021), and support access to records and respond to data requests from clients (Millar 2017). Backup procedures are generally categorised into two, namely traditional and modern media. Some examples of traditional backup procedures include floppy diskettes, tape drives, and removable cartridges (Saffady 2021). Examples of modern media for backup are CD, DVD, flash disks, HDD, SSD, cloud storage, and DNA (Hofman 2021; Saffady 2021).

This study sought to investigate different aspects of backup procedures, including the knowledge and skills of staff in selected public healthcare facilities in Malawi. The present study found that backup procedures for records were conducted in the five public healthcare facilities in Malawi. Some of the backup procedures were regular backup of physical and electronic records, availability of backup equipment such as Google Drive and servers, the existence of a reliable power supply for conducting backup procedures, development of backup manuals and knowledge and skills of staff on backup procedures. There is abundant room for further improvement in the development of backup procedure manuals and improving the knowledge and skills of staff handling records in the five public healthcare facilities in Malawi. Backup procedure manuals are important as they support staff in properly conducting backups in line with the requirements of the healthcare facilities. In addition, the backup procedures also ensure consistency in backup according to national and international standards such as ISO. Another interesting finding obtained through interviews with records officers and observations made by the researcher revealed that medical records in all five public healthcare facilities were properly backed up through the Microsoft Office Access database and DHIS III, centralised government servers, computers, CDs, DVDs, hard drives and flash disks. It was also observed that all five public healthcare facilities were equipped with a reliable power supply through the ESCOM line, a generator set and solar. A reliable power supply is important in implementing backup procedures for records.

The findings of the current study, however, do not align with previous research (Adu & Ngulube 2017; Anyira 2020; Marutha & Ngoepe 2018; Marutha 2021; Marutha 2019; Mensah & Adams 2014), which indicated that healthcare facilities lacked backup procedures for medical records.

6.2.3 File formats

Recent advancements in ICTs pose challenges to the long-term preservation of records. To ensure continued access and preservation, organisations, including healthcare facilities, must adopt reliable file formats. File format is the organisation of data within files, usually designed to facilitate the storage, retrieval, processing, presentation, and/or transmission of the data by software (InterPARES2 n.d.). PREMIS (2008:195) also considers file format as a specific, pre-

established structure for the organisation of a digital file or byte stream. Different file formats exist for different types of records. For example, for records in document format, the recommended file formats are PDF (Portable Document Format) and DOC (Drago 2019; Han & Wanm 2018). For Video files, Universitat Wien (2024) recommends file formats such as AVI, MPEG-2, MKV and MP4. The recommended file formats for pictures include TIFF, JPG and PNG.

Against this backdrop, the study sought to establish the file formats being implemented for various types of medical records in the five public healthcare facilities in Malawi. The study found that file formats such as PDF, SQL and TIFF are not being used for preserving medical records in Malawi's public healthcare facilities. As displayed in Table 5.14 in Chapter Five, healthcare staff such as data entry clerks, nurses and clinicians agreed on the use of file formats and necessary equipment and software available to preserve records respectively in the healthcare facilities in Malawi. The findings suggest that file formats are used, but the majority of staff are not aware or knowledgeable about them. Interestingly, observations made by the researcher in all five public healthcare facilities painted a picture that digital files were formatted with formats such as DOC, PDF, TIFF, and JPEG. The observations also indicate the use of the file formats in preserving medical records. One of the issues that emerges from these findings is that staff need to be informed about file formats through meetings and training sessions. However, it is premature to conclude that this level of awareness would translate to the actual use of file formats in the preservation of records among staff. As such, further research should be done to investigate the correlation between the level of awareness of staff and the adoption of preservation strategies such as file formats in public healthcare facilities in Malawi.

Consistent with the findings of the present study, a study by Smith and Macdonald (2006) in Australian hospitals found that hospitals faced challenges in implementing file formats such as PDFs and pictures for preserving medical records despite the proliferation of electronic records in various formats. Although the findings of the present study are consistent with those of Smith and Macdonald (2006), they disagree with Alnashmi *et al* (2022) and Edmund, Ramaiah and Gulla (2009) in that a significant application of file formats such as PDF for plain text or XML documents, SQL for spreadsheets, SQL for databases, and TIFF for pictures were used for preserving medical records.

The findings in Table 5.20 of Chapter Five indicate that health passports require specific file formats. This may be due to physical health passports being among the primary records created or received by healthcare facilities in Malawi. These records need to be migrated into electronic formats to enable future access and use by both healthcare staff and patients.

6.2.4 Dehumidification

According to Dehghani, Date and Akbarzadeh (2018:89), dehumidification is the removal of water from the air. Dehumidification controls the temperature levels in the storage area for records, thereby shielding records from abnormal humidity levels (Crocket 2018; Miller 2022; Yeo 2017). However, Miller (2022) argues that the process of dehumidification should be accompanied by a strict monitoring regime of temperature and humidity of the storage area for records. Dehghani, Date and Akbarzadeh (2018) also argue that an investment in an alternative power supply if the existing main power supply is intermittent is a wise decision in dehumidification. Several methods exist for dehumidifying the storage place for records such as storing records from outside walls to encourage air circulation, keeping records out of basements or attics, good ventilation, packing

records in archival containers made of polyester, storing fragile records in one location for monitoring (Miller 2022), use of dehumidifier equipment (Dehghani, Date & Akbarzadeh 2018), solar thermal-driven dehumidification (Ge *et al* 2018), space heaters, chilling, open coil duct heaters, energy recovery ventilators, and desiccators (Purushothama 2024).

For this reason, the study sought to examine the mechanisms for dehumidification in the five public healthcare facilities in Malawi. The study found that all five public healthcare facilities in Malawi lacked dehumidification equipment, such as space heaters and energy recovery ventilators. However, the study found that some healthcare facilities followed best practices for dehumidifying storage places, such as good ventilation, storing records away from outside walls, keeping records out of the basement, and packaging records in archival containers. In addition, some healthcare facilities have implemented alternative methods to enhance air circulation in record storage areas, including air vents, fans, and air conditioners.

6.2.5 Metadata

One of the most important features for ensuring long-term preservation of records is metadata. Metadata supports all the functions in the preservation of records, such as access, storage, retrieval and disposal (Crocket 2017; Miller 2022; Yeo 2021). Simply defined, metadata is “data about data” (Crocket 2017:20; Miller 2022:1). Crocket (2017:44) further defines metadata as descriptive information about records and archives. Metadata is categorised into three, namely descriptive metadata, administrative metadata and structural metadata (Allen 2020; Miller 2022; Riley 2017). Descriptive metadata provides intellectual access to the digital collection through elements such as title, author, date of publication, subject, publisher and description (Franks 2018). Allen (2020) argues that administrative metadata facilitates the management of data or records and describes elements such as permissions, rights, preservation, usage, resolution, bit depth, colour space, file format, and compression. Structural metadata includes the organisation of the file. Structural metadata is mostly used by computers and describes the relationship among the parts of the digital object (Allen 2020; Crocket 2018; Franks 2018). The common metadata standards or schemes are PREMIS, MODS, and METS (Brown 2014).

Accordingly, this study aimed to identify the metadata practices being implemented in the five public healthcare facilities in Malawi. The findings, as summarised in Table 5.16 in Chapter Five, found that metadata activities such as metadata creation, adoption of metadata standards and metadata documentation were rarely done in the five public healthcare facilities in Malawi. The findings presented in Table 5.20 in Chapter Five also found that case files and registers were some of the records formatted with metadata. This could be due to a large number of case files and registers being created, accessed and used in public healthcare facilities in Malawi. The present study also found that staff handling records, such as data entry clerks and clinical and nursing staff, lacked knowledge and skills to create and assign metadata to records. An implication of this is the possibility that medical records are not properly preserved, which compromises access, storage, retrieval and timely disposal of records in the public healthcare facilities in Malawi. In addition, the theoretical lenses for the study, such as the DCC Curation Lifecycle Model and OAIS Model (Consultative Committee for Space Data Systems 2002; Higgins 2008; Read & Ginn 2015), have discussed the importance of metadata in the preservation of records. It has been argued that institutions need to include metadata at the time of creation of records (Consultative Committee for Space Data Systems 2002; Higgins 2008; Read & Ginn 2015). This should be fulfilled according to documented policies and procedures of institutions.

The findings of the present study are consistent with those of Gisemba, Ng'eno and Bosire (2022) and Mensah and Adams (2014) who found that medical records were not preserved using documented, implemented, or circulated metadata at different stages of records management such as creation and maintenance for several reasons such as lack of documentation for metadata and the allocation of explicit metadata for medical records. Consequently, the healthcare facilities had challenges in accessing records and the timely disposal of inactive records (Gisemba, Ng'eno & Bosire 2022). Contrasting findings to those of the present study were found in the studies by Shahrul Asari, Hussin and Samsudin (2017) and Edmund, Ramaiah and Gulla (2009), which found that countries such as the USA, Germany, Spain and Singapore were advanced in the use of metadata for preserving medical records

6.2.6 Damage repair

Several factors have been noted to cause the deterioration of physical or analogue records. Some of the contributing factors to the deterioration of records include acidity (Miller 2022), fluctuations in or excessive levels of temperature and relative humidity, excessive exposure to light (Miller 2022), air pollution (Ligterink & Di Pietro 2018), destruction from biological agents such as moulds or insects, and abuse and mishandling (Myo 2016). The recommended temperature for storing records is 18-20 Degrees Celsius with a relative humidity of 35-40% (Crocket 2017). The damage to records due to acidity can be controlled by using mass deacidification, encapsulation, archival-quality envelopes, folders and boxes (Miller 2022). Excessive exposure to light can be repaired by using incandescent lights (Miller 2022), controlling photocopying and scanning of records by creating a master physical or digital copy (Saffady 2021), and using curtains and blinds in the storage area for records (IRMT 2018). According to Ligterink and Di Pietro (2018), air pollution can be controlled by the installation of air filtration systems. Other ways of repairing damaged records due to pollution include treating the wood shelving with acrylic paint to keep acidic words from further damaging records or storage boxes (IMRT 2018; Ligterink & Di Pietro 2018; Myo 2016). Biological agents are also one of the major contributors to the damage of paper-based records. It is recommended that records be stored at optimal temperature and relative humidity (Crocket 2017). Records infected with moulds can be repaired by drying them and then vacuuming off the moulds using a low-suction vacuum, which prevents spores from being dispersed (IMRT 2018).

Therefore, the present study sought to investigate damage repair for records in the five public healthcare facilities in Malawi. The study found that damaged records in public healthcare facilities were not regularly repaired, and equipment for repairing records was not available. A lack of careful handling and effective storage mechanisms for records exposes them to further harsh environmental conditions such as humidity, pollution and biological agents (Ligterink & Di Pietro 2018; Myo 2016). This finding implies that the damage made to records renders them unusable, as it is difficult to refer to the information therein. As such, it is fair to conclude that this denies healthcare staff access to vital information which may be useful in the provision of care to patients.

The findings of the present study agree with those of Marutha (2021) and Popoola (2021), who found that healthcare facilities in South Africa and Nigeria, respectively, lacked control mechanisms for controlling temperature in the filing storages, water leak detectors and carbon dioxide fire extinguishers. In disagreement with the findings of the present study, studies by Asunmo and Yaya (2016) and Yaya *et al* (2015) found that some health institutions in Nigeria

utilised several strategies for repairing damaged medical records, such as computerisation, binding, lamination, microfilming, encapsulation and de-acidification. A possible explanation for differences in these findings may be the exposure of staff to computer and ICT skill training, computerisation, refreshing, and regular training of manpower in records management and microfilming (Yaya *et al* 2015).

6.2.7 Privacy and security

Security and privacy are some of the significant functions of a preservation programme for medical records. The adoption of electronic health records was suggested to be the solution to the problem of lack of security and privacy (Keshta & Odeh 2021). However, the implementation of electronic health records systems has been halted due to privacy and security concerns (Keshta & Odeh 2021). Privacy is regarded as the right of individuals to keep information about themselves from being disclosed to others (Office of the Australian Information Commissioner 2014). It is justified that the information of a patient should be released to others with the patient's permission or allowed by law (Ozair *et al* 2015). Security is defined as the level at which accessing someone's personal information is restricted and allowed only for those authorised (Gupta 2018; Sittig & Singh 2015). In electronic health records, Dehling and Sunyaev (2014) suggested three basic security requirements, namely confidentiality, integrity and availability. Confidentiality can be defined as restricting information to persons who are not authorised to access data during either storage or transmission, or when they are being treated (Keshta & Odeh 2021:178). Confidentiality can be achieved through data encryption, controlling access to electronic health records systems (Keshta & Odeh 2021:178), and the integrity of records professionals (Gupta 2018). However, the use of encryption has been towards health data sent through networks and less to health data stored in storage media such as computers (Dehling & Sunyaev 2014). Confidentiality protects records from unauthorised access, unauthorised deletion and unwarranted modification. The availability means the system can be accessed and is fully operational (Crocket 2017; Saffady 2021). This entails that any authorised person can use the system.

Therefore, the study sought to ascertain the privacy and security measures for medical records in the five public healthcare facilities in Malawi. The study found that the privacy and security measures as implemented in the public healthcare facilities were only authorised users accessing records, doors and windows of the records storage area and filing cabinets are securely locked, security measures such as firewalls, passwords, encryption, and redaction are used to protect electronic records, and regular security and facility inspections take place in the records storage area, offices etc. However, the findings found that CCTV cameras were not consistently installed in all offices and records storage areas across the five public healthcare facilities in Malawi. On privacy and security of different types of records, the study findings in Table 5.20 in Chapter Five found that security measures applied to all types of records, with registers and health passports being the most secure. The theoretical frameworks guiding the study, such as the Records Lifecycle model, DCC Curation Lifecycle Model and OAIS Model, argued for implementing tight security measures for records, such as passwords, CCTV cameras, firewalls, and encryption (Consultative Committee for Space Data Systems 2002; Higgins 2008; Read & Ginn 2015).

Similarly, observations made by the researcher in all five public healthcare facilities in Malawi found that CCTV cameras were lacking. A few departments at Hospital E were installed with CCTV cameras for security monitoring of records. Nevertheless, it was observed that other security measures were implemented in the healthcare facilities, such as burglar bars and locking

the doors to the offices and records storage rooms. Furthermore, findings through interviews with records officers in all five public healthcare facilities in Malawi found that several measures are being implemented to ensure the privacy and security of records, such as restricting access to records, locking records officers, use of passwords on computers and obtaining authorisation letters for entry to records storage areas. The privacy and security measures implemented signify that public healthcare facilities in Malawi recognise the value of medical records. Therefore, an investment in CCTV cameras in records offices and records storage areas would improve the privacy and security of medical records in the public healthcare facilities in Malawi. These findings showed that at least privacy and security measures for records have been enhanced in public healthcare facilities in Malawi.

In line with the present findings, a previous study by Yaya *et al* (2015) in Nigeria demonstrated that health institutions properly preserved medical records with the installation of physical security of records, such as security personnel, emergency preparedness, surveillance, perimeter security, alarm systems and locking records. The findings observed in this study mirror those of the previous study by Mensah and Adams (2014), which found that both public and private hospitals in Ghana had fire extinguishers, smoke detectors and fire detectors for the safety and security of medical records. Contrasting findings to those of the present were also found in the studies by Marutha (2020) and Marutha (2019), and Masuku and Ngulube (2020), which found that healthcare facilities lacked security measures such as encryption, redaction, CCTV cameras, security locks at entrance to the records storeroom, burglar-proofing equipment, firefighting equipment, smoke and water detectors.

6.2.8 Disposal

The retention of unnecessary paper and electronic records wastes staff time, organisational resources, space, and equipment. Therefore, disposal is the appropriate action for eliminating such types of records from the system. According to the University of Aberdeen (2024:1), disposition is the appropriate destruction or transfer of records to the archives at the end of their retention periods. The two major ways of disposing of records include destruction and transfer to records centres or archives (Franks 2018; University of Aberdeen 2024). Franks (2018) outlines four major destruction methods for paper records, such as shredding, recycling, maceration, and pulping. The most common destruction methods for electronic records include deleting the contents of the storage media for records and formatting (Franks 2018; Upward *et al* 2019). One of the disadvantages of deletion is that the method does not eradicate data or information hidden in hard drives or servers (Franks 2018). To address this problem, Upward *et al* (2019) suggest the use of formatting rather than deletion. Formatting permanently removes data and system information from the hard drive or server. Nevertheless, Franks (2018) argues that the destruction of records must be irreversible to safeguard the exposure of the contents to unauthorised personnel. The transfer of records involves moving the records to a records centre or archive for further review or permanent storage (Franks 2018). In other circumstances, the transfer also entails donating the records to other individuals and organisations (University of Aberdeen 2024).

The study aimed to examine the mechanisms for disposing of medical records in the five public healthcare facilities in Malawi. The findings found that the disposal of records was being implemented at the five public healthcare facilities in Malawi. Some of the disposal mechanisms for records include properly disposing of records according to the retention and disposal policy, disposal methods have been established such as transferring records to a records centre or archives,

burning, and shredding, and a disposal manual exists that guides staff in properly disposing of records. Another interesting finding obtained through observations was that all medical records were not disposed of on-site at the hospital level but were transferred to the National Records and Archives Services of Malawi for destruction or permanent preservation. It was also observed that healthcare facilities lacked equipment for disposing of records, such as incinerators and shredders. Similar findings were found through interviews with records officers that medical records were not destroyed at the hospital level but were transferred to the National Records and Archives Services of Malawi for permanent preservation. The differences in the findings could be attributed to a lack of awareness of the records retention and disposal policy and guidelines by data entry clerks, and nursing and clinical staff on the restriction to destroy records, but transfer medical records to the National Records and Archives Services of Malawi for permanent preservation. The implementation of disposal for records is in tandem with the recommendations of the Records Lifecycle model, DCC Curation Lifecycle Model and OAIS Model that records need to be properly disposed of according to the established policies (Consultative Committee for Space Data Systems 2002; Higgins 2008; Read & Ginn 2015).

These findings align with previous studies indicating that healthcare facilities adhere to established policies, procedures and guidelines for records' disposal. For instance, Marutha (2021) found that healthcare institutions in South Africa's Limpopo Province comply with prescribed disposal procedures. Similarly, Pyrene (2015) reported that a South African hospital disposed of obsolete medical records after the mandated retention period, following Health Professions Council of South Africa (HPCSA) requirements, facilitated by existing medical records management policies and procedures. In Zimbabwe, Masuku and Ngulube (2020) observed that hospitals in the Bulawayo and Matabeleland South provinces disposed of outdated paper-based records and transferred them to the National Archives of Zimbabwe (NAZ) following established policies and procedures.

The study further sought to establish disposal applicable to specific categories of medical records to improve the preservation of such records. This was achieved through a crosstabulation of disposal and types of medical records. The findings presented in Table 5.20 in Chapter Five found that disposal methods for records applied to all types of records, with the majority of them being registers and health passports at the five public healthcare facilities in Malawi. This finding is unsurprising, given the importance of all records in delivering care within Malawi's public healthcare facilities. It suggests that these facilities generate more registers and health passports than other types of records, necessitating proper disposal procedures.

6.3 Preservation policies and standards

Preservation policies and standards are a cornerstone of efficient and effective records management (Adjei & Mensah 2016). Policies and standards provide a mandate to records officers and staff handling the preservation of records in an institution (Shepherd & Yeo 2003). As such, the policies, procedures, and standards stipulate and guide record officers on all the activities related to preservation, including the implementation of preservation strategies. In addition, the policies, standards and procedures are a commitment from management and the entire health system that the preservation of medical records is serious and obligatory (Crocket 2017). Therefore, public healthcare facilities in Malawi must develop and implement policies, standards, procedures and legislative frameworks that will assist in guiding the preservation of medical records and achieve their goals and objectives (Katuu 2015; Marutha 2018).

The models guiding this study, discussed in Chapter Two, such as the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model, have all emphasised the significance of implementing policies, procedures, and standards in preserving medical records. For example, the DCC Curation Lifecycle Model is flexible in complementing other standards, policies, and reference frameworks at the implementation level of preservation activities such as OAIS and ISO 15489 (ISO 2016). Furthermore, Section 3.6 of Chapter Three of this study has discussed two major aspects of policies and standards, such as legal and regulatory frameworks and standardisation and best practices. Guided by the models and literature, the study examined the preservation policies, standards, guidelines and procedures, and legislation currently implemented in the five public healthcare facilities in Malawi. The themes under this research question were the following:

1. Policies
2. Standards
3. Guidelines and procedures
4. Legislation

6.3.1 Policies

Policies are significant because they provide a mandate to records officers and staff handling the preservation of records in an institution (Adjei & Mensah 2016). Policies demonstrate a high level of commitment by management that medical records are critical organisational records and deserve proper and efficient management (Crocket 2017). As such, policies guide the conduct of all preservation activities in institutions such as healthcare facilities. The study endeavoured to determine the existence of policies that guide the preservation of medical records in the five public healthcare facilities in Malawi. As displayed in Table 5.21 in Chapter Five, the study found that the five public healthcare facilities had written and approved policies such as records management policy, retention and disposal policy, and HMIS policy. In addition, the study also found that data entry clerks and ICT officers were aware of the policies through sensitising/awareness campaigns and meetings.

In contrast to earlier findings, however, the findings of the study obtained through interviews with records officers, hospital directors and administrators revealed that healthcare facilities lacked written and approved policies for preserving records. Similar findings obtained through document reviews in the five healthcare facilities in Malawi also revealed that policies for preserving records do not exist. Specifically, Hospital B was in the process of drafting the policy, and Hospitals C and E adopted the HMIS policy for the preservation of records. The study found that national policies for preserving records were updated at the national level. A possible explanation for the contrasting findings could be a lack of understanding of preservation policies by data entry clerks, ICT officers and clinical and nursing staff. The national policies, guidelines and regulations, such as the HMIS policy, may not substitute institutional policies for preserving records. This demonstrates a knowledge gap about preservation in general, among staff handling records in the public healthcare facilities in Malawi. These results provide further support for the hypothesis that the provision of training and awareness campaigns targeting staff handling records would increase their knowledge about different aspects of the preservation of records, including policies. Nevertheless, the adoption of national policies highlights the commitment of management in healthcare facilities to properly preserve medical records. The commitment by management is also

demonstrated through communicating the policies to staff handling records, such as data entry clerks, ICT officers and clinical and nursing staff.

This study produced findings which corroborate the findings of a great deal of the previous work in this field. For example, previous research by Adjei and Mensah (2016), Anyira (2020), Asunmo and Yaya (2016), Chikuni and Mnjama (2010), Gisemba, Ng'eno and Bosire (2022), Luthuli and Kalusopa (2017), Luthuli (2017), Makeleni and Cilliers (2021), Marutha (2019), Marutha and Ngulube (2012), Mensah and Adams (2014), Masuku and Ngulube (2020), Masuku (2019), Ngwenya (2020), Smith and Macdonald (2006) and Yaya *et al.* (2015) found the absence of a comprehensive internal policy framework to anchor medical records management and preservation activities in different sections of the hospital. The present study further revealed that staff were not aware of a written medical records management policy, and the policy had not been adopted by the top management. There are several possible explanations for this finding, such as displaying negligence regarding the awareness of these policies and procedures (Alnashmi *et al* 2022). Consequently, procedures for titling, indexing, classifying, and describing medical records were lacking at the hospital.

The findings of the present study differ from those of Alnashmi *et al* (2022), Amin *et al* (2020), Mampe and Kalusopa (2012), Pyrene (2015) and Tavakoli, Saghaiannejad and Habibi (2012), which found that healthcare facilities had well-stipulated policies and procedures governing the preservation of medical records.

6.3.2 Standards

Standards are important instruments that ensure consistency in the preservation of medical records across geographical boundaries (Lavoie 2014). Standards also act as a guide and best practices for the preservation of medical records (Faria, Guimarães & Ferreira 2022). Several standards and best practices exist that may guide the preservation of medical records. Most of the standards are developed by the ISO, such as ISO 15489, ISO 20652, ISO 14721, ISO/TR 18492, and ISO 9001. However, in the preservation of medical records, two ISO standards are common, such as ISO 15489 for records management and ISO 14721 for preserving digital materials (ISO 2001; ISO 2012). Specific standards have also emerged which are relevant in the preservation of medical records, such as Moreq (Model Requirements for the Management of Electronic Records) (Moreq 2024), HL7 (Health Level Seven International) (Duda *et al* 2022), PREMIS, METS and DC (Library of Congress 2015).

To investigate standards currently existing in the five public healthcare facilities in Malawi, one of the questions was to determine the adoption and level of awareness of staff on the standards for preserving medical records. The study found that public healthcare facilities have adopted standards for preserving medical records such as ISO 15489, ISO 20652, ISO 9001, Moreq, and HL7. Standards enhance the validity and utility of patient data and improve the structure of medical records for inclusion in an electronic environment (Carpenter *et al* 2007). Several questions remain unanswered at present on how healthcare facilities assign metadata to the records due to the absence of metadata standards such as PREMIS, METS and DC (Library of Congress 2015). Future studies on the current topic are therefore recommended. The absence of metadata standards complicates the consistent description and online accessibility of digital materials for users. Metadata standards assist records officers in categorising various collections, including photographs, images, text documents, spreadsheets, and PDFs (Duff & Pitti 2024). These standards

enable online access to digital content through elements like title, creator, subject, description, publisher, contributor, date, type, format, identifier, source, language, relation, and coverage (Zavalina & Burke 2021).

The study also found that healthcare facilities in Malawi lacked standards relating to file formats. Most of the file formats are non-proprietary and open format standards such as ISO/IEC 26300 and ISO 19005 (ISO/IEC 2015). Non-proprietary and open format standards can support healthcare facilities in developing a sustainable digital preservation programme for records (ISO/IEC 2015).

The study further found that staff handling records, such as data entry clerks and ICT officers, were aware of the standards through awareness campaigns, meetings, seminars and workshops. However, the findings gathered through document review found that all five healthcare facilities lacked standards for preserving records. The use of the HMIS policy as a standard for preserving records was noted in some public healthcare facilities in Malawi, such as Hospital E. The HMIS policy is not a standard for preserving records but rather a general framework for managing health information in healthcare facilities in Malawi. The findings obtained through interviews with records officers, hospital administrators, and hospital directors also found that healthcare facilities lacked the standards for preserving records, and some staff were not aware of the policies and standards. The reasons behind the differences in the findings could emanate from the lack of knowledge among healthcare staff about policies and standards for preserving medical records.

Following the present findings, a previous study by Tavakoli, Saghaiannejad and Habibi (2012) found that healthcare facilities in Iran lacked relevant policies and standards, such as a complete, clear and up-to-date schedule for the retention of health records. This situation contributed to the lack of space in health facilities due to the accumulation of destructible records and premature destruction of records (Tavakoli, Saghaiannejad & Habibi 2012). This study produced findings which corroborate the findings of a great deal of the previous work in this field by Asunmo and Yaya (2016), Luthuli (2017), Gisemba, Ng'eno and Bosire (2022), Makeleni and Cilliers (2021), Marutha (2019), Marutha and Ngulube (2012), Mensah and Adams (2014), Ngwenya (2020), Smith and Macdonald (2006) and Tavakoli, Saghaiannejad and Habibi (2012). Due to a lack of standards, Mensah and Adams (2014) argued that private hospitals in Ghana never destroyed or transferred their records to the records centre, while the public hospitals transferred some of their records to the national archives based on need.

6.3.3 Guidelines and procedures

In addition to standards, guidelines, and procedures play a crucial role in preserving medical records. They provide practical steps for implementing records management policies, standards, and legislation (Gisemba, Ng'eno & Bosire 2022). Consequently, this study aimed to examine the guidelines and procedures used in the preservation of medical records across five public healthcare facilities in Malawi. Specifically, it focused on investigating guidelines and procedures for records disposal, filing, backup, and access/retrieval within these facilities.

As displayed in Table 5.23 in Chapter Five, the findings of the study found that the five public healthcare facilities in Malawi had guidelines and procedures for disposing of records, filing, titling, indexing, classifying, describing records, backing up records, and accessing/retrieving records. Contrasting findings obtained from interviews with records officers found that healthcare

facilities lacked the standards for preserving records, as intimated by the records officers. Similar findings to those of interviews obtained through document review found that all five healthcare facilities lacked guidelines and procedures for preserving records. In addition, findings through document review also revealed that all healthcare facilities lacked a programme/schedule for the preservation of records. The findings suggest that healthcare facilities were not systematic in preserving medical records. It was also found that healthcare facilities such as Hospital E adopted standard operating procedures (SOPs) to guide the management of medical records by all staff at the hospital. It is difficult to explain this, but contrasting findings in the present study could emanate from a lack of knowledge of preservation guidelines and procedures among data entry clerks and nursing and clinical staff. The HMIS policy is not a relevant standard for preserving records, but rather a general framework for managing health information in healthcare facilities in Malawi.

Similar findings to those of the present study were found in the previous studies by Adjei and Mensah (2016), Alnashmi *et al* (2022), Gisemba, Ng'eno and Bosire (2022), Luthuli and Kalusopa (2017), Luthuli and Kalusopa (2020), Makeleni and Cilliers (2021) and Mutsagondo (2021) that procedures and guidelines for titling, indexing, classifying, and describing medical records were lacking in healthcare facilities. Some of the procedures lacking were guidelines for security and confidentiality of records, records retention and destruction, access, cataloguing of records and circulation of records (Adjei & Mensah 2016). Luthuli and Kalusopa (2017) argued that the lack of guidelines and procedures compromised the delivery of health services in the hospital.

The findings of this study contrast with those of Alnashmi *et al* (2022), Amin *et al* (2020), Cowan and Haslam (2006) and Pyrene (2015), who found that healthcare facilities were guided by updated guidelines and procedures for the filing, storage, and retrieval of medical records. Some of the procedures were the White Paper on the Transformation of Public Service Delivery, South Africa 1997; the Guidelines by HPCSA, 2008: the Constitution of South Africa (1996); the Promotion of Administrative Justice Act, no.3 of 2000; Promotion of Access to Information Act no. of 2000; and the National Health Act, no 61 of 2003 (Pyrene 2015). Some of the guidelines and procedures were developed by the Ministry of Health and National Archives (Amin *et al* 2020). For proper implementation of standards, Alnashmi *et al* (2022) proposed that hospital staff should be trained on standards through workshops and seminars, and should be widely circulated to health staff (Alnashmi *et al* 2022).

6.3.4 Legislation

Legislation supports the implementation of institutional policies, guidelines and procedures for the preservation of medical records. Legislation is very important in the preservation of medical records as it eliminate preservation errors such as duplication of data, capturing incorrect spellings and using inaccurate formats and ensures that medical records are of good quality and that they are consistent across healthcare departments or institutions (Makeleni & Cilliers 2021). As such, several legislation exist that govern the preservation of medical records such as the HIPA Act of 1996 (Rose, Kumar & Kass 2023; Coventry & Branley 2018), Data Protection Act 2018, GDPR of 2016, ISO 15189: 2012: Medical Laboratories and WHO Guidelines (ISO 2016; WHO 2018), PHIPA of 2004 (Baron & Lemmens 2023), PDPA (Setiawati 2020; Ong 2020), Protection of Personal Information Act (Act No.4 of 2013), Copyright Act (Act No.98 of 1978), National Archives Act, Access to Information Act of 2017, Medical Services Act of 2018, and Data Protection Act of 2024 (Ministry of Health 2018; Tough & Lihoma 2018).

The study investigated legislation that governs the preservation of medical records in the five public healthcare facilities in Malawi. The study found that the five public healthcare facilities in Malawi adhere to laws for preserving records, such as the National Archives Act, Access to Information Act of 2017, Public Health Act of 2021, Medical Services Act of 2018, and Data Protection Act of 2024. The study further found that the pieces of legislation exist in the health facilities. Furthermore, the study also found that staff were aware of these laws for preserving records through awareness campaigns, meetings, seminars and workshops. Similar findings obtained through interviews with hospital directors and hospital administrators found that several methods for raising the level of awareness of staff on policies, standards, and legislation were implemented, such as orientations, training, mentoring, and meetings. The findings are encouraging, considering the significance of legislation in the preservation of records in healthcare facilities.

This finding is in agreement with the findings of previous studies by Allam and Jones (2020), Aljeraisly *et al* (2021), Asogwa (2012), Baron and Lemmens (2023), Chaterera, Ngulube and Rodrigues (2014), Katuu (2015), Makeleni and Cilliers (2021), Marutha (2019), Ndenje-Sichalwe, Ngulube and Stilwell (2011), Ngwenya (2020), Ong (2020), Sarabdeen, Chikhaoui and Ishak (2022), Setiawati (2020) and Tough and Lihoma (2018) which showed that healthcare facilities were guided by legislation such as the public health act (chapter 15:17) (2018), Public Health Act Chapter 15:09 (2002), Medical Services Act Chapter 15:13 (2001), and National Aids Council of Zimbabwe Chapter 15:14 (2000). These findings agree with the findings of other studies, in which general legislation for preserving records exist, such as the National Health Act, Data Protection Act, Access to Information Act and National Archives Act (Anyira 2020; Magama 2018; Masuku & Ngulube 2020; Mutsagondo 2018).

Despite this, document review findings revealed that none of the five healthcare facilities had specific legislation for preservation of records. Additionally, interviews with records officers indicated that there were no existing methods to raise staff awareness of policies, standards, or legislation. In the absence of specific legislation, Hospital C adopted the Health Sector Strategic Plan III and the HMIS policy and guidelines provided by the Ministry of Health to guide preservation of records. While not a formal legislation, the HMIS policy and guidelines outline best practices for managing health information, including storage, access, retention periods, disposal practices, and data security (Ministry of Health 2021). This suggests that the lack of specific legislation and comprehensive guidelines may hinder effective preservation of records. This finding is concerning and highlights the need for further research into the impact of specific legislation on the preservation of records in public healthcare facilities in developing countries.

The lack of specific legislation on the preservation of medical records has been reported in previous studies. For instance, studies by Heart *et al* (2009), Luthuli (2017), Marutha (2019), Marutha and Ngulube (2012), Ngwenya (2020), and Tough and Lihoma (2018) have found that the lack of specific legal and regulatory frameworks was one of the factors that negatively impacted on proper preservation of medical records in healthcare facilities. However, Tough and Lihoma (2018) argued that general legislation such as the National Archives Act, Access to Information Act of 2017, Public Health Act of 2021, Medical Services Act of 2018, and Data Protection Act of 2024 existed for preserving records despite the absence of specific legislation.

6.4 Storage mechanisms

One of the major functions of preservation is to ensure proper storage of records for access, security and proper disposal. Storage or storing is the placement of records onto a shelf or into a file drawer, according to a plan (Read & Ginn 2015:118). Storage also means saving a record in an electronic medium that is readable by a computer. Depending on their nature, records can be stored in both physical and electronic formats using various equipment such as folders, shelves, drawers, and computers (Read & Ginn 2015). Some examples of storage mechanisms for physical records are shelves, medicine cupboards, folders, file cabinets, cartons, and airtight containers (Chenthara *et al* 2020; Gisemba, Ng'eno & Bosire 2022; Kumar, Bharti & Amin 2021; Kumar, Kumar & Sodhi 2022; Luthuli & Kalusopa 2020; Smith & Macdonald 2006). For electronic records, storage mechanisms mostly in use include computers, external hard drives, servers, cloud, blockchain technology, Compact Discs, Flash Disks, and Floppy Disks (Ahmed *et al* 2020; Decman 2011; Verma 2022). Properly storing records has major benefits such as enhancing access to records, ensuring the security and safety of records and equipment, timely disposal of records and reduction of storage costs. Ultimately, properly kept records support prompt medical decision-making by healthcare staff and the timely provision of treatment to the patients (Marutha & Ngoepe 2018; Marutha 2019).

The Records Lifecycle model adopted for this study argues that records are not static but have a lifespan resembling that of a living organism. As such, management of records needs to consider the entire lifespan, popularly known as the “lifecycle” of a record. In the lifecycle of a record, the model argues that records need to be properly managed, including storage from the point of creation to final disposition (Marutha 2011). Likewise, the DCC Curation Lifecycle Model supports the implementation of storage methods for records according to relevant standards such as OAIS and ISO 15489 (ISO 2016) (Higgins 2008:138). The OAIS Model emphasises the importance of storage, maintenance and retrieval of records. The model discusses specific functions of archival storage such as migration, error checking, implementing disaster recovery strategies, and retrieval. The third research question sought to examine the storage mechanisms for medical records at the selected public healthcare facilities in Malawi. The themes under this research question were the following:

1. Cloud storage
2. Blockchain technology
3. Artificial intelligence
4. DNA storage
5. Computers
6. Portable storage media
7. Storage rooms
8. Physical storage equipment

6.4.1 Cloud storage

The challenges with offline storage of records have given rise to cloud storage. It is argued that cloud-based storage offers numerous benefits, such as protection of data and information while achieving a reduction of costs in infrastructure, business processes, and other applications (Franks 2018). This growth has also prompted healthcare facilities to adopt the model of preserving medical records. The use of cloud storage offers benefits to institutions including healthcare

facilities such as accessing IT services on demand, from any device, and at any time (Sunyaev & Sunyaev 2020), broad network accessibility, resource pooling, multitenancy, reliability and scalability, economies of scale (Rashid & Chaturvedi 2019), lower IT costs of purchasing and operating IT infrastructure at an institutional level (Franks 2018), and customization and measured services (Jamsa 2022).

Therefore, the study investigated the use of cloud storage in the preservation of medical records in public healthcare facilities in Malawi. The study found that healthcare facilities in Malawi do not use cloud storage to store records. Partly, this is due to a lack of ICT infrastructure that supports the use of cloud storage services for records and a lack of knowledge and skills among data entry clerks, ICT officers, and clinical and nursing staff to store records in the cloud. This is a worrisome situation for healthcare facilities in Malawi, which are struggling with inadequate space to store records. Cloud storage can reduce storage demand for records in healthcare facilities and minimise costs associated with storing records onsite. Further research is needed to conduct a cost-benefit analysis of adopting cloud storage in Malawi's public healthcare facilities. The other implication of the study is that public healthcare facilities need to implement policies and procedures that could guide the use of cloud storage for records (Decman 2011). The policies and procedures can outline specific data privacy and network security measures to be implemented for records in the cloud. This is important as the use of cloud storage to store medical records has been marred with security concerns (Franks 2018; Sunyaev & Sunyaev 2020).

However, the findings obtained through a crosstabulation of storage mechanisms and types of records presented in Table 5.33 in Chapter Five revealed that health passports and case files were managed using cloud storage. This is despite the fact that the technologies were not used to store medical records in the public healthcare facilities in Malawi. This inconsistency may originate from the fact that the use of cloud storage to store medical records is at the personal staff level and not the institutional level, hence insignificant compared to the volume of records in the public healthcare facilities in Malawi.

The findings of the present study confirm those of Decman (2011), in Slovenia, that the country lacked the use of cloud storage for medical records despite advancements in the use of computer hardware and networking in the healthcare system. Decman (2011) attributed this to a lack of policies to encourage the use of computer hardware and networking to store medical records in Slovenia. In contrast to the findings of the present study, previous studies by Li, Shih and Wang (2018), Sun *et al* (2020), Verma (2022) and Zala and Shukla (2022) found that cloud storage was in use for storing medical records despite security concerns.

Despite the benefits of cloud storage, Li, Shih and Wang (2018) and Zala and Shukla (2022) proposed the use of a more secure cloud-based medical e-health record system, such as blockchain. This corroborates the ideas of Franks (2018) and Sunyaev and Sunyaev (2020) that the use of cloud services is marred with challenges such as a lack of data security and privacy, cost management, performance challenges, interoperability, high demand on the network, and a lack of knowledge and expertise in the use of the service. Notwithstanding the challenges with cloud storage, cloud storage offers many opportunities for the preservation of medical records in developing countries amid dwindling health budgetary allocation, obsolete ICT infrastructure, lack of trained ICT personnel, and ineffective disaster recovery procedures (Marutha 2021; Masuku & Ngulube 2020).

The study also aimed to examine the relationship between storage mechanisms and record types across the five healthcare facilities in Malawi. The findings, as presented in Table 5.33, indicate that various storage media are employed for preserving medical records. Notably, cloud storage was predominantly used for preserving health passports and case files. This suggests that, in public healthcare facilities, records are primarily stored in electronic formats, including computers, portable storage devices, and physical forms.

6.4.2 Blockchain technology

Shahnaz, Qamar and Khalid (2019) have argued that the challenges with paper-based systems can be resolved through the adoption of blockchain technology. The adoption of this technology is critical in the era where medical records are increasingly being created in electronic format. Blockchain technology comprises a series of blocks that are connected and are continuously growing by storing data on the blocks (Shahnaz, Qamar & Khalid 2019:147783). It utilises a decentralised approach that allows the information to be distributed and each piece of data to have shared ownership. The technology uses a harsh system of providing security to a batch of data available in a peer-to-peer network. The architecture of blockchain eliminates third-party intervention or centralised control of data. Blockchain technology offers several benefits, including security, anonymity, data transparency, integrity and a tamperproof platform for storing medical records (Shahnaz, Qamar & Khalid 2019).

The present study found that the five public healthcare facilities have not adopted blockchain technology to store electronic records for various reasons. Some of the reasons as revealed by the present study were the lack of an ICT infrastructure that supports blockchain technology, and the lack of knowledge and skills among data entry clerks, ICT officers, and clinical and nursing staff to store records using blockchain technology. This is a worrisome situation considering that the non-use of blockchain denies the healthcare facilities in Malawi the benefits of using the technology, such as enhanced security, data anonymity, data transparency, integrity and a tamperproof platform for storing medical records (Shahnaz, Qamar & Khalid 2019). This is an important issue for future research on the feasibility of implementing blockchain technology in the preservation of records in healthcare facilities in Malawi. As healthcare facilities generate/receive more digital records, blockchain technology is a feasible option that could improve access and use of medical records while ensuring their security.

Several implications have emanated from the study. Firstly, the challenge of a lack of knowledge and skills among staff handling records may be resolved by continuous professional development (Shahnaz, Qamar & Khalid 2019). Secondly, public healthcare facilities need to adopt standards and principles that could guide staff in preserving records through blockchain technology. However, Shahnaz, Qamar and Khalid (2019) argued that the development of standards and principles for blockchain technology is non-existent and would take some time for certified international standards authorities to develop them. The situation may be different in future as the technology is being developed and used by healthcare facilities in some countries in Asia (Chenthara *et al* 2020; Li *et al* 2018; Liu *et al* 2018; Tan *et al* 2021; Xia *et al* 2017).

The findings of the present study match those of Benifa, Mini and Krishnan (2021), Chen *et al* (2019), Ivan (2016), Kumar, Bharti and Amin (2021), Kumar, Kumar and Sodhi (2022), Singh *et al* (2022), Stafford and Treiblmaier (2020), Sun *et al* (2020) and Verma (2022) that most developed and developing countries have not adopted blockchain technology for storing medical records. The

use of mobile devices integrated with cloud computing was evident in most healthcare facilities (Verma 2022). The failure to adopt the technology led to a myriad of security concerns in the storage of medical records using traditional methods such as computers, hard drives, and CDs (Ivan 2016; Stafford & Treiblmaier 2020). Similar sentiments were shared by Chen *et al* (2019), Li *et al* (2018), Liu *et al* (2018), Tan *et al* (2021) and Xia *et al* (2017) that blockchain-based data preservation system offers a reliable storage solution for security and verifiability of stored data while preserving the privacy of users. Nowrozy *et al* (2024) proposed the adoption of different techniques for preserving medical records to ensure data privacy, such as cloud computing, Ethereum-based blockchain, and cryptography.

However, the findings of the present study do not support the previous research by Chenthara *et al* (2020), Haddad *et al* (2023), Li *et al* (2018), Liu *et al* (2018), Tan *et al* (2021), Xia *et al* (2017) in China and Malaysia that healthcare facilities have adopted blockchain technology to store medical records due to data integrity, data privacy, data scalability, and data security through encryption. The findings from previous studies hypothesised that the use of blockchain was due to efficiency and security in storing medical records with decentralised storage of medical metadata (Chenthara *et al* 2020; Haddad *et al* 2023; Xia *et al* 2017). The findings suggest that blockchain technology could be the future of the preservation of medical records if properly implemented and managed.

6.4.3 Artificial intelligence

Artificial intelligence (AI) refers to the capability of computers to perform tasks similar to those performed by humans (Khalid *et al* 2023). Unlike cloud computing and blockchain, artificial intelligence is a collection of technologies that offer seamless services to users. AI mimics human thinking through computer programs. To fully function and achieve optimum results, AI relies on a lot of data besides computational capability. Due to its potential, AI is widely used in business and society and is being adopted in healthcare. Milana and Ashta (2021) further argued that every industry will benefit from AI. This is partly due to the huge amount of data being created in health, which surpasses the human's capacity to process and use (Khalid *et al* 2023). Artificial intelligence has the potential to transform the entire healthcare system and improve service delivery (Davenport & Kalakota 2019). Some of the common AI technologies in health are machine learning, natural language processing, rule-based expert systems, physical robots and robotic process automation (Davenport & Kalakota 2019). The use of AI has several opportunities such as the ability to process large amounts of data to support complex decisions within the shortest time (Khalid *et al* 2023). This is practically impossible for human beings to achieve such huge and complex tasks.

In view of the foregoing, the study investigated the use of AI for the preservation of medical records in the five public healthcare facilities in Malawi. The study found that AI is rarely used for the preservation of medical records in public healthcare facilities in Malawi. Specifically, the study found that healthcare facilities do not use AI to store records (92, 52%) and that AI has not improved the storage and retrieval of medical records (69, 38%). Concerning knowledge and skills on AI, the study found that data entry clerks, ICT officers and clinical and nursing staff lacked the knowledge and skills in AI (98, 54%). These findings are rather disappointing but expected considering the level of ICT adoption and use in public healthcare facilities in Malawi. Nevertheless, the use of AI in the preservation of medical records could have reduced the workload of staff managing large volumes of records (Davenport & Kalakota 2019).

Despite the potential of AI, healthcare facilities need to invest in staff training to use the technology. The knowledge and skills of staff in AI are vital in reducing the risks associated with the technology, such as data privacy and confidentiality (Hall & McGraw 2014; Qayyum *et al* 2020). In addition, public healthcare facilities also need to establish strict regulations, standards and guidelines that regulate access and use of patients' data and information in AI. The unwarranted use of health data and information in AI could result in a serious breach of patients' rights, privacy and confidentiality and could result in lawsuits (Khalid *et al* 2023). This is important as patients' data and information are highly regulated through legislation such as the General Data Protection Regulation in the European Union, the Data Protection Act in the UK and the HIPA Act in the USA (Coventry & Branley 2018; Hoofnagle, Van Der Sloot & Borgesius 2019; Rose, Kumar & Kass 2023) and Data Protection Act, 2024 in Malawi.

6.4.4 Deoxyribonucleic acid (DNA) storage

Approximately, the global demand for data storage is expected to grow to 1.75×10^{14} GB by 2025 (Carmean *et al* 2018). As such, the demand for long-term storage devices is also increasing (Gu, Li & Cao 2014). Therefore, innovative methods are required for long-term preservation of data with reduced labour and storage costs, energy consumption and insufficient data density (Hilbert & López 2011). Deoxyribonucleic acid (DNA) storage is one of the innovative solutions that offer long-term preservation of data at a reduced cost (Doricchi *et al* 2022). Storage of data through DNA technology involves translating data directly into the nucleotide sequence using chemical DNA synthesis (Caruthers 2011; Doricchi *et al* 2022). Despite the benefits, the use of DNA data storage poses risks such as data readout, sequencing and the high cost of the technology (Doricchi *et al* 2022). However, potential solutions are being developed, such as the programmable three-dimensional structure of DNA for easy data reading and reducing the amount of reading time for erasing and rewriting data (Chen *et al* 2020; Chen *et al* 2019; Dickinson *et al* 2021).

The present study was designed to investigate the use of DNA storage for preserving medical records in five public healthcare facilities in Malawi. The findings revealed that none of the facilities employed DNA storage methods, and a significant majority (87%) of data entry clerks, ICT officers, and clinical and nursing staff lacked knowledge and skills in DNA technology. These findings are not very encouraging, considering the value of DNA technology in the storage of records. Several explanations for these exist. Firstly, DNA storage relies on the availability of sophisticated technologies to preserve medical records. Secondly, reading the data stored in the DNA structure also requires knowledge and skills of staff handling the records.

However, one unanticipated finding was that DNA storage was used to store all types of records in public healthcare facilities in Malawi. It is difficult to explain this finding, but it might be related to the use of the technology at a personal level by staff in the public healthcare facilities in Malawi. As such, the use of the technology might be insignificant compared to the volume of records created/received in public healthcare facilities. Without technology and the knowledge and skills of staff, the implementation of DNA technology is almost impossible in public healthcare facilities in Malawi. Therefore, major investment in relevant technology and improving the knowledge and skills of staff in DNA technology through training is essential if public healthcare facilities in Malawi are to benefit from the technology. Similar sentiments were shared by Dickinson *et al* (2021) and Chen *et al* (2019) that DNA technology requires investment in relevant technologies and trained personnel to manage it (Dickinson *et al* 2021; Chen *et al* 2019).

6.4.5 Computers

According to Encyclopaedia Britannica (2023), a computer is a device for processing, storing, and displaying information. In healthcare, computers are increasingly being used to assist in the provision of quality care (Joos, Wolf & Nelson 2019). Computers and information systems are being used in assessing, planning, documenting, and evaluating care in healthcare facilities (Joos, Wolf & Nelson 2019). In addition, computers are also being used to store medical records (Abdekhoda, Dehnad & Zarei 2019; Yaya *et al* 2015). The advantages of storing medical records on a computer are enhanced security and confidentiality of records (Hepisuthar 2021). This is achieved by implementing security features such as passwords, encryption, and positioning a computer in a secure room. However, the probability of loss of medical records due to hard drive malfunction or failure is very high in computers (Hepisuthar 2021). In addition, the challenge of computers for storing medical records is technological obsolescence. This implies that records held in computers may be inaccessible over time if not promptly migrated to new hardware or software. The problem of intermittent power supply can also affect the operations of computers, especially in developing countries (Yaya *et al* 2015). Nevertheless, the benefits of the use of computers in preserving medical records outweigh the challenges of using the technology (Abdekhoda, Dehnad & Zarei 2019; Hepisuthar 2021; Yaya *et al* 2015).

The findings of the present study revealed that the public healthcare facilities in Malawi have an adequate number of computers for storing records (93, 54%). Similar findings were obtained through a crosstabulation of storage methods and types of records and presented in Table 5.33 in Chapter Five, that computers were mostly adopted for preserving health passports, case files and registers. In addition, the study found that computers have improved the security of stored records (102, 56%) while reducing the storage costs for records in the five public healthcare facilities in Malawi (103, 58%). Similar findings obtained through interviews with records officers also confirmed that public healthcare facilities were equipped with modern computers and enabled with the DHIS III database and internet connectivity. In addition, the findings obtained through observations in all five healthcare facilities revealed that computers, servers, internet, and databases (i.e. EMR for outpatient, Offline MS Access for backup of register records) were used for preserving medical records. It was also observed in all the healthcare facilities that special computers called J2 existed and were funded by the EGPAF and World Bank for outpatient and inpatient services. The findings demonstrate that computers are vital technologies for the preservation of medical records. This is because computers are enabled with security features such as passwords and encryption. Computers are also portable, which enables them to be positioned in a secure room. However, the use of computers also requires basic knowledge and skills of staff in end-user computing. It was also observed that all the staff handling records had prior knowledge of end-user computing and demonstrated proficiency in operating a computer. This is a positive development as far as the preservation of records is concerned in public healthcare facilities.

The widespread use of computers for storing medical records in public healthcare facilities aligns with findings from previous studies. Research by Alnashmi *et al* (2022), Decman (2011) and Edmund, Ramaiah, and Gulla (2009), in Singapore, Kuwait, and Slovenia, respectively, highlighted advancements in computer hardware and networking within healthcare systems for preservation of records. These studies emphasised that computers enhance records' access, reduce physical space requirements, lower storage costs, and improve security (Edmund, Ramaiah, & Gulla 2009). In Africa, similar studies by Marutha and Ngulube (2012) in South Africa and

Masuku and Ngulube (2020) in Zimbabwe also reported the use of computers for the storage of medical records. The studies found that records in the hospitals were kept in computer databases for capturing and storing patient information, among others (Marutha & Ngulube 2012; Masuku & Ngulube 2020).

However, the findings of the current study do not support the previous research by Amin *et al.* (2020) in Malaysia, which found that the university hospital lacked computers, which contributed to missing files, damaged files, inadequate filing space and inadequate hardware. The study suggested that a lack of a policy framework on preservation was one of the contributing factors to a lack of computers for the preservation of records in healthcare facilities (Amin *et al.* 2020). Contrasting findings to those of the present study were also reported in the studies by Asunmo and Yaya (2016) and Yaya *et al.* (2015) in Nigeria, which found that healthcare facilities had an inadequate supply of computers and other ICT devices, outdated or non-existent hardware, software and network connectivity.

6.4.6 Portable storage media

The developments in ICTs have given rise to a series of portable storage media for records such as floppy diskette, tape drive, removable cartridge, CD, DVD, flash disk, HDD, and SSD. Others can be categorised as traditional, such as floppy diskettes, tape drives, and removable cartridges while CDs, DVDs, flash disks, HDDs, and SSDs can be considered as among the modern storage media (Saffady 2021). Portable storage media such as tapes are relatively cheap, although not commonly used in modern organisations (Touray 2021). Unlike tapes, DVDs offer several advantages compared to CDs, such as higher capacity (Smallwood 2019). Alternative storage media such as Flash drives are portable and have varying storage capacities ranging from 8 to 256 gigabytes (GB) (Zhang & Zhang 2021). The recent developments in ICT have given rise to HDDs and SSDs, which offer additional space for the storage of records (Lerner & Bonnet 2021).

The present study examined portable storage media, recognising their potential in the preservation of records. The study found that public healthcare facilities have adopted modern media such as CDs, DVDs, flash disks, hard disk drives, and solid-state drives for storing records (69, 38%). The study also found that traditional media such as microfilm, cassettes, and floppy disks were not used for storing records (100, 55%). Furthermore, observations made by the researcher in all five public healthcare facilities in Malawi ascertained that tablets, flash disks and hard disks were used for preserving records. Similar findings obtained through a crosstabulation of storage methods and types of records, and presented in Table 5.33 in Chapter Five, also revealed that traditional and modern portable storage media were used for preserving all types of records in healthcare facilities. It was also evident that healthcare facilities adopted modern storage media for preserving records, such as CDs, DVDs, flash disks, and hard disk drives, compared to traditional media such as floppy diskettes and tape drives. The findings demonstrate that public healthcare facilities have modernised the means for storing records in line with technological developments. The adoption of new media for storing records also ensures that records are accessible, secure and used at the point of call. Eventually, this ensures the availability of information for healthcare service delivery in the public healthcare facilities in Malawi.

However, these findings contrast with those of Asunmo and Yaya (2016) and Marutha and Ngulube (2012) in Nigeria and South Africa respectively, which reported that the hospitals surveyed stored records using outdated technologies such as vinyl discs, video discs, lamination,

microgroove discs, shellac discs, mylar, floppy discs, magnetic tape, cellulose acetate, and microfilming. One of the reasons for these findings was the limited deployment of ICT in healthcare facilities (Asunmo & Yaya 2016).

6.4.7 Storage rooms

Storage rooms are among the most common storage areas for medical records. The storage rooms protect records from environmental factors, pests, human carelessness and mould. These factors can cause damage to physical media and speed up the rate of deterioration. Storage rooms should always be cleaned without chemicals or water, using a vacuum cleaner where possible (Read & Ginn 2015). Vacuum cleaners should always be cleaned to avoid spreading dust around the storage room (Read & Ginn 2015; Saffady 2021). In addition, uncontrollable access to storage rooms risks damage and theft of records (Crockett 2017; Miller 2022). To protect records from these threats, Crockett (2017) argues that storage space should be in a brick, stone or concrete building and kept dark, cool, dry, well-ventilated, pest-free and secure. Windows and doors should be locked all the time (Crockett 2017; Franks 2018; Saffady 2021). If possible, the storage rooms should be installed with air conditioning, heating, and ventilation to regulate the temperature and relative humidity (Saffady 2021; Franks 2018). Electrical wires and water pipes should be installed far from the storage area (Franks 2018; Saffady 2021).

For this reason, the study investigated the use of storage rooms for preserving medical records in the five public healthcare facilities in Malawi. The study found that storage rooms were regularly cleaned and dusted, well-ventilated, had adequate lighting, and with blinds and thick curtains to insulate records from the sun. Similar findings obtained through interviews with records officers also revealed that the storage rooms in all five public healthcare facilities were in a good state in terms of cleanliness, ventilation, temperature and lighting. The study also found that storage rooms and storage equipment were used for preserving all types of records. In addition, observations made in the healthcare facilities also revealed that storage rooms were clean and dust-free despite the few instances of dust in some departments handling records. The storage rooms had no sign of dampness, cracks, damage or deterioration, though spots of leakage exist, which show that they were recently maintained. It was also observed that some records storage rooms were equipped with blinds and thick curtains to insulate the room from direct sunlight. However, some storage rooms in the healthcare facilities lacked blinds, thick curtains, and adequate lighting. Despite the condition of the storage rooms, it was observed that records were not kept at the recommended temperature of 18 to 21 Degrees Celsius. Healthcare facilities must consider improving air ventilation in the storage rooms and installing air conditioners. This could improve the temperature of the rooms. A good storage environment for records ensures that records are protected from environmental and human factors that may lead to loss or deterioration of records.

These findings agree with those of Alnashmi *et al* (2022), Anyira (2020), Asunmo and Yaya (2016), Chaterera, Ngulube and Rodrigues (2014), Gisemba, Ng'eno and Bosire (2022), Katuu (2015), Luthuli (2017), Luthuli and Kalusopa (2017), Marutha (2021), Marutha and Ngulube (2012), Masuku and Ngulube (2020), Mensah and Adams (2014), Ngwenya (2020) and Tough and Lihoma (2018), in which medical records were stored in storage rooms with air conditioners, equipped with fire extinguishers and sand buckets, lockable doors to the main storage area, a CCTV Security system was installed and electronic record management system was available.

However, one interesting finding was that the air conditioners were not evenly installed in storage rooms to regulate temperature in the rooms in all five public healthcare facilities. Some departments at Hospital E had air conditioners installed in the storage rooms for records. Another interesting finding was that some records storage rooms in Hospital C and Hospital E were located in the patients' wards. This compromised the air ventilation of the storage rooms. Overall, the study found that public healthcare facilities had good air ventilation systems despite inadequate air vents and air conditioners.

In addition, the study found that storage rooms in public healthcare facilities were unevenly equipped with equipment such as fire extinguishers, smoke detectors and fire alarms for disaster preparedness. Similar findings obtained through observations made in the five healthcare facilities indicated that fire extinguishers were in use, but not in all records storage areas. It was also observed that fire extinguishers were positioned far from the records storage rooms. Smoke detectors and fire alarms were observed in Hospital E in a donor-funded building, but were lacking in most of the storage rooms and offices in the public healthcare facilities in Malawi. The interviews with records officers in all five public healthcare facilities also found that fire extinguishers and PVA water-based paint were used in some storage rooms for disaster preparedness.

It was also observed that the healthcare facilities had inadequate space to maintain record storage equipment. The existing space in some healthcare facilities was improvised and was originally designed for patients' wards, healthcare staff offices, and restrooms for healthcare staff on night duty. This is a worrisome situation considering that preservation of records requires space for physical records and storage equipment. Saffady (2021) argues that the size of the space selected for storing records should be based on the estimated volume of the records. One recommended rule for estimating states that one-third of all records are active and can be found in offices, one-third are inactive and should be stored in a records centre, and one-third (or more) have no value and should be destroyed (Franks, 2018). The purpose of the rule is to create additional space for new records by eliminating valueless records while maintaining records of significance to the organisation (Saffady 2021). As such, public healthcare facilities need to consider increasing the space for records by identifying additional rooms or constructing other storage rooms. The use of off-site storage is another feasible option if financially viable (Alnashmi *et al* 2022). To address the challenge of a lack of equipment and storage rooms, public healthcare facilities need financial support from the government, donors and well-wishers. Similar sentiments were expressed by records officers, hospital administrators and hospital directors about the inadequate nature of the budget for records management functions in the public healthcare facilities in Malawi.

This study produced results which corroborate the findings of a great deal of the previous work in this field. For example, a study by Mensah and Adams (2014) in Ghana found that the preservation of records was given very little attention by the hospitals, characterised by a lack of adequate storage facilities. In some cases, some records were kept on the floor, and others in metal containers that were far from the records units in the public hospitals. Mensah and Adams (2014) argued that such circumstances negatively impacted timely retrieval or loss of records and the lack of space for keeping records. Similar findings to those of the present study were also reported in previous studies by Gisemba, Ng'eno and Bosire (2022), Luthuli and Kalusopa (2017) and Ngwenya (2020) that healthcare facilities lacked space consistent with the volume of records. Due

to a lack of space, Ngwenya (2020) lamented that medical records with torn boxes were placed on the floor, supported with planks and bricks, in some healthcare facilities in South Africa. Files were also stacked up in open cabinets due to a shortage of storage room and equipment (Ngwenya 2020). In South Africa, some hospitals resorted to using containers called *khulukuthu* ('dumping area') and Outpatient Departments (OPD) for storing records due to a lack of storage space (Luthuli & Kalusopa 2017).

6.4.8 Physical storage equipment

Physical storage equipment offers convenient storage while supporting access to records. The common storage equipment for records includes shelves, storage boxes, vaults, and filing cabinets (Franks 2018; Millar 2017; Saffady 2021). Shelves are amongst the oldest storage equipment for physical records (Smallwood 2019). Cognisant of the different types of shelves, Smallwood (2019) argues that shelves for records should be open metal or wooden racking secured to the floor and ceiling. Shelves should be positioned away from the outside walls to avoid dampness (Franks 2018; IRMT 2004; Millar 2017). Wooden shelving or cabinets sealed and treated with fire-resistant solvent-free paint or water-based varnish is acceptable for boxed material or bound volumes (IRMT 2004). However, metal shelves are highly recommended for loose volumes of records (Saffady 2021). The standard shelf should not be more than 200cm for easy shelving and accessibility to the records (Saffady 2021). Chikuni and Mnjama (2010) also argued that static wooden open-racking type of shelving, which is up to 2 metres high, is recommended for the storage of medical records.

The study found that physical storage equipment, such as shelves, cupboards, folders, file cabinets, boxes, and airtight containers, existed and were adequate for storing records. The study further found that shelves, cupboards, folders, file cabinets, boxes, and airtight containers were in good working condition. The findings through observations made in all five public healthcare facilities also confirmed that storage equipment, such as storage rooms, folders, shelves, cartons, archival boxes, steel cabinets, and registers (admission books), were used for preserving records. Similar findings obtained through interviews with records officers also revealed that healthcare facilities in Malawi use different types of storage mechanisms for physical records, such as shelves, archival boxes and folders. The findings are rather encouraging, considering that preservation of records partly depends on storage equipment. These findings show that the budget allocation to public healthcare facilities was mostly channelled towards the purchase of storage equipment for records.

The findings observed in this study mirror those of the previous studies that have examined the physical storage equipment for records. For instance, previous studies by Gisemba, Ng'eno and Bosire (2022), Ngwenya (2020) and Pyrene (2015) found that medical records were preserved using steel and wooden open racking type of shelves which is up to 2 metres high, medicine cupboards, floor, static and mobile filing cabinets, corridors, storage rooms, storerooms, duty rooms, boxes, and folders/covers. The present findings seem to be consistent with research by Anyira (2020), Awogbami, Opele and Awe (2020), Chikuni and Mnjama (2010), Luthuli and Kalusopa (2020), Mampe and Kalusopa (2012), Marutha (2019) and Marutha (2021), which found that healthcare facilities used shelves, cabinets and drawers for storage and retrieval of records.

However, the study found that healthcare facilities lacked adequate space to maintain file cabinets, boxes and airtight containers for storing records. Other challenges included a lack of storage shelves, archival boxes, metal and wooden cabinets and folders. The lack of space impedes the

efforts by healthcare facilities to maintain storage equipment. To address the challenge of space, public healthcare facilities may consider identifying additional rooms or constructing other storage rooms for the preservation of records. In addition, the use of off-site storage is another feasible option for healthcare facilities to increase space for the preservation of records (Alnashmi *et al* 2022). Marutha (2019) also alluded that increasing the budget allocation towards the preservation of medical records in public healthcare facilities would address most of the challenges that are experienced by healthcare facilities, such as lack of space and lack of storage equipment, for example, shelves, archival boxes, metal and wooden cabinets and folders. Storing medical records in appropriate storage equipment such as shelves, archival boxes, and cabinets protects them from harsh environmental conditions such as high temperature, high humidity, dirt and dust (Luthuli & Kalusopa 2020; Marutha 2019). High temperatures result in the brittleness of paper, which results in crumbling (Chikuni & Mnjama 2010).

Similar challenges to those of the present study were reported in previous studies by Anyira (2020), Awogbami, Opele and Awe (2020), Gisemba, Ng'eno and Bosire (2022), Luthuli and Kalusopa (2020), Mampe and Kalusopa (2012) and Marutha (2019), such as a lack of storage equipment, such as shelves, cupboards, and filing equipment, and a limited budget allocation for medical records management. A similar study by Ngwenya (2020) also unveiled the challenges of a lack of standard, regulated equipment for the storage of medical records, with torn boxes placed on the floor supported with planks and bricks in healthcare facilities in South Africa. It was also noticeable that some files were stacked up in open cabinets due to a shortage of storage room and equipment for records (Ngwenya 2020). Consequently, records staff had to climb on top of file piles to access records, making it difficult to retrieve them promptly (Ngwenya 2020).

6.5 Preservation knowledge and skills

Healthcare facilities need staff who have the requisite knowledge and skills in the preservation of medical records (Mensah 2011). Staff with the required skills, knowledge and competencies can properly manage medical records based on the best practices for records management (Amin *et al* 2020). National Records of Australia (2020) recommends that the records manager should possess professional skills and competencies such as sound knowledge of records management theory and practice and the ability to apply and adapt records management standards and best practices effectively in the organisation's context. In addition, the records manager is expected to have personal skills and competencies such as communication skills, enthusiasm and proactive, a positive attitude, teamwork, flexibility and adaptability, and good analytical skills (National Records of Scotland 2020; Amin *et al* 2020).

Guided by the OAIS, DCC Curation and Lifecycle models, the present study was designed to assess the knowledge and skills of health staff in preserving records in the public healthcare facilities in Malawi. The themes under this research question included the following:

1. Knowledge and skills
2. Competencies
3. Ethical considerations

6.5.1 Knowledge and skills

Preservation of medical records partly hinges on the knowledge and skills of staff handling the records. With proper knowledge and skills, staff can properly receive, assemble, code, enter, and

file records (Bhat, Gijo & Jnanesh 2016). In addition, staff can also manage digital records by assigning appropriate metadata based on acceptable standards and guidelines. Therefore, staff must possess the required level of knowledge and skills in preserving medical records. This can be achieved through formal education and attending workshops, conferences, or seminars on the preservation of medical records (Adu & Ngulube 2017; Gisemba, Ng'eno & Bosire 2022; Mensah & Adams 2014).

The study sought to examine the level of knowledge and skills of staff on the preservation of medical records in the public healthcare facilities in Malawi. The findings from interviews with records officers, hospital administrators, and hospital directors indicated that the majority of staff responsible for preserving records possessed the MSCE. Only a few staff members had diplomas in fields such as ICT. Given the nature of these qualifications, the study suggests that staff possessed the basic knowledge and skills required to work with hardware and software, including computers, scanners, printers, photocopiers and databases. These findings provide further support for the hypothesis that qualifications in MSCE and ICT may not offer staff the knowledge and skills in receiving, assembling, coding, entering, filing and disposing of records as revealed by the study. Due to the irrelevance of the qualifications in records management, it is not surprising that the level of knowledge and skills in the preservation of records was low, as revealed by the records officers in the five healthcare facilities. It can be deduced that this lack of knowledge and skills negatively impacts the records personnel's ability to execute their tasks with due diligence and support the health service delivery to patients (Park, Lee & Boo 2018). Tough and Lihoma (2018) have also argued that a lack of staff with the necessary skills and knowledge in medical records management could lead to data loss, data errors, missing records, lawsuits and other records-related challenges. It can thus be suggested that staff handling records need to be enrolled in information sciences-related programmes and courses such as records management, public policy and research, medical information management, and information processing and data analysis (Park, Lee & Boo 2018).

The findings of the present study agree with those of Abore *et al* (2022), Adeleke *et al* (2019), Adjei and Mensah (2016), Adegboyega and Saâ (2019), Adu and Ngulube (2017), Asunmo and Yaya (2016), Anyira (2020), Awogbami, Opele and Awe (2020); Bhat, Gijo and Jnanesh (2016), Dube and Mnjama (2017), Gisemba, Ng'eno and Bosire (2022), Luthuli and Kalusopa (2020, 2017), and Luthuli (2017), Makeleni and Cilliers (2021), Marutha (2021, 2019), Masuku and Ngulube (2020), Mensah and Adams (2014), Newa and Mwantimwa (2019), Ngwenya (2020), Poursaghar *et al* (2008), Tough and Lihoma (2018), Yaya *et al* (2015). These studies attest that most healthcare facilities in developing countries were manned by staff who have very limited experience or skills in receiving, assembling, coding, entry, and filing records. The majority of staff handling records in these countries had qualifications in Information Technology, nursing and other health-related fields besides records management (Masuku & Ngulube 2020). There are several possible explanations for this result. Firstly, a lack of recruitment of qualified personnel to handle records management functions in healthcare facilities (Bhat, Gijo & Jnanesh 2016). Secondly, outdated curricula with a lack of emerging issues such as public policy and research, medical information management, and information processing and data analysis (Park, Lee & Boo 2018). Thirdly, a lack of funding towards the preservation of records activities (Yaya *et al* 2015). Lastly, lack of professional standards and regulations on the management of medical records and information (Adeleke *et al* 2019). However, the findings of the present study do not support the

previous research by Amin *et al* (2020) and Park, Lee and Boo (2018), which found that the medical records personnel had the right knowledge and skills in the preservation of records.

Furthermore, the present study also found a significant shortage of staff dedicated to preserving records. Interviews with records officers revealed that all healthcare facilities faced a similar issue, with an insufficient number of staff responsible for the preservation of records. The exact cause of this shortage is unclear, but it may be related to the high volume of records generated and received, as well as the size of healthcare facilities in Malawi. These findings align with those of Amin *et al* (2020), who reported that the University Hospital in Malaysia also struggled with an inadequate number of records professionals, despite having staff with the necessary skills and competencies for managing medical records.

The present study also found that no staff in all public healthcare facilities have attended continuous professional development activities on the preservation of records, such as workshops, short courses, seminars, and internships, and there was a lack of support towards these professional development initiatives. Similarly, the findings from the document review also confirmed that staff handling records in public healthcare facilities lacked short courses, workshops, and seminars on the preservation of records. This was evidenced by a lack of written and approved continuous professional development guidelines and other relevant documentation in public healthcare facilities in Malawi, as revealed by the study. Furthermore, the findings through interviews with records officers, hospital directors and hospital administrators revealed that healthcare facilities plan for continuous professional development activities. However, the views of records officers were that staff handling records rarely attend continuous professional development activities such as short courses, seminars and internships (Msiska, Kunitawa & Kumwenda 2017; Tough & Lihoma 2018; Tough & Lihoma 2017). This is against the proposition by Pourasghar *et al* (2008) that physicians and nurses should attend workshops or courses after graduation to get more training and information on the preservation of medical records.

Similar findings to those of the present study were reported in a study by Gisemba, Ng'eno and Bosire (2022), which revealed that staff handling records acquired some medical records management skills on the job but never attended workshops, conferences, or seminars. The study established that some staff took the initiative to train themselves in medical records management due to a lack of capacity-building opportunities at the hospital (Gisemba, Ng'eno & Bosire 2022). One possible explanation for this finding is the lack of funding to support staff in attending short courses, seminars, and internships on the preservation of medical records, as revealed by the study. The issue of lack of funding towards the continuous professional development of staff was well reported in previous studies by Edmund, Ramaiah and Gulla (2009), Khumalo, Dube and Mnjama (2017) and Yaya *et al* (2015).

The present study further found that the minimal budget allocation towards the preservation of records was never utilised for preservation activities but channelled to other priority areas in public healthcare facilities. Buttressing this point, Mosweu and Bwalya (2024) argue that healthcare facilities face competing budgeting allocations with other sectors by the government (Mosweu & Bwalya 2024). Consequently, healthcare facilities lacked adequate and sustainable financial resources for implementing digital preservation activities, including purchasing ICT equipment. Despite the budgetary constraints, Keakopa (2016) posits that records preservation efforts need to

be budgeted for and cost within the national budget. Nevertheless, healthcare facilities in Malawi must exploit other avenues for funding from donors and private organisations as government funding has proved to be unsustainable.

Despite the challenges of irrelevant qualifications and low levels of knowledge, the present study found that healthcare facilities offered on-the-job orientations, monitoring, and follow-up to staff responsible for the preservation of records. Similar findings to those of the present study were revealed through interviews with records officers that the five healthcare facilities provide on-the-job orientations, monitoring, and follow-up to staff handling records. This is a very commendable initiative by the healthcare facilities in Malawi to support staff in gaining knowledge and skills in the preservation of records amid financial challenges facing public institutions in Malawi. However, more needs to be done by healthcare facilities to support staff for training to improve their knowledge and skills in the preservation of records.

6.5.2 Competencies

Besides knowledge and skills, the staff responsible for preserving records needs to possess the required competencies. According to the National Records of Scotland (2020) and Amin *et al* (2020), some of the critical competencies for staff handling records include communication skills, enthusiasm, positive attitude, teamwork, flexibility, effective advisory and influencing skills, sharing knowledge and experience, good analytical skills, integrity, and networking.

Having identified the knowledge and skills, it was necessary to investigate the competencies of staff responsible for preserving medical records. The findings revealed that staff handling records were competent in areas such as communication, positive attitude, teamwork, leadership, flexibility and networking (93, 52%). This entails that staff handling records have the basic competencies required in managing records. However, the study found that staff were not competent in areas such as artificial intelligence, data processing, disease classification and cancer registration (88, 48%). As technology evolves, the need for new competencies in the preservation of records emerges. The findings suggest that staff need to upgrade their knowledge, skills and competencies to remain relevant in handling emerging formats of medical records such as PDF/A and XML. As such, healthcare facilities need to support staff to attend training sessions, workshops and seminars on the preservation of records. This includes developing continuous development guidelines and standards, and allocating adequate resources towards the activities (Yaya *et al* 2015; Adeleke *et al* 2019).

Similar findings to those of the present study were revealed in the research by Kamatula & Kemoni (2018), Newa and Mwantimwa (2019) and Park, Lee and Boo (2018) that records managers from developing countries need additional competencies such as analysis of big data, artificial intelligence, statistics, data processing, disease classification, cancer registration, security and personal information protection analysis to operate in the modern technological world.

6.5.3 Ethical consideration

Medical records are beneficial as they support the delivery of care to patients. Medical records contain sensitive and confidential data about patients, and they need to be protected through ethical considerations. However, recent developments in technologies have compromised the security and privacy of patients' information (Sulmasy, López & Horwitch 2017). As such, several ethical challenges have emerged due to the rise of different technologies in healthcare (Afzal & Arshad

2021; Miesperä, Ahonen, Reponen 2013; Varkey 2020). The major ethical issues are autonomy, beneficence/non-maleficence, privacy and confidentiality, justice and fidelity.

The present study found that ethical considerations, including privacy, confidentiality, justice, and fidelity, were consistently observed when handling medical records (120, 72%), and staff were aware of these ethical principles (126, 70%). Similar findings emerged from interviews with records officers in all five healthcare facilities in Malawi, where it was revealed that staff conducted themselves professionally and adhered to ethical standards in preserving medical records. Adherence to ethical principles such as privacy and confidentiality fosters trust and supports the sharing and access to health data. This encourages individuals to share personal information, knowing that their privacy, autonomy, and confidentiality will be upheld (Hilty *et al* 2016; Porsdam *et al* 2016). Additionally, Porsdam *et al* (2016) argued that the application of electronic medical records in line with the principles of autonomy, beneficence, and justice can enhance the quality of life and equitable distribution of healthcare services.

6.6 Summary

The chapter presented an in-depth interpretation and discussion of the research results presented in Chapter Five. Interpretation and discussion were guided by the theoretical framework presented in Chapter Two. As such, the study was underpinned by three models, namely the Records Lifecycle model, the DCC Curation Lifecycle Model, and the OAIS Model. Discussion of findings was also contextualised in the literature to highlight the similarities and differences between the study findings and those of previous studies. Data from questionnaires, interviews, document reviews and observations were triangulated to achieve convergence and complementarity of quantitative and qualitative data results. The Chapter was logically organised according to themes derived from the research questions presented in Chapter One.

The study established that the status of the preservation of medical records was somewhat poor in all five public healthcare facilities in Malawi. Inconsistencies in the implementation of preservation strategies such as migration, backup, file formats, metadata, privacy and security and disposal were discussed. The discussion also focused on preservation policies and standards as a legal and regulatory framework that guides the preservation of medical records in healthcare facilities. The issue of storage mechanisms was also discussed with a focus on cloud storage, DNA technology, artificial intelligence, computers, portable storage media, storage rooms and physical storage equipment in healthcare facilities. The issues of knowledge and skills of staff responsible for the preservation of medical records were deliberated.

Several barriers have been identified related to preservation strategies for medical records in the public healthcare facilities in Malawi. All the healthcare facilities lacked hardware and software for the preservation of records, such as servers, equipment for repairing records, dehumidifiers, software and databases. Healthcare facilities lacked modern methods for storing records, such as cloud storage, DNA storage, artificial intelligence, and blockchain. The use of traditional methods such as computers, portable storage media, storage rooms and physical storage equipment was evident in all the healthcare facilities. The lack of preservation strategies and equipment negatively impacted on implementation of migration methods, backup, and the use of file formats and metadata. The challenge of office space for data entry clerks was huge in all five public healthcare facilities. Some data entry clerks were housed in small rooms with poor ventilation in patients' wards, stores and restrooms. Disaster preparedness equipment and strategies such as air

conditioners, air vents, fire extinguishers, smoke detectors and the use of water-based paint were revealed by the study. However, not all departments/sections in the five healthcare facilities had such equipment. This exposes the healthcare facilities to risks and threats such as fire, flood, high temperatures and humidity, biological agents, theft and vandalism, which threaten the existence of the records.

The issue of lack of written and approved policies, standards, guidelines and procedures for the preservation of medical records was found to be prevalent in the five healthcare facilities. This is despite the existence of such documents as HMIS policy and standard operating procedures (SOPs). It was encouraging to learn that all healthcare facilities adhered to general laws for preserving records, such as the National Archives Act, Access to Information Act of 2017, Public Health Act of 2021, Medical Services Act of 2018, and Data Protection Act of 2024. However, specific laws for the preservation of medical records were not present in the healthcare facilities. Furthermore, standards such as ISO 15489, ISO 20652, ISO 9001, Moreq, HL7, PREMIS, METS and DC were not present in the healthcare facilities.

The findings also revealed that data entry clerks, ICT officers, as well as clinical and nursing staff, lacked the necessary knowledge and skills in tasks such as receiving, assembling, coding, titling, entering, and filing records. Staff were specifically found to be inadequate in areas like artificial intelligence, data processing, disease classification, and cancer registration. Several factors contribute to this, including insufficient funding; lack of office space; inadequate storage equipment; a shortage of staff; limited management support for attending workshops, short courses, seminars, and internships related to record preservation; and the absence of continuous professional development guidelines. These challenges have a negative impact on the preservation efforts in public healthcare facilities in Malawi.

The next chapter (Seven) provides a detailed summary of the findings, conclusions and recommendations for public healthcare facilities in Malawi on how preservation of medical records can be improved. The chapter also outlines the proposed framework for the preservation of medical records in the public healthcare facilities in Malawi.

CHAPTER SEVEN

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This chapter serves as a comprehensive overview of the entire study. It encapsulates the summary of findings, conclusions, and recommendations derived from the results detailed in Chapter Five, as well as the interpretations and discussions presented in Chapter Six. According to Wojcik (2024), the summary of findings, conclusions, and recommendations constitutes a critical final segment of the research paper, underscoring its significance in framing the entirety of the research endeavour. By synthesising the research, this chapter not only highlights the study's overarching contributions but also elucidates its implications for both academic inquiry and practical applications. It offers a clear roadmap for future research directions, ensuring that subsequent studies build upon the established findings and further explore the topic's nuances. This holistic presentation facilitates a deeper understanding of the research's impact while paving the way for ongoing exploration and innovation in the field (Wojcik 2024).

The purpose of this study was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records. To achieve this purpose, the study sought to address five research questions outlined in Section 1.6 of Chapter One.

This study employed a mixed methods research (MMR) approach, grounded in the pragmatism paradigm, which allowed for a comprehensive exploration of the research questions. While the quantitative aspect was predominant, the qualitative component served as a valuable supplementary element, reflecting the convergent mixed methods design implemented throughout the study. Guided by three foundational models - the Records Lifecycle model, the OAIS Model, and the DCC Curation Lifecycle Model - this research engaged a total population of 415 participants. This diverse cohort included nurses, clinicians, hospital directors, administrators, records officers, data entry clerks, and ICT officers, ensuring a rich array of perspectives and insights. Data collection was multifaceted, utilising questionnaires, interviews, observations, and document analysis to gather comprehensive information. The analysis of quantitative data was performed using IBM's SPSS version 20.0, facilitating the generation of both descriptive and inferential statistics. For qualitative data, transcription and thematic analysis were conducted with the support of ATLAS.ti software, enabling the identification of key themes and sub-themes that emerged as the major findings of the study. This rigorous methodological framework not only enhances the validity of the findings but also contributes significantly to the understanding of the complexities within the healthcare and information management landscapes.

The presentation of the summary and conclusion of the study is aligned with the main themes derived from the research questions presented in Chapter One and subsequent chapters. The section on recommendations includes a proposed framework for improving preservation practices in public healthcare facilities in Malawi. The chapter also presents the implications of the study on theory, policy and practice. Lastly, suggestions for further research originating from the study have also been made.

7.2 Summary of the findings of the study

This section presents a summary of the findings of the study, which have been structured according to the key themes derived from the research questions and highlighted in Chapters Five and Six. Data was collected through quantitative and qualitative methods consistent with the pragmatic worldview.

7.2.1 Preservation strategies

The first research question of the study was to establish the preservation strategies currently in place at selected public healthcare facilities in Malawi. Data on the research was collected and organised according to the following themes: migration; backup procedures; file formats; dehumidification; metadata; damage repair; privacy and security; and disposal of records. The summary of findings related to the themes is as follows:

7.2.1.1 Migration

The literature highlights the crucial role of migration in facilitating access to and utilisation of records for effective healthcare service delivery. This study found that migration practices were implemented in all five public healthcare facilities in Malawi, with clear evidence of various migration methods, adequate equipment, comprehensive documentation of migration procedures, and knowledgeable staff equipped with the necessary skills. Notably, registers constituted the majority of records migrated from one medium to another. However, the findings indicate that the establishment and enforcement of relevant policies and standards could significantly enhance the migration processes across these facilities.

7.2.1.2 Backup procedures

Several benefits exist for implementing backup such as saving time and money, increasing the productivity of an organisation in the case of a disaster, preparing for disaster, eliminating the threats of accidental deletion of records, mitigating the negative impact of software bugs and hardware failures on the organisation and ability to reproduce results of the past for the continuity of business of the organisation, and support access to records and respond to data requests from clients (Millar 2017). The study established that backup procedures for records were conducted in the five public healthcare facilities in Malawi. Some of the backup procedures were regular backup of physical and electronic records; availability of backup media such as Google Drive and servers; the existence of a reliable power supply for conducting backup procedures; development of backup manuals; and knowledge and skills of staff on backup procedures. An assessment in all five public healthcare facilities also revealed that records were properly backed up through the Microsoft Office Access database, DHIS III, centralised government servers, computers, CDs, DVDs, hard drives and flash disks. The study also revealed that all five public healthcare facilities were equipped with a reliable power supply through the ESCOM line, a generator set and solar.

7.2.1.3 File formats

File formats play a critical role in the storage, retrieval, processing, presentation, and transmission of data and records within software systems. They ensure that various types of digital records are accessible in formats compatible with the existing technological infrastructures. The study found that all five healthcare facilities utilised file formats such as DOC, DOCX, PDF, and TIFF for formatting digital files. The study further examined the availability of necessary equipment and software, which was found to be present in all facilities, suggesting that the infrastructure to support proper record preservation exists. Importantly, all medical records were being preserved

using various file formats, except for health passports, which remained in physical format. Despite the utilisation of diverse file formats, the findings underscore a significant knowledge gap: the majority of staff responsible for managing records lacked awareness and understanding of file formats. This situation highlights the imperative for targeted training and educational initiatives, which could enhance the effectiveness of record preservation and ensure that valuable health information is maintained in accessible and sustainable formats across Malawi's public healthcare system.

7.2.1.4 Dehumidification

Dehumidification is important because it aids in regulating the temperature and humidity of records storage rooms. This is achieved by removing the water from the air using equipment such as dehumidifiers, space heaters, open coil duct heaters, energy recovery ventilators, and desiccators. The study revealed that all five public healthcare facilities in Malawi lacked dehumidification equipment, such as space heaters and energy recovery ventilators. The study also revealed a lack of best practices for dehumidifying storage places, such as good ventilation, storing records away from outside walls, keeping records out of the basement, and packaging records in archival containers. Despite this situation, the study established that all public healthcare facilities in Malawi implemented alternative methods to enhance air circulation in record storage areas, including air vents, fans, and air conditioners.

7.2.1.5 Metadata

Metadata is crucial for all aspects of record preservation, including access, storage, retrieval, and disposal. The study found that the five public healthcare facilities in Malawi infrequently engaged in essential metadata activities, including metadata creation, the adoption of standards such as PREMIS, MODS, and METS, and thorough metadata documentation. Despite this lack of widespread adoption, the findings indicated that certain medical records, notably case files and registers, did contain metadata across all facilities. Furthermore, the study revealed a significant knowledge gap among staff responsible for records management, particularly data entry clerks and clinical and nursing personnel, who often lacked the necessary skills and understanding to create and assign metadata effectively to records. This highlights an urgent need for training and development initiatives to empower staff and improve the overall metadata practices in these healthcare facilities.

7.2.1.6 Damage repair

According to the literature, several ways exist for repairing damaged physical or analogue records. This includes storing records at 18-20 Degrees Celsius with a relative humidity of 35-40%; mass deacidification; encapsulation; using archival-quality envelopes, folders and boxes; and using curtains and blinds in the storage area for records. The study established that damaged records in public healthcare facilities were not regularly repaired. Furthermore, an assessment of all five public healthcare facilities revealed that the equipment and materials for repairing records, such as vacuum cleaners, archival-quality envelopes, folders and boxes, laminators, and binders, were not available.

7.2.1.7 Privacy and security

Security and privacy are fundamental components of a comprehensive preservation program for medical records. This study found that various privacy and security measures were implemented across all public healthcare facilities in Malawi. These measures included restricted access to

records by authorised users, the requirement for authorisation letters to enter records storage areas, and secure locking mechanisms for doors, windows, and filing cabinets within those areas. Additionally, security protocols such as the use of firewalls, password protections on computers, and encryption and redaction techniques were employed to safeguard electronic records. Regular security inspections and assessments of the records storage areas and office environments further bolstered these security efforts. The study also identified additional privacy and security measures, including the installation of burglar bars and the locking of office doors and records storage rooms. Importantly, it was established that these security measures were applied to all types of records, with registers and health passports being among the most secure. However, a comprehensive assessment across all healthcare facilities indicated that the installation of CCTV cameras for security monitoring was inconsistent. Specifically, only select departments within Hospital E had CCTV cameras installed to enhance the security monitoring of records. This inconsistency highlights potential vulnerabilities in the overall security framework and suggests the need for a more uniform implementation of surveillance measures across all healthcare facilities to ensure the protection of sensitive medical records.

7.2.1.8 Disposal

Disposal of records in public healthcare facilities was given priority despite several impediments in its implementation. The study established that the disposal of records was being implemented at the five public healthcare facilities in Malawi. Some of the disposal mechanisms for records included properly disposing of records according to the retention and disposal policy; transferring records to a records centre or archives; burning; shredding; and a disposal manual that guides staff in properly disposing of records. An assessment of all five public healthcare facilities revealed that all medical records, including registers and health passports, were not disposed of on-site at the hospital level but transferred to the National Records and Archives Services of Malawi for destruction or permanent preservation. Some of the challenges in the disposal of records in healthcare facilities were a lack of equipment for disposing of records, such as incinerators and shredders, and a lack of awareness of the records retention and disposal policy and guidelines among healthcare staff handling.

7.2.1.9 Preservation strategies

The first research question aimed to identify the preservation strategies currently employed in selected public healthcare facilities in Malawi. The findings revealed inconsistencies in the implementation of these strategies across the facilities. Notably, while preservation methods such as migration, appropriate file formats, backup procedures, dehumidification, and protocols for privacy and security were in place, there were notable gaps in the utilisation of metadata and damage repair processes. Overall, the results indicate that preservation strategies are being implemented in all five public healthcare facilities; however, there remains significant potential for improvement.

7.2.2 Preservation policies and standards

Proper preservation of records rests on the existence of relevant policies and standards. The second research question of the study was to examine the preservation policies and standards of the selected public healthcare facilities in Malawi. The data required to answer the research question was collected and arranged according to the following themes: policies, standards, guidelines and procedures, and legislation. The findings are summarised below:

7.2.2.1 Policies

The literature underscores the importance of policies in the realm of records preservation through three critical functions. Firstly, policies provide a clear mandate to records officers and staff responsible for preserving records within an institution. This formal directive is essential for ensuring accountability and consistency in preservation efforts. Secondly, policies serve as comprehensive guidelines that direct all preservation activities in institutions, including healthcare facilities, promoting systematic and effective practices. Thirdly, the existence of robust policies signals a strong commitment from management, acknowledging that medical records are vital organisational assets. Despite the clear benefits of such policies, this study found that public healthcare facilities in Malawi often lack written and approved records preservation policies. For example, while Hospital B is currently drafting its policy, Hospitals C and E have only adopted the HMIS policy for preservation purposes. Furthermore, the investigation highlighted that national policies for records preservation have been updated at the national level; however, there remains a significant gap at the local facility level. Most alarmingly, many staff members were unaware of any existing written medical records management policy, suggesting a failure of top management to adopt and implement necessary policies within public healthcare facilities. This lack of awareness and action highlights an urgent need for the establishment and enforcement of comprehensive preservation policies to protect critical medical records and enhance the overall integrity of healthcare processes in Malawi.

7.2.2.2 Standards

Standards are important instruments that ensure consistency in the preservation of medical records across geographical boundaries. The study established that public healthcare facilities in Malawi have adopted standards for preserving medical records, such as ISO 15489, ISO 20652, ISO 9001, Moreq, and HL7. The study further revealed that staff handling records, such as data entry clerks and ICT officers, were aware of the standards through awareness campaigns, meetings, seminars and workshops. However, an assessment made in all five public healthcare facilities in Malawi revealed that standards were not adopted for preserving medical records. It was evident that some healthcare facilities, such as Hospital E, adopted the HMIS policy as a standard for preserving records. In addition, the study also revealed that standards for creating file formats such as ISO/IEC 26300 and ISO 19005 did not exist in all five public healthcare facilities in Malawi.

7.2.2.3 Guidelines and procedures

The study also aimed to investigate the guidelines and procedures for records disposal, filing, backup, and access/retrieval within the selected public healthcare facilities. It was found that all five facilities in Malawi had established guidelines and procedures for disposing of records, filing, titling, indexing, classifying, describing records, backing up data, and accessing/retrieving information. For instance, Hospital E had implemented an HMIS policy along with SOPs to direct the management of medical records across the hospital staff. However, an assessment of all five public healthcare facilities revealed a significant deficiency; none had guidelines or procedures specifically for preserving records. Additionally, the study indicated that all facilities lacked a dedicated programme or schedule for the preservation of these records.

7.2.2.4 Legislation

Legislation facilitates the implementation of institutional policies, guidelines, and procedures for preserving medical records. The study found that the five public healthcare facilities in Malawi

comply with several laws, including the National Archives Act, the Access to Information Act of 2017, the Public Health Act of 2021, the Medical Services Act of 2018, and the Data Protection Act of 2024. These laws are available within the facilities, and staff members are knowledgeable about them due to awareness campaigns, meetings, seminars, and workshops.

An assessment made in all five public healthcare facilities in Malawi revealed that none of the five healthcare facilities had specific pieces of legislation for preservation of records. In the absence of specific legislation, Hospital C adopted the Health Sector Strategic Plan III and the HMIS policy and guidelines provided by the Ministry of Health to guide record preservation. Furthermore, methods for raising staff awareness of policies, standards, or legislation were non-existent.

7.2.2.5 Preservation policies and standards

The study results on preservation policies and standards revealed that healthcare facilities in Malawi lacked relevant policies, standards, procedures, guidelines, and legislation for the preservation of records. However, attempts have been made by all public healthcare facilities in Malawi to implement proxy preservation policies and standards such as HMIS policy, SOPs, and Health Sector Strategic Plan III. In addition, staff handling records were not aware of the policies, standards, procedures, guidelines, and legislation. Furthermore, awareness campaigns, meetings, seminars and workshops to raise awareness among staff about preservation policies and standards were not conducted.

7.2.3 Storage mechanisms

The preservation of records relies significantly on effective mechanisms for storage, access, security, and proper disposal. The third research question of this study aimed to examine the storage methods for medical records in selected public healthcare facilities in Malawi. The data was collected and categorised into eight themes: cloud storage, blockchain technology, artificial intelligence, DNA storage, computers, portable storage media, storage rooms, and physical storage equipment. The findings are summarised below:

7.2.3.1 Cloud storage

Cloud storage offers many benefits compared to offline storage. The literature has registered several benefits of cloud storage, such as the protection of data and information, reduction of costs in infrastructure, accessing IT services on demand, and broad network accessibility. The study revealed that public healthcare facilities in Malawi do not use cloud storage to store records. Several reasons were unveiled by the study as to the non-use of cloud storage in public healthcare facilities in Malawi. Some of the reasons were a lack of ICT infrastructure that supports the use of cloud storage services for records and a lack of knowledge and skills of data entry clerks, ICT officers, and clinical and nursing staff to store records in the cloud. However, the study established that some records, such as health passports and case files, were preserved in a cloud. Overall, the study has established that cloud storage is not being used to store records in all five public healthcare facilities in Malawi.

7.2.3.2 Blockchain technology

The literature suggests that the use of blockchain technology for the storage of records is gaining ground in some developing countries such as China and Malaysia. The technology offers benefits such as security, anonymity, data transparency, integrity and a tamperproof platform for storing medical records. The study revealed that all five public healthcare facilities have not adopted

blockchain technology to store electronic records for various reasons. Some of the reasons as revealed by the study were the lack of an existing ICT infrastructure that supports blockchain technology, and the lack of knowledge and skills among data entry clerks, ICT officers, and clinical and nursing staff to store records using blockchain technology.

7.2.3.3 Artificial intelligence

Artificial Intelligence (AI) is touted as the panacea for addressing the challenges of preserving huge amounts of data being created in healthcare facilities. AI can process large amounts of data within a short time and help improve healthcare service delivery. The study revealed that AI is rarely used for the preservation of medical records in public healthcare facilities in Malawi. Specifically, the study revealed that healthcare facilities do not use AI to store records (92, 52%) and that AI has not improved the storage and retrieval of medical records (69, 38%). In addition, the study also revealed that data entry clerks, ICT officers and clinical and nursing staff lacked the knowledge and skills in AI (98, 54%).

7.2.3.4 DNA storage

Deoxyribonucleic acid (DNA) storage represents a groundbreaking solution for the long-term preservation of data at a significantly reduced cost. Despite its potential, this study found that none of the healthcare facilities in Malawi currently utilise DNA storage methods. Alarmingly, a substantial majority (87%) of data entry clerks, ICT officers, and clinical and nursing staff lack the knowledge and skills necessary to implement DNA technology effectively. However, the study also established that DNA storage was used to store all types of records in all five public healthcare facilities in Malawi.

7.2.3.5 Computers

A computer is a common and useful technology that has transformed the processing, storing, and displaying of information in every sector, including health. Computers and information systems have the functionality to store medical records and ensure the security and confidentiality of records. The study revealed that public healthcare facilities in Malawi have an adequate number of computers for storing records such as health passports, case files and registers (93, 54%). In addition, the study revealed that computers have improved the security of stored records (102, 56%) while reducing the storage costs for records in the five public healthcare facilities in Malawi (103, 58%).

The assessment of all five public healthcare facilities revealed the use of computers, servers, internet, and databases (including EMR for outpatient services and Offline MS Access for backup records) for preserving medical records. For instance, Hospital D utilised specialised computers called J2, funded by the EGPAF and the World Bank, for both outpatient and inpatient services. Additionally, all staff responsible for handling records across the facilities demonstrated prior knowledge of end-user computing and proficiency in operating computers.

7.2.3.6 Portable storage media

From time immemorial, portable storage media have served the purpose of storing records. As technology evolves, traditional media such as floppy diskettes and tape drives are being replaced with newer media such as flash disk, HDD, and SSD. The study established that public healthcare facilities have adopted modern media such as CDs, DVDs, flash disks, hard disk drives, and solid-state drives for storing records (69, 38%). The study also established that traditional media such

as microfilm, cassettes, and floppy disks were not used for storing records (100, 55%). An examination in all five public healthcare facilities in Malawi revealed that tablets, flash disks and hard disks were used for preserving records. However, the study also revealed that both traditional storage media (floppy diskettes and tape drives) and modern storage media (CDs, DVDs, flash disks, and hard disk drives) were used for preserving all types of records in healthcare facilities.

7.2.3.7 Storage rooms

Storage rooms are crucial for protecting records from environmental factors, pests, carelessness, and mould. The study found that these rooms were regularly cleaned, well-ventilated, and adequately lit, with some equipped with blinds and thick curtains to shield records from sunlight. An assessment of five public healthcare facilities in Malawi revealed that storage rooms were generally clean and dust-free, although a few instances of dust were noted. No signs of dampness, cracks, or deterioration were observed, although some leakage was present, indicating recent maintenance. However, some storage rooms lacked blinds and adequate lighting and did not maintain the recommended temperature of 18 to 21 degrees Celsius for optimal record preservation.

The study also established that air conditioners were not evenly installed in storage rooms to regulate temperature in the rooms in all five public healthcare facilities. For example, some departments at Hospital E had air conditioners installed in the storage rooms for records. Despite the challenge of the lack of air conditioners, the study established that public healthcare facilities had good air ventilation systems with air vents.

The issue of lack of space was revealed by the study as some records storage rooms in Hospital C and Hospital E were located in the patients' wards. As such, healthcare facilities lacked space to maintain records storage equipment and offices for data entry clerks, records officers and ICT staff. The existing space in some healthcare facilities was improvised and was originally designed for patient wards, healthcare staff offices, and restrooms for healthcare staff on night duty.

In addition, the study revealed that storage rooms in all five public healthcare facilities were unevenly equipped with equipment such as fire extinguishers, smoke detectors, fire alarms, and PVA water-based paint for disaster preparedness. The study revealed that fire extinguishers were positioned far from the records storage rooms. Smoke detectors and fire alarms existed in Hospital E in a donor-funded building but lacked in most of the storage rooms and offices in the public healthcare facilities in Malawi. The study further revealed the challenge of inadequate budget for records management functions in all the public healthcare facilities in Malawi.

7.2.3.8 Physical storage equipment

Physical storage equipment, such as shelves and filing cabinets, provides a practical solution for convenient storage while facilitating access to records. This study confirmed that public healthcare facilities in Malawi possess various forms of physical storage equipment—including shelves, cupboards, folders, file cabinets, boxes, and airtight containers—that are adequate for record storage and generally in good working condition. However, significant challenges persist. The study highlighted a critical lack of sufficient space to accommodate file cabinets, boxes, and airtight containers, which hampers effective record management. Additionally, many facilities face shortages of essential items such as storage shelves, archival boxes, and both metal and wooden cabinets. These limitations underscore the urgent need for investment in physical storage

infrastructure to enhance records management in Malawi's public healthcare facilities. Healthcare administrators can improve the organisation, accessibility, and preservation of vital records if they address these challenges. In this way, hospitals ultimately contribute to more efficient healthcare delivery.

7.2.3.9 Storage mechanisms

The findings showed that all five healthcare facilities have adopted different portable storage media for preserving records. Specifically, computers, portable storage media, storage rooms, and physical storage equipment were used to preserve records in all the public healthcare facilities in Malawi. However, public healthcare facilities have not exploited the potential of using cloud storage, blockchain technology, artificial intelligence, and DNA storage to preserve records. This represents an opportunity for healthcare facilities to implement such technologies and improve the preservation of records.

7.2.4 Preservation knowledge and skills

The fourth research question assessed the preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi. Relevant data was gathered and organised under the following three themes: knowledge and skills; competencies; and ethical considerations. The findings are summarised below:

7.2.4.1 Knowledge and skills

Implementation of preservation activities hugely depends on the knowledge and skills of staff handling the records. The study established that the level of knowledge and skills of staff handling the records was low. The study also revealed that the majority of staff responsible for preserving records possessed the MSCE, and a few staff members had diplomas in fields such as ICT. Besides the level of knowledge, skills, and qualifications, the study revealed a significant shortage of staff dedicated to preserving records.

The study also revealed that staff responsible for record handling in public healthcare facilities seldom participated in continuous professional development activities, such as workshops, seminars, and internships, and there was inadequate support for these initiatives. Some of the key challenges included the absence of written and approved guidelines for professional development and insufficient funding. Furthermore, the minimal budget allocated for records preservation was often redirected to other priority areas rather than utilised for preservation activities. Despite these challenges, the study noted that healthcare facilities provided on-the-job orientations, monitoring, and follow-up for staff tasked with preserving records.

7.2.4.2 Competencies

According to National Records of Scotland (2020) and Amin *et al* (2020), some of the critical competencies for staff handling records include communication skills, enthusiasm, positive attitude, teamwork, flexibility, effective advisory and influencing skills, sharing knowledge and experience, good analytical skills, integrity, and networking. The study findings established that staff handling records were competent in areas such as communication, positive attitude, teamwork, leadership, flexibility and networking (93, 52%). However, the study revealed that staff were not competent in areas such as artificial intelligence, data processing, disease classification and cancer registration (88, 48%). The study entails that staff handling records were somewhat competent in preserving records.

7.2.4.3 Ethical consideration

Medical records contain sensitive and confidential data about patients, and they need to be protected through ethical considerations. The study revealed that ethical considerations, including privacy, confidentiality, justice, and fidelity, were consistently observed when handling medical records (120, 72%), and staff were aware of these ethical principles (126, 70%). The study implies that staff handling records in all five public healthcare facilities in Malawi were ethical.

7.2.4.4 Preservation knowledge and skills

The study revealed that staff involved in record handling possessed a low level of knowledge and skills, particularly in areas such as artificial intelligence, data processing, disease classification, and cancer registration. Nonetheless, staff demonstrated competencies in communication, teamwork, leadership, flexibility, and networking. Regarding ethics, the findings indicated that staff consistently respected privacy, confidentiality, justice, and fidelity in the management of medical records and were aware of these ethical principles.

7.3 Conclusions

A conclusion is the final section of the research report that summarises and presents key findings and insights obtained from the study (Makar, Akingunola, Aherne, Cole, Aklilu, Zhang, Wong, Hayden, Li, Kirk & Scott 2018). Makar *et al* (2018) warn researchers against adding new information or data not discussed in the main body of the research report. As such, the conclusions section reaffirms the purpose of the study, discusses the key findings and offers insights gained from the study. The conclusion has been written according to the findings of the study and research questions.

7.3.1 Conclusion on preservation strategies in selected public healthcare facilities in Malawi

The findings of the study indicate that selective public healthcare facilities in Malawi have established several effective preservation strategies, including migration, appropriate file formats, backup procedures, dehumidification, privacy and security measures, and disposal practices. Notably, staff demonstrated substantial knowledge and skill in migrating records, ensuring that this critical process was implemented effectively. Backup procedures were consistently applied to all record types, while dehumidification efforts, achieved through the installation of air vents and air conditioners, were executed in storage rooms and offices. Furthermore, robust privacy and security protocols were enforced for all records, and disposal was carried out according to established policies. However, significant gaps remain in the implementation of metadata standards and damage repair processes. Across all five facilities, the absence of metadata creation and assignment reflects a critical area for improvement, as staff lacked the necessary knowledge and skills to effectively manage this aspect of the preservation of records. Additionally, the lack of available equipment and materials for repairing damaged records further highlights the deficiencies in the current practices. In conclusion, the implementation of preservation strategies in selected public healthcare facilities in Malawi was inadequate with a pressing need to enhance capabilities in metadata management and damage repair to ensure comprehensive preservation of medical records. These gaps need to be addressed to safeguard vital health information and improve overall records management practices in the healthcare sector.

7.3.2 Conclusion on preservation policies and standards of the selected public healthcare facilities in Malawi

The study findings revealed that preservation policies and standards were lacking in the public healthcare facilities in Malawi. Public healthcare facilities lacked standards for preserving records such as ISO 15489, ISO 20652, ISO 9001, Moreq, and HL7. Staff were not aware of such standards; guidelines and procedures for disposing of records, filing, titling, indexing, classifying, describing records, backup up records, and accessing/retrieving records were not available; and specific pieces of legislation for preservation of records were absent and methods for raising staff awareness on policies, standards, or legislation were non-existing. However, general policies and guidelines such as Health Sector Strategic Plan III, HMIS Policy and Guidelines, and SOPs were adopted in public healthcare facilities to guide the management of medical records. The conclusion from this finding is that the implementation of preservation policies and standards in the public healthcare facilities in Malawi is poor. Ministry of Health in consultation with the National Records and Archives Services of Malawi, needed to develop relevant policies and standards that would guide preservation in all the public healthcare facilities in Malawi.

7.3.3 Conclusion on storage mechanisms for medical records at the selected public healthcare facilities in Malawi

The findings revealed that computers, portable storage media, storage rooms, and physical storage equipment were the main storage mechanisms for medical records in the public healthcare facilities in Malawi. The study further revealed that robust storage mechanisms such as cloud storage, blockchain technology, artificial intelligence, and DNA storage were not adopted in the healthcare facilities. Some of the barriers to the implementation of robust storage mechanisms were a lack of ICT infrastructure, a lack of funding, and a lack of knowledge and skills among staff handling records. Subsequently, the study concluded that the implementation of storage mechanisms for records in public healthcare facilities was at an initial stage. Therefore, there is a need for huge investment by the Ministry of Health and all relevant stakeholders in ICT infrastructure, knowledge and skills of staff handling records and allocation of adequate resources towards the adoption of robust technologies such as cloud storage, blockchain technology, artificial intelligence, and DNA.

7.3.4 Conclusion on preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi

The study revealed that the majority of staff responsible for preserving records possessed the MSCE, and a few staff members had diplomas in fields such as ICT. Besides the level of knowledge, skills and qualifications, the study revealed a significant shortage of staff dedicated to preserving records. The study established that staff handling records were competent in areas such as communication, positive attitude, teamwork, leadership, flexibility and networking. However, the study revealed that staff were not competent in areas such as artificial intelligence, data processing, disease classification and cancer registration. In ethics, the study established that staff handling records uphold privacy, confidentiality, justice, and fidelity when handling medical records, and staff were aware of these ethical principles. From these findings, the study concluded that the level of preservation knowledge and skills of staff in selected public healthcare facilities was low. Therefore, exposure of staff to staff to training, seminars and workshops would improve their knowledge and skills in preserving records.

7.3.5 Overall conclusion on the research problem

The purpose of this study was to investigate the preservation strategies of medical records at selected public healthcare facilities in Malawi with the view to proposing a framework for the preservation of these records. The research problem draws attention to the fact that the preservation of medical records in public healthcare facilities in Malawi is done in an uncoordinated and unsustainable manner without following any established preservation policies and standards, inadequate storage mechanisms, and a lack of knowledge and skills in preservation by healthcare staff. The literature attributed poor preservation practices to a lack of a framework for the preservation of medical records in healthcare facilities. Poor preservation practices have been widely researched and reported in the literature by various scholars such as Adeleke *et al* (2019), Adu and Ngulube (2017), Alnashmi *et al* (2022), Amin *et al* (2020), Anyira (2020), Asunmo and Yaya (2016), Doricchi *et al* (2022), Gisemba (2022), Kalusopa *et al* (2021), Katuu and Van der Walt (2016), Katurura and Cilliers (2016), Luthuli (2017), Magama (2018), Marutha (2021), Masuku and Ngulube (2020), Mensah and Adams (2014), Mensah (2011), Mosweu (2023), Porogo (2022), Tough and Lihoma (2018), Shahrul Asari, Hussin and Samsudin (2017), Yaya *et al* (2015) and Zhan and Xuan (2021).

The preservation of records in public healthcare facilities in Malawi faces several significant challenges. While the study established that preservation strategies are implemented in all five facilities, there is a noticeable lag in the adoption of critical practices such as metadata management and damage repair. The absence of clear preservation policies and standards was evident, with staff largely unaware of any existing guidelines. Furthermore, there are no effective methods for raising awareness among staff regarding these essential policies or relevant legislation. Instead, healthcare facilities have primarily relied on general policies, such as the Health Sector Strategic Plan III and the HMIS policy and guidelines, along with the SOPs to manage medical records. Some of the current storage mechanisms utilised include computers, portable storage media, storage rooms, and physical storage equipment; however, advanced technologies such as cloud storage, blockchain, artificial intelligence, and DNA storage have not been adopted. The factors contributing to this shortfall include inadequate ICT infrastructure, limited funding, and insufficient knowledge and skills among staff responsible for record preservation. Most staff hold only the MSCE, with few possessing diplomas in ICT-related fields. This lack of expertise is compounded by a critical shortage of personnel dedicated to records preservation. Although staff demonstrate competencies in areas such as communication, teamwork, leadership, and flexibility, they lack essential skills in artificial intelligence, data processing, disease classification, and cancer registration. As a result, these challenges may have severely impacted healthcare facilities, such as access to vital records being compromised, valuable office space being wasted on paper storage, and costs associated with storing medical records may rise significantly. Furthermore, essential records may be misplaced or lost. This can lead to increased stress among employees as they struggle to locate and share information efficiently (Adetunji 2021). Addressing these challenges is crucial for improving the efficacy and reliability of record preservation in Malawi's public healthcare sector.

Several strategies were proposed to address the challenges. Some of the solutions were increasing budget allocation towards the preservation of records, supporting staff for continuous professional initiatives, and developing policies, guidelines, and standards. However, more needs to be done to improve the preservation of records in the public healthcare facilities in Malawi. Therefore, the

present study recommended realistic ways of improving the preservation of medical records in the public healthcare facilities in Malawi. The recommendations have been discussed in the next section, including the framework for the preservation of medical records in healthcare facilities in Malawi.

7.4 Recommendations

In line with the findings discussed in the preceding sections, the study proposes recommendations aimed at improving the preservation of medical records in public healthcare facilities in Malawi.

7.4.1 Recommendations on preservation strategies in selected public healthcare facilities in Malawi

The study found that the implementation of preservation strategies at selected public healthcare facilities in Malawi was inadequate with a lack of metadata and damage repair for preserving records. The study, therefore, recommends the following:

1. All public healthcare facilities in Malawi should adopt metadata standards for records. Records Officers in consultation with the ICT staff should spearhead the process of drafting the standards, such as PREMIS, METS and DC. However, the metadata standards should be tailored to the needs and context of public healthcare facilities in Malawi. The draft standards should be shared with senior management, including staff handling records, for input. The National Records and Archives Services and other stakeholders can be consulted as authorities in records and archives management in Malawi. The plan for drafting metadata standards should include training staff in using and assigning metadata to medical records. Brown (2014) asserts that metadata standards support the consistent description and online accessibility of digital materials for users (Brown 2014). As such, metadata standards assist records officers in categorising various collections, including photographs, images, text documents, spreadsheets, and PDFs (Duff & Pitti 2024).
2. Public healthcare facilities should prioritise the professional development of staff involved in the preservation of records. The study recommends that these personnel be encouraged to attend seminars, workshops, and short courses focused on record preservation, particularly in metadata management. The records officers should collaborate with senior management, including hospital directors and administrators, to develop and support continuous professional development plans with adequate resources. Additionally, records officers should advocate for increased budget allocations to training in medical records preservation. Potential donors, such as the Malawi Liverpool Wellcome Trust, EGPAF, and Lighthouse, can also be approached for funding assistance for staff training initiatives.
3. For preservation strategies to be effectively implemented, equipment and materials for repairing records should be available in all five public healthcare facilities in Malawi. Equipment such as binders and laminators should exist in all the public healthcare facilities in Malawi. The availability of equipment and materials for repairing records requires a huge financial investment. The investment can be directed towards purchasing the equipment and materials, space and training of staff in repairing the records. Therefore, the study recommends that public healthcare facilities in Malawi in consultation with the Ministry of Health and development partners should invest in purchasing equipment for repairing records, allocating space for conducting repairs and training staff in repairing records. Repairing records is vital as it improves access and use of records over a prolonged period.

7.4.2 Recommendations on preservation policies and standards of the selected public healthcare facilities in Malawi

The study revealed significant deficiencies in the implementation of preservation policies and standards within public healthcare facilities in Malawi. To address these shortcomings, the study offers several recommendations:

1. Policies are fundamental for establishing an effective preservation program in any institution, including healthcare facilities. They empower staff responsible for record management to make informed decisions regarding preservation activities. Therefore, healthcare facilities should develop targeted policies specifically addressing preservation, such as records management, retention and disposal, and preservation policies. These tailored policies should encompass critical aspects of a preservation program, including preservation strategies, storage solutions, staff capacity building, and security measures for records. The currently adopted general policies, such as the HMIS policy, inadequately highlight the importance of record preservation.
2. With advancements in technology, public healthcare facilities are increasingly generating records in digital formats. To ensure consistency in the storage and utilisation of these records, it is essential for facilities to adopt and implement preservation standards, including ISO 15489, ISO 20652, ISO 9001, ISO/IEC 26300, ISO 19005, Moreq, and HL7. Zavalina and Burke (2021) emphasise that standards facilitate online access to digital content through critical elements such as title, creator, subject, description, publisher, contributor, date, type, format, identifier, source, language, relation, and coverage. The responsibility for developing and implementing such standards should fall to records officers and health information management system officials, in consultation with ICT staff within the facilities. Collaboration with external stakeholders, such as the National Records and Archives Services, can enhance the development and validation processes of these standards. To ensure successful implementation, the creation of standards should follow a structured approach similar to other strategic policies in healthcare facilities, involving staff participation during the development phase and training on their application to raise awareness and promote usage.
3. In addition to policies and standards, guidelines and procedures are vital for the effective preservation of medical records. They provide practical steps for implementing records management policies, standards, and legislative requirements (Gisemba, Ng'eno, & Bosire 2022). Guidelines should outline clear processes for record disposal, filing, titling, indexing, classification, description, backup, and access/retrieval. The study urges healthcare facilities in Malawi to develop comprehensive guidelines and procedures for all preservation-related functions. Furthermore, staff should receive training and be informed about these guidelines through meetings, workshops, and seminars. Copies of these guidelines and procedures must be widely circulated among all staff members involved in records management, with both digital and physical copies made accessible. Centralised locations, such as the records office or HMIS office, should house these resources for easy retrieval.
4. Legislation plays a critical role in the preservation of medical records by minimising errors such as data duplication, incorrect spelling, and improper formatting. This ensures the quality and consistency of medical records across various departments and institutions (Makeleni & Cilliers 2021). Malawi has relevant legislation, including the National

Archives Act, the Access to Information Act of 2017, the Public Health Act of 2021, the Medical Services Act of 2018, and the Data Protection Act of 2024, which can facilitate the preservation of records in healthcare settings. The study recommends that the National Records and Archives Services of Malawi collaborate with the Ministry of Health and development partners to conduct extensive training and awareness campaigns focused on staff handling records in all healthcare facilities across Malawi. It is further recommended that these training initiatives be sustained over time, contingent upon resource availability. Targeted groups for the training campaigns should include hospital directors, administrators, ICT staff, records officers, HMIS staff, data entry clerks, as well as clinical and nursing staff. For effective implementation, the training could be structured in three phases: the first phase targeting senior personnel such as hospital directors and administrators; the second phase focusing on records staff like ICT personnel, records officers, and data entry clerks; and the third phase aimed at clinical and nursing staff.

7.4.3 Recommendations on storage mechanisms for medical records at the selected public healthcare facilities in Malawi

The study found that the implementation of storage mechanisms for records in public healthcare facilities was at an initial stage. The study recommends the following to improve the situation:

1. Storage mechanisms are fundamental to the preservation of records, as they ensure access, security, timely disposal, and cost reduction (Marutha & Ngoepe 2018; Marutha 2019; Read & Ginn 2015). The study recommends that the Ministry of Health and key stakeholders, such as the Malawi Liverpool Wellcome Trust, EGPAF, and Lighthouse, enhance healthcare facilities in Malawi by improving ICT infrastructure, including computers, servers, and internet connectivity. A robust ICT infrastructure will facilitate the digital storage of records and enhance access for all healthcare staff. This foundation will enable the implementation of advanced storage mechanisms like cloud storage, blockchain technology, AI, and DNA storage. The implementation of these technologies should be phased on availability of financial and human resources, among others. On a short-term, healthcare facilities may consider implementing a low cost encrypted cloud storage and AI applications for character optical recognition and auto-indexing of medical records. Blockchain may be considered for tamper-evident logs on a long-term. However, further research is needed on the feasibility of implementing DNA storage for medical records in healthcare facilities in Malawi. Additionally, healthcare facilities should be supported with additional physical storage equipment, such as shelves, medicine cupboards, folders, file cabinets, cartons, and airtight containers, to improve access, security, and privacy of physical records.
2. Healthcare facilities in Malawi, as one of the low-income countries, have a dire need for funding. Subvention received from the government through the Ministry of Health barely supports preservation activities in healthcare facilities. As such, funding towards preservation can improve the general management of records in healthcare facilities. Therefore, the study recommends that alternative sources of funding be identified from funders such as the World Bank and African Development through the government of Malawi for purchasing ICT infrastructure, purchasing physical storage equipment, and training staff on how to properly store records.
3. Knowledge and skills of staff are critical resources in implementing storage mechanisms for records in the public healthcare facilities in Malawi. The study recommends that

healthcare facilities need to invest in this critical resource by training staff to work with modern and traditional storage mechanisms for records. Therefore, staff should be supported to attend continuous professional development initiatives within and outside the healthcare facilities. Healthcare facilities in Malawi can venture into a memorandum of understanding (MoU) with training institutions in records and archives management, such as Mzuzu University, National Records and Archives Services of Malawi, University of Malawi and Malawi University of Science and Technology. The MoUs will support the training needs of staff for a longer period at a reduced training fee. The training institutions can offer relevant training programmes on cloud storage, blockchain technology, artificial intelligence and DNA storage.

7.4.4 Recommendations on preservation knowledge and skills of health staff at selected public healthcare facilities in Malawi

The study found that the level of preservation knowledge and skills of staff in selected public healthcare facilities was low. Therefore, the study recommends the following:

1. Preservation of medical records partly hinges on the knowledge and skills of staff handling the records. With proper knowledge and skills, staff can properly receive, assemble, code, enter, and file records (Bhat, Gijo & Jnanesh 2016). The study recommends that healthcare facilities in Malawi should support staff to attend short courses, seminars, and workshops on the preservation of records. This is particularly important for most staff with MSCE, Diplomas in ICT, and others. Training in preservation will also improve staff's competencies in artificial intelligence, data processing, disease classification and cancer registration. Training institutions exist in Malawi that can support the continuous professional development of staff, such as Mzuzu University, National Records and Archives Services of Malawi, University of Malawi and Malawi University of Science and Technology. In the long term, healthcare facilities should consider recruiting staff to manage records with relevant qualifications in records management, archives management, information management, and library and information science. Therefore, short-term and long-term training plans and guidelines should be developed by senior management in all the public healthcare facilities in Malawi.

7.5 Proposed framework for the preservation of records

The preservation of records in public healthcare facilities needs to be guided by established standards and procedures in a preservation programme within a preservation framework (Marutha 2020). The framework recognises that preservation and enduring access to the health facilities' records must be fully supported by a preservation programme that includes the implementation of preservation strategies, dissemination of policies and standards, and establishment of best practices, and these activities must be perpetual (University of Minnesota 2022). This study highlights the importance of coordinated and sustainable preservation efforts at both the health facility and national levels. To achieve this, all stakeholders in the healthcare sector, including the Ministry of Health, National Records and Archives Services, various governmental and non-governmental organisations, and healthcare personnel, need to work collaboratively on preserving medical records. Consequently, this study proposes a framework for the sustainable and coordinated preservation of medical records in Malawi's public healthcare facilities. Table 7.1 shows mapping of key features of the models to the new framework and features added or modified. Consequently, Figure 7.1 highlights the logical pathway for the development of the

framework. The framework, illustrated in Figure 7.2, is grounded in the literature review, conceptual framework, and findings and recommendations of the study.

Table 7.1: Mapping Key Features of the Models to New Framework and Features Added/Modified

Key features of the models	Key features of the new framework	Features added/modified in the new framework
Records Lifecycle Model • Creation • Distribution • Use, decision, reference • Maintenance • Disposition	• Creation/receipt • Storage • Use • Safety and security • Disposal	• Creator • User • Infrastructure (storage equipment, internet connectivity equipment power supply equipment etc.) • Environmental conditions • Preservation strategies (dehumidification, damage repair, migration, disposal, metadata, file formats, etc.) • Capacity building initiatives (training, seminars, etc.) • Legal and regulatory framework
DCC Curation Lifecycle Model • Description and representation • Preservation planning • Curate and preserve • Conceptualise • Create/receive • Ingest • Data transfer • Preservation actions • Storage • Security • Data transfer • Dispose • Reappraisal and reselected • Data migration	• Capture • Safety and security • Storage • Metadata • File formats • Disposal • Migration • Safety and security	
OAIS Model • Producer • Consumer • Management • Archive • Ingest • Archive storage • Archive repository • Data management • Administration • Access	• Access • Repository • Storage • Administration and management functions	

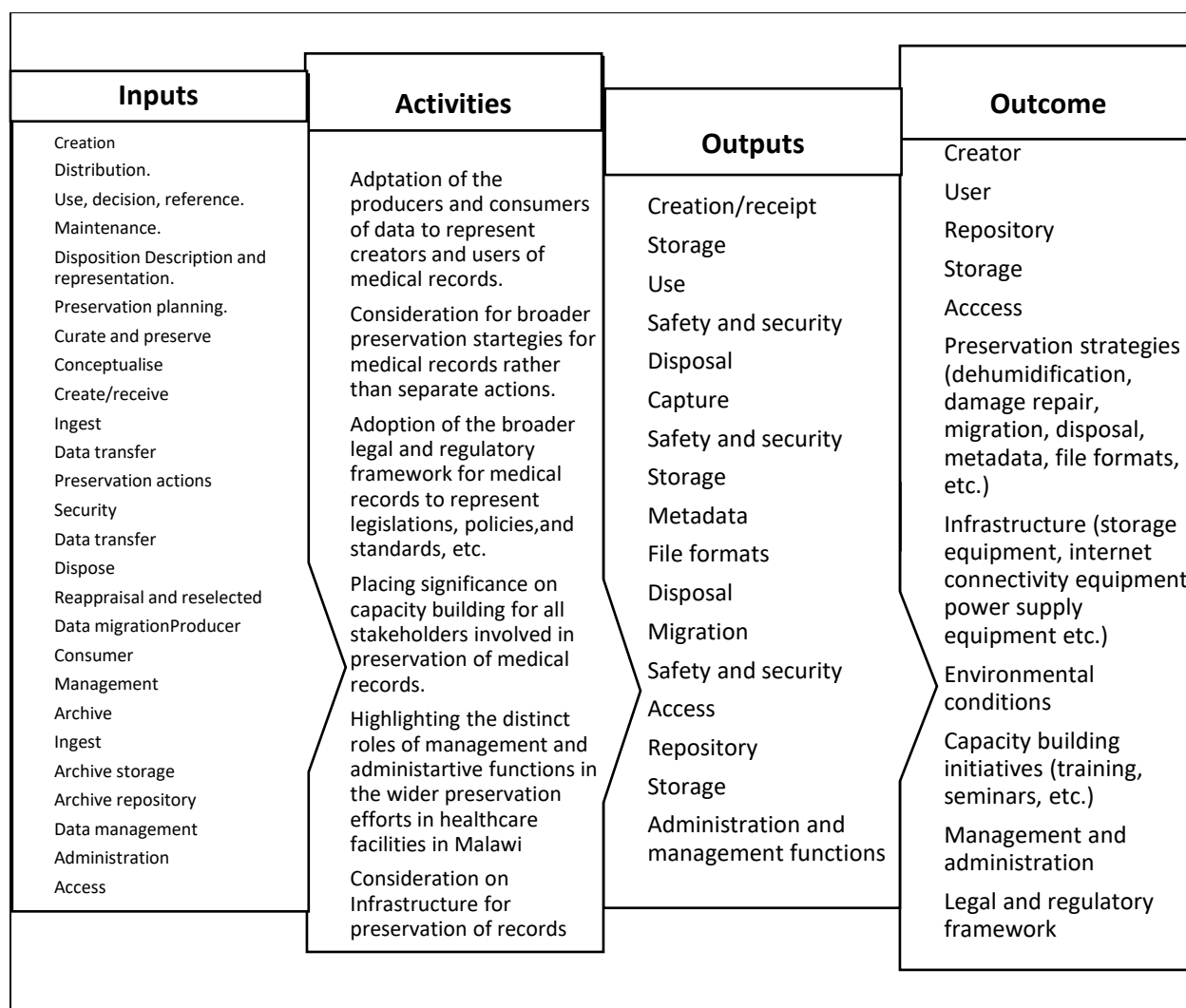


Figure 7.1: Logical Pathway for the Development of the Framework

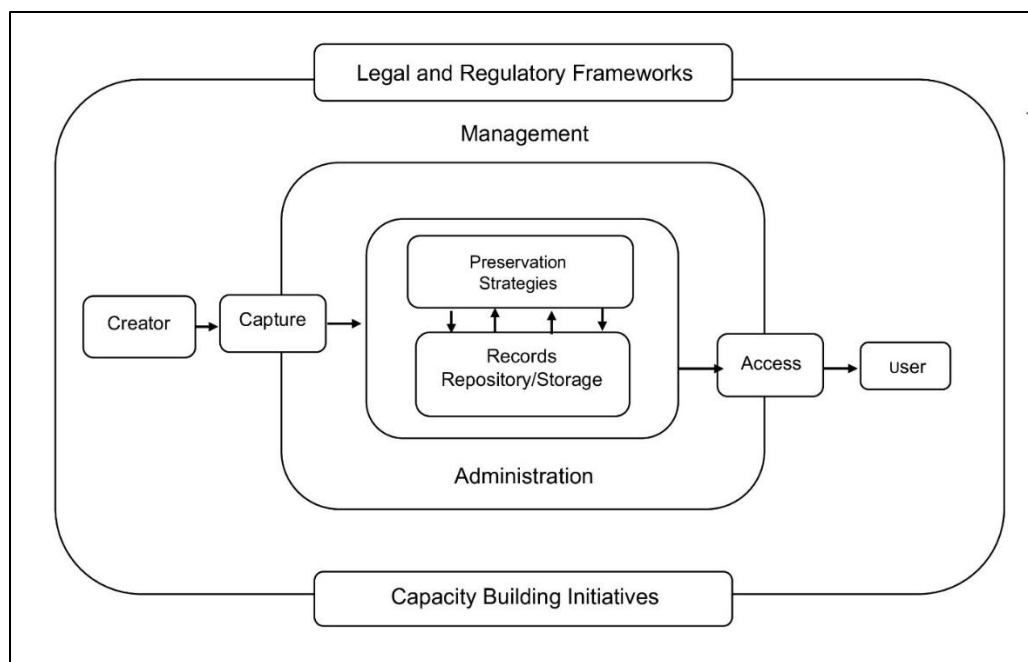


Figure 7.2: Framework for Preservation of Medical Records in Malawi

The proposed framework underscores the fact that preservation of medical records needs to be done in a coordinated and sustainable manner across the lifecycle of records from creation to disposal. The components of the proposed framework have been discussed below.

1. Creators of records, such as hospital administrators, hospital directors, clinical and nursing staff, and ICT directors, are responsible for the creation and/or receipt of records. The records created/received need to be captured by the system for storage. According to the proposed framework, capturing involves documenting the records created/received by identifying elements such as title, author, and date of creation. Capturing also involves ingesting, in the case of digital records, the record into the records repository for permanent preservation. Capture ensures that records exist as evidence of business transactions and can be stored, distributed, accessed and understood by users. Following the OAIS Model, capture/ingest involves checking the quality of records for errors, missing content, and fading information. This ensures that the information accessed is of good quality and can be accessed and used by users in the healthcare facility. Therefore, the proposed framework adopts the Records Lifecycle model, DCC Curation Lifecycle Model and OAIS Model by focusing on create/receive, capture, and access of records. Furthermore, the proposed framework adapts the models by focusing on the creator and user of physical and electronic records.
2. The Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model emphasise the significance of storage in the preservation of records. Storage is regarded as the epicentre of all preservation activities. The records that have been captured need to be stored in a storage facility or repository for future reference or use. The storage facilities must have the required storage equipment while meeting the recommended environmental conditions to safeguard the integrity of records. In the process of storing records, preservation strategies are implemented to ensure long-term preservation of records. Preservation strategies such as migration, backup, safety and security, metadata, file

formats, disaster preparedness, and disposal ensure records are accessible and their metadata is preserved. Preservation strategies also ensure that records are authentic, reliable and usable while maintaining their integrity. The implementation of the preservation strategies must be supported by the necessary infrastructure such as internet connectivity and reliable power supply. In the proposed model, preservation strategies and storage/records repository are complementary. As such, the proposed framework adopts the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model by focusing on storage, repository, metadata, file formats, disposal, migration, and safety and security, while adapting the models with emphasis on infrastructure, environmental conditions, and preservation strategies of physical and electronic records.

3. Based on efficiency and effectiveness in storage, records are easily accessible by users at any time. This is possible because the records are properly described, captured, and metadata added. Access can be achieved physically and digitally. Physically, the user can submit a description of the requested records to the records officer. A description of the records can be obtained from the finding aids, such as registers, inventories, card catalogues, and databases. Digitally, the user can query the database system using a phrase or keywords. The system can display the hints of the records related to the query. The heart of preservation is to ensure long-term storage of records for access by users. Therefore, the proposed framework extends the Records Lifecycle model, DCC Curation Lifecycle Model and OAIS Model with a focus on access to physical and electronic records, rather than data, across their lifecycle through the use of finding aids such as registers, inventories, card catalogues, and databases.
4. To ensure the effective and efficient preservation of records, it is essential to establish robust administration and management functions. The OAIS Model stipulates that a records repository or storage area must incorporate administration activities integral to its operation. The administrative function encompasses the management of routine activities, which include obtaining information from record creators, facilitating access, implementing preservation strategies, storing records, and drafting preservation policies and standards. Additionally, this function involves capacity building for users of the system. In this context, records officers, HMIS officers, and Information and Communication Technology (ICT) officers are tasked with executing the administrative responsibilities of the repository. These administrative entities communicate with the management entity of the repository through regular meetings, detailed reports, and other means of information exchange. The management entity is responsible for overseeing broader policy objectives, such as determining the types of records to be managed and identifying funding sources for the repository. Importantly, the management entity does not engage in the routine administrative tasks of the repository. Typically, the management entity is composed of key figures, including the hospital administrator, records officer, ICT officer, and heads of clinical and nursing departments, who collectively guide the strategic direction and operational oversight of the records repository or storage facilities. The proposed framework enhances the Records Lifecycle model, DCC Curation Lifecycle Model and OAIS Model by considering the administration and management functions in preservation activities such as types of records to be managed and source of funding for preservation of records in healthcare facilities in Malawi.
5. The preservation function in the healthcare facility must operate within the legal and regulatory framework. Examples of legal and regulatory frameworks include legislation,

policies, standards, procedures and guidelines. These instruments guide all the activities of preservation in a healthcare facility, such as the implementation of preservation strategies, storage methods, access requirements and definition of users of the repository/records storage. In addition, legal and regulatory frameworks also impact on capacity building of staff in the preservation of records. As such, the preservation of records is dependent on robust legal and regulatory frameworks. This aspect of the proposed framework enhances the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model by highlighting the significance of broader legal and regulatory framework in the preservation of records across their lifecycle.

6. A critical component of the proposed preservation framework is capacity-building initiatives. All stakeholders involved in preservation—creators, users, administrators, and managers—require training to effectively engage with the system. For instance, creators must receive training on how to produce complete records in appropriate formats, such as PDF, and should be informed about submitting these records to the repository with the correct metadata. Users also need training on how to access the record system effectively. Administrators require training in implementing preservation strategies, including migration, backup, safety and security measures, metadata management, file formats, damage repair, and record disposition. Additionally, they should be trained in the application of various storage mechanisms, such as cloud storage, blockchain technology, and artificial intelligence. Finally, managers need training on the fundamental functions of the preservation system. This training is vital for raising awareness among managers about the system's role and its impact on healthcare service delivery. Equipped with this knowledge, managers can advocate for financial resources and promote policies that support preservation activities in public healthcare facilities in Malawi. This component of the proposed framework extends the Records Lifecycle model, DCC Curation Lifecycle Model, and OAIS Model by focusing on broader capacity building initiatives focusing on all the stakeholders in preservation such as creators, users, administrators, and managers.

7.6 Research implications for theory, policy and practice

Research is implemented to find solutions to research problems by providing recommendations (Shibambu 2019). The present study has highlighted significant issues regarding the preservation of records in the selected public healthcare facilities in Malawi with a view to proposing a framework for the preservation of these records. The findings of the present study conform with those of Chorwe-Sungani (2021), Kamatula (2018), Kayira (2023), Mavazika (2022), Newa and Mwantimwa (2019), and Tough and Lihoma (2018) on the challenges of preservation of medical records in public healthcare facilities in Malawi. The present study builds on the findings of these studies and contributes to the literature on preservation and records management, where empirical studies are limited. In addition, the recommendations and proposed framework for the preservation of medical records in the public healthcare facilities in Malawi can improve the implementation of preservation activities. The study anticipates informing the formulation and implementation of legislation and policies at institutional and national levels, on preservation strategies, storage mechanisms, and the knowledge and skills of staff handling medical records. Some of legislations to be considered for formulation and implementation include the Health Institutions and Facilities Act, Electronic Health Record Systems Regulation, Medical Record Service Regulation, and Electronic Records (Evidence Act). Other legislations such as National Archives Act, Access to

Information Act, and Data Protection Act can be revised to reflect the current changes in medical records management.

7.7 Suggestions for future research

This study employed a mixed methods approach to investigate the preservation of medical records in the selected public healthcare facilities in Malawi. The present study is revolutionary in the sense that it was conducted in a developing country such as Malawi. The findings expose the major challenges of preservation of medical records facing public healthcare facilities in Malawi. Nevertheless, the present study is by no means exclusive to covering all issues of the preservation of medical records in greater depth. Given the conclusions derived from this study and the subsequent recommendations being advanced, the study suggests the following future research areas:

1. The study findings mirrored the preservation of medical records in the public healthcare facilities in Malawi. Similar studies of the same magnitude could be replicated in other healthcare facilities in Malawi, such as private and Christian Health Association of Malawi (CHAM) hospitals.
2. The study investigated the research problem using a convergent research design. Comparative studies can be undertaken to investigate the preservation of medical records in similar jurisdictions, regionally and internationally, to gain insights into the similarities and differences in the research themes.
3. The present study investigated migration as one of the preservation strategies implemented in the public healthcare facilities in Malawi. As much as the issues of general policies and standards were investigated, the study falls short of examining specific policies and standards related to the migration of records. Therefore, future research should focus on policies and standards for the migration of medical records in healthcare facilities locally, regionally and internationally.
4. This study investigated the awareness of health staff regarding file formats. However, it did not explore the relationship between staff awareness and the adoption and use of file formats in the preservation of medical records. Therefore, further research is needed to examine the correlation between the level of staff awareness and the adoption of preservation strategies, such as the use of file formats, in public healthcare facilities.
5. The study found that public healthcare facilities in Malawi have adopted general policies for preserving records, such as the HMIS policy and guidelines. It was argued that the national policies, guidelines and regulations may not substitute institutional policies for preserving records. However, it is not clear from the study the impact of adopting such general instruments to guide the preservation of records in healthcare facilities in Malawi. Further investigation must be done on the extent of the use of such general instruments and their impact on the preservation of records in healthcare facilities.
6. The present study investigated storage mechanisms for records, including cloud storage, blockchain technology, artificial intelligence, and DNA storage, revealing issues related to their adoption, benefits, challenges, and staff knowledge and skills. However, the study did not adequately address costs, infrastructure needs, required skills, policies, standards, and potential risks associated with implementing these technologies in healthcare facilities in Malawi. Therefore, further research is needed to assess the cost-benefit analysis of adopting cloud storage, blockchain technology, artificial intelligence, and DNA storage

compared to traditional computers and portable storage media for preservation of records in healthcare settings in Malawi and abroad.

7. As emphasised by the present study, migration of records is important because it ensures long-term preservation and access to records. The study investigated the migration of records, including methods and equipment, documentation and capacity building of staff. However, the study did not investigate digitisation of records, which is a critical component of a preservation programme. It is recommended that future studies should focus on the digitisation of records in healthcare facilities. Future studies may consider exploring issues such as digitisation equipment, digitisation procedures and guidelines, digitisation policies and standards, and capacity building of staff involved in the digitisation of records in healthcare facilities.

7.8 Final conclusion

The research set out to unravel preservation strategies at selected public healthcare facilities in Malawi with a view to proposing a practical framework for preserving medical records. Specific preservation issues relevant to the research were preservation strategies, policies and standards, storage mechanisms, knowledge and skills, and a framework for preservation of medical records. Furthermore, challenges and opportunities related to the preservation of medical records were identified and discussed. All in all, this research challenges the traditional ideologies of preserving medical records without following any established preservation policies and standards, inadequate storage mechanisms, and a lack of knowledge and skills in preservation by healthcare staff. The research achieves this by unearthing the current status of preservation of medical records in selected public healthcare facilities in Malawi and proposes a practical framework for guiding preservation activities by healthcare staff. Considering the significance of medical records in the delivery of healthcare services to patients, this research holds the promise of supporting timely access and use of medical records by healthcare staff. This is possible through the adoption of the proposed framework for preserving medical records. Therefore, this study calls upon all stakeholders in the healthcare system in Malawi to support the adoption and implementation of the proposed framework for the preservation of medical records. Consequently, the delivery of healthcare services and the welfare of patients in the public healthcare facilities in Malawi would greatly improve.

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APPENDICES

Appendix 1: Questionnaire for Data Entry Clerks and ICT Officers

QUESTIONNAIRE NO	

QUESTIONNAIRE FOR DATA ENTRY CLERKS AND ICT OFFICERS

FRAMEWORK FOR THE PRESERVATION OF MEDICAL RECORDS IN SELECTED PUBLIC HEALTHCARE FACILITIES IN MALAWI

Dear Respondent,

My name is Austine Phiri, a Senior Lecturer in the Department of Information Sciences at Mzuzu University, Malawi. I am working on my PhD at the Department of Information Science at the University of South Africa. I am grateful for your time to answer these questions designed to collect data concerning the preservation of medical records in selected public healthcare facilities in Malawi. The information provided herein would be useful in improving the preservation of medical records in Malawi and enhancing access and use of information for healthcare service delivery. You have been selected to respond to this questionnaire and your participation is voluntary. This questionnaire will take approximately 10 minutes to answer. Information obtained through this questionnaire is designed for academic purposes only. The data will be analysed and interpreted by the researcher alone and will be treated with the utmost confidentiality. To ensure confidentiality and maintain anonymity, you do not have to write your name on this questionnaire. The information will be handled confidentially and only the researcher will have access to it. Your willingness to respond to the questionnaire items will be highly appreciated.

For further information, please contact the researcher through the following means:

Mobile: +265 995 635 299

Email: austine_phiri@yahoo.com; 16672313@mylife.unisa.ac.za

Department of Information Science, University of South Africa, South Africa

Section A: Demographic Profile

1. Health Facility

Name	Tick
Mzuzu Central Hospital	
Kamuzu Central Hospital	
Queen Elizabeth Central Hospital	
Zomba Central Hospital	
Zomba Mental Hospital	

2. Department/Section (*Specify*) _____

3. Gender (*Tick*)

Gender	Tick

Male	
Female	

4. Highest Qualification (*specify*) _____

5. Work Position (*specify*) _____

6. Age Group (*Tick*)

Category	Tick
18-24	
25-30	
31-35	
36-40	
41-45	
46-50	
51-55	
56-60	
60-65	
Other (<i>specify</i>)	

7. Types of medical records created and received (*You may tick more than one*)

S/N	Type	Tick
1	Health passports	
2	Case files	
3	Registers	
4	Personal notes	
5	Laboratory results	
6	Radiology reports	
7	Doctors, clinical reports	
8	Nurses' patient reports	
9	Birth certificates	
10	Death certificates	
11	Others (<i>specify</i>)	

Section B: Preservation Strategies

8. Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Migration					

1	Physical records are migrated to electronic format through scanning and other means.					
2	Migration equipment and software, such as scanners, computers, servers and databases, are available.					
3	Documentation for migration procedures has been developed and is used by staff.					
4	Staff have the knowledge and skills to migrate records.					
	Backup procedures					
5	Physical and electronic records are regularly backed up.					
6	Backup equipment is available, such as computers, Google Drive, and servers.					
7	A reliable power supply exists to support backup procedures for records such as the ESCOM line, solar power, and a generator set.					
8	Back-up procedure manuals have been developed for use by staff.					
9	Staff handling records have the knowledge and skills to back up records.					
	File formats					
10	File formats are used to preserve records such as PDF, SQL and TIFF.					
11	Necessary equipment and software are available to manage records in various formats such as PDF, SQL, and TIFF.					
	Dehumidification					

12	Dehumidification equipment is available, such as space heaters and energy recovery ventilators.					
13	Best practices are followed for dehumidifying storage places, such as good ventilation, storing records away from outside walls, keeping records out of the basement and packaging records in archival containers.					
	Metadata					
14	Metadata has been created to identify and locate physical and electronic records.					
15	Appropriate metadata standards have been adopted, such as PREMIS, METS, DC, etc.					
16	Metadata documentation is available for use by staff.					
17	Data entry clerks and ICT officers have the knowledge and skills to create and assign metadata to records.					
	Damage repair					
18	Damaged records are regularly repaired by straightening folded edges and pages, etc.					
19	Equipment for repairing records is available.					
	Privacy and Security					
20	Only authorised users have access to records.					
21	Doors and windows of the records storage area and filing cabinets are securely locked.					

22	CCTV cameras have been installed in offices, records storage areas, etc.					
23	Security measures such as firewalls, passwords, encryption, and redaction are used to protect electronic records.					
24	Regular security and facility inspections take place in the records storage area, offices, etc.					
	Disposal of records					
25	Records are properly disposed of according to the retention and disposal policy.					
26	Disposal methods have been established, such as transferring records to a records centre, burning, and shredding.					
27	A disposal manual exists that guides staff in properly disposing of records.					

Section C: Policies and Standards

9. Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Policies					
28	Written and approved policies are available, such as records management policy, retention and disposal policy, health information management policy, guidelines and regulations.					
29	Data entry clerks and ICT officers are aware of the					

	policies through sensitising/awareness campaigns and meetings.					
	Standards					
30	Standards have been adopted for managing medical records, such as ISO 15489, ISO 20652, ISO 9001, Moreq, and HL7.					
31	Data entry clerks and ICT officers are aware of the standards through awareness campaigns, meetings, seminars and workshops.					
	Guidelines and procedures					
32	Procedures for disposing of records have been developed at the facility.					
33	Filing procedures for titling, indexing, classifying, and describing records are available.					
34	Guidelines and procedures for the backup of records are available to staff.					
35	Guidelines and procedures for accessing/retrieving records are available to staff.					
	Legislation					
36	The facility adheres to laws such as the National Archives Act, Access to Information Act of 2017, Data Protection Act of 2024, etc.					
37	The pieces of legislation exist in the health facility.					
38	Staff are aware of these laws for preserving records through awareness campaigns, meetings, seminars and workshops.					

Section D: Storage Mechanisms

10. Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Cloud storage					
39	A healthcare facility uses cloud storage to store records.					
40	An ICT infrastructure exists that supports the use of cloud storage services for records.					
41	Data entry clerks and ICT officers have the knowledge and skills to store records in the cloud.					
	Blockchain technology					
42	The facility uses blockchain technology to store electronic records.					
43	An ICT infrastructure exists that supports the use of blockchain technology.					
44	Data entry clerks and ICT officers have the knowledge and skills to store records using blockchain technology.					
	Artificial Intelligence					
45	The facility uses Artificial Intelligence to store records.					
46	Artificial Intelligence has improved the storage and retrieval of medical records.					
47	Data entry clerks and ICT officers have the knowledge and skills in Artificial Intelligence.					
	DNA Storage					

48	The facility uses DNA to store records.					
49	Data entry clerks and ICT officers have the knowledge and skills in DNA technology.					
	Computers					
50	An adequate number of computers is available for storing records.					
51	Computers have improved the security of stored records in the facility.					
52	Computers have reduced the storage costs for records in the facility.					
	Portable storage media					
53	Traditional media such as microfilm, cassettes, and floppy disks are used for storing records.					
54	Modern media such as CDs, DVDs, flash disks, hard disk drives, and solid-state drives are used for storing records.					
	Storage rooms					
55	Storage rooms are regularly cleaned and dusted.					
56	Storage rooms are well-ventilated.					
57	Air conditioners have been installed to regulate the temperature in the rooms.					
58	Adequate lighting has been installed in the rooms.					
59	Blinds and thick curtains have been installed in the rooms to insulate records from the sun.					
60	The rooms are equipped with equipment such as fire extinguishers and fire					

	alarms for disaster preparedness.					
	Physical storage equipment					
61	Equipment such as shelves, cupboards, folders, file cabinets, boxes, and airtight containers exist and are adequate for storing records.					
62	Shelves, cupboards, folders, file cabinets, boxes, and airtight containers are in good working condition.					
63	There is adequate space to maintain file cabinets, boxes and airtight containers for storing records.					

Section E: Knowledge and Skills

- Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Knowledge and skills					
64	Staff responsible for preserving records have the necessary qualifications.					
65	An adequate number of staff is available for preserving records.					
66	Staff have knowledge and skills in receiving, assembling, coding, titling, entry and filing records.					
67	Staff have been exposed to workshops, short courses,					

	seminars, and internships on preservation.					
68	Staff are supported by the institution to attend workshops, short courses, seminars, and internships on preservation.					
69	On-job orientations, monitoring, and follow-up are available to staff responsible for preservation.					
70	Staff have the knowledge and skills to work with hardware and software such as computers, scanners, printers, photocopiers, databases etc.					
	Competencies					
71	Staff have the competencies in areas such as communication, positive attitude, teamwork, leadership, flexibility and networking.					
72	Staff are competent in areas such as artificial intelligence, data processing, and disease classification.					
	Ethical considerations					
73	Ethical considerations such as privacy, confidentiality, justice and fidelity are adhered to when handling medical records.					
74	Staff are aware of ethical considerations such as privacy, confidentiality, justice and fidelity.					

**END OF QUESTIONNAIRE
THANK YOU FOR YOUR TIME**

Appendix 2: Questionnaire for Clinical and Nursing Staff

QUESTIONNAIRE NO	

QUESTIONNAIRE FOR CLINICAL AND NURSING STAFF

FRAMEWORK FOR THE PRESERVATION OF MEDICAL RECORDS IN SELECTED PUBLIC HEALTHCARE FACILITIES IN MALAWI

Dear Respondent,

My name is Austine Phiri, a Senior Lecturer in the Department of Information Sciences at Mzuzu University, Malawi. I am working on my PhD at the Department of Information Science at the University of South Africa. I am grateful for your time to answer these questions, designed to collect data concerning the preservation of medical records in selected public healthcare facilities in Malawi. The information provided herein would be useful in improving the preservation of medical records in Malawi and enhancing access and use of information for health service delivery. You have been selected to respond to this questionnaire, and your participation is voluntary. This questionnaire will take approximately 10 minutes to answer. Information obtained through this questionnaire is designed for academic purposes only. The data will be analysed and interpreted by the researcher alone and will be treated with the utmost confidentiality. To ensure confidentiality and maintain anonymity, you do not have to write your name on this questionnaire. The information will be handled confidentially, and only the researcher will have access to it. Your willingness to respond to the questionnaire items will be highly appreciated.

For further information, please contact the researcher through the following means:

Mobile: +265 995 635 299

Email: austine_phiri@yahoo.com; 16672313@mylife.unisa.ac.za

Department of Information Science, University of South Africa, South Africa

Section A: Demographic Profile

11. Health Facility

Name	Tick
Mzuzu Central Hospital	
Kamuzu Central Hospital	
Queen Elizabeth Central Hospital	
Zomba Central Hospital	
Zomba Mental Hospital	

12. Department/Section (*Specify*) _____

13. Gender (*Tick*)

Gender	Tick
Male	

Female	

14. Highest Qualification (*specify*) _____

15. Work Position (*specify*) _____

16. Age Group (*Tick*)

Category	Tick
18-24	
25-30	
31-35	
36-40	
41-45	
46-50	
51-55	
56-60	
60-65	
Other (<i>specify</i>)	

17. Types of medical records created and received (*You may tick more than one*)

S/N	Type	Tick
1	Health passports	
2	Case files	
3	Registers	
4	Personal notes	
5	Laboratory results	
6	Radiology reports	
7	Doctors, clinical reports	
8	Nurses' patient reports	
9	Birth certificates	
10	Death certificates	
11	Others (<i>specify</i>)	

Section B: Preservation Strategies

18. Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree not agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Privacy and Security					

1	Only authorised users have access to medical records.					
2	Doors and windows of the records storage area and filing cabinets are securely locked.					
3	CCTV cameras have been installed in offices, records storage areas, etc.					
4	Security measures such as firewalls, passwords, encryption, and redaction are used to protect electronic records.					
	Disposal of records					
5	Records are properly disposed of according to the retention and disposal manual and policy.					
6	Disposal methods have been established, such as burning and shredding.					

Section C: Policies and Standards

19. Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree not agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Policies and standards					
7	Policies are available for preserving medical records, such as records management policy, retention and disposal policy, health information management policy, guidelines and regulations.					
8	Clinical and nursing staff are aware of the policies through sensitising/awareness campaigns and meetings.					

9	Filing procedures for titling, indexing, classifying, and describing records are available.					
10	Guidelines and procedures for accessing/retrieving records are available to staff.					

Section D: Storage Mechanisms

20. Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Cloud storage					
11	The facility uses cloud storage to store records.					
12	Clinical and nursing staff have the knowledge and skills to store records in the cloud.					
	Blockchain technology					
13	The facility uses blockchain technology to store electronic records.					
14	Clinical and nursing staff have the knowledge and skills to store records using blockchain technology.					
	Artificial Intelligence					
15	The facility uses Artificial Intelligence to store records.					
16	Clinical and nursing staff have the knowledge and skills in Artificial Intelligence.					
	Portable storage media					
17	Traditional media such as microfilm, cassettes, and floppy disks are used for storing records.					

18	Modern media such as CDs, DVDs, flash disks, hard disk drives, and solid-state drives are used for storing records.					
	Storage rooms					
19	Storage rooms are regularly cleaned and dusted.					
20	Storage rooms are well-ventilated.					
21	Air conditioners have been installed to regulate the temperature in the rooms.					
22	Adequate lighting has been installed in the rooms.					
23	Blinds and thick curtains have been installed in the rooms to insulate records from the sun.					
24	The rooms are equipped with equipment such as fire extinguishers and fire alarms for disaster preparedness.					
	Physical storage equipment					
25	Equipment such as shelves, cupboards, folders, file cabinets, boxes, and airtight containers exists and is adequate for storing records.					
26	Shelves, cupboards, folders, file cabinets, boxes, and airtight containers are in good working condition.					
27	There is adequate space to maintain file cabinets, boxes and airtight containers for storing records.					

Section E: Skills and Knowledge

2. Please rate the following statements on a 5-point scale as follows:

	1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree					
	Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
S/N	Knowledge and skills					
28	Clinical and nursing staff have knowledge and skills in receiving, assembling, coding, titling, entering and filing records.					
29	Clinical and nursing staff have been exposed to workshops, short courses, seminars, and internships on preserving records.					
30	Clinical and nursing staff are supported by the institution to attend workshops, short courses, seminars, and internships on preserving records.					
31	On-the-job orientations, monitoring, and follow-up are available to clinical and nursing staff.					
	Competencies					
34	Clinical and nursing staff are competent in areas such as artificial intelligence, data processing, disease classification and cancer registration.					

**END OF QUESTIONNAIRE
THANK YOU FOR YOUR TIME**

Appendix 3: Interview Guide for Hospital Directors and Administrators

INTERVIEW GUIDE FOR HOSPITAL DIRECTORS AND ADMINISTRATORS

Time:	Date:

Section A: Background Information

1. Health Facility

Name	Tick
Mzuzu Central Hospital	
Kamuzu Central Hospital	
Queen Elizabeth Central Hospital	
Zomba Central Hospital	
Zomba Mental Hospital	

2. Department/Section (*Specify*) _____

3. Gender (*Tick*)

Gender	Tick
Male	
Female	

4. Highest qualification (*specify*) _____

5. Designation (*specify*) _____

6. Please, could you describe your job?

Section B: Policies and Standards

7. Does the facility have written and approved policies for preserving records, such as records management policy, retention and disposal policy, health information management policy, guidelines and regulations?
8. If yes in question 7 above, are the policies updated?
9. Does the facility adhere to relevant laws (legislation) for preserving records?
10. Are the staff aware of the policies, standards and legislation for preserving records at the facility?
11. If yes in question 10 above, what strategies have been implemented by the facility to raise the level of awareness of staff of the existing policies?

Section C: Storage Mechanisms

12. Does the health facility have a budget/funding for purchasing records storage equipment and other resources?

Section D: Knowledge and Skills

13. What are the qualifications of staff responsible for preserving records?
14. What strategies are implemented by the facility to build the capacity of staff responsible for preserving records?

15. Does the facility support staff to attend short courses, seminars, and internships in the preservation of records?
16. Does the facility offer on-the-job orientations, monitoring, and follow-up for staff responsible for records?
17. Does the facility have funding for the continuous professional development of staff in the preservation of records?
18. Does the facility have continuous professional development guidelines for staff responsible for records?

**END OF INTERVIEW
THANK YOU FOR YOUR TIME**

Appendix 4: Interview Guide for Records Officers

INTERVIEW GUIDE FOR RECORDS OFFICERS

Time:	Date:

Section A: Background Information

1. Health Facility

Name	Tick
Mzuzu Central Hospital	
Kamuzu Central Hospital	
Queen Elizabeth Central Hospital	
Zomba Central Hospital	
Zomba Mental Hospital	

2. Department/Section (*Specify*) _____

3. Gender (*Tick*)

Gender	Tick
Male	
Female	

4. Highest qualification (*specify*) _____

5. Designation (*specify*) _____

6. Please, could you describe your job? _____

7. What are the types of records created and received by the health facility? _____

Section B: Preservation Strategies

8. What are the strategies adopted by the facility in preserving records?
9. What measures have been implemented to ensure the privacy and security of records?
10. How are records disposed of at the facility?

Section C: Policies and Standards

11. Does the facility have written and approved policies for preserving records?
12. Does the facility have standards for preserving records?
13. Does the facility adhere to relevant legislation for preserving records?
14. Are staff aware of the policies and standards for preserving records at the hospital?
15. What methods have been adopted by the facility to raise the level of awareness of staff on policies, standards, and legislation?

Section D: Storage Mechanisms

16. What are the storage mechanisms for physical and electronic records at the facility?
17. If yes in question 16 above, what is the condition of the storage equipment and rooms in terms of cleanliness, ventilation, temperature and lighting?

18. Does the facility have a budget for purchasing storage equipment and other records preservation-related activities?
19. What are some of the disaster preparedness measures implemented by the facility?

Section E: Knowledge and Skills

20. What are the qualifications of staff responsible for preserving medical records?
21. In your opinion, what is the level of knowledge and skills of staff on the preservation of records?
22. Does the facility have an adequate number of staff responsible for preserving records?
23. Does staff adhere to ethical considerations such as privacy, confidentiality, justice and fidelity when handling medical records?
24. Does the facility support staff to attend short courses, seminars, and internships on the preservation of records?
25. Does the facility offer on-the-job orientations, monitoring, and follow-up for staff responsible for preserving records?
26. Does the facility have funding for the continuous professional development of staff in the preservation of records?
27. Does the facility have continuous professional development guidelines for staff?

**END OF INTERVIEW
THANK YOU FOR YOUR TIME**

Appendix 5: Observation Checklist

OBSERVATION CHECKLIST

1. Health Facility

Name	Tick
Mzuzu Central Hospital	
Kamuzu Central Hospital	
Queen Elizabeth Central Hospital	
Zomba Central Hospital	
Zomba Mental Hospital	

2. Department/Section (*Specify*) _____

List of activities to observe

1. Availability of equipment for preservation of medical records:

Equipment	Available	Not Available
Equipment for preserving records, such as computers, scanners, servers, and databases		
Equipment for disposing of records, such as shredders and incinerators.		
Dehumidification equipment, such as space heaters and energy recovery ventilators		
Electricity supply equipment such as ESCOM line, solar power, and a generator set.		

2. Availability of equipment for storing records:

Equipment	Available	Not Available
Storage equipment for physical records, such as shelves, cupboards, folders, file cabinets, boxes, and airtight containers		
Storage devices for electronic records such as cassettes, CDs, DVDs, Flash Disks, computers, hard disk drives, solid-state drives, servers, and flash drives		

3. Condition of facilities for storing medical records:

Condition	Yes	No
Cleaned and dusted storage rooms		
Installation of air ventilation systems in the storage facilities, such as air vents and air conditioners		

Closed-circuit television (CCTV) cameras are installed.		
The ceilings, corners, and walls of storage rooms are very clean and sound without evidence of dampness, cracks, damage or deterioration.		
Records are kept at a recommended temperature of 18 to 21 Degrees Celsius.		
Disaster preparedness equipment is installed, such as fire alarms, fire extinguishers, water leak detectors, smoke detectors and fire detectors.		
Adequate space to maintain file cabinets, boxes and airtight containers		
Blinds and thick curtains have been installed to insulate records from the sun.		

4. Assembling, coding, titling, entry and filing system for records
5. Programmed continuous professional development activities such as workshops, short courses, seminars, and internships on notice boards and in offices.

END OF OBSERVATION CHECKLIST

Appendix 6: Document Review Checklist

DOCUMENT REVIEW CHECKLIST

1. Health Facility

Name	Tick
Mzuzu Central Hospital	
Kamuzu Central Hospital	
Queen Elizabeth Central Hospital	
Zomba Central Hospital	
Zomba Mental Hospital	

2. List of documents to review

- Policies for preserving records
- Standards for preserving records
- Legislation for preserving records
- Guidelines and procedures for preserving records
- Continuous professional development guidelines
- Budget/funding for preservation of records

3. Programme/schedule for the preservation of records

	Tick
Available	
Not Available	

4. Analysis of short courses, workshops, and seminars on the preservation of records

	Tick
Available	
Not Available	

END OF DOCUMENT REVIEW CHECKLIST

Appendix 7: Ethical Clearance from UNISA



COLLEGE OF HUMAN SCIENCES RESEARCH ETHICS REVIEW COMMITTEE

20 November 2023

Dear Mr Austine Phiri

NHREC Registration # :
Rec-240816-052
CREC Reference # :
16672313_CRECHS_2023

Decision:
Ethics Approval from 20 November
2023 to 20 November 2024

Researcher(s): Name: Mr. A. Phiri
Contact details: 16672313@mylife.unisa.ac.za
Supervisor(s): Name: Prof. A. D. S. Rodrigues
Contact details: trodriqu@unisa.ac.za

Title: Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi

Degree Purpose: PhD

Thank you for the application for research ethics clearance by the Unisa College of Human Science Ethics Committee. Ethics approval is granted for one year.

The *low-risk application* was reviewed by College of Human Sciences Research Ethics Committee, in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the



University of South Africa
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PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

- confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
 6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
 7. No fieldwork activities may continue after the expiry date (**20 November 2024**). Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **16672313_CREC_CHS_2023** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,

Signature:



Prof. KB Khan
CHS Research Ethics Committee Chairperson
Email: khankb@unisa.ac.za
Tel: (012) 429 8210

Signature: PP



Prof ZZ Nkosi
Exécutive Dean: CHS
E-mail: nkosizz@unisa.ac.za
Tel: 012 429 6758



University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
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Appendix 8: Ethical Clearance from MZUNIREC



MZUZU UNIVERSITY

DIRECTORATE OF RESEARCH

Mzuzu University
Private Bag 201
Luwinga
Mzuzu 2
MALAWI
TEL: 01 320 722
FAX: 01 320 648

MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC)

Ref No: MZUNIREC/DOR/23/120

15/11/2023.

Austine Phiri,
Mzuzu University,
P/Bag 201,
Luwinga,
Mzuzu 2.

austine_phiri@yahoo.com

Dear Austine,

RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR PROTOCOL REF NO: MZUNIREC/DOR/23/120: FRAMEWORK FOR THE PRESERVATION OF MEDICAL RECORDS IN SELECTED PUBLIC HEALTHCARE FACILITIES IN MALAWI.

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required to be sought from the Mzuzu University Research Ethics Committee (MZUNIREC) in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee with a final report of the study. The Committee reserves the right to carry out compliance inspection of this approved protocol at any time as may be deemed by it. As such, you are expected to properly maintain all study documents including consent forms.

Committee Address:

Secretariat, Mzuzu University Research Ethics Committee, P/Bag 201, Luwinga, Mzuzu 2; E-mail address: mzunirec@mzuni.ac.mw

Wishing you a successful implementation of your study.

Yours Sincerely,



Gift Mbwele

SENIOR RESEARCH ETHICS ADMINISTRATOR

For: CHAIRMAN OF MZUNIREC

Committee Address:

Secretariat, Mzuzu University Research Ethics Committee, P/Bag 201, Luwinga, Mzuzu 2; E-mail address: mzunirec@mzuni.ac.mw

Appendix 9: Authorisation Letter from Mzuzu Central Hospital

Telephone: 01320916/878
Fax: 320223/320973/878
Email:
mzuzucentraldirector@gmail.com



In reply please quote No.
The Hospital Director
Mzuzu Central Hospital
P/Bag 209
Luwinga
Mzuzu 2

05th June, 2023

Austine Phiri, PhD Student
University of South Africa
Preller Street, Muckleneuk Ridge
P.O. Box 392 UNISA 0003
Pretoria, South Africa.

Phone: (+265) 995635299
Email: ur@mzuni.ac.mw

Dear Mr. Austine Phiri,

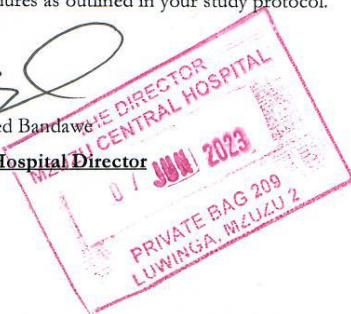
PERMISSION TO CONDUCT A RESEARCH STUDY AT MZUZU CENTRAL HOSPITAL

Reference is made to your email received on Tuesday 22nd May, 2023 in which you are seeking permission to conduct a research study titled *"Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi."* at Mzuzu Central Hospital (MCH). MCH Research Committee has now reviewed your study protocol and I am pleased to inform you that permission has been granted. You can use this letter as evidence of support from an institution (MCH) when seeking ethical clearance from COMREC/NHSRC/NCST or any other recognized Institutional Review Board (IRB).

Note: Please take note that MCH policy requires that you pay a financial contribution to the institution which is pegged at 5% of your total research budget before you can start implementing your study at the facility. If the study will be implemented in multiple sites an appropriate amount shall be determined taking into account the number of sites in which the study is to be implemented. Payment is strictly through National Bank of Malawi, Mzuzu Central Hospital Research and Partnership Account, Current account number **1004797902**.

When you are ready for data collection at MCH you will be required to present this letter, ethical approval letter from a recognized ethical review body and evidence of payment of the stipulated fees to the Chairperson of MCH Research Committee before you can begin data collection. We trust that you shall strictly adhere to study procedures as outlined in your study protocol.


Dr. Ted Banda
The Hospital Director



Appendix 10: Authorisation Letter from Kamuzu Central Hospital

REF. NO. KCH/RESEARCH
TELEPHONE NO.: (265) 753 555
TELE FAX NO.: (265) 756 380

PLEASE ADDRESS ALL
COMMUNICATIONS TO: THE
HOSPITAL DIRECTOR
E-MAIL: Kch@sdpn.org.mw



MINISTRY OF HEALTH
KAMUZU CENTRAL HOSPITAL
P. O. Box 149
LILONGWE
MALAWI
5TH JUNE 2023

Ref : nhsr/2023

The Chairman,
Mzuzu University Research Ethics Committee,
Private Bag 201,
Luwinga,
Mzuzu 2.

Dear Sir,

**SUPPORT LETTER FOR A STUDY TITLED" FRAMEWORK FOR
PRESERVATION OF MEDICAL RECORDS IN SELECTED PUBLIC HEALTHCARE
FACILITIES IN MALAWI."**

I write to express my support for the above study to be undertaken by the investigator.

We look forward to facilitating the successful conduct and execution of the study once all the required regulatory approvals are obtained.

Dr Jonathan Ngoma
Hospital Director



Appendix 11: Authorisation Letter from Zomba Central Hospital

Telephone No.: 01 526266/01525195
Telefax No.: (265) 1 524538
Telex No.:
E-Mail: medzch@malawi.net



ZOMBA CENTRAL HOSPITAL
P.O. BOX 21
ZOMBA
MALAWI

All correspondences should be addressed to:
The Hospital Director

16th June 2023

The Chairman
Mzuzu University Research and Ethics Committee
Private bag 201
Luwinga 2
MZUZU

LETTER OF NO OBJECTION

On behalf of Zomba Central Hospital management, I am pleased to inform you that **Mr Austine Phiri** would like to conduct a study at Zomba Central Hospital, and a no objection has been granted.

The study title is: 'FRAMEWORK FOR THE PRESERVATION OF MEDICAL RECORDS IN SELECTED PUBLIC HEALTHCARE FACILITIES IN MALAWI.'

Your consideration will be greatly appreciated.

Yours faithfully,


Saulos Nyirenda (Dr)
HOSPITAL DIRECTOR



Appendix 12: Authorisation Letter from Zomba Mental Hospital



Zomba Mental Hospital,
P.O. Box 38,
Zomba.
26/05/2023.

Austine Phiri,
University of South Africa,
Preller St, Muckleneuk, Pretoria, 0002,
South Africa.

Dear Sir,

PERMISSION TO CONDUCT A STUDY AT ZOMBA MENTAL HOSPITAL

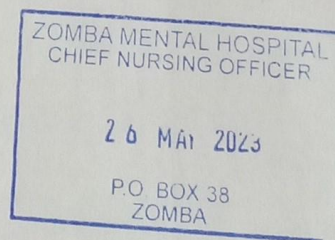
Permission is hereby granted to Austine Phiri, student number **16672313** of the University of South Africa, to carry out his research at Zomba Mental Hospital entitled **“Framework For The Preservation Of Medical Records In Selected Public HealthCare Facilities In Malawi”** upon ethical approval from relevant ethics and research committee.

In your dissemination plan, remember to share a copy of the findings to Zomba Mental Hospital too.

Be advised that the hospital is at liberty to withdraw support at any stage should there be any breach of study protocol. You are further asked to pay K50,000 to Zomba Mental Hospital as a research fee before you commence the study.

Emmanuel Mpoola – Chair, Research Committee

For: Hospital Director



Appendix 13: Authorisation Letter from Queen Elizabeth Central Hospital

Telephone: (265)874 333/877 333
Facsimile: (265)874 603
Email: queenshospital@malawi.net

All Communications should be addressed to:
The Hospital Director



In reply please quote No.
QUEEN ELIZABETH CENTRAL HOSPITAL
MINISTRY OF HEALTH
P. O. BOX 95
BLANTYRE
MALAWI

Ref. QE/Research/12/07/2024 – 0257

12 July, 2024

The Chairperson
National Health Sciences Research Committee
P. O. Box 30377
Lilongwe 3

Dear Sir/ Madam,

**FRAMEWORK FOR PRESERVATION OF MEDICAL RECORDS IN SELECTED PUBLIC
HEALTHCARE FACILITATION IN MALAWI**

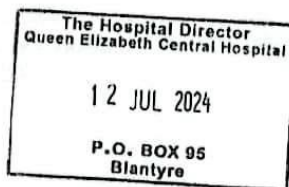
I write to support the conduct of the above research activity in this hospital by Mr Austine Phiri and his study team. The study investigate the framework for preservation of public records in selected public facilities.

We request that the findings of the study be made available to our Hospital Research Committee and the relevant department in this hospital.

We wish the study team success.

Yours faithfully


Dr Kelvin Mponda
Hospital Director



Appendix 14: Informed Consent for UNISA

CONSENT TO PARTICIPATE IN THIS STUDY

Research title: Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi

Researcher: Austine Phiri
PhD Student (16672313)
Department of Information Science
University of South Africa
South Africa
Phone: +265 995 635 299
Email: 16672313@mylife.unisa.ac.za

Supervisor: Professor Tony Rodrigues
Department of Information Science
University of South Africa
South Africa
Phone: +27 12 429 6568
Email: trodrigu@unisa.ac.za

Chairperson of CREC: Professor Kgashane Johannes Malesa
College of Human Sciences Research Ethics Committee
University of South Africa
South Africa
Phone: +27 12 429 4780
Email: maleskj@unisa.ac.za

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the interview.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname..... (please print)

Participant Signature.....Date.....

Researcher's Name & Surname: **Austine Phiri**

Researcher's signature: _____ Date: _____

Appendix 15: Informed Consent for MZUNIREC



Mzuzu University Research Ethics Committee (MZUNIREC)

Informed Consent Form for Research in Information Science

Introduction

I am **Austine Phiri** from the **University of South Africa**. We are researching the **Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi**. This consent form may contain words that you do not understand. Please ask me to stop as we go through the information, and I will take time to explain. If you have questions later, you can ask them of me or another researcher.

Purpose of the research

The purpose of the study is to propose a new framework for the preservation of records in selected public healthcare facilities in Malawi.

Type of Research Intervention

This research will involve your participation through a questionnaire, individual interview, observations and document analysis.

Participant Selection

You are being invited to take part in this research because of your involvement in medical records management at the public health facility in Malawi.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate nothing will change. You may skip any question and move on to the next question.

Duration

The research takes place from March 2022 to November 2024.

Risks

You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.)

Reimbursements

You will not be provided any incentive to take part in the research.

Sharing the Results

The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Following this, we will publish the results so other interested people may learn from the research.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact Mr Austine Phiri through the details below;

Austine Phiri
PhD Student (16672313)
Department of Information Sciences
University of South Africa
Phone: +265 995 635 299
Email: 16672313@mylife.unisa.ac.za
Alt. Email: austine_phiri@yahoo.com

This proposal has been reviewed and approved by the Mzuzu University Research Ethics Committee (MZUNIREC) which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find out more about the Committee, contact Mr Gift Mbwele, Mzuzu University Research Ethics (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwingu, Mzuzu 2, Phone: 0999404008/0888641486

Do you have any questions?

Part II: Certificate of Consent

I have been invited to participate in research about the framework for the preservation of medical records at the selected public healthcare facilities in Malawi.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Print Name of Participant _____

Signature of Participant _____

Date _____
Day/month/year

If illiterate ¹

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

¹ A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

Print name of witness _____

Thumbprint of participant

Signature of witness _____

Date _____

Day/month/year



Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands the research project. I confirm the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher/person taking the consent _____

Date _____

Day/month/year

Appendix 16: Participant Information Sheet

PARTICIPANT INFORMATION SHEET

Research title: Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi

Researcher: Austine Phiri

Ethics clearance reference number:

Research permission reference number (if applicable):

17th June 2023

Dear Prospective Participant

My name is Austine Phiri and I am doing research with Tony Rodrigues, a professor, in the Department of Information Science towards a PhD in Information Science at the University of South Africa. We are inviting you to participate in a study entitled “Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi”.

WHAT IS THE PURPOSE OF THE STUDY?

I am conducting this research to find out systems, processes, and procedures for preserving medical records in public healthcare facilities in Malawi and recommended a framework. This study is expected to collect important information that could help in development and implementation of strategies, policies, and standards for preserving medical records in public healthcare facilities in Malawi. The framework from the study may act as a standard for preserving medical records which may reduce loss and premature destruction of important medical records. In addition, the adoption of effective storage mechanisms may minimize the challenges of inadequate space and increased storage costs in public health facilities in Malawi. The study may expose the training needs of staff handling records and strategies to improve their knowledge, skills and competencies may be implemented. The health facility may use the evidence from the study as a blueprint to lobby for additional funding towards preservation of medical records.

WHY AM I INVITED TO PARTICIPATE?

You are invited to participate in the study because you are involved in handling medical records at the health facility. The information about you was requested from the Human Resources Office of your institution. A total number of 199 respondents have been sampled to participate in the study from a population of 410.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

The study involves questionnaire, interviews, observation checklist, and document checklist. You will be expected to respond to questions through the data collection methods indicated. For questionnaire, the questions will be rated using a Likert scale from 1 to 5. 1 = strongly disagree, 2=disagree, 3=neither disagree not agree, 4=agree, 5=strongly agree. You will be required to tick the one that applies on each and every question structured according to the themes of the study. Questions in the interviews will be both closed and open ended and you are expected to respond to them accordingly as prompted by the researcher. Filing questionnaire is expected to take 15 minutes and interviews will last for 30 minutes. The researcher will be responsible for observing and analyzing documents using observation and document checklists. Data collection exercise is expected to last for 10 days in each health facility.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participating in this study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

This study is expected to collect important information that could help in development and implementation of strategies, policies, and standards for preserving medical records in public healthcare facilities in Malawi. The framework from the study may act as a standard for preserving medical records which may reduce loss and premature destruction of important medical records. In addition, the adoption of effective storage mechanisms may minimize the challenges of inadequate space and increased storage costs in public health facilities in Malawi. The study may expose the training needs of staff handling records and strategies to improve their knowledge, skills and competencies may be implemented. The health facility may use the evidence from the study as a blueprint to lobby for additional funding towards preservation of medical records.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

Participation may inconvenience you based on time spent in this study. However, the researcher will make sure that filing questionnaires and attending interviews are done during less demanding periods such as tea and lunch breaks.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

You have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know

about your involvement in this research OR your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a code number or a pseudonym and you will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings.

Your answers may be reviewed by people responsible for making sure that research is done properly, including the members of the Research Ethics Review Committee. Otherwise, records that identify you will be available only to people working on the study, unless you permit other people to see the records.

Anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings. In such circumstances, a report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard/filing cabinet at Mzuzu University for future research or academic purposes; electronic information will be stored on a password-protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. Hard copies will be shredded and/or electronic copies will be permanently deleted from the hard drive of the computer through the use of a relevant software programme.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

No payment or reward will be offered, financial or otherwise. Any costs incurred by the participant will be explained and justified in adherence to the principle of fair procedures (justice).

HAS THE STUDY RECEIVED ETHICS APPROVAL?

This study has received written approval from the Research Ethics Review Committee of the Department of Information Science, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact Austine Phiri at +265 995 635 299 or austine_phiri@yahoo.com.

Should you have concerns about how the research has been conducted, you may contact my supervisor at +27 12 429 6568, trodriques@unisa.ac.za.

Thank you for taking the time to read this information sheet and for participating in this study.

Thank you.

Austine Phiri
PhD Student
Department of Information Science
University of South Africa
South Africa

Phone: +265 995 635 299

Email: austine_phiri@yahoo.com; 16672313@mylife.unisa.ac.za

Appendix 17: Confirmation of Editing



17th March 2025

To whom it may concern,

RE: Confirmation of Editing of PhD Dissertation: “Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi.”

This letter serves to certify that I edited the PhD dissertation of Austine Phiri (Student Number: 16672313) titled “Framework for the Preservation of Medical Records in Selected Public Healthcare Facilities in Malawi.” The dissertation will be submitted in accordance with the requirements for the degree of Doctor of Philosophy in Information Science in the subject of Records Management at the University of South Africa.

The editing process focused on language use, spelling, punctuation, sentence construction, coherence and overall structure of the work to ensure that the dissertation adhered to standards of academic writing. Additionally, I provided suggestions for improving academic formulation, sentence construction, coherence and the overall presentation of the dissertation.

S.N.K

Serah N. Kasembeli, PhD (English Studies)

Senior editor, Drkasembelicentre.org

serah@drkasembelicentre.org

Appendix 18: Screenshot of Turnitin Report

Similarity Report	
PAPER NAME	AUTHOR
PHIRI Compiled Research Report_PhD_1 6672313.docx	AUSTINE PHIRI
WORD COUNT	CHARACTER COUNT
143785 Words	844356 Characters
PAGE COUNT	FILE SIZE
353 Pages	10.9MB
SUBMISSION DATE	REPORT DATE
Feb 6, 2025 4:24 PM GMT+2	Feb 6, 2025 4:31 PM GMT+2
● 18% Overall Similarity The combined total of all matches, including overlapping sources, for each database. • 10% Internet database • 13% Publications database • Crossref database • Crossref Posted Content database • 0% Submitted Works database ● Excluded from Similarity Report • Manually excluded sources	
Summary	