OCCUPATIONAL HEALTH AND SAFETY INFORMATION MANAGEMENT SYSTEM BASED ON DISTRICT HEALTH INFORMATION SYSTEM

BY

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DECLARATION

I, Timothy Muloongo Lwiindi do hereby declare that this dissertation is my own original work and has not been submitted to any other college, institution, or university other than the University of Zambia.

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APPROVAL

This dissertation, by Timothy Muloongo Lwiindi has been approved as partial fulfilment of the requirements for the award of Master of Science in Computer Science

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DEDICATION

To my son Ethan Chileleko Lwiindi for the emotional support throughout this Journey, you have been the driving force in my life, there were many times I wanted to give up but every time I looked at you, you gave me the strength to go on. May the light of the lord continue shinning upon you all the days of your life, may you have God's favour in everything you do throughout the days of your life.

ABSTRACT

There is a significant gap in research on occupational health and safety in Africa. This study addresses this need by investigating the potential of District Health Information Software 2 (DHIS2) to develop health information systems that cater specifically to the requirements of occupational health and safety, filling a critical knowledge gap in the region. Data from Health Information Systems are extremely important; nevertheless, the majority of developing countries' methods for collecting, collating, compiling, analysing, and reporting health data are insufficient, erroneous, and tardy, rendering the data worthless for decision making. This study investigates how different user perceptions affect the health and safety behaviours at work. The purpose is to carry out a baseline study with the intention of investigating the difficulties encountered by NEPAD (the New Partnership for Africa's Development) in terms of exchanging occupational health data with regional partners. A questionnaire was sent out to a random sample of people who interact with occupational health and safety data as part of a descriptive research study. This study surveyed 210 individuals who work with occupational health and safety data, representing various departments such as Workers' Compensation, OSHD, OHSI, and MSD. Of the 140 questionnaires sent out, 130 were completed and included in the analysis, yielding a response rate of 93%. This high response rate was considered a success, as it closely matched the target sample size for the research. Statistical Package for Social Scientists (SPSS) was used to do descriptive and correlation analysis on the data to investigate whether users of the Occupational Health Information Management System believed that the software would improve their performance and efficiency in carrying out their tasks. According to the findings of the study, factors such as Effort Expectancy, Performance Expectancy, and Social Influence have a significant impact on behavioural Intentions to use occupation health information management systems. A prototype was developed and deployed for users to interact with and later gave feedback that showed improved performance and efficiency in conducting their tasks.

Keywords: Health Information Systems, Occupational Health and Safety, Occupational Health Information Management System, District Health Information System, DHIS.

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LIST OF ABBREVIATIONS

UTAUT	unified theory of acceptance and use of technology
HIS	Health Information System
DHIS	District Health Information System
WHO	World health Organisation
OSH	Occupational safety and health
HMN	Health Metrics Network
SDMX	Statistical Data and Meta-data Exchange
ILO	International Labor Organisation
NEPAD	New Partnership for Africa's Development
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action

1. INTRODUCTION AND BACKGROUND

1.1 Introduction

In Africa as a whole, there is not enough research pertaining to occupational health and safety [1][2]. The purpose of this study is to investigate the potential application of District Health Information Software (DHIS) as a component of an information systems infrastructure tool in the context of occupational health and safety focusing specifically on Zambia. It investigates how various risk perceptions can affect the way safety and health precautions are taken in the workplace. The World Health Organization (WHO) explains that a Health Information System (HIS) is a system that integrates data collection, processing, reporting, and use of the information that is necessary for improving the effectiveness and efficiency of health service delivery through better management at all levels of health service delivery [1][3].

1.2 Background

DHIS2 is a tool that will be used for the collection, validation, analysis, and presentation of aggregate statistical data, tailored (but not limited) to integrated health information management activities. It is a generic tool rather than a pre-configured database application, with an open meta-data model and a flexible user interface that allows the user to design the contents of a specific information system without the need for defining programming libraries. This is a modular web-based software package built with free and open-source Java frameworks.

1.3 Statement of the Problem

Effective sharing and utilization of occupational health and safety (OHS) data remain a significant challenge across industries, hindering the identification and mitigation of workplace hazards. The lack of standardized data sharing practices and inadequate infrastructure results in inefficient data collection and reporting, limited access to reliable and timely OHS data, insufficient collaboration and knowledge sharing among stakeholders.

Conducting a baseline study to identify the challenges and barriers to sharing OHS data and developing a model and prototype using the District Health Information System (DHIS) to facilitate data sharing and improve OHS outcomes. Addressing the challenges in sharing OHS data, will contribute to creating safer and healthier work environments for employees worldwide.

1.4 Aim of the Study

To develop a model using District Health Information Software 2(DHIS2) as an information infrastructure and build a prototype to validate the developed model.

1.5 Research Objectives

i. Conduct a baseline study to identify the challenges faced by NEPAD in sharing Occupational Health data with regional partners.

ii. Develop a model and prototype using District Health Information Software 2(DHIS2) to help with data sharing.

1.6 Research Questions

i. What are the challenges faced by NEPAD in collecting Occupational Health data from regional partners?

ii. How best can District Heath Information Software 2 (DHIS) be used as a tool for data collection on occupational health?

1.7 Significance of the Study

Health information systems offer many potential benefits for healthcare, including financial benefits and for improving the quality of patient care [4].

1.8 Scope of the study

This study was designed to explore how District Health Information Software (DHIS2) framework can be used as an information systems infrastructure tool in relation to occupational health and safety. The aim was to analyse how different risk perceptions can influence the behaviour of security and health related to work. In this paper we will look at DHIS2 (District Health Information System) as an information infrastructure with a closer look at Zambia.

1.9 Organization of the Dissertation

The dissertation is divided into five chapters as follows.

Chapter One covers the introduction to the dissertation and information on the background of the study. The statement of the problem is given, followed by the aim and objectives. The research questions, scope and significance of the study are also covered in this chapter. Chapter Two outlines the various literature done by different scholars on the subject matter, identifying findings and gaps. Chapter Three highlights the methodology that was employed to carry out the study, discussing the design, population, data collection methods, techniques, and analysis. The proposed research method, hypothesis and ethical considerations are also covered. Chapter Four presents the analysis of the collected data. The chapter also tests and presents the results of the hypothesis stated in Chapter three. It will interpret, discuss, and conclude the results the research results. Chapter Five answers the study

questions discussed in the first chapter. Conclusions and recommendations are given based on the findings of the study.

1.10 Chapter Summary

This chapter has given a background and problem statement regarding occupational health and safety based on District Health Information system. The aim of the study was highlighted, and the objectives were used to answer the research questions and lastly the significance of the study was given to define the beneficiaries of the study.

2 LITERATURE REVIEW

2.1 Introduction

Data collected from health information systems (HIS) plays a crucial role in monitoring health, evaluating healthcare services, and enhancing their delivery. However, in many developing nations, challenges such as incomplete, inaccurate, and untimely data hinder effective data collection, collation, analysis, and reporting, rendering it less useful for health decision-making. There is a rising demand for high-quality health information in these countries due to donor-driven resource allocation based on performance metrics. Consequently, several initiatives have been launched to modernize existing paper-based systems through computerization. Kenya's Vision 2030: First Medium-Term Plan (2008-2012) identified the necessity to bolster the national HIS to furnish timely and comprehensible health information. Nevertheless, past assessments revealed weaknesses and poor integration in Kenya's HIS despite escalating demand for health information. Recognizing the pivotal role of a functional HIS, Kenya embarked on a comprehensive overhaul, opting to replace the outdated system with the free and open-source web-based District Health Information Software (DHIS2). This review delves into the challenges of HIS implementation in developing countries and explores how various nations are addressing these challenges through computerization. It specifically examines the increasing adoption of DHIS2 as the HIS solution across different developing countries and evaluates the outcomes of its implementation in Africa. Within this context, the study assesses DHIS2's potential as a catalyst for improving health data availability and utilization in Kenya.

The DHIS2 system offers Kenya unprecedented potential to transition from an era characterized by unreliable and fragmented HIS to one marked by the availability and utilization of high-quality health information for informed decision-making. However, it's crucial to acknowledge that implementing a technically sound system like DHIS2 isn't sufficient in itself to ensure improved reporting and utilization of HIS data. Adequate support and acceptance from national and local authorities, as well as from all stakeholders, are imperative for the success of the system. [4].

In the past, data collection in developing countries has predominantly relied on paper-based routine health information systems (HIS). However, there is currently a gradual transition from manual to computerized systems. The anticipated benefits of introducing computer-based systems include significant cost reductions and the timely delivery of healthcare services in these countries. Moreover, there are expectations of improvements such as streamlining the quantity and types of data collected, enhancing formats and procedures for data recording and reporting. One of the primary benefits

expected from computerizing data capture processes is the ability to analyze data both at the point of collection and at subsequent levels. This facilitates managers and decision-makers at higher levels of the data hierarchy to access disaggregated data from lower levels of the system. However, there are challenges encountered in introducing information and communication technology (ICT)-based initiatives to transform HIS in developing countries. These challenges are often context-specific and include inadequate financial and infrastructural resources such as computers, poor internet connectivity, and lack of electricity. Additionally, there's limited human resource capacity to manage the new systems and technologies, fragmented and uncoordinated organizational structures, and a multitude of heterogeneous stakeholders with varying data demands. Thus, it is crucial to consider contextual differences when studying the acceptance and utilization of computerized information systems in developing countries. Another key approach that developing countries are adopting to strengthen their national HIS is decentralization of health decision-making processes to peripheral levels, particularly districts. This entails empowering these levels to play a more significant role in the development and implementation of national HIS, as well as utilizing HIS information for informed decision-making.

It is crucial to note that computerization alone does not resolve the challenges faced by health information systems (HIS) as mentioned earlier. The new national HIS systems in developing countries must also aim for standardization and integration to address the proliferation of parallel and fragmented systems introduced to cater to the demands of various donors and stakeholders. Establishing comprehensive health information systems with readily available and accessible information for all stakeholders will create an environment conducive to utilizing such information for decision-making. Furthermore, developing countries need to foster a culture of information utilization by providing training to healthcare workers in data analysis and other data management skills. Regular review and feedback workshops should also be initiated to address issues related to data quality, usage, and dissemination. Additionally, decentralizing the HIS system as much as possible while simultaneously improving infrastructure and exploring innovative ways of utilizing new and existing technologies is essential. Braa and Sahay suggest that developing countries should start utilizing the available HIS information rather than waiting for it to reach a perceived level of 'good' quality. They argue that only through data usage and feedback processes can this quality be enhanced. DHIS is designed to empower healthcare workers by facilitating decentralized decision-making and management of health services. This includes analysing service provision levels, predicting service requirements, and evaluating performance in meeting healthcare targets. The HISP network focuses on action research and local participation to customize health information software,

enhancing local knowledge and skills in computers, design, data handling, and utilization. DHIS's success in South Africa and its adaptability to local contexts have led to its export to countries like Mozambique, India, Malawi, Mongolia, Cuba, Tanzania, Ethiopia, Vietnam, and Kenya. Being based on Free and Open-Source Software (FOSS), DHIS2 offers countries the opportunity to acquire the software for free and customize it according to local needs, including mimicking manual health data collection tools and translating the software into local languages. The overall objective of DHIS2 implementation is to generate, analyze, and disseminate health information to facilitate effective policy formulation, management, planning, budgeting, implementation, monitoring, and evaluation of health services and programs. DHIS2 supports the collection and analysis of routine health services data, as well as non-routine data such as population estimates, facility workload, and survey data.

The DHIS2 platform allows for the generation of standard or customized reports, data quality analysis, and provides a dashboard for monitoring and evaluating health program indicators. Its modular web interface facilitates the incorporation of various modules, enabling the replication of complex paper reporting formats unique to each country. This promotes data use at all levels for decision-making. Previously, developing countries relied on paper-based routine Health Information Systems (HIS), but there's now a transition to computerized systems, offering cost reductions and timely healthcare service delivery. DHIS, a free open-source platform, aids decentralized decision-making and health service management, utilized by over 73 countries worldwide. It is supported by various organizations, including NORAD, PEPFAR, The Global Fund, UNICEF, and the University of Oslo. [11][12][13].

The ultimate measure of success for a Health Information System (HIS) lies in the level of demand for it and the utilization of its data by the intended audience for informed decision-making. Evidence suggests that when DHIS is implemented collaboratively with local health authorities and involves all essential stakeholders, the likelihood of success increases. Conversely, lack of cooperation and involvement may hinder success.

Here's a summary of successful DHIS implementations in Africa:

South Africa: DHIS implementation began in 1995, initially focusing on three trial areas in Cape Town. The objective was to design and implement shared data standards to address significant fragmentation of health services and programs inherited from apartheid. Over time, DHIS in South Africa has matured in its use of information for decision-making and improving health services.

Malawi: Malawi has experienced positive outcomes with DHIS deployment and utilization. Starting with a paper/computerized hybrid system in 2002, Malawi is transitioning to DHIS. Data usage has advanced, with DHIS information being used to assist management decisions through graphical

representation. The system facilitates decentralization of decision-making and offers tools for district-level analysis and performance monitoring.

Mozambique: Despite challenges, Mozambique recognized the importance of human and institutional capacity for DHIS development. Training programs were launched for health and IT professionals, including Master's in health informatics programs. However, implementation faced challenges due to misaligned expectations between DHIS implementers and health policymakers.

Zanzibar: The Health Management Information System (HMIS) Unit of Zanzibar's Ministry of Health, supported by the Danish International Development Agency, initiated a process to strengthen HMIS and implement DHIS. Success was attributed to DHIS providing an integrated national data framework, facilitating stakeholder collaboration and regular data-use workshops.

Tanzania: DHIS implementation in Tanzania began in 2002 but faced challenges in achieving its objective of an integrated national health information system. While the system was deemed accurate and reliable, usability and content were rated poorly. Challenges included computer illiteracy, lack of skills for data interpretation, and the system's inflexibility.

In response to HIS challenges, Tanzania developed strategies outlined in its Health Sector Strategic Plan III (HSSP III 2009 - 2015) and adopted DHIS2 as the core HMIS software. The National eHealth Strategy (2013 – 2018) aims to enhance integration of diverse information systems into DHIS2, supported by technical and financial assistance from various partners. Various technology acceptance models and theories, including the UTAUT model, have been applied to understand HIS adoption. These models consider factors such as performance expectancy, effort expectancy, facilitating conditions, and behavioural intention. However, there is still a lack of research on the effects of HIS implementation for data collection and decision-making, particularly in Zambia. This study aims to address this gap.

In the study of information technology implementations in organizations, there has been a proliferation of competing explanatory models of individual acceptance of information technology. The present work advances individual acceptance research by unifying the theoretical perspectives common in the literature and incorporating four moderators to account for dynamic influences including organizational context, user experience, and demographic Research on information and communication technology (ICT) adoption has grown over the past 20 years, with e-health applications showing great potential for improving healthcare access and quality in Africa. However, the adoption and spread of e-health in Africa and other developing regions have been slow and complex. To successfully implement IT applications, it's essential to consider the attitudes and

commitment of stakeholders, particularly healthcare professionals. While many studies have explored technology adoption, there is a need to investigate e-health acceptance decisions in Africa. This paper aims to build upon the existing UTAUT model by incorporating additional factors and moderators to better understand e-health adoption in African healthcare settings. [22].

2.2 Occupational Health and Safety

Occupational safety and health (OSH) is generally defined as the science of the anticipation, recognition, evaluation, and control of hazards arising in or from the workplace that could impair the health and well-being of workers, taking into account the possible impact on the surrounding communities and the general environment. This definition takes into account the fact that OSH is a multidisciplinary field that focuses on the health and safety of workers as well as the general environment. This field must necessarily cover a huge scope because it involves a diverse range of fields of study as well as numerous occupational and environmental dangers. In order to coordinate and implement all of the "building blocks" that make up national OSH systems in a way that protects workers as well as the environment, a wide variety of structures, skills, knowledge, and analytical powers are required.

The scope of occupational safety and health has expanded steadily and consistently in response to changes in social norms, governmental structures, technical advancements, and economic conditions. In recent years, globalization of the world's economies and its implications have been viewed as the largest driver for change in the world of work, and consequently in the scope of occupational safety and health, in both positive and negative ways. This perception is based on the fact that globalization of the world's economies has occurred at a rapid pace in recent decades. The liberalization of world trade, rapid technological advancement, significant developments in transport and communication, shifting patterns of employment, changes in work organization practices, the different employment patterns of men and women, and the size, structure, and life cycles of both businesses and new technologies are all factors that can generate new types and patterns of hazards, exposures, and risks.

Alterations in population sizes, migrations of existing populations, and the resulting stresses placed on the global environment all have the potential to have an impact on occupational health and safety.

The personal, social, and economic costs of occupational accidents, illnesses, and diseases as well as large industrial disasters have long been a source for worry at all levels, ranging from the individual workplace to the national and international levels.

Over the course of many years, in order to keep up with advances in technology and the economy, several preventative measures and tactics, as well as techniques to regulate, decrease, or eliminate occupational hazards and risks, have been developed and put into ongoing use. Nevertheless, despite continual although sluggish progress, occupational accidents and diseases are still far too common, and the cost of these problems, both in terms of the human misery they cause and the economic burden they impose, continues to be enormous. According to a recent report published by the International Labor Organization (ILO, 2003b), the leading causes of death among workers include work-related malignancies, cardiovascular and cerebrovascular illnesses, and certain infectious diseases. According to Hamalainen, Takala, and Saarela (2006), the overall yearly rate of occupational accidents, including fatal and nonfatal incidents, is estimated to be 270 million. There are around 160 million people who suffer from work-related diseases, and approximately two-thirds of those workers are absent from work as a result for a period of four working days or longer.

Accidental occupational injuries are the fourth most cause of death connected to work, following job-related malignancies, cardiovascular disorders, and certain infectious diseases. Recent data from the International Labor Organization (ILO) and the World Health Organization (WHO) reveal that overall occupational injury and disease rates are slowly dropping in most industrialized countries (ILO, 2003a), but they are level or growing in developing and industrializing countries:

According to the European Statistics on Accidents at Work (ESAW), before the enlargements in 2004 and 2007, each year in the 15 Member States of the European Union (EU), approximately 5,000 workers were killed in accidents at work, and approximately 5 million workers were victims of accidents at work leading to more than three days' absence from work (EU, 2004). This was according to the European Statistics on Accidents at Work (ESAW).

Both India and China have rates of workplace fatalities and accidents that are comparable to one another: 10.4 and 10.5 per 100,000 for occupational fatalities, and 8,700 and 8,028 for occupational accidents.

The incidence of fatalities per 100,000 workers in sub-Saharan Africa is 21, and the rate of accidents per 100,000 workers is 16,000. According to these numbers, 54,000 workers are killed on the job every year, and 42 million people are injured on the job every year, resulting in at least a three-day absence from work.

Around 30,000 people are killed on the job each year in Latin America and the Caribbean, while another 22.6 million people are injured on the job seriously enough that they miss at least three days of work.

Occupational and industrial accidents are both caused by variables that can be avoided, and these causes can be eliminated by putting into practice procedures and methods that are already known about and readily available. This is evidenced by steadily decreasing accident rates in countries that have undergone industrialization. Therefore, the implementation of preventative measures provides enormous benefits, both to individuals and to the economy.

International labor standards, codes of practice, the provision of technical advice, and the dissemination of information are the methods that the ILO use to improve occupational safety and health. By these means, it seeks to develop the capacity of member states to improve working conditions in an effort to reduce the risk of occupational accidents and diseases that are associated to employment.

Since its inception in 1919, the creation of international labor standards has been one of the primary responsibilities of the International Labor Organization (ILO). Conventions and recommendations are the forms that they take, and they address a variety of social and labor issues.

Conventions are analogous to multilateral international treaties in that they are open to ratification by member states and, once approved, generate particular binding duties. Conventions are also known as accords. It is expected that a government that has ratified a Convention will put its provisions into effect through legislation or other suitable mechanisms, as specified in the body of the Convention. Additionally, the government is obligated to provide frequent reports on the manner in which it is applying Conventions that it has ratified. The amount of compliance is open for review and feedback from the public by the ILO supervisory mechanism.

Complaints on purported violations of the agreement may be lodged by the governments of other ratifying states, as well as by groups representing either workers or employers. There are processes in place for investigating and responding to complaints of this nature.

On the other hand, recommendations are meant to provide non-binding guidelines that could potentially direct both national policy and practice. They frequently expound on the provisions of Conventions that cover the same issue, or they cover subjects that have not yet been covered by a Convention. Even though there are no substantive obligations entailed, member states do have certain important procedural obligations in regard to Recommendations. These include the obligation to submit the texts to their legislative bodies, the obligation to report on the resulting action, and the obligation to report occasionally at the request of the ILO Governing Body on measures taken or envisaged to give effect to the provisions. Although there are no substantive obligations entailed, member states do have certain important procedural obligations.

When viewed as a whole, the Conventions and Recommendations that have been established by the International Labor Organization (ILC) are considered to be an international labour code that specifies minimum standards in the area of social and economic labour.

A significant amount of influence has been exercised by ILO standards on the laws and regulations of member States. This can be seen by the fact that numerous texts have been modelled on the pertinent provisions of ILO instruments. ILO standards are frequently taken into consideration during the drafting of new laws and amendments. This is done to ensure compliance with previously ratified conventions or to pave the way for the ratification of further conventions. Indeed, governments frequently consult the ILO, both formally and informally, about the compatibility of proposed legislative texts with international labour standards.

In addition to establishing labor rules, the International Labor Organization also creates codes of practice.

These are to be used as a guide for implementing the labor standards or for addressing a particular issue, and they offer advice that can be rather technical and scientifically thorough at times. In the same tripartite environment as the development of labor standards, the International Labor Organization (ILO) develops its codes of practice through a meeting of experts appointed by the Governing Body rather by the ILO's constituents.

After the gathering of specialists has finished drafting the code, the Governing Body will be asked to give their approval for the code's publishing. The adherence to a code of practice does not carry any legal weight.

These codes have, historically speaking, been developed in the form of model rules, which offer a structure for the implementation of policy at the national level.

However, it appears that their use and function are undergoing some kind of change, and a new trend that has emerged is to place a greater emphasis on their potential to provide organizations with technical guidance that is hands-on and personalized. As a result, not only are they relevant to national authorities and services, but also to employers, employees, and businesses in both the public and private sectors today.

The core of the International Labor Organization's (ILO) policy on workplace health and safety is primarily outlined in three international labor conventions, as well as the recommendations that go along with them.

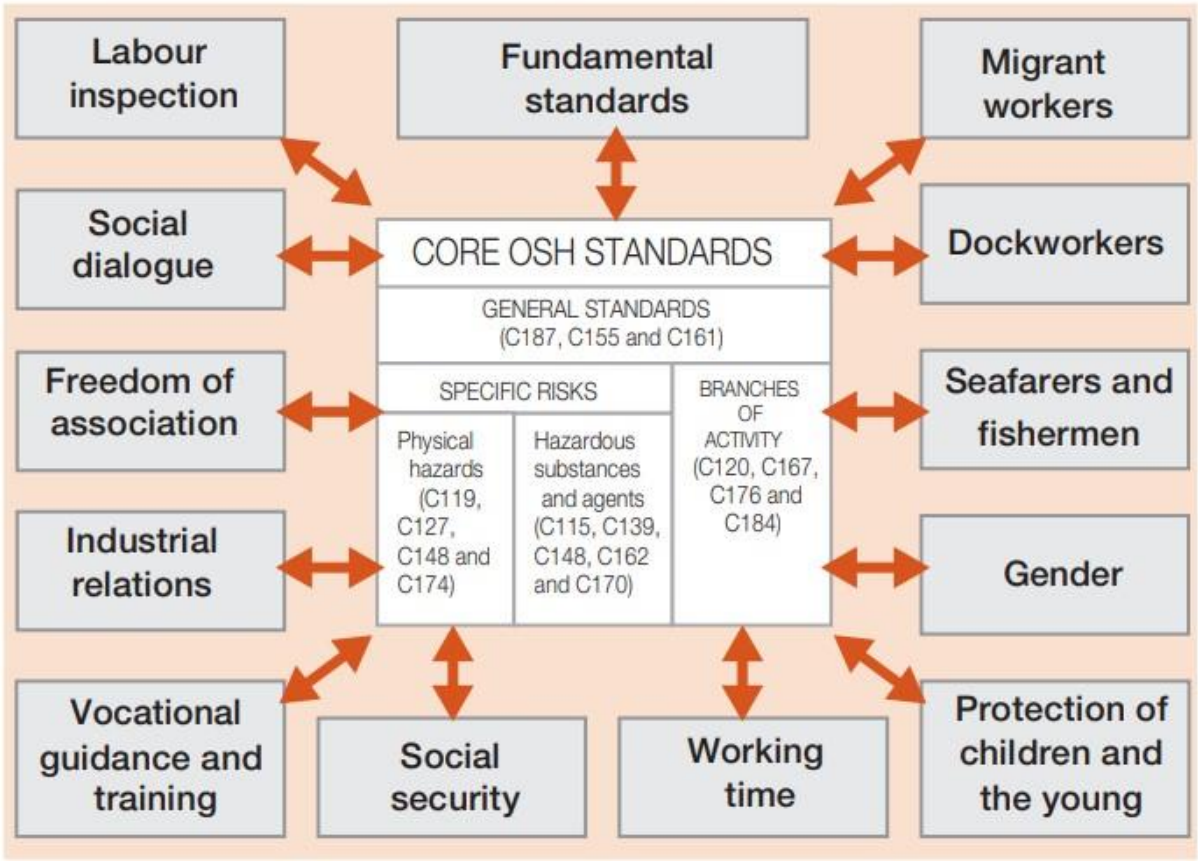
The Promotional Framework for Occupational Safety and Health Convention (No. 187) and its accompanying Recommendation (No. 197) were introduced in 2006. These regulations aim to create a permanent system for enhancing occupational safety and health, as well as fostering a culture of proactive safety and health measures. Governments must collaborate with the most representative organizations of employers and workers to actively work towards achieving and sustaining a safe and healthy working environment. This involves creating or updating a national policy, improving a national system, and implementing national programs focused on occupational safety and health. The number is 3. The procedure must consider the principles outlined in the ILO instruments that are relevant to the Convention. It should also have a methodology to assess the potential measures that might be implemented to ratify ILO Conventions linked to occupational safety and health.

The International Labor Organization (ILO) Occupational Safety and Health Convention, 1981 (No. 155), and its accompanying Recommendation (No. 164), provide for the adoption of a national occupational safety and health policy and describe the actions that are to be taken by governments and within enterprises to promote occupational safety and health and improve the working environment. In addition, the ILO Occupational Safety and Health Convention, 1981 (No. 155), provides for the adoption of a national occupational safety and health policy. The Protocol of 2002 to the Occupational Safety and Health Convention (No. 155), which is an annex to the Convention, calls for the establishment and periodic review of requirements and procedures for the recording and notification of occupational accidents and diseases, as well as for the publication of related annual statistics. This protocol was added in order to supplement the Convention.

Convention No. 161 of the International Labor Organization (ILO) and Recommendation No. 171 of the ILO, both from 1985, provide for the establishment of occupational health services at the enterprise level. These services are designed to ensure the implementation of health surveillance systems and to contribute toward the implementation of the OSH policy.

Figure 1

How the core of OSH Standards relate to ILO Standards



Occupational safety and health are a multifaceted field that encompasses various scientific disciplines, technologies, economic, legal, and industry-specific areas. Despite its complexity, certain fundamental principles apply: all workers have rights that must be protected, and employers, governments, and workers themselves must ensure safe and healthy working conditions. Specifically, work should be safe, dignified, and fulfilling, with opportunities for personal growth and service to society. To achieve this, occupational safety and health policies must be established and implemented at national and enterprise levels, communicated effectively, and regularly reviewed. A national system for occupational safety and health must be established, including mechanisms for building a preventive safety culture. Social partners and stakeholders must be consulted in policy formulation, implementation, and review. Programmes and policies should focus on prevention and protection, prioritizing primary prevention at the workplace level. Continuous improvement is crucial, and information collection and dissemination are vital for effective programmes and policies. Health promotion, occupational health services, compensation, rehabilitation, and curative services are essential. Education and training are critical components of safe working environments, and workers, employers, and authorities have specific responsibilities and obligations. Finally, policies must be

enforced through a system of inspection to ensure compliance with occupational safety and health measures and labour legislation.

It should come as no surprise that several of these general ideas overlap with one another. All the activities that have been mentioned are predicated, for instance, on the collection and distribution of information regarding various aspects of occupational health and safety. Information is necessary for the prevention of occupational injuries and diseases as well as the treatment of those injuries and diseases. It is also required for the formulation of efficient policies and for making certain that these policies are followed to the letter. Information is necessary for educational and training purposes.

The above list is by no means exhaustive, despite the fact that these fundamental principles serve as the framework for occupational safety and health programs and policies. The more specific a field is, the more likely it is that it will have its own set of related principles. In addition, ethical considerations surrounding issues such as people's rights to privacy must be taken into account whenever new policies are developed [24].

2.3 OSH Management System

It is of the utmost importance to reduce the risk of occupational injuries and illnesses, as well as to safeguard, improve, and maintain the health of workers.

In this context, the process of maintaining a safe and healthy workplace involves the identification of hazards occurring in or from the workplace, as well as the assessment and control of the related risks that could affect the health and well-being of workers. These are the core concepts of the process.

Because of the growing complexity and rapid evolution of the working world over the past several decades, it has become necessary to take a systems-based approach to the management and maintenance of a safe and healthy working environment.

OSH management systems have been around for several decades and have shown that they play a crucial role in successfully improving the application of OSH in the workplace by assuring integration into the processes of company planning and development. The implementation of an OSH management system not only provides a more effective participation of workers in determining and carrying out preventative measures, but it also makes this participation more secure.

There is no universal standard for occupational safety and health management, thus businesses should carefully evaluate their requirements in light of their resources and adapt their OSH management system accordingly.

A substantial number of standards and guidelines for occupational safety and health management systems have been produced, and many nations have formulated national OSH programs that also integrate the management systems approach. Because of the tripartite approach that they take, the "Guidelines on occupational safety and health management systems ILO-OSH 2001" that the International Labor Organization (ILO) issued in 2001 have become a widely used model for setting national standards in this field. These guidelines were published at the international level.

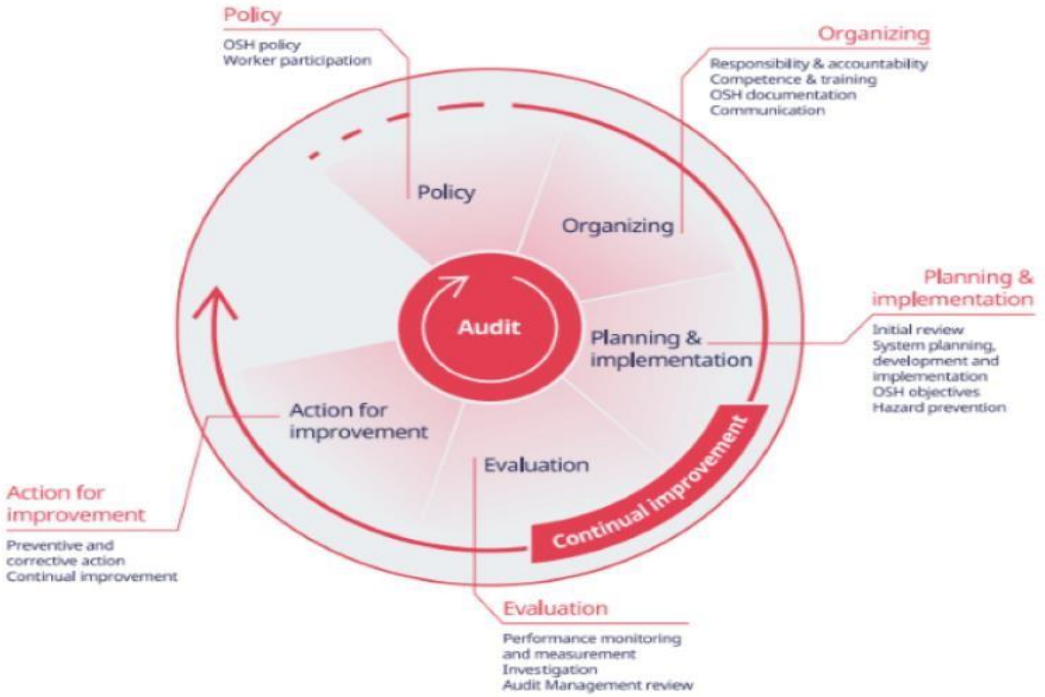
An Occupational Safety and Health (OSH) management system is a collection of interconnected parts designed to develop OSH policy and objectives, and to effectively attain those objectives. Implementing a systems-based approach to occupational safety and health (OSH) management in the workplace guarantees that the effectiveness of prevention and protection measures is consistently assessed and upheld through suitable and timely enhancements.

Employers are advised to implement an Occupational Safety and Health (OSH) management system to provide a safe and healthy working environment and comply with national laws and regulations regarding OSH requirements.

The system should encompass the fundamental components of policy, organization, planning, implementation, assessment, and action for enhancement, as depicted in the diagram.

Figure 2

OSH Management Cycle



2.4 Related Works and Gaps in the Literature

The ultimate measure of success for a Health Information System (HIS) lies in the demand for and utilization of its data by the intended users for informed decision-making. Evidence suggests that successful implementation of DHIS2 is contingent upon collaboration among local health authorities and active involvement of all relevant stakeholders during the implementation process. Conversely, when these factors are lacking, the chances of success diminish. Here are examples illustrating both successful and less successful applications of DHIS2 data for decision-making in Africa.

The Health Metrics Network (HMN), established in 2005, has been instrumental in providing global guidance and a cohesive strategy for the development of national Health Information Systems (HIS). It advocates for the creation of interoperable subsystems within a national framework to integrate collected data and make it accessible in a centralized data repository. The HMN Framework, in its third version, aims to offer recommendations tailored to the current status of health information systems, human resources, and technical infrastructure in African countries. However, challenges such as disparities in technological infrastructure between urban and rural areas, and reliance on paper-based data sources in regions like Africa, necessitate innovative solutions to achieve interoperability and integration.

Sierra Leone, selected as a pilot nation by the HMN in 2007, embarked on a project in 2008 to consolidate fragmented health data reporting systems at the district level using DHIS2 as a data warehouse. The initiative successfully persuaded diverse stakeholders to standardize and exchange health information by incorporating various data collection tools into DHIS2 and standardizing data components. Consequently, DHIS2 was expanded to cover all 13 districts, facilitating comprehensive data analysis by the Ministry of Health. Furthermore, the integration of DHIS2 with the HIV/AIDS program, initially excluded, led to improved data collection and reporting on HIV-related services.

The utilization of the SDMX-HD standard for data exchange between OpenMRS and DHIS2 in Sierra Leone exemplifies the adoption of open XML-based standards to enhance compatibility between different systems. Despite challenges such as inadequate internet access and varying levels of infrastructure and skills across different regions, the interoperability between DHIS2 and OpenMRS offers a scalable solution adaptable to diverse configurations. This adaptability is crucial for addressing challenges and ensuring seamless integration of health data systems in African countries [23].

2.5 A Summary of the Related Works

Health Information Systems (HIS) data is crucial for informed decision-making, but in many developing countries, the data collection process is often flawed, resulting in incomplete, inaccurate, and delayed information. These limitations severely undermine the usefulness of the data for decision-making purposes, hindering effective healthcare planning and delivery [2]. Table 1 shows a summary of some literature reviewed and the gaps identified [2][3][4][5][6][7].

Table 1

Related Works

No.	Author	Paper	Gap
1	Josephine Karuri, Peter Waiganjo, Daniel Orwa, Ayub Manya	DHIS2: The Tool to Improve Health Data Demand and Use in Kenya "journal Vol. 8 No. 1 (2014) https://jhidc.org/index.php/jhidc/article/view/113	Data management issues: inadequate collection, collation, compilation, analysis, and reporting of health data making the data not useful for decision making.
2	Adaletey DL, Poppe O, Braa J	Cloud computing for development – improving the health information system in Ghana. In: 2013 IST-Africa conference and exhibition, IST Africa, Nairobi, Kenya, 2013.	Limited access to reliable and timely OHS data, makes emerging nations' health care systems expensive and slow.
3	Braa J, Monteiro E, Sahay S.	Networks of action: sustainability health information systems across developing countries. MIS Quarterly. 2004;28(3):337–62.	Poor collaboration and knowledge sharing among stakeholders yields incomplete health data unsuitable for decision-making.

4	Josephine Karuri, Peter Waiganjo, Daniel Orwa, Ayub Manya, DHIS2	DHIS2: The Tool to Improve Health Data Demand and Use in Kenya, Journal of Health Informatics in Developing Countries: Vol. 8 No. 1 (2014)	Unidentified hazards leading to increased workplace injuries and illnesses
5	Jean Panda Lukongo Kitronza, Jacques Lofandjola Masumbuko, Philippe Mairiaux	Workers' Perceptions of Occupational Safety and Health in a Textile Industry in the Democratic Republic of Cong	There is Lack of awareness on Health Information System in developing Countries
6	Braa J, Hanseth O, Heywood A, Mohammed W, V S	Developing Health Information Systems in Developing Countries: The flexible standards strategy. MIS Quarterly. 2007; 31:381–402	The Lack of Health Information Systems in developing Countries

2.6 Chapter Summary

This chapter reviewed the literature by the other scholars and researchers on the subject matter of effectiveness of district health information software (DHIS2) in relation to health and how it's been implemented in other countries stating some of the challenges faced. It also reviewed how if properly implemented can improve record management and service delivery. From the discussions, most studies have focused on the importance of digitization and its barriers and how it's been implemented in other health sectors, but they have not advised how it can be used in relation to occupational health and safety specifically in Zambia. This study therefore seeks to fill this research gap.

THEORETICAL BACKGROUND AND RESEARCH MODEL

3.1 Introduction

There are a number of alternative adoption models available for information technology, including Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Theory of Reasoned Action (TRA) and Rogers' Innovation Diffusion Theory. In the parts that follow, a review of these models will be made using two criteria: We incorporated previous research that either compares the three models or focuses exclusively on occupational health.

This study investigates the application of three well-known models in the technology adoption held: the Technology Acceptance Model (TAM) (Davis 1989), the Theory of Planned Behaviour (TPB) (Ajzen 1991), and the Theory of Reasoned Action (TRA) (Ajzen and Fishbein 1980). The Technology Acceptance Model (TAM) was developed by Davis (1989), Rogers' Innovation Diffusion Theory (Roger, 1960) and the Theory of Planned Behaviour (TPB) was developed by Ajzen (1991). The primary goal of this analysis is to determine which of the models provides a more compelling explanation for the customers' decision to implement an occupational health and safety information management system.

3.1.1 Theory of Reasoned Action (TRA)

The TRA model is one that has received a significant amount of attention within the field of social psychology. In the TRA, two distinct components that contribute to behavioural intention are identified. These factors include an individual's attitude toward the conduct in question and their own subjective norm. According to Ajzen and Fishbein (1980), in order to acquire a more profound comprehension of the elements that influence behaviour, it is necessary to investigate the beliefs that individuals have about both themselves and their surroundings. As a result, beliefs are considered to be the foundation of a person's attitude as well as their subjective norm, and they ultimately define a person's actions and intentions. Regarding the target behaviour, an individual's pleasant or bad sensation (evaluative effect) is referred to as their attitude toward completing the behaviour. A person's perception that the majority of the people who are significant to him or her think that he or she should or should not execute the activity, as well as that person's incentive to comply with the specific referents, are both examples of what is meant by the term "subjective norm." TRA has had a significant amount of usage in the past. In the field of information technology, TRA has also been used as the basis to test several technologies and spanning a variety of subject areas, such as management

information system (Celuch et al., 2004), e-commerce (Grandon 2005), MS Word processing (Davis et al., 1989), and e-banking (Shih and Fang 2004; Shih and Fang 2006). According to Davis et al. (1989), one of the most useful aspects of TRA when viewed from the point of view of information systems is the theory that attitude, and subjective norm are able to moderate the effect of external variables on the intention to utilize new information technology. However, three pieces of empirical support given in this study (Davis et al., 1989; Shih and Fang 2004; and Shih and Fang 2006) failed to find a meaningful association between perceived norm and behavioural intentions.

3.1.2 Theory of Planned Behaviour (TPB)

The TPB is an all-purpose model that has been implemented in a wide variety of fields, with its roots in the field of social psychology. TPB is an extension of the TRA (Ajzen 1991; Fishbein and Ajzen 1975). This is because the TRA is unable to cope with behaviour that individuals have inadequate volitional control over (Ajzen 1991). It provides more precise information, providing additional insight into why an individual or group might not use a system, and was found to be well supported by empirical evidence (Ajzen 1991). The theory of planned behaviour (TPB) contends that people's actions are governed by their intentions, which in turn are influenced by their perceived behavioural control, in addition to attitude and subjective norm. The term "perceived behavioural control" refers to the awareness of both the internal and the external resource restrictions that are imposed on the performance of the behaviour. Control beliefs are a reflection of the perceived difficulty (or ease) with which the behaviour can be altered, and Ajzen (1991) found that perceived facility functions as an essential weighing factor. In the context of the health information system, "control beliefs" refer to the knowledge of how to use a health information management system to execute one's responsibilities, while "facility" refers to the external resource restrictions, such as time, money, and resources. Ajzen (2001) compiled a large number of studies that proved the applicability of Theory of Planned Behaviour to a wide variety of subject matter areas. These works offer a substantial amount of assistance for Theory of Planned Behaviour. In addition, there is an abundance of empirical evidence that suggests TPB effectively explains individual intentions in adopting several new information technologies. Some of these technologies include but are not limited to computing resource centre (Taylor and Todd 1995b), telemedicine technology (Chau and Hu 2001), virtual banking (Liao et al., 1999), web site (Riemenschneider et al. 2003), Internet management system (Celuch et al. 2004), e-commerce. (GraThe empirical findings produce conflicting conclusions. Only four out of eight studies that used TPB were unable to find a significant relationship between PBC and behavioural intentions (Liao et al. 1999; Riemenschneider et al. 2003; Celuch et al., 2004; Shih and Fang 2004; Grandon

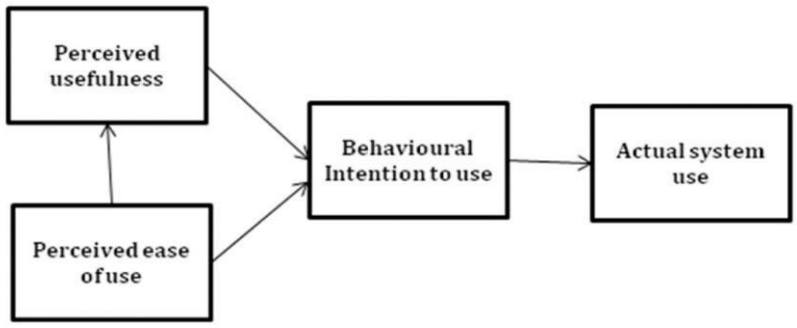
2005)). This is because TPB depend primarily on attitude toward the behaviour and subjective norm. In addition, the subjective norm was not found to play a role in behavioural intentions in four of the five studies (Mathieson 1991; Tan and Teo 2000; Chau and Hu 2001; Shih and Fang 2004), and one of the five studies (Liao et al., 1999) was unable to test the relationship between the subjective norm and behavioural intentions because there were no reliable measurements.

3.1.3 Technology Acceptance Model (TAM)

Davis (1989) established the TAM model using the TRA as his starting point. It asserts that an individual's usage of a system is governed by the behavioural intents of that individual, which in turn is determined by his attitude toward the activity, which in turn is determined by two beliefs: perceived usefulness and perceived ease of use as can be seen in Figure 3 below.

Figure 3

Technology Acceptance Model (TAM) (Davis, 1989)

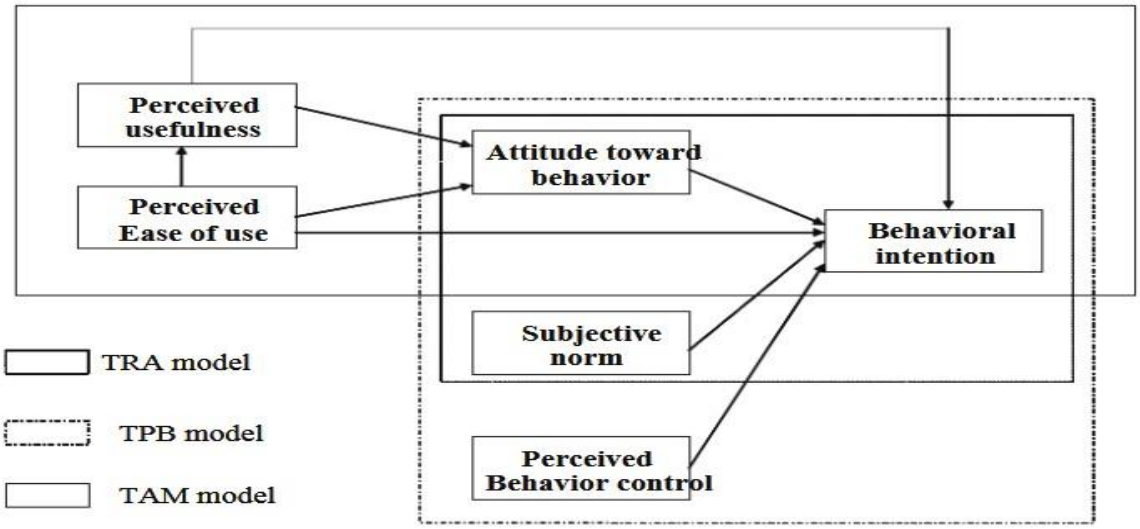


The amount to which an individual believes that using the system will improve his or her job performance is referred to as that individual's perceived usefulness of the system. Both the term "perceived usefulness" and "perceived ease of use" refer to the degree to which an individual believes that making use of the system will not need any effort on their part. The TAM is the model that information systems researchers have used the most frequently to describe or anticipate the motivating reasons that are behind user acceptance of technology, and it is also the model that has received the most attention. TAM was applied to a wide variety of technologies in a number of research. To the best of our knowledge, there have been a total of five studies that have compared TAM to other

competing models. These studies focused on email (Davis 1989), spreadsheets (Mathieson 1991), telemedicine (Chau and Hu 2001), university computing resource centers (Taylor and Todd 1995b), and website usage (Riemenschneider et al. 2003). In addition, five studies (Suh and Han 2002; Wang et al. 2003; Pikkarainen et al. 2004; Lassar et al., 2005; Erriksson et al., 2005) used TAM in the context of e-banking. In recent years, a number of researchers have made adjustments to the original TAM (for example, Venkatesh and Davis in 2000, Venkatesh et al. in 2003, Yi et al. in 2006). The initial TAM will serve as the primary focus of this investigation. Empirical support was discovered between the various TAM constructs, in addition to the state of the art work done by Legris et al., (2003).

Figure 4

The theoretical model of TRA, TPB and TAM



3.1.4 Rogers' Innovation Diffusion Theory (Roger, 1960)

One of the most widely accepted theories for analysing the adoption of information technology (IT) and gaining an understanding of how innovations in IT spread both within and between communities is Rogers' Innovation Diffusion Theory [102][103]. From the perspective of this theory, innovation can be defined as an idea, a method, or a technology that is regarded as being new or unfamiliar to individuals inside a specific area or social system. Within the context of the social system, the process by which information about an innovation spread from one individual to another over the course of time is referred to as diffusion.

The success of an IT innovation is determined by four key factors: communication channels, innovation qualities, adopter characteristics, and the social system [103]. Communication channels are the means by which individuals acquire information about an innovation and assess its use. It encompasses both mass media and interpersonal communication.

An invention possesses five user-perceived traits, namely relative advantage, compatibility, complexity, trialability, and observability [103]. Relative advantage refers to the extent to which a user sees the benefits or enhancements of adopting an innovation compared to the incumbent technology [103]. Compatibility refers to the degree to which an innovation aligns with the current technical and social context [103]. The prospects for diffusion and adoption of an invention are enhanced when it can effectively integrate or cohabit with current values, past experience, and the demands of future adopters [104][105]. Complexity is a measure of the level of difficulty that an innovation is thought to have in terms of understanding, implementing, or using it [103]. End consumers are more likely to quickly adopt an invention that is less complicated [104][105]. Trialability refers to the capacity of an innovation to undergo evaluation and testing without requiring complete dedication or significant expense [103]. An innovation that has a higher level of trialability is more likely to be embraced by individuals [105]. Observability refers to the degree to which the advantages of an innovation are apparent to potential users [103]. An innovation will only be accepted if the outcomes are seen as useful [105].

Rogers has classified the members of a social system into five categories according to their views towards an innovation: innovators, early adopters, earlier majority, later majority, and laggards. In a social system, innovators constitute a mere 2.5% of the population and are the initial group to embrace a new idea. Rogers asserts that innovators possess the capacity to comprehend and employ intricate technical expertise that is crucial for introducing innovation from external sources into the social system. The subsequent cohort consists of the early adopters, who exhibit a higher level of integration within the social system compared to the innovators. They possess extensive knowledge of the innovation, have strong connections with emerging technology, and exhibit higher levels of economic prosperity. The initial two cohorts of adopters account for 16% of the population within a given social system. The subsequent two cohorts, comprising 68% of the social system's population, consist of adopters who fall into the categories of earlier and later majority. The remaining 16% of individuals in the social system are referred to as laggards. The individuals that exhibit the greatest resistance to adopting an invention are typically those who lack the necessary resources and are unaware or uninformed about the innovation [103].

3.2 Proposed Conceptual framework.

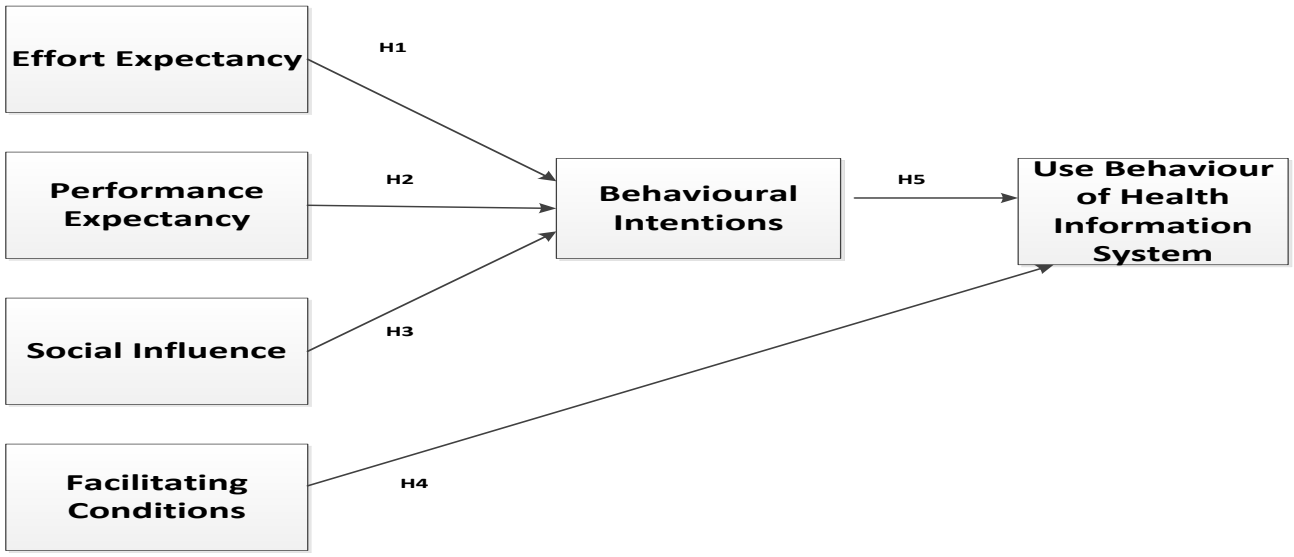
Various models were examined in this research. Both health awareness and behavioural intention were part of this paradigm. Finding out why people want to use health information systems was the driving force for this study. Researchers compared the various adoption hypotheses.

3.2.1 Research Hypothesis

Figure 5 below shows the proposed research model is based on the UTAUT model by Venkatesh et al. (2003). It shows the research hypothesis.

Figure 5

UTAUT model by Venkatesh et al.



H1: Effort expectancy

H2: Performance expectancy

H3: Social influence

H4: Facilitating conditions.

H5: behavioural intentions

3.2.2 Operationalization of the hypothesis

Effort Expectancy (H1)

Effort expectancy positively influences behavioural intentions for Occupational Health Information Management System. It is expected that increased levels of ease of use of Occupational Health Information Management System will increase the behavioural intention to use Occupational Health Information Management System hence this hypothesis.

Performance expectancy (H2)

Performance expectancy positively influences behavioural intention to use Occupational Health Information Management System. It is expected that an efficient and more productive system will increase the behavioural intention to use Occupational Health Information Management System hence the hypothesis.

Social influence (H3)

Social influence conditions positively influence behavioural intentions for use of Occupational Health Information Management System. People in my environment who use Occupational Health Information Management System have improved staff relations and morale.

Facilitating conditions (H4)

Facilitating conditions directly influence the use behaviour of Occupational Health Information Management System. It is generally expected that consistent support on the use of Occupational Health Information Management System will directly influence their use behaviour and the majority of respondents who indicated that they had the knowledge necessary to use Occupation Health Information Management System also believed that it would be useful in carrying out their tasks hence this hypothesis.

Behavioural intentions (H5)

Behavioural Intentions directly influence the usage of Occupational Health Information Management System. Most of the respondents who have intentions to use Occupation Health Information Management System also believed that it would be useful in carrying out their tasks.

This research clearly demonstrates the necessity of comprehensively knowing user attitudes and preferences on the uptake of information and communication technology (ICT). With the rapid introduction of technical advances and a growing number of failures, it is crucial to get deep insights into the factors that influence the adoption and usage of these innovations. The study focused on the research problem domain and aimed to investigate the researcher's beliefs regarding the important impacts on the acceptance and utilization of health information systems.

3.3 Chapter Summary

This chapter's primary focus was on the alternative adoption models available for information technology, including Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Theory of Reasoned Action (TRA) and Rogers' Innovation Diffusion Theory. An explanation about each theory was given. The study discusses the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which distinguishes between values that are dependent and those that are independent. It evaluates the expected performance, the expected effort, the social influence, the facilitating conditions, the behavioural objectives, and the usage behaviour.

4 RESEARCH METHODOLOGY

4.1 Introduction

This chapter discusses the research methodologies that were employed in the study. The chapter includes the research design, study population, sampling design, data collection techniques and the data analysis techniques. This chapter also includes the proposed research model, the research hypothesis and concludes the ethical considerations.

4.2 Research Design

The research adopted the descriptive research design to help analyse the impact of having an Occupational Health and Safety Information Management System for collection of occupational Health and Safety information for mine employees on the Copperbelt in Zambia. Quantitative data was collected in the form of a questionnaire. The use of questionnaires helped the study to generalize findings from data collected from the respondents.

4.3 Baseline Study

Safety and health are of utmost importance in every human activity. Occupational Health and Safety (OHS) are particularly important in mining activities as risks are inherently associated with them. Globally, several initiatives are on to protect human lives and ensure their health. The International Labour Organization has provided a code of practice that would prevent fatality and illness in industries. In Zambia, there are two pieces of legislation regulating occupational safety and health in Zambia. These are the Factories Act (Cap 441) and the Occupational Health and Safety Act 36 of 2010.

The Factories Act has been enacted to "make further and better provision for the regulation of the conditions of employment in factories and other places as regards the safety, health and welfare of persons employed therein; to provide for the safety, examination and inspection of certain plant and machinery and to provide for purposes incidental to or connected with the matters aforesaid."

The Occupational Health and Safety Act establishes the Health and Safety Institute and provides for its functions; the establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work; the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with the activities of persons at work.

4.3.1 Variables

The utilization the occupational health and safety information management system stands as the dependent variable in this study. The study uses the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which distinguishes between values that are dependent and those that are independent. It evaluates the expected performance, the expected effort, the social influence, the facilitating conditions, the behavioural objectives, and the usage behaviour.

4.3.2 Population of the Study

Population is the entire aggregation of items from which samples can be drawn for a study (Opoku, 2009). The population targeted for this study consisted of who work with occupational health and safety information from Workers' compensation, Occupational Safety and Health Services Department (OSHD), Occupational Health and Safety Institute (OHSI) and Mine Safety Department (MSD). The study population size was 210 of individuals who work with occupational health and safety information.

4.3.3 Sample Size and Sampling Technique

The sample size was determined using the Taro Yamane (1967) formula with a 95% confidence level. The formula is as shown:

$$n=N/ (1+N (0.05)^2) \quad (1)$$

Where, n = the required sample size, N = the total population and e = the allowable error (%).

Substituting numbers in the formula gives us:

$$n=210 / (1 + 210(0.05)^2) \quad (2)$$

A total of 140 questionnaires were distributed of which a positive response of 130 was received for analysis. The researcher considered this as a success since it represented 93% of the sample size that was selected for the study. Data analysis was undertaken using the Statistical Package for Social Scientists (SPSS) software where the hypotheses of the study was tested. Correlation and descriptive analysis were used to test the impact of having a Health Information System for collecting occupational health data.

4.3.4 Data Collection Methods

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes [42]. The data collection component of research is common to all fields of study. This study made use of primary data obtained from questionnaires.

4.3.5 Instruments for Data Collection

The data collection instrument used in this study as a basis for collecting, recording and measuring data which is required to provide answers to our research questions was a questionnaire.

4.3.6 Questionnaire

Foddy (1995) defines a questionnaire as a carefully written set of questions about a subject that has given to a carefully selected sample of human beings. The questionnaire was designed in three parts: the first part being the demographic of respondents, the second part is the computer knowledge and experience, and the third part access and adoption of occupational health and safety. The questionnaire is designed using the UTAUT values model that has dependant and independent values. It assesses the performance expectancy, effort expectancy, social Influence, facilitating conditions, behavioural intentions and use behaviour.

4.3.7 Data Analysis

Data analysis was undertaken using the Statistical Package for Social Scientists (SPSS) software where the hypotheses of the study was tested. Correlation and descriptive analysis were used to test the impact of having a Health Information System for collecting occupational health data.

4.4 System Design and Implementation

Figure 6 below shows the block diagram for the systems design and implementation.

Figure 6

System Design and implementation

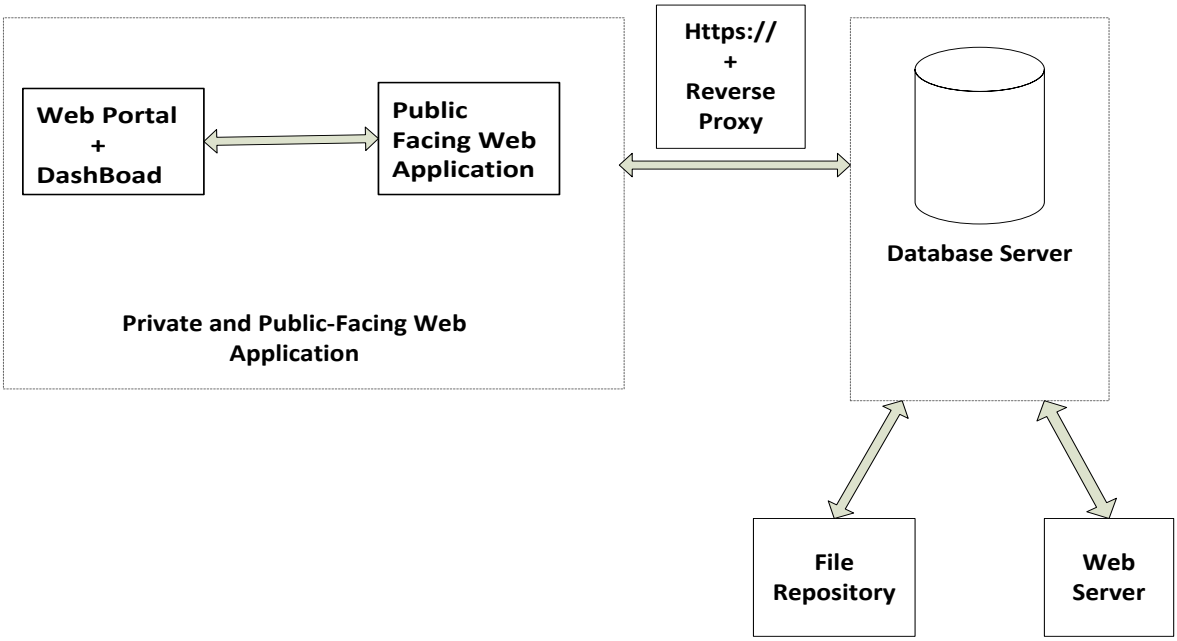


Figure 6 above shows a three-tier system the presentation tier, application tier and database tier. The **Presentation Tier** which is the User Interface (UI), this is a layer that interacts with end-users. It could be a web browser, mobile app, or any other client-side application.

Application Tier has Business Logic and Services/APIs. This layer contains the core application logic, algorithms, and processing. It's responsible for handling user requests, executing business rules, and managing communication between the presentation and data tiers. Application server provides services or APIs to the presentation tier. These services encapsulate the business logic and interact with the data tier. **Data Storage Tier** Stores and manages data for the health information system.

Having these three levels separate makes the system modular, scalable, and easy to manage. When you change something in one tier, like the user interface, it doesn't affect the other levels directly. Better scalability is also possible because each tier can be grown separately based on the needs of the system.

4.4.1 Systems requirements

Table 2 below shows the systems functional requirements of what the system is supposed to do in terms of specific features, capabilities, and functionalities.

Table 2
Functional requirements

Process	Description	System

		Domain/Module
Register client and retrieve the record	The system should be able to register new clients and retrieve records of existing clients while triaging (i.e., to *decide the order of treatment)* for various available services the system can provided to the client	Client Registration
Book Appointment	The system should allow to book appointment for medical consultation and/or examination	Appointment Booking
Client Record	1. The system should allow user to record medical, family, socio-economic and work-related history about clients.	Nursing Services
	2. The system should allow user to record anthropometric measurements.	
	3. The system should allow for entry of vital signs and vision records.	
	4. The system should allow user to record HIV Counselling and Testing Processes and results for Clients	
	5. Print client Certificates with QR Code	
Clinical Examination	1. The system should allow users with adequate rights for the recording of clinical examination results by the clinician.	Client Screening
	2. The system should have clinical decision support (CDS) features to assist medical staff to diagnose disease conditions (including occupational diseases) in line with Standard Controlled Medical Vocabulary (CMV)	
	3. System should have Computerized Physician Order Entry (CPoE) allowing the Physician to order labs and other investigations for a client	
	4. The system should allow authorized	

	Physician/Radiologist to input radiological report i.e., interpretation of radiological images according to ILO classification of radiographs	
	5. The System should allow authorized user to retrieve medical images from archive to be read by a physician for medical decision making.	
Lab Investigation	1. The system should be able to allow authorized user to log lab collected lab samples using bar code	Laboratory Investigation
	2. The system should be able to allow authorized user to input Laboratory investigation reports (i.e. laboratory, hygiene, and other investigation results)	
Radiological	The system should allow authorized radiologist to import medical images from existing system to be read by a physician/radiologist for medical decision making.	Radiological Investigation
Hygiene Data info	1. The system should be able to allow authorized user to perform risk assessment inspection scoring including identification of hazard and associated risks according to standards.	Occupational Hygiene
	2. The system should have a decision support function that will be able to recommend risk mitigation actions based on identified risks.	
	3. The System should allow compliance inspections and monitoring during site visit to companies according to the OHS Act No. 36 of 2010. 4. The System should allow authorize user from the ministries of mines and labor to input update and print hygiene data	
Client Booking and Tracking	1. The System should be able to allow clients to register, making test bookings, and track results through its public facing portal.	Client Portal Registration,

	2. The system should allow the individual client to view medical certificate	Booking, Tracking and Reporting
Alerts	1. The system should be able to send email alerts to inform them that the result is ready	Alerts
	2. The system should be able to send results via SMS	
Incident Reporting and Investigation	3. The system should be able to allow authorized user to perform incident reporting and notification	Reports

4.4.2 Flow charts

The Figure 7 and Figure 8 below shows the user registration flow chart and management system respectively.

Figure 7

User Registration

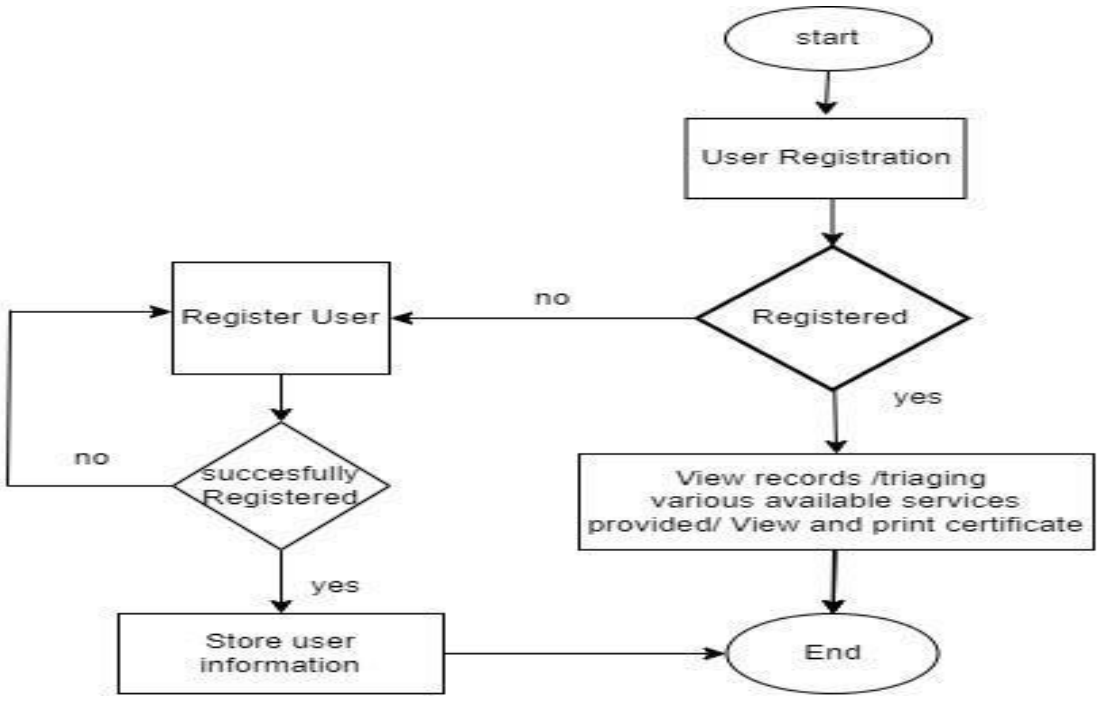


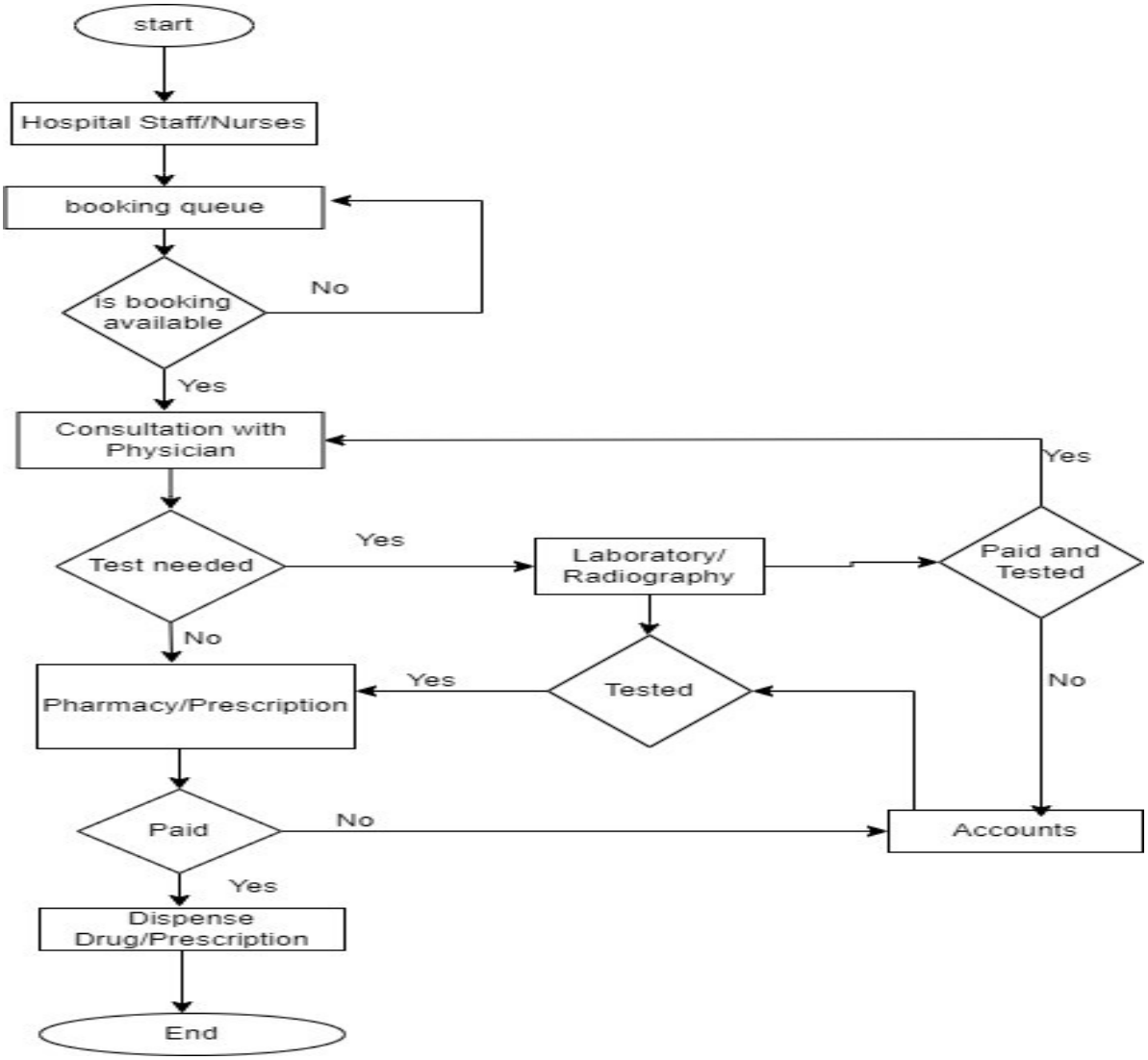
Figure 7 above shows the user registration and login process that users go through to either register or log in to their profiles. A client that is registered login successfully can view their records and triage through the various services available and in an event that they undertook any tests they can view and print their test results certificates.

Management System

Figure 8 below shows the Management system for the health facility members of staff. They check to see if the client has been booked of which if they haven't booked, they are required to do so before being assigned to the next available physician. The Physician examines the patient who later recommends either a lab test or give a prescription. The client will have to ensure that the bills are paid for before checking out.

Figure 8

User management



4.4.3 Use Case Diagram

Figure 9 below shows the use case diagram which shows the interactions between users and the system and depicts how users interact with the system to achieve specific goals.

Figure 9

Use Case Diagram

4.4.4 Entity Relationship Diagram

An Entity Relationship (ER) Diagram is a type of flowchart that illustrates how "entities" such as people, objects or concepts relate to each other within a system. ER Diagrams are most often used to design or debug relational databases in the fields of software engineering, business information systems, education, and research.

ER diagrams are related to data structure diagrams (DSDs), which focus on the relationships of elements within entities instead of relationships between entities themselves. ER diagrams also are often used in conjunction with data flow diagrams (DFDs), which map out the flow of information for processes or systems.

Peter Chen (a.k.a. Peter Pin-Shan Chen), currently a faculty member at Carnegie-Mellon University in Pittsburgh, is credited with developing ER modelling for database design in the

1970s. While serving as an assistant professor at MIT's Sloan School of Management, he published a seminal paper in 1976 titled "The Entity-Relationship Model: Toward a Unified View of Data."

In a broader sense, the depiction of the interconnectedness of things dates back to least ancient

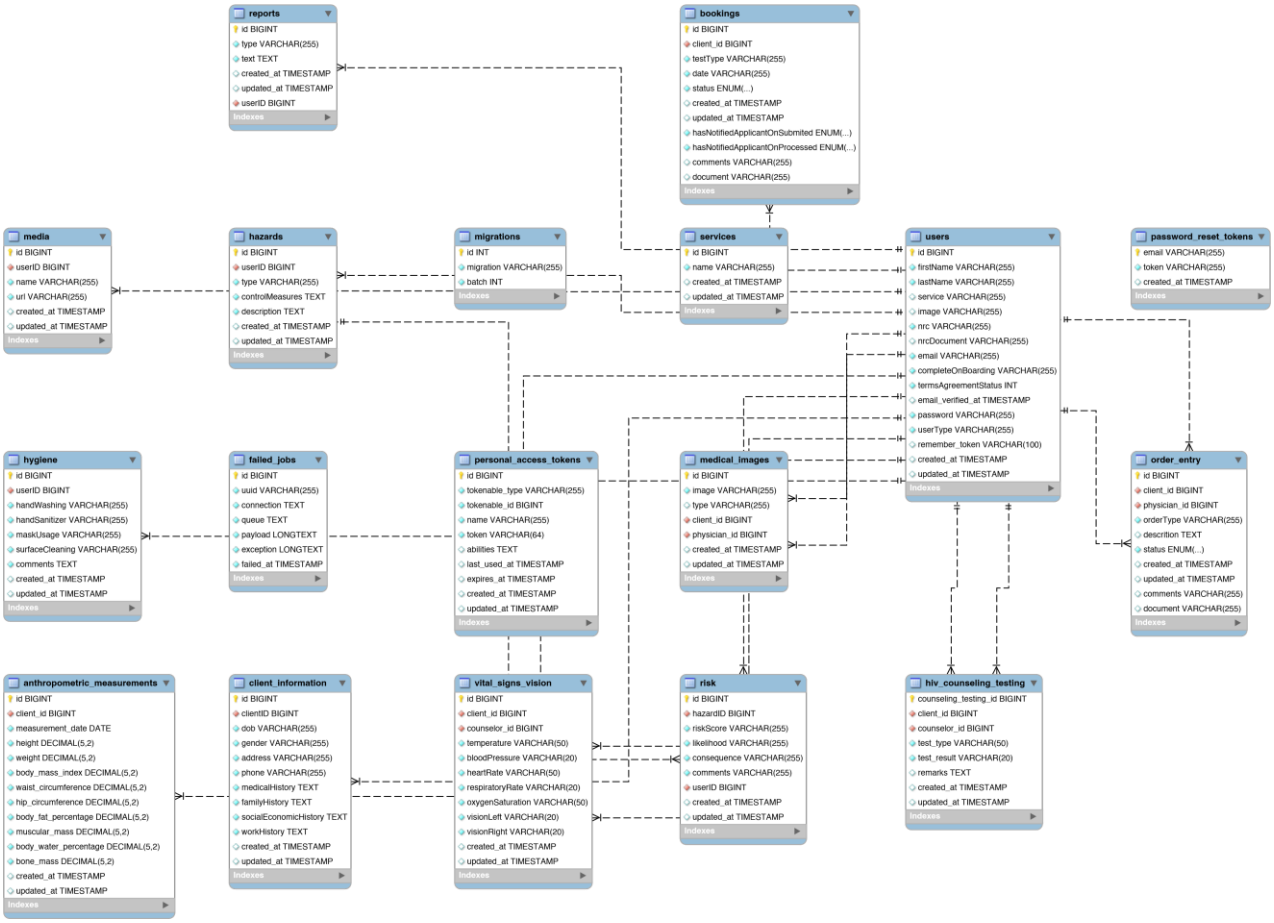
Greece, with the works of Aristotle, Socrates, and Plato. It's seen more recently in the 19th and 20th Century works of philosopher-logicians like Charles Sanders Peirce and Gottlob Frege. By the 1960s and 1970s, Charles Bachman (above) and A.P.G. Brown were working with close predecessors of Chen's approach. Bachman developed a type of Data Structure Diagram, named after him as the

Bachman Diagram. Brown published works on real-world systems modelling. James Martin added ERD refinements. The work of Chen, Bachman, Brown, Martin, and others also contributed to the development of Unified Modelling Language (UML), widely used in software design [44][45][46].

The Figure 10 below shows Entity Relationship Diagram

Figure 10

Entity Relationship Diagram



4.4.5 Web Application Design and Implementation

The web application comprises two sub-functions, contributing to a comprehensive medical records system designed to streamline patient data management and enhance healthcare decision-making. The primary sub-function is the web UI application, featuring an intuitive graphical user interface that empowers authorized users to interact seamlessly with the system. Through this user-friendly

interface, healthcare professionals can efficiently record and manage medical, family, socio-economic, and work-related histories of clients. Additionally, the web UI application allows users to enter anthropometric measurements, record HIV counselling and testing processes and results, and input vital signs and vision records, ensuring a comprehensive and detailed medical record for each patient.

4.4.6 Hardware Requirements

DHIS2 is a database intensive application and requires that your server has an appropriate amount of RAM, number of CPU cores and a fast disk. These recommendations should be considered as rules-of-thumb and not exact measures. DHIS2 scales linearly on the amount of RAM and number of CPU cores so the more you can afford, the better the application will perform.

RAM: At least 2 GB for a small instance, 12 GB for a medium instance, 64 GB or more for a large instance.

CPU cores: 4 CPU cores for a small instance, 8 CPU cores for a medium instance, 16 CPU cores or more for a large instance.

Disk: SSD is recommended as storage device. Minimum read speed is 150 Mb/s, 200 Mb/s is good, 350 Mb/s or better is ideal. At least 100 GB storage space is recommended but will depend entirely on the amount of data which is contained in the data value tables. Analytics tables require a significant amount of storage space. I planned and ensured that the server can be upgraded with more disk space as needed.

4.4.7 Software Requirements

DHIS2 runs on all platforms for which there exists a Java JDK, which includes most popular operating systems such as Windows, Linux and Mac. DHIS2 runs on the PostgreSQL database system. DHIS2 is packaged as a standard Java Web Archive (WAR-file) and thus runs on any Servlet containers such as Tomcat and Jetty.

The DHIS2 team recommends Ubuntu 18.04 LTS operating system, PostgreSQL database system and Tomcat Servlet container as the preferred environment for server installations.

This chapter provides a guide for setting up the above technology stack. It should however be read as a guide for getting up and running and not as an exhaustive documentation for the mentioned environment. We refer to the official Ubuntu, PostgreSQL, and Tomcat documentation for in-depth reading.

The dhis2-tools Ubuntu package automates many of the tasks described in the guide below and is recommended for most users, especially those who are not familiar with the command line or administration of servers. It is described in detail in a separate chapter in this guide.

Later DHIS2 versions require the following software versions to operate.

- An operating system for which a Java JDK or JRE version 8 or 11 exists. Linux is recommended.
- Java JDK. OpenJDK is recommended.
- For DHIS 2 version 2.38 and later, JDK 11 is required.
- For DHIS 2 version 2.35 and later, JDK 11 is recommended and JDK 8 or later is required.
- For DHIS 2 versions older than 2.35, JDK 8 is required.
- PostgreSQL database version 9.6 or later. A later PostgreSQL version such as version 14 is recommended.
- PostGIS database extension version 2.2 or later.
- Tomcat servlet container version 8.5.50 or later, or other Servlet API 3.1 compliant servlet containers.

4.5 Chapter Summary

This chapter's primary focus was on the research approach that was taken for this particular investigation. An explanation of qualitative research as a method for data collection and analysis was given. This chapter discusses the procedures that were followed throughout the data collecting, and it also provides information about the sample.

5 RESULTS

5.1 Introduction

This chapter describes and analyses the information generated from the data that was obtained from the administration of the questionnaires. The results will be presented using determined and suitable data analysis instruments and in this regard the study has made use of descriptive statistics which is presented in distribution tables, charts and graphs showing absolute and relative values. A total of 140 questionnaires were distributed of which a positive response of 130 was received for analysis. The researcher considered this as a success since it represented 93% of the sample size that was selected for the study. This gave a total percentage of 93% answered and 7% unanswered. Results are presented using tables, charts, graphs.

5.2 Baseline Study Results

The approach employed in this research was a mixture of qualitative and quantitative techniques to obtain the desired result. The respondents' characteristics include gender, age, education, and profession. Thereafter the chapter will present research findings and analysis.

Gender

Figure 11 and Figure 12 below shows the gender for the respondents in form of a pie chart as shown in Figure 11, of which 39.2% are female and 60.8% are male respondents.

Figure 11

Gender Respondents Pie Chart

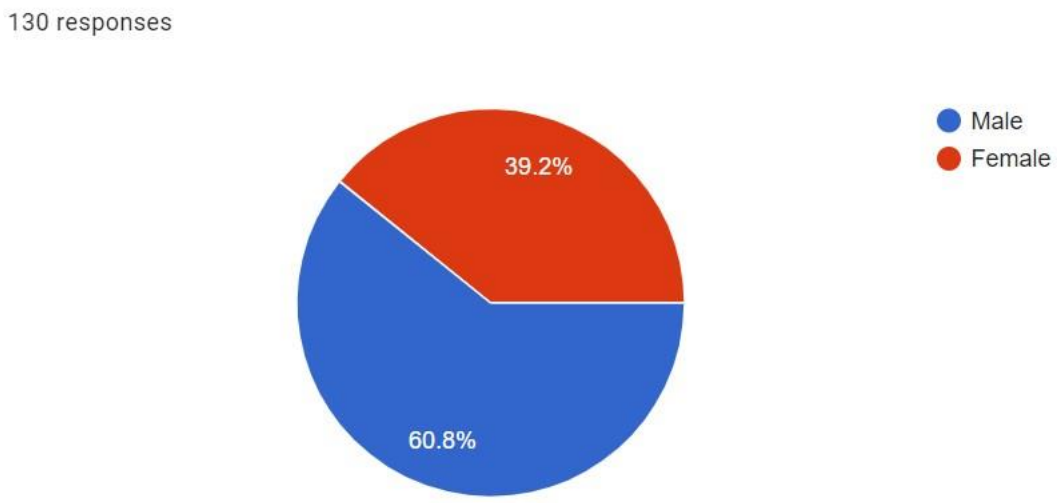
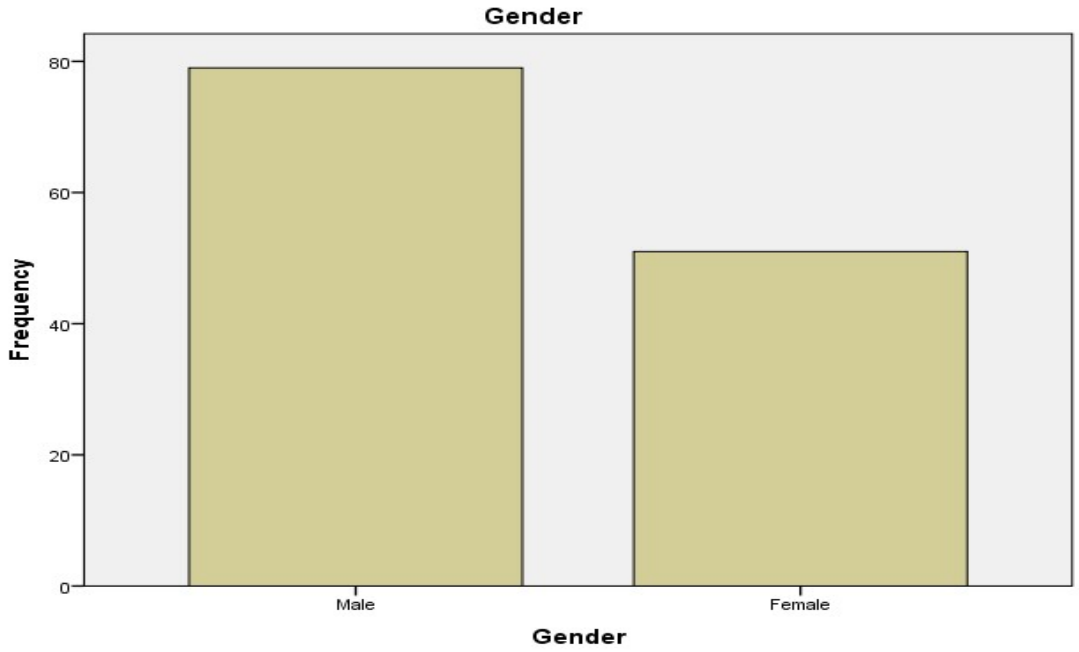


Figure 12 below represents the gender respondents in form of a histogram.

Figure 12

Gender Respondents Histogram



The findings in Table 3 below show the actual statistics for the respondents. It shows that most of the respondents were male. Specifically, out of the total number of respondents 79 representing 60.8 percent were males while 51 representing 39.2 were females.

Table 3

Gender for the Respondents

Gender		Frequency	Percent	Cumulative Percent
Valid Male		79	60.8	60.8
Female		51	39.2	100.0
Total		130	100.0	

Age

Figure 13 and Figure 14 shows Age-group distribution for the respondents in form of a pie chart and histogram.

Figure 13

Age Distribution Pie Chart

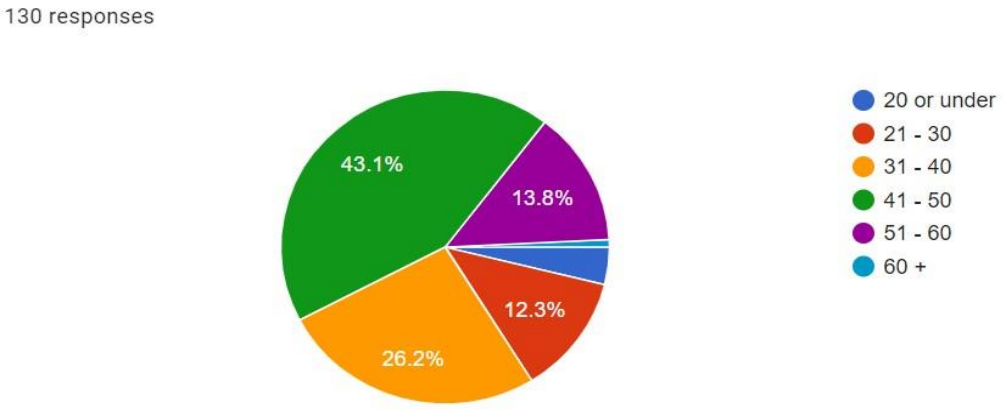
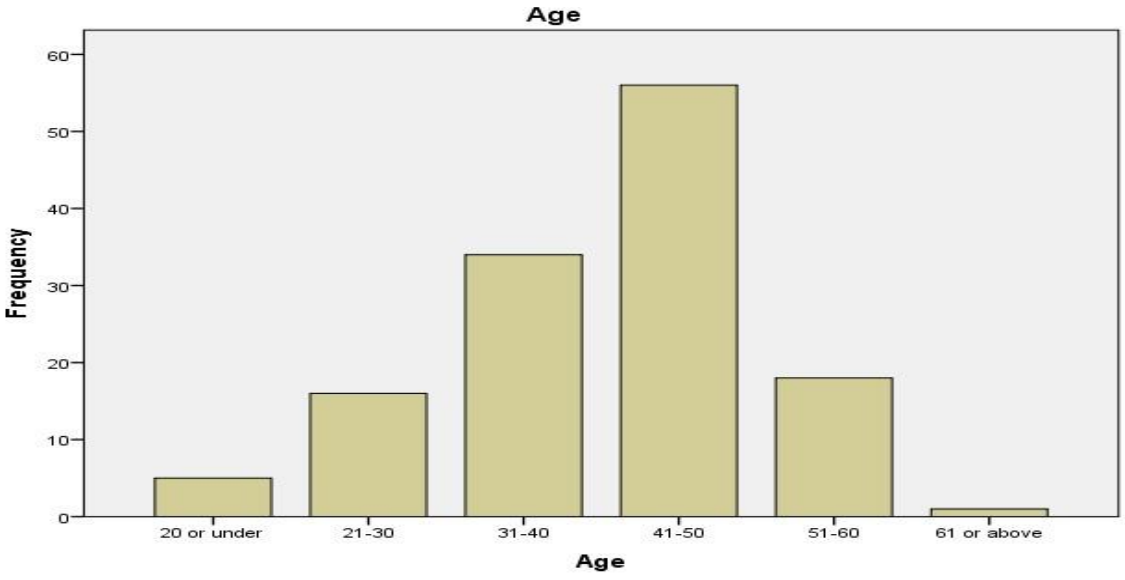


Figure 14

Age Distribution Histogram



The findings in Table 4 below have shown that many of the respondents were aged 41-50 years accounting for 43.1 percent. On the other hand, the findings have shown that the least proportion of respondents indicated that they were above 61 years and above accounting for

0.8 percent.

Table 4

Age-groups for the Respondents

Age		Frequency	Percent	Cumulative Percent
Valid	20 or under	5	3.8	3.8
	21-30	16	12.3	16.2
	31-40	34	26.2	42.3
	41-50	56	43.1	85.4
	51-60	18	13.8	99.2
	61 or above Total	1	0.8	100.0
		130	100.0	

Level of Education

Figure 15 and Figure 16 show the respondents highest level of education attained in form of the pie chart and histogram.

Figure 15

Highest Level of Education

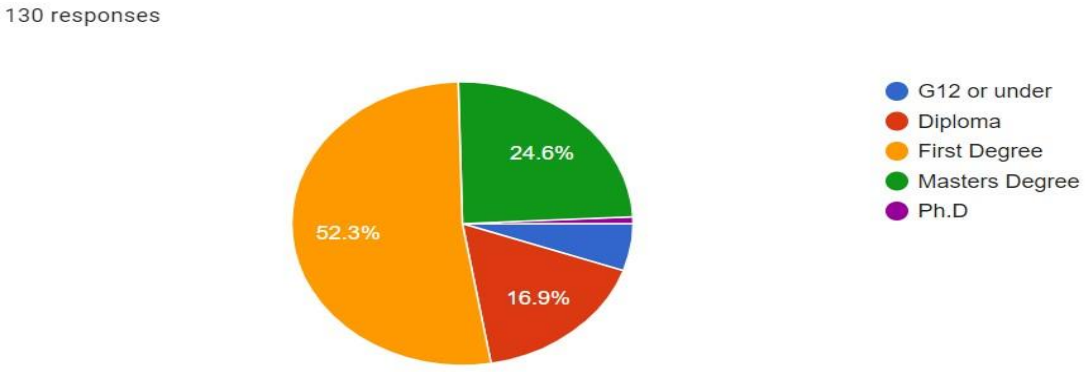


Figure 16

Highest Level of Education

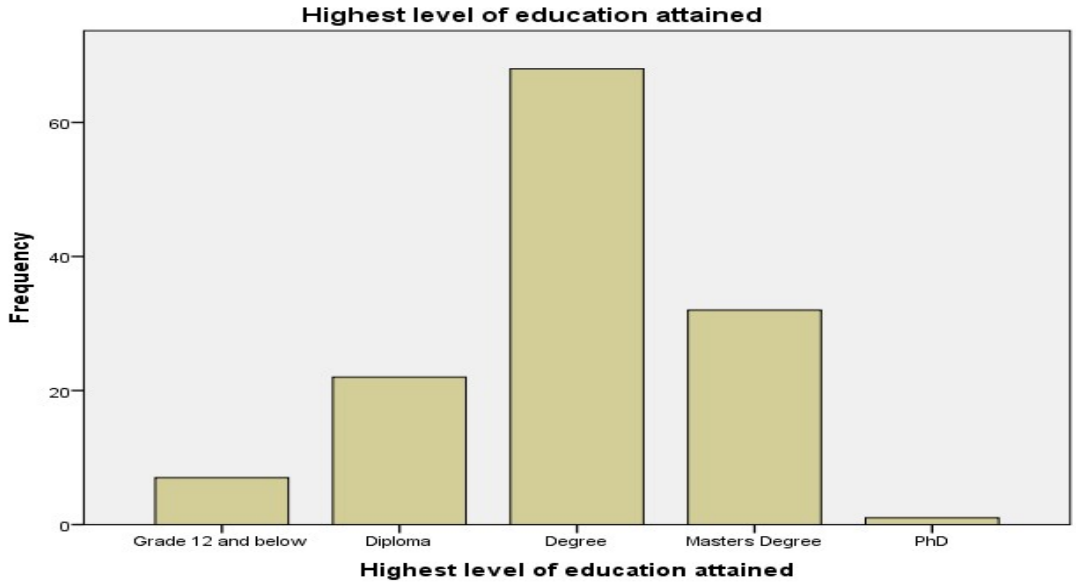


Table 5

Highest Level of Education attained.

		Frequency	Percent	Cumulative Percent
Valid	Grade 12 and	7	5.4	5.4
		22	16.9	22.3

below Diploma	68	52.3	74.6
Degree	32	24.6	99.2
Master's degree	1	0.8	100.0
PhD	130	100.0	
Total			

The findings in Table 5 have shown that most of the respondents indicated Degree as their highest level of education attained accounting for 52.3 percent while the least proportion of the respondents indicated PhD as their highest level of education attained accounting for 0.8 percent.

Table 6

Highest level of education attained.

Highest level of education attained	I think that Occupational Health Management System would be useful in carrying out my tasks					
	Strong Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Grade 12 and below	0	1	1	1	4	7
Diploma	0	0	3	9	10	22
Degree	0	0	5	27	36	68
Master's degree	1	0	0	11	20	32
PhD	0	0	0	0	1	1
Total	1	1	9	48	71	130

Table 7

Chi-Square Tests

	Value	df	Asymp. Sig. (2sided)
Pearson Chi-Square	27.674a	16	0.035l
N of Valid Cases	130		

The findings in Table 7 have revealed that most respondents that had degrees also believed that Occupational Health Management System would be useful in carrying out their work. The findings further revealed that the Chi-square test has shown in Table 8 that there is a statistically significant relationship between the highest level of education attained by an individual and their belief that Occupational Health Management System would be useful in carrying out their tasks. This is evidenced by the asymptotic significant value (p-value) 0.035.

Table 8

I think the Occupational Health Information Management System would increase my productivity and efficiency.

	I think that Occupational Health Management System would be useful in carrying out my tasks					
	Strong Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Strongly Disagree	1	0	0	0	0	1
Neutral	0	1	5	3	3	12
Agree	0	0	3	31	21	55
Strongly Agree	0	0	1	14	47	62
Total	1	1	9	48	71	130

Table 9

Chi-Square Tests

	Value	df	Asymp. Sig. (2sided)
Pearson Chi-Square	182.728a	12	0.000
N of Valid Cases	130		

The findings in Table 9 have revealed that most respondents believed that the Occupation Health Information Management System would increase their productivity and efficiency and believed that it would be useful in carrying out their tasks.

The finding has further revealed that the Chi-square test as shown in Table 10 indicates a statistically significant relationship between the respondents' belief that Occupational Health Management System would increase their productivity and efficiency and that it would be useful in carrying out their tasks. This is evidenced by the asymptotic significant value (pvalue) 0.000.

Table 10

I think that interaction with Occupational Health Information Management System is clear and easy to understand.

	I think that Occupational Health Management System would be useful in carrying out my tasks					Total
	Strong Disagree	Disagree	Neutral	Agree	Strongly Agree	
Disagree	0	0	2	0	2	4
Neutral	0	1	1 4	4	3	9
	1	0	2	31	23	59
	0	0	9	13	43	58

Agree						
Strongly Agree	1	1		48	71	130
Total						

Table 11

Chi-Square Tests

	Value	df		Asymp. Sig. (2-sided)
Pearson Chi-Square	42.880a	12		0.000
N of Valid Cases	130			

The findings in Table 11 have revealed that most respondents that believed that Occupation Health Information Management System was clear and easily understandable also believed that it would be useful in carrying out their tasks.

The findings further revealed that, the Chi-square test as shown in Table 12 indicates a statistically significant relationship between the respondents' belief that Occupational Health Management System was clear and easily understandable and their belief that it would be useful in carrying out their tasks. This is evidenced by the asymptotic significant value (pvalue) 0.000.

Table 12

People in my environment who use the Occupational Health Information Management System have improved staff relations and morale.

	I think that Occupational Health Management System would be useful in carrying out my tasks					
	Strong Disagree	Disagree	Neutral	Agree	Strongly Agree	Total

Strongly Disagree	0	0	0	0	1	1
Disagree	0	0	2	1	2	5
Neutral	1	1	3	5	3	13
Agree	0	0	2	31	30	63
Strongly Agree	0	0	2	11	35	48
Total	1	1	9	48	71	130

Table 13

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	45.015a	16	0.000
N of Valid Cases	130		

The findings in Table 13 have shown that most respondents that reported that people in their environment who used Occupation Health Information Management System had improved staff relations and morale also believed that it would be useful in carrying out their tasks. The findings further revealed that the Chi-square test as shown in Table 14 indicates a statistically significant relationship between the respondents who reported that people in their environment who used Occupational Health Management System had improved staff relations and morale and their belief that it would be useful in carrying out their tasks. This is evidenced by the asymptotic significant value (p-value) 0.000.

Table 14

On a weekly basis, how many times do you use Occupational Health Information Management System.

	I think that Occupational Health Management System would be useful in carrying out my tasks					Total
	Strong Disagree	Disagree	Neutral	Agree	Strongly Agree	
Not at all	1	0	4	5	5	15
Once a week	0	0	2	4 34	3	9
2-3 times	0	1	3	5	47	85
More than 4 times	0	0	0	48	16	21
Total	1	1	9		71	130

Table 15

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.726a	12	0.006
N of Valid Cases	130		

The findings in Table 1have shown that respondents who use Occupation Health Information Management System more frequently also believed that it would be useful in carrying out their tasks.

The findings further revealed that the Chi-square test as shown in Table 15 indicates a statistically significant relationship between the frequency respondents use Occupational Health Management System in a week and their belief that it would be useful in carrying out their tasks. This is evidenced by the asymptotic significant value (p-value) 0.006.

Table 16

I have the knowledge necessary to use the Occupational Health Information Management System.

	I think that Occupational Health Management System would be useful in carrying out my tasks					Total
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Strongly Disagree	0	0	1	0	0	1
Disagree	0	0	2	2	2	6
Neutral	0	1	3	6	4	14
Agree	1	0	1	23	20	45
Strongly Agree	0	0	2	17	45	64
Total	1	1	9	48	71	130

Table 17

Chi-Square Tests

	Value	df	Asymp. Sig. (2sided)
Pearson Chi-Square	47.118a	16	0.000
N of Valid Cases	130		

The findings in Table 17 have shown that most respondents who indicated that they had the knowledge necessary to use the Occupation Health Information Management System also believed that it would be useful in carrying out their tasks.

The findings have further revealed that the Chi-square test as shown in Table 18 indicates a statistically significant relationship between respondents having the knowledge necessary to use Occupational

Health Management System and their belief that it would be useful in carrying out their tasks. This is evidenced by the asymptotic significant value (p-value) 0.000.

Table 18

I intend to use the system in the next few months.

	I think that Occupational Health Management System would be useful in carrying out my tasks					Total
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Strongly Disagree	1	0	0	2	1	4
Disagree	0	1	0	0	0	1
Neutral	0	0	6	4	5	15
Agree	0	0	1	18	23	42
Strongly Agree	0	0	2	24	42	68
Total	1	1	9	48	71	130

Table 19

Chi- Square Tests

		Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square		191.861a	16	0.000
N of Valid Cases		130		

The findings in Table 18 have shown that most of the respondents who have intentions to use Occupation Health Information Management System also believed that it would be useful in carrying out their tasks.

The findings have further revealed that through the Chi-square test as shown in Table 19 which indicates a statistically significant relationship between the respondents' intention to use Occupational Health Management System and their belief that it would be useful in carrying out their tasks. This is evidenced by the asymptotic significant value (p-value) 0.000.

5.3 System Automation and Implementation Results

The existing procedure is labour-intensive and reliant on physical documents, resulting in a lack of timely service delivery to patients. A web-based appointment booking solution was chosen to replace the manual paper-based appointment system and allow patients to schedule appointments themselves at any time, day, or night Admin Login

Figures below show the implementation results for the admin login screen and dashboard.

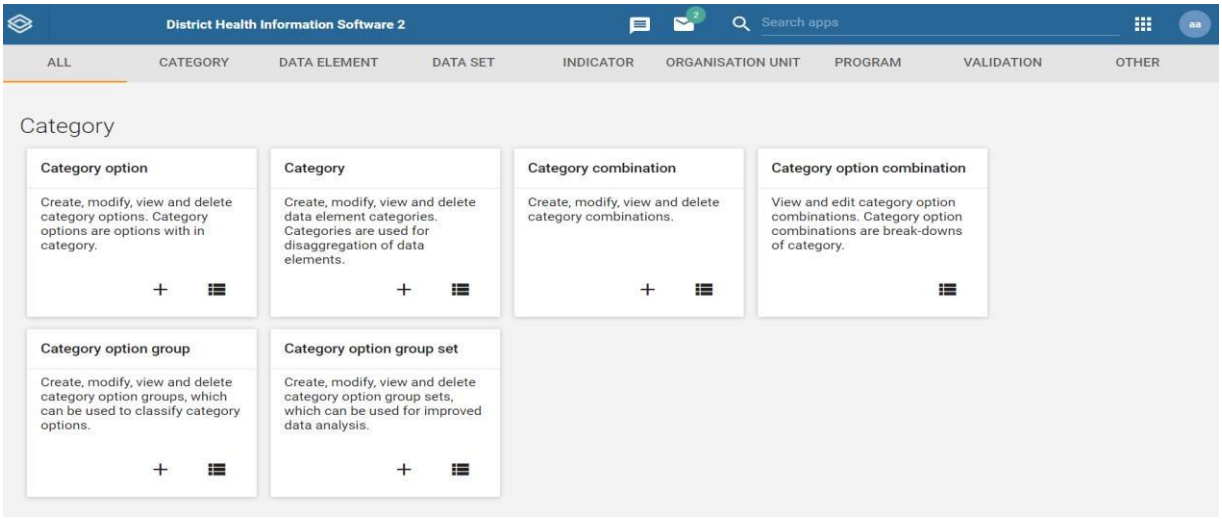
Figure 17

Admin Login

Figure 17 above shows the admin login screen. The web login allows admins login and to create the various organizational units as shown in Figure 18 below. A health facility, department/subunit, or administrative entity, such as a health district, can be an organizational unit.

Figure 18

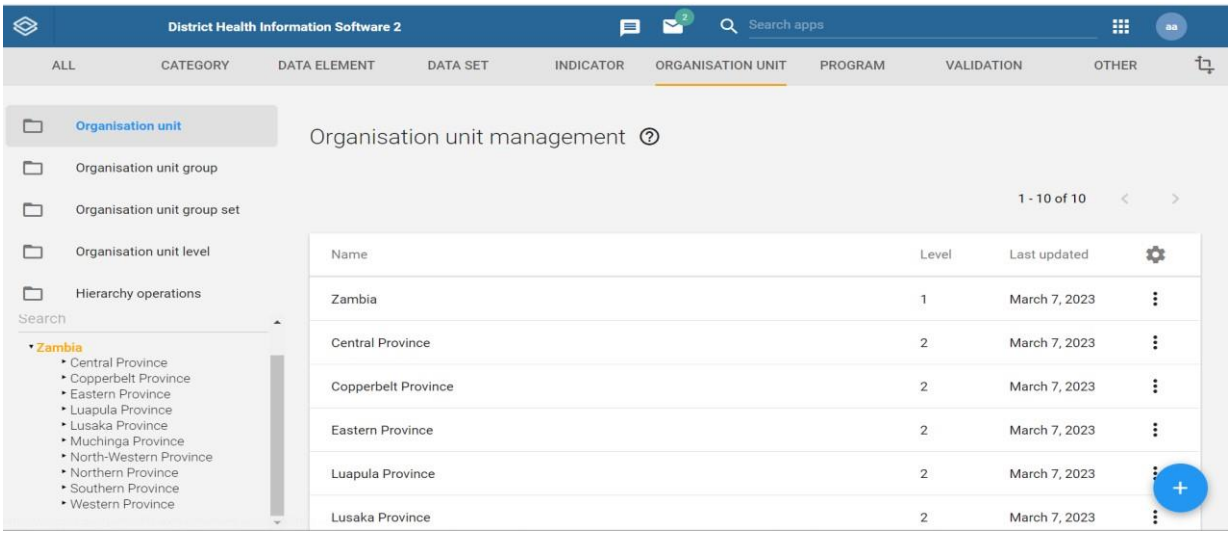
Admin Dashboard



Once logged in the hierarchy reflects health administration's tiers. The hierarchy is at provincial, district, and facility levels. There is one organizational structure in DHIS2. Therefore, it is necessary to carefully describe and align this hierarchy with the structure. The major organizational hierarchy's geographical areas and levels will affect the application's usability and performance. Additionally, "Organization unit groups and group sets" explains how to handle different hierarchies and levels. As shown in Figure 19 below

Figure 19

Organizational Unit

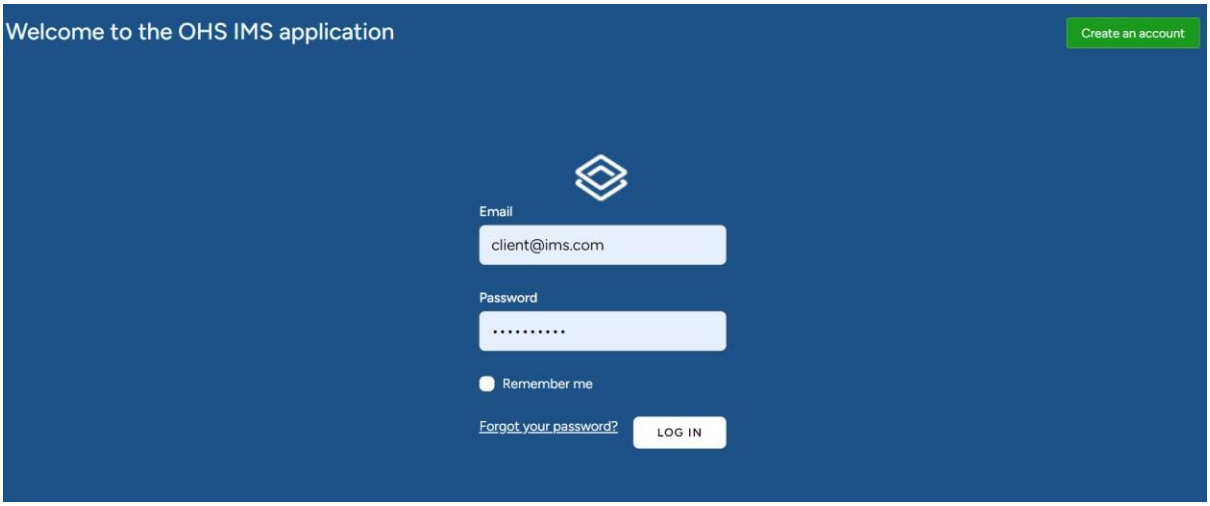


Client Login

Figure 20 below shows the clients login screen. It enables client login with their usernames and password or create their own account in an event they don't have. It also allows the clients to reset their passwords.

Figure 20

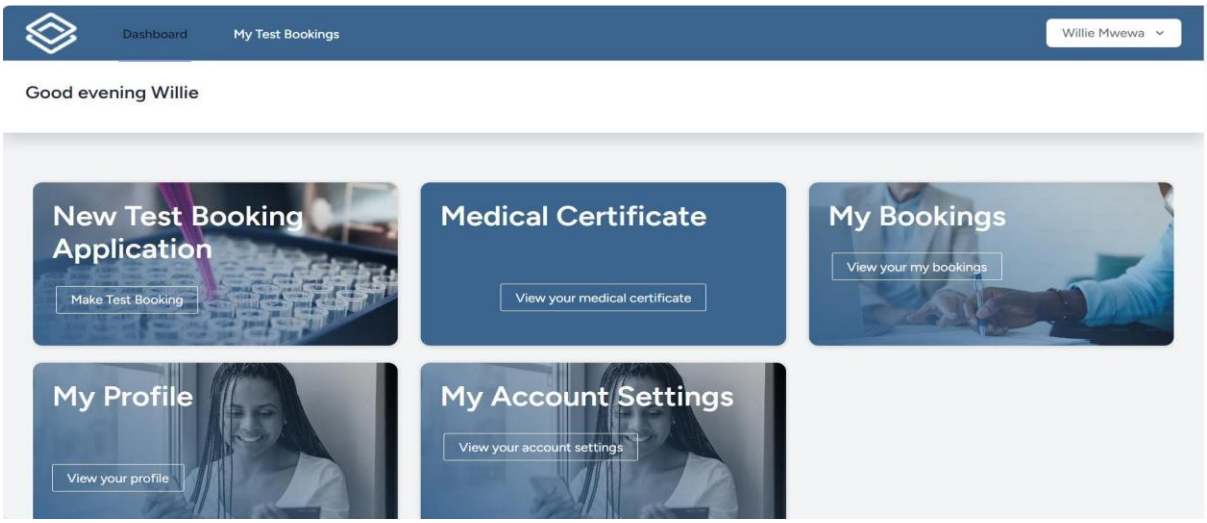
Client Login



Once the user logs in the system show them the options available to them. They can book their testing, view their profiles and medical certificates showing their specific test results as shown in Figure 21 below.

Figure 21

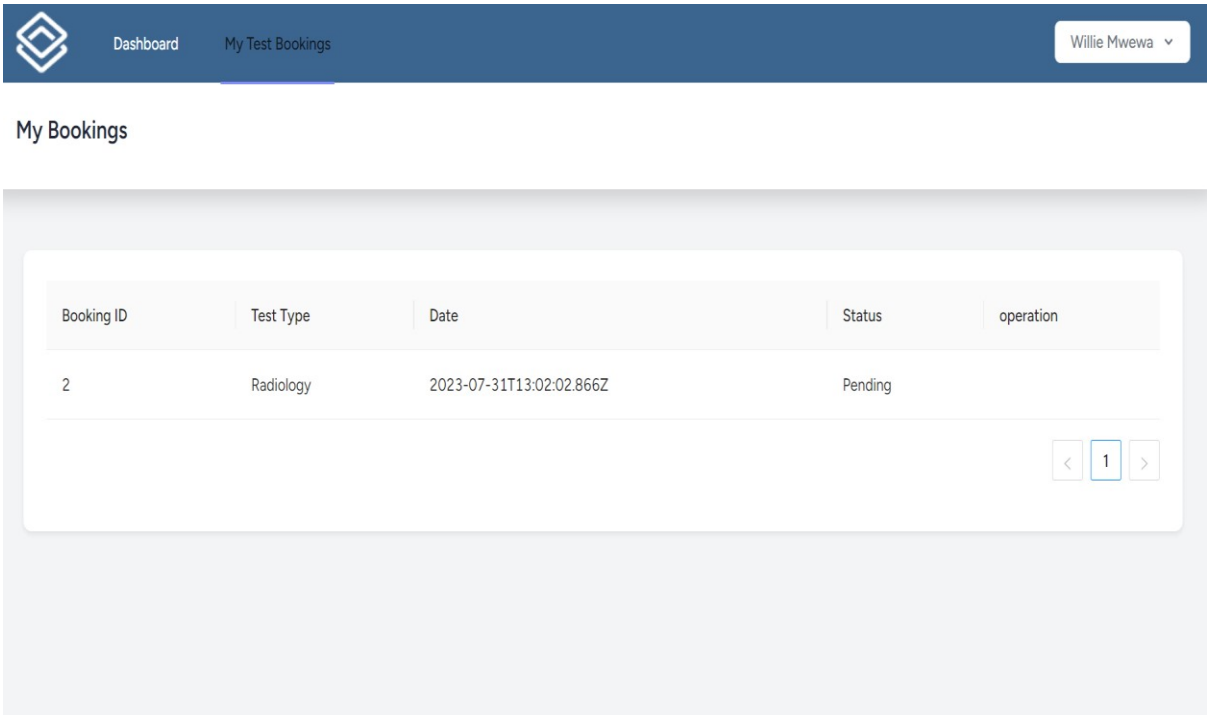
Client Dashboard



Under my test bookings the client is able to track the progress of the results. They can view the type of test they booked for, and the date as can be seen in Figure 22 below.

Figure 22

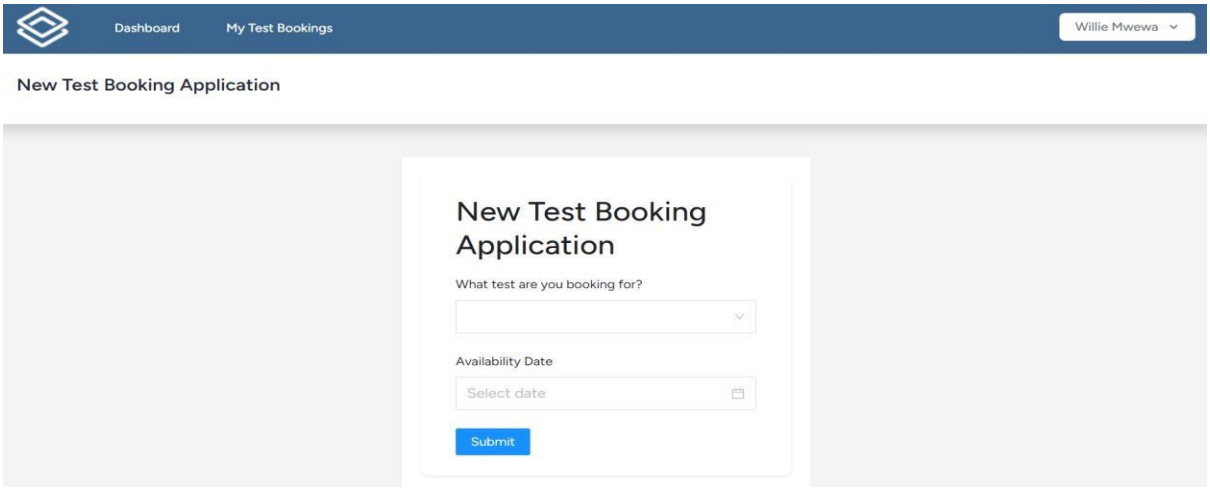
My Test Bookings



Clients can make new test bookings as can be seen in Figure 23 below they can select the type of booking they want and select the date when they want to undertake the test.

Figure 23

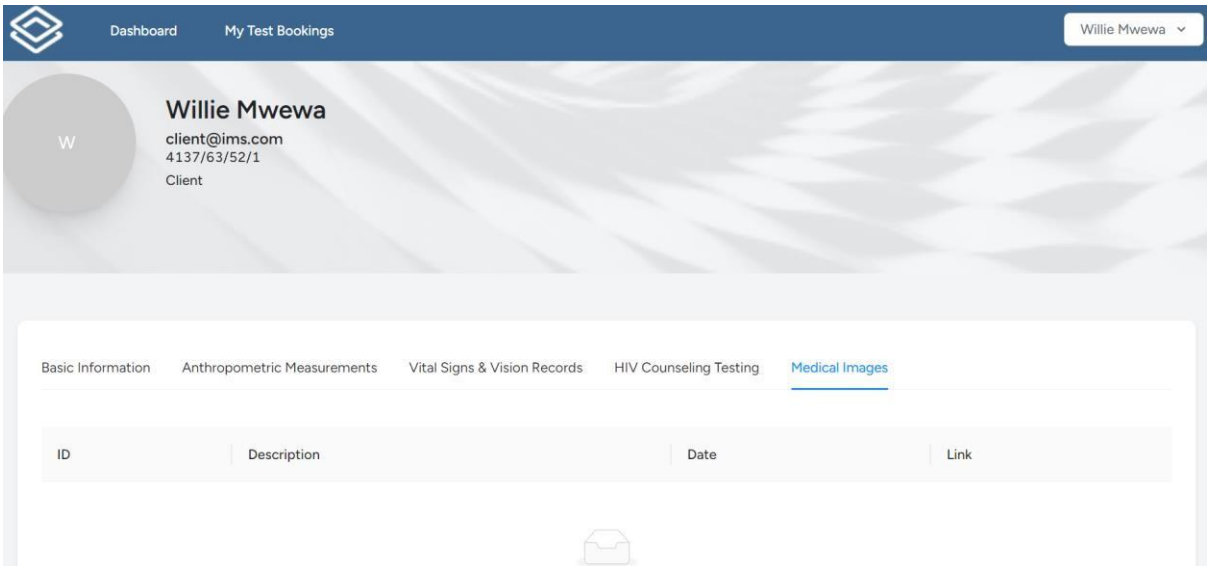
New Test Bookings



Users can view their profiles and their information on their medical profile as can be seen in Figure 24 below. They can view the basic information, various measurements of vital signs and all the tests that they have undertaken under their profile.

Figure 24

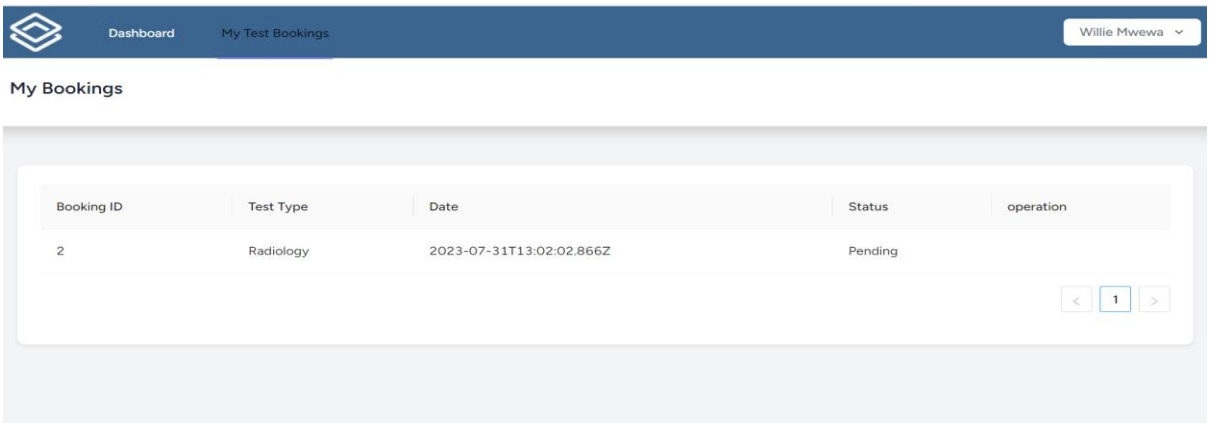
User Profile



Clients can view all the test bookings that have been made under their profiles as can be seen in the Figure 25 below. They can view the status of their request based on the current status under the status tab.

Figure 25

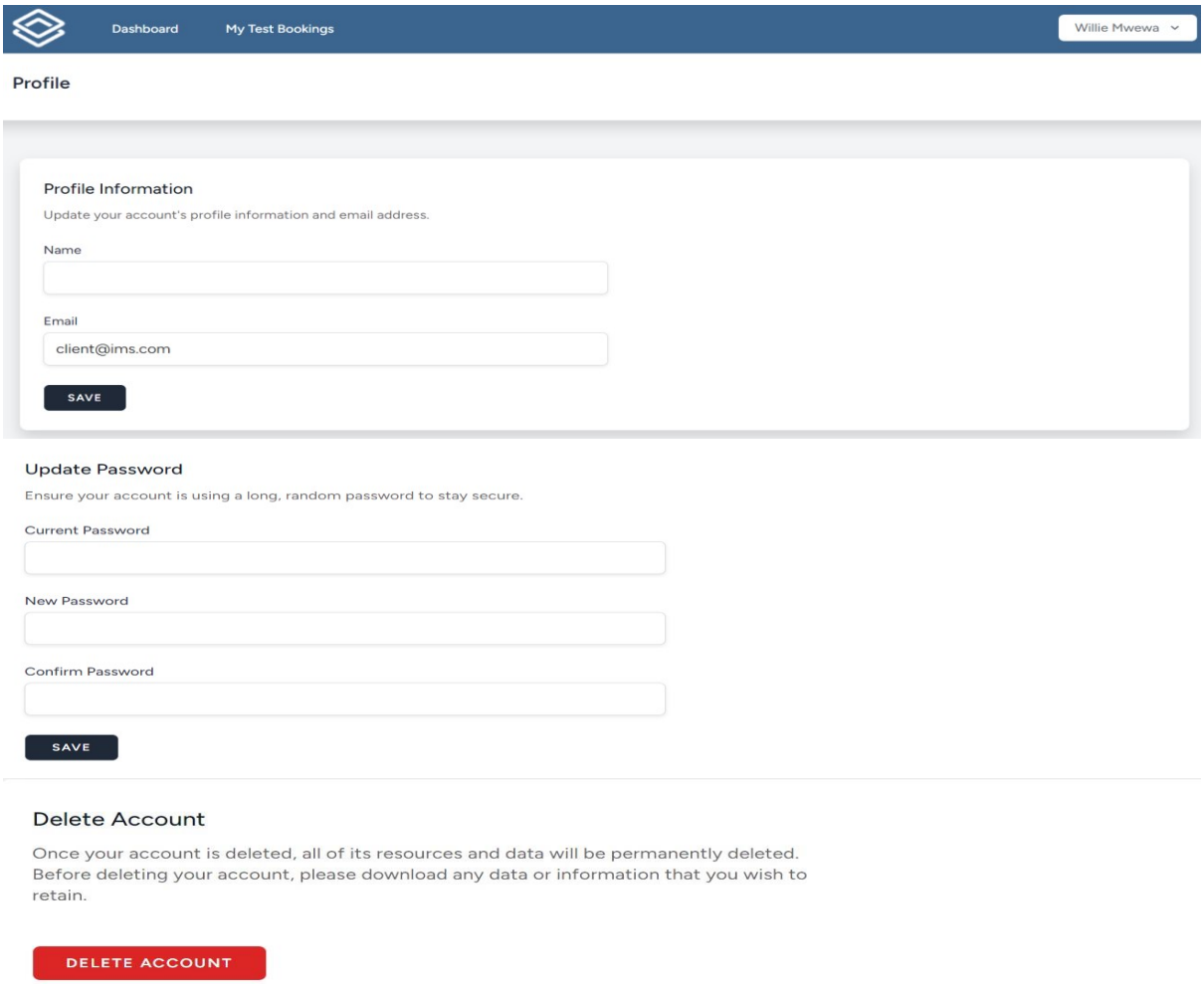
Test Booking



Clients can edit their account settings as can be seen Figure 26 below they can edit their usernames, update their password details and delete their account if it's no longer required.

Figure 26

Update User Profile



Physicians Login

The Physicians can login and create profiles in an event they don't have an existing account.

They can also reset their passwords in an event they forget their login credentials as shown in

Figure 27 below

Figure 27

Physician Login

The physician's dashboard allows them to view and register new clients. They can view the test bookings and make new order entries for various tests as can be seen in Figure 28 below.

Figure 28

Physician Dashboard

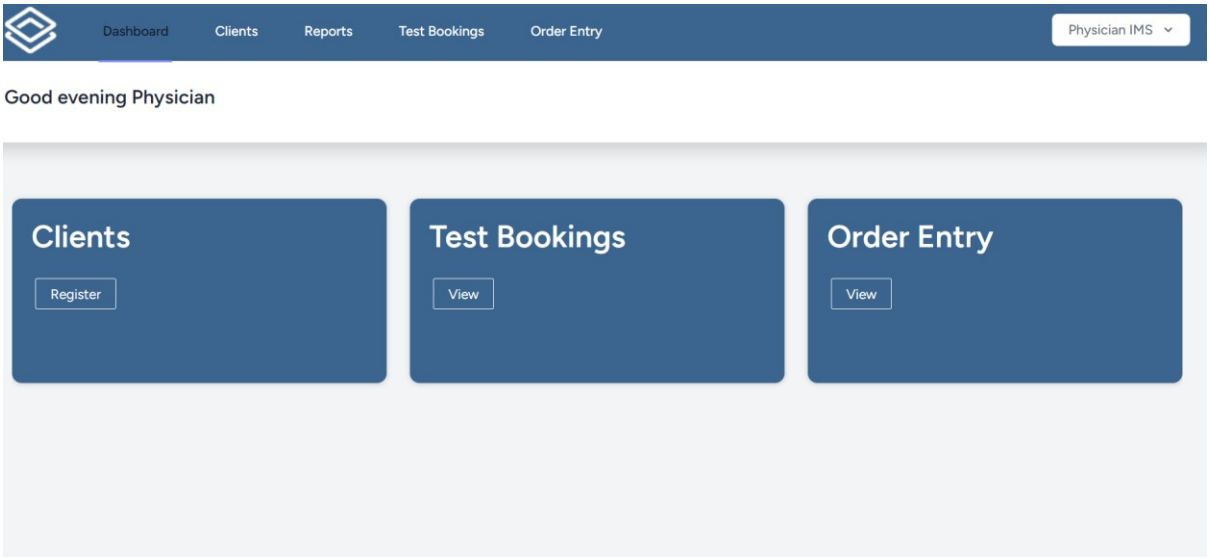
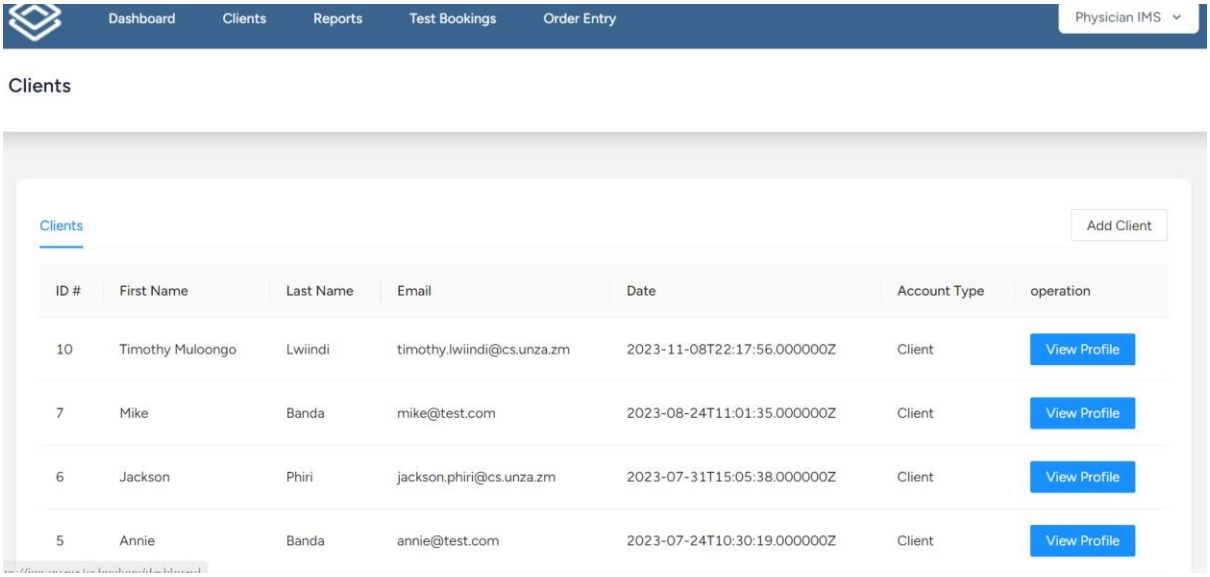


Figure 29 below shows physicians registering new clients and view profiles for the clients that already exist. They are able to view basic account information like client's names and the account type.

Figure 29

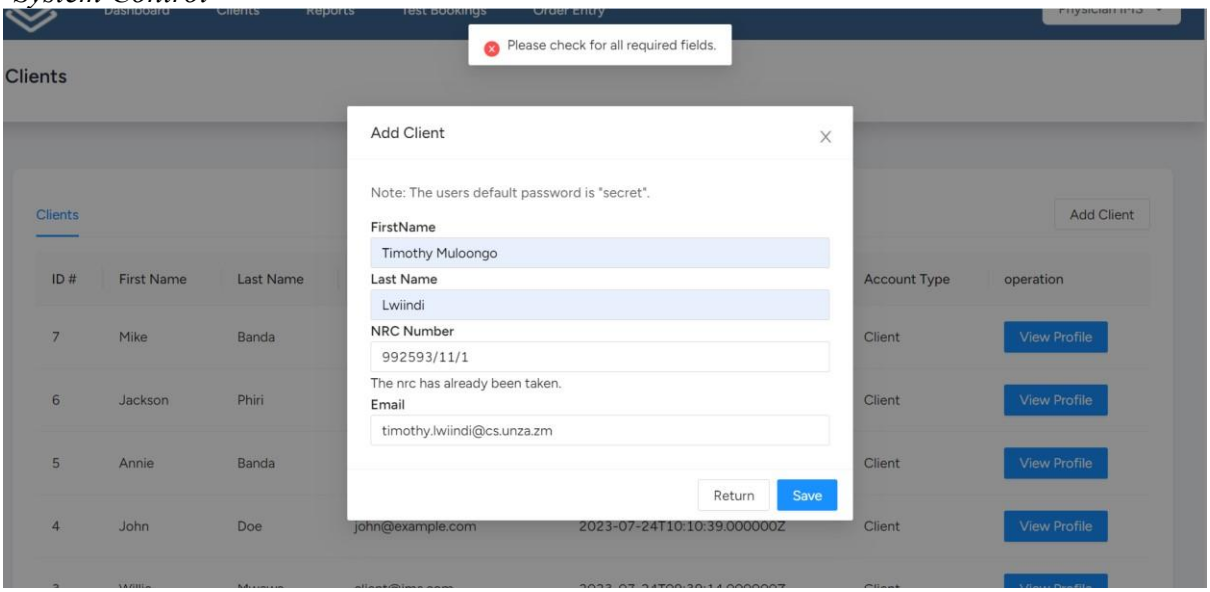
Registering New client



The system is built with controls that won't allow duplicate records as can be seen in the Figure 30 below. The NRC and email address are supposed to be unique records as they prevent duplicate records.

Figure 30

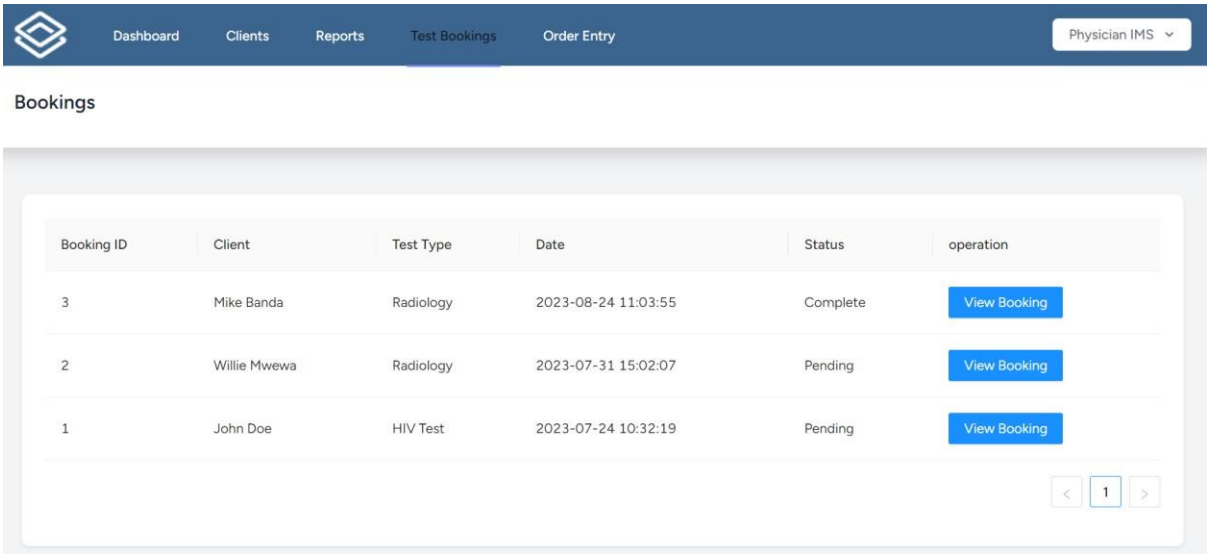
System Control



The physician can view test bookings and process them based on their status. They are either pending or complete, for those that are pending can be processed and completed provided the lab results have been uploaded as show in Figure 31 below.

Figure 31

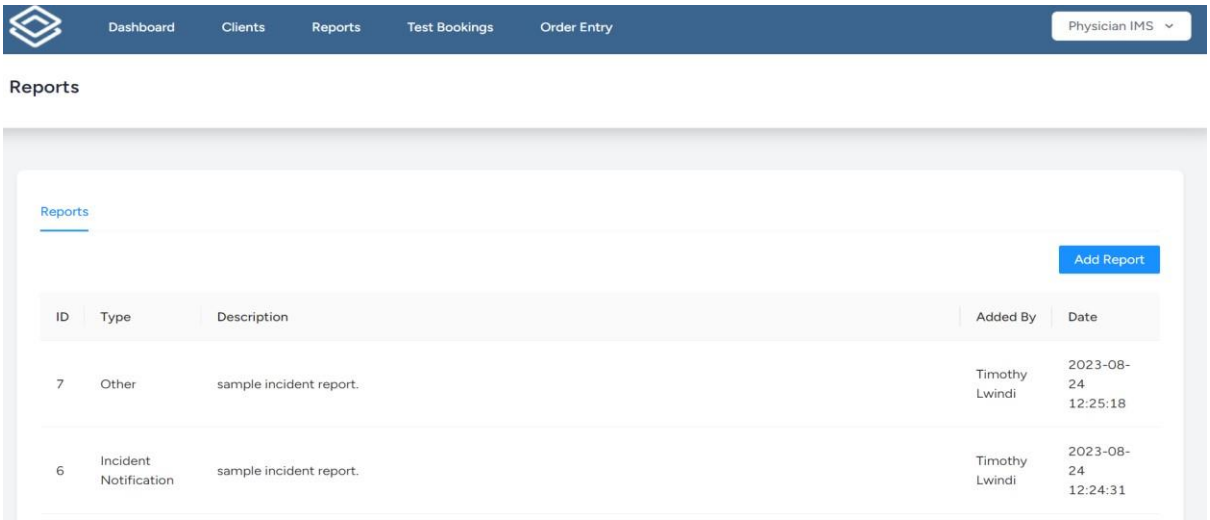
Process Test Bookings



A physician is able to add reports based on the findings for the clients as can be seen in the Figure 31 below,

Figure 32

User Reports

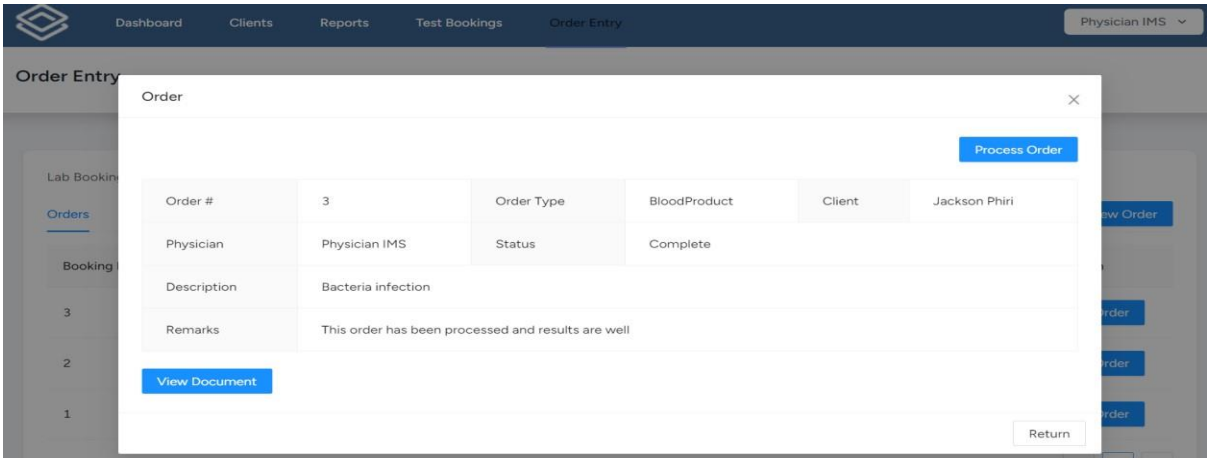


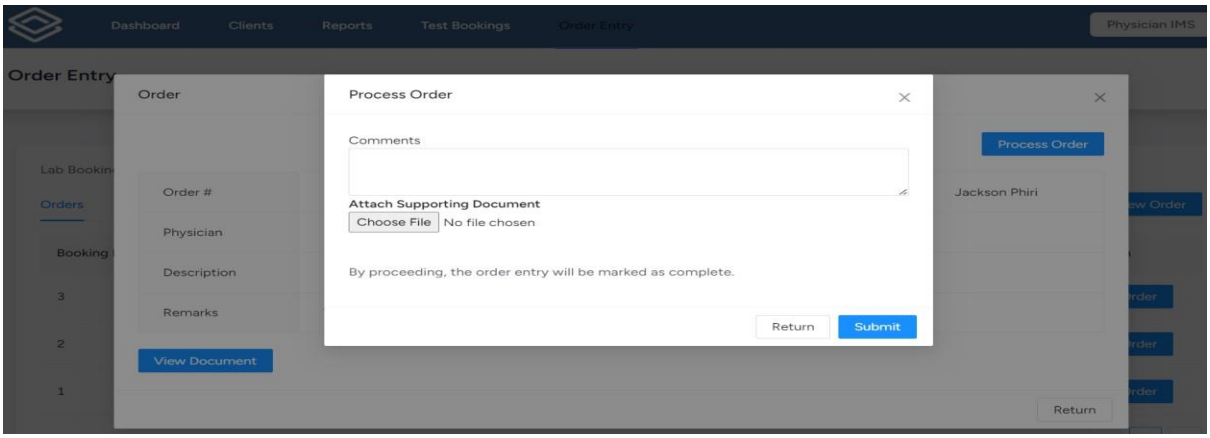
ID	Type	Description	Added By	Date
7	Other	sample incident report.	Timothy Lwindi	2023-08-24 12:25:18
6	Incident Notification	sample incident report.	Timothy Lwindi	2023-08-24 12:24:31
5	Other	Lorem ipsum dolor sit amet consectetur adipisicing elit. Eligendi, voluptatum rem architecto cumque, dolores laudantium expedita magni laboriosam quo, possimus reprehenderit suscipit. Labore illo ipsum magni, eveniet aspernatur illum quidem? Lorem ipsum dolor sit amet consectetur adipisicing elit. Eligendi, voluptatum rem architecto cumque, dolores laudantium expedita magni laboriosam quo, possimus reprehenderit suscipit. Labore illo ipsum magni, eveniet aspernatur illum quidem?	Timothy Lwindi	2023-08-11 16:09:37
4	Laboratory Report	Lorem ipsum dolor sit amet consectetur adipisicing elit. Eligendi, voluptatum rem architecto cumque, dolores laudantium expedita magni laboriosam quo, possimus reprehenderit suscipit. Labore illo ipsum magni, eveniet aspernatur illum quidem? Lorem ipsum dolor sit amet consectetur adipisicing elit. Eligendi, voluptatum rem architecto cumque, dolores laudantium expedita magni laboriosam quo, possimus reprehenderit suscipit. Labore illo ipsum magni, eveniet aspernatur illum quidem?	Timothy Lwindi	2023-08-11 16:09:32

The physician can make new order entries and process the orders for those whose status is not complete and complete them so that the status changes as shown in the Figure 33 below.

Figure 33

Process Order





Hospital Admin Login

Administrators can login and reset their account passwords when they forget the login credentials as can be seen in Figure 34 below.

Figure 34

Hospital Admin Login

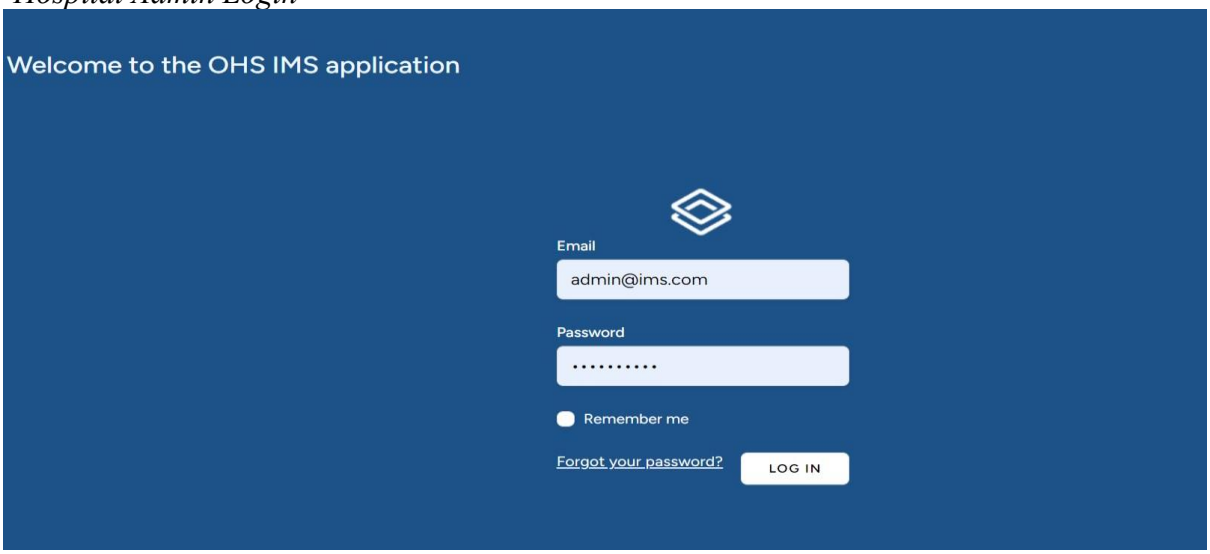


Figure 35 below shows the admin dashboard. It enables them to register clients and add or remove the services (tests) as shown in Figure 36 that can be performed in an event the need arises.

Figure 35

Hospital Admin Dashboard

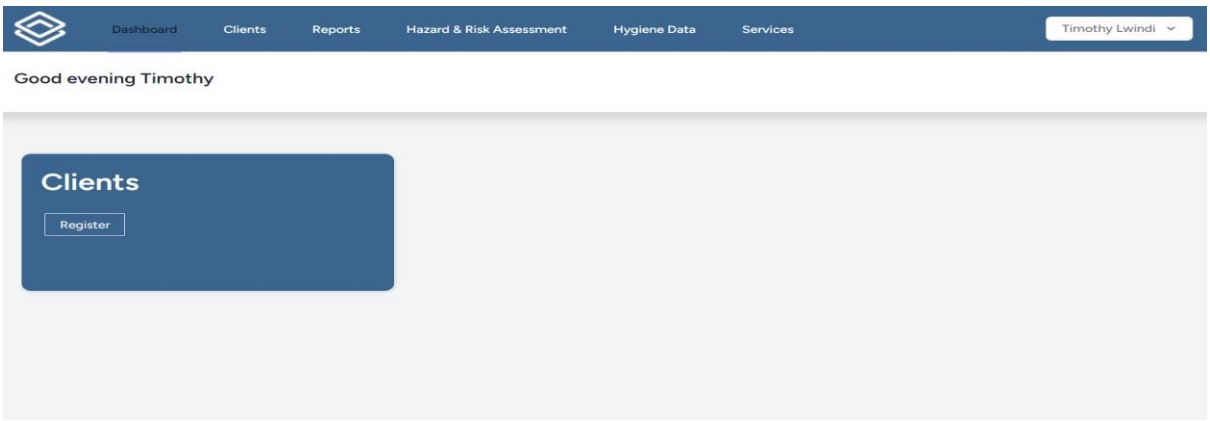
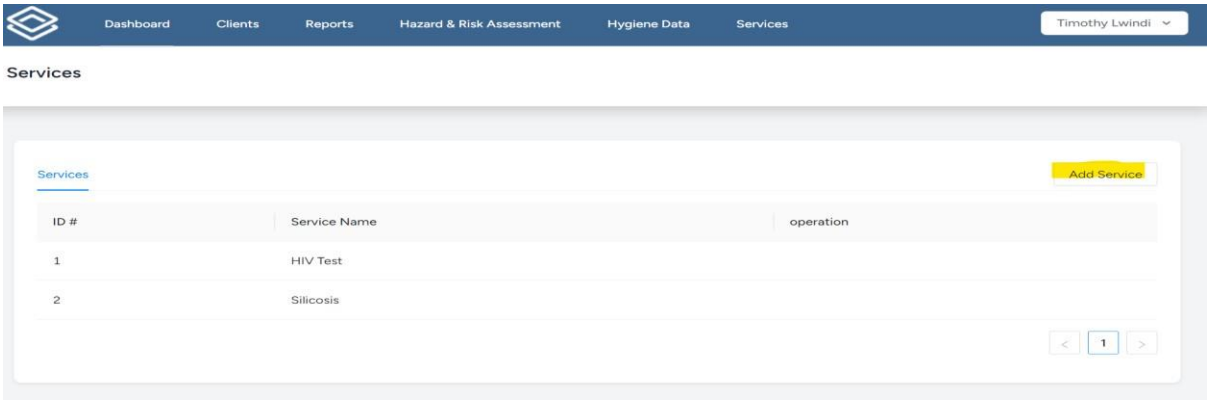


Figure 36

Services



Client certificate

Clients can view and download their certificates after undergoing a test. Below is a sample certificate for the client as show in figure 32.

Figure 37

Client Certificate Sample

5.4 Chapter Summary

This chapter presented the results of the descriptive analysis and explains why each analysis was undertaken. The chapter also presented the results of the correlation and regression analysis which utilized Chi-square test which indicated a statistics significant relationship. The results of the hypothesis testing were also presented.

6 DISCUSSION AND CONCLUSIONS

6.1 Introduction

This chapter presents answers to the study questions in the first chapter. The conclusions and answers to the study questions are founded on descriptive, regression and correlation analysis results. The chapter also recommends how occupational health and safety management system using district health information software can be used as a tool for data collection and sharing occupational health and safety information.

6.2 Discussion

This study found a statistically significant association between one's degree of education and their perception that an Occupational Health Management System would be effective in carrying out their duties. The study also found a statistically significant association between employees' beliefs that an Occupational Health and Information Management System will boost their productivity and efficiency in carrying out their responsibilities. Similarly, the study found a statistically significant association between people's beliefs that the interface with the Occupational Health Information Management System is clear and easy to grasp, and that the system will be effective in carrying out their jobs. The study also discovered a statistically significant link between persons who had people in their environment whose Occupational Health Information Management System had enhanced staff relations and morale in performing their responsibilities. Furthermore, the study discovered a statistically significant link between the weekly frequency of use of the Occupational Health Management Information System and their perception that the system will be effective in carrying out their activities. The study also discovered a statistically significant association between possessing the knowledge required to operate an Occupational Health Management Information System and individuals' view that the system would be effective in carrying out their tasks. Furthermore, the study found a statistically significant link between individuals' desire to utilize an Occupational Health Information Management System and their perception that the system would be effective in carrying out their jobs.

6.2.1 Challenges faced by NEPAD in sharing Occupational Health data with regional partners.

The first question was to identify the challenges faced by NEPAD in collecting Occupational Health data from regional partners. Most of the records are paper based and the record management system is poor.

Table 20

Chi-Square Tests

Hypothesis	P - Value	Relationship
Performance Expectancy	0.000	Statistically Significant Value
Effort Expectancy	0.000	Statistically Significant Value
Social Influence	0.000	Statistically Significant Value
Facilitating Conditions	0.006	Statistically Significant Value
Behavioural Intentions	0.000	Statistically Significant Value

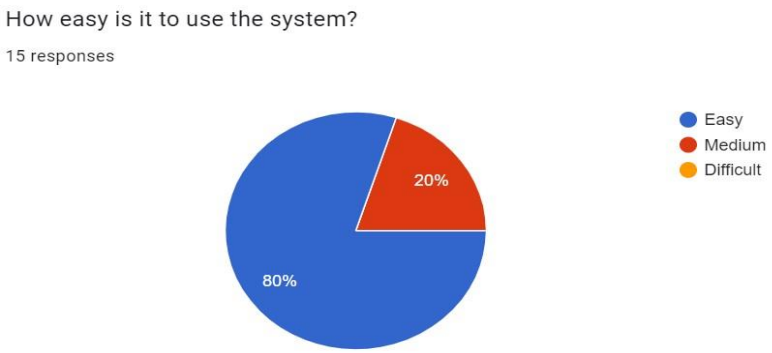
The Table 20 above shows the findings of the Chi-Square test which have reviewed that there is a statistically significant relationship between performance expectancy and the use behaviour of Occupational Health Management System as is evidenced by the asymptotic significant value (p-value) of 0.000. The findings also show that there is a statistically significant relationship between effort expectancy and the use behaviour of the Occupational Health Management System as is evidenced by the asymptotic significant value (p-value) of 0.000. The findings also show that there is a statistically significant relationship between social influence and the use behaviour of Occupational Health Management System as is evidenced by the asymptotic significant value (p-value) of 0.000. Further the research shows that there is a statistically significant relationship between facilitating conditions and the use behaviour of Occupational Health Management System as is evidenced by the asymptotic significant value (p-value) of 0.006. The findings also show that there is a statistically significant relationship between behavioural intentions and the use behaviour of Occupational Health Management System as is evidenced by the asymptotic significant value (p-value) of 0.000.

6.2.2 Health Information Management System for data sharing

How best can District Heath Information Software 2 (DHIS) be used as a tool for data collection on occupational health. It's evident that district health information software when implemented is an excellent tool for data collection and has given most African countries an opportunity to move from paper based to digital health information excellent for decision making. Below are the results obtained from the user feedback.

Figure 38

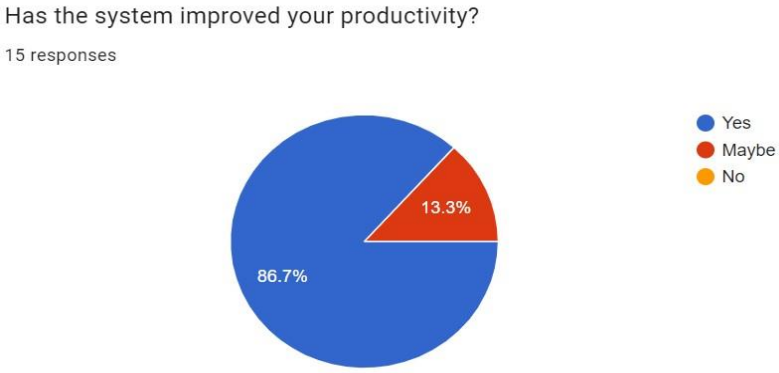
User System response



Out of the 15 respondents 80% found the system very easy to use and 20% found it relatively easy to use as shown in Figure 38 above.

Figure 39

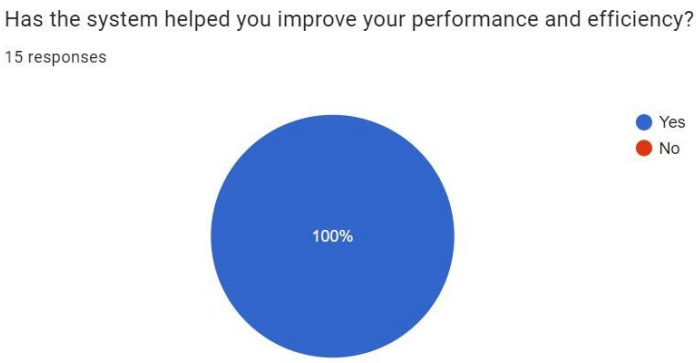
User productivity response



Out of the 15 responses 86.7% believed that the system increased their work productivity and 13.3% where not too sure if the system improved their productivity, as shown in Figure 39 above.

Figure 40

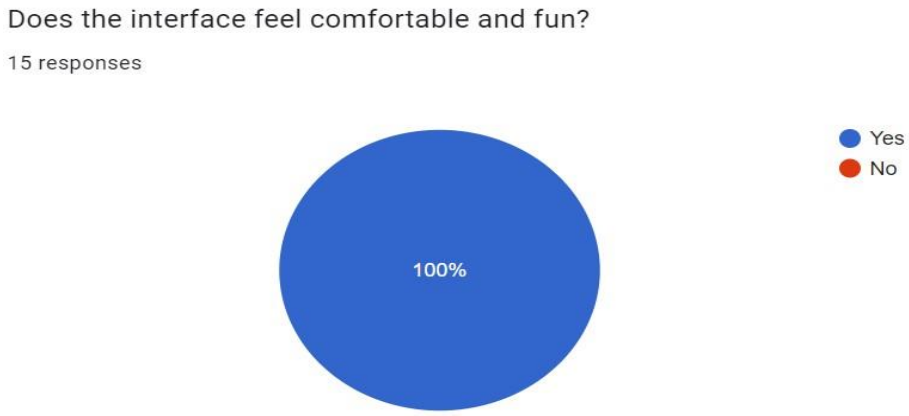
User performance and efficiency



Out of the 15 responses all users feel that the system has helped them improve their performance and efficiency in carrying out their tasks as shown in Figure 40 above.

Figure 41

User system interface response



Out of the 15 responses all users had no challenges using the system, they are all comfortable using the system as shown in Figure 41 above.

6.3 Conclusions

This study provides insights into the effects of a Health Information System with regards to occupational health and safety information. Further, it shows the application of the UTAUT model on the use and adoption of occupational health information management system. This is supported by the respondent's response that believe that Occupational Health Management System would increase their productivity and efficiency and that it would be useful in carrying out their tasks shown in table 4 and table 5 respectively. On the application of the UTAUT model by Venkatesh et al. (2003), the study concludes that of the hypotheses stated, Effort Expectancy, Performance Expectancy and Social

Influence significantly influence behavioural. Intentions for users to use occupation health information management system.

6.4 Recommendations

A national health information system's ultimate purpose is to provide high-quality data that can then be used to generate relevant information for evidence-based decision making in creating health-care treatments. It is thus clear that, when implemented, the DHIS2 system has provided unparalleled opportunity for most African countries to transition from the era of unreliable and fragmented HIS systems to the more ideal position of availability and utilization of excellent health information for decision making.

6.5 Future Works

There is a need to continue the process of developing the system in order to meet the needs of all stakeholders and to encourage widespread use of this system in Zambia for the benefit of all residents. It is necessary to increase health workers' sense of data ownership and to dispel the myth that a health worker's involvement ends when they gather data and transmit it to the next level.

6.6 Chapter Summary

This chapter discussed and concluded the study. The chapter showed how the research questions were answered. The results to the hypothesis testing were also presented and a conclusion was drawn.

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APPENDICES

Appendix 1 - Questionnaire

SURVEY QUESTIONNAIRES

PART ONE: DEMOGRAPHIC INFORMATION (PLEASE TICK [√])

1. Gender: Male [ ] Female [ ]

2. Marital Status: Single [ ] Married [ ] Divorced [ ] Other [ ]

3. Age: 20 or under [ ] 21-30 [ ] 31-40 [ ] 41-50 [ ] 51-60 [ ] 61+ [ ]

4. Highest level of education: G12 and below [ ] Diploma [ ] First degree [ ] Masters [ ] Ph.D. [ ]

5. Occupation (Please specify, e.g. “Stands Officer”):

…….

PART TWO: COMPUTER KNOWLEDGE AND EXPERIENCE (PLEASE TICK [√])

7. How do you describe your general knowledge about computers? Very poor [ ] Poor [ ] Moderate [ ] Good [ ] Very good [ ]

8. How would you describe your Internet knowledge? Very poor [ ] Poor [ ] Moderate [ ] Good [ ] Very good [ ]

9. How long have you been using the Internet? Don't use [ ] Less than 1yr [ ] 1- 2 yrs. [ ] More than 2 yrs. [ ]

10. How often do you use the Internet per day? Don't use [ ] Less than 1hrs [ ] 1-3 hrs. [ ] 4-8 hrs. [ ] More than 8 hrs. [ ]

PART THREE: OCCUPATIONAL HEALTH AND SAFETY DATA ACCESS FACTORS

Using a rating scale from the lowest point of 1 to the highest point of 5, please circle the number that indicates your level of agreement or disagreement with the following statement.

SD = strongly disagree | D = Disagree | N = Neutral | A = Agree | SA = Strongly Agree | NA= Not Application

No	Statement					
1	I think that Occupational Health Information Management System would be useful in carrying out my tasks	1	2	3	4	5
2	I think that Occupational Health Information Management System would enable me conduct tasks more quickly	1	2	3	4	5
3	I think that using Occupational Health Information Management System would increase my productivity and efficiency	1	2	3	4	5
4	I think using Occupational Health Information Management System would improve my performance	1	2	3	4	5

1	I think that interaction with Occupational Health Information Management System is clear and easily understandable	1	2	3	4	5
2	I think it's easy to become skillful at using Occupational Health Information Management System	1	2	3	4	5
3	I find Occupational Health Information Management System easy to use	1	2	3	4	5
4	I think that learning to use Occupational Health Information Management System is easy for me	1	2	3	4	5
1	People in my environment who use Occupational Health Information Management System have improved staff relations and morale	1	2	3	4	5
2	Occupational Health Information Management System Increases regulatory compliance	1	2	3	4	5
3	People in my environment who use Occupational Health Information Management System have more confidence at doing their work	1	2	3	4	5
4	Occupational Health Information Management System Improves public image and Public Relations	1	2	3	4	5
5	Having Occupational Health Information Management System boosts corporate and social responsibility	1	2	3	4	5

1	I have the resources necessary to use Occupational Health Information Management System	1	2	3	4	5
2	I have the knowledge necessary to use Occupational Health Information Management System	1	2	3	4	5
3	Help/guidance will be available on using Occupational Health Information Management System	1	2	3	4	5
4	Occupational Health Information Management System will reduce cost associated with accidents and incidents	1	2	3	4	5
5	I am aware and understand the services/activities that can be done on Occupational Health Information Management System	1	2	3	4	5
1	I intend to use the system in the next months.	1	2	3	4	5
2	I predict I would use Occupational Health Information Management System in the few next months.	1	2	3	4	5
3	I would find it easy to use the system	1	2	3	4	5
4	I plan to use the system the next occasion.	1	2	3	4	5
5	I intend to perform my work using Occupational Health Information Management System	1	2	3	4	5

PART FOUR: ACTUAL USE OF OCCUPATIONAL HEALTH INFORMATION MANAGEMENT SYSTEM (PLEASE TICK [√])

1. How long have you been using the Occupational Health Information Management System? Under 1 year [ ] 1-2 years [ ] 3- 5 years [ ] 5- 10 years [ ] more than 10 years [ ]

2. On a weekly basis, how many times do you use Occupational Health Information Management System? Not at all [ ] once a week [ ] 2-3 times [ ] 3-4 times [ ] more than 4 times [ ]

3. How frequently do you use your Occupational Health Information Management System for the following services?

Functionality	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
Capture data					
Register a client					
Register an industry					
Book an appointment					
Make payments					
Action/Account Control	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
Query client data					
Retrieve client records					
Generate reports					
Receive alert					

SURVEY QUESTIONNAIRES UAT

---

1. How easy is it to use the system?

*

Easy
Medium
Difficult

2. How easy is it to complete assignments and scenarios using this system?

*

Easy
Meduim
Difficult

3. How comfortable are you with using the system?

*

Comfortable

Fairly comfor

Not comforta

4. Is the system easy to learn?

*

Easy
Medium
Not easy

5. Has the system improved your productivity?

*

Yes
Maybe
No

6. Does the system give an error message and how to fix it?

*

Yes always
Sometimes
Not at all

7. Has the system helped you improve your performance and efficiency?

*

Yes
No

8. Is information on the system clearly presented?

*

Very clearly

Clearly
Not clear

9. Do you think effective presentation of information can help complete tasks?

*

Yes
No

10. Does the interface feel comfortable and fun?

*

Yes
No

Appendix 3: Publications

Timothy Muloongo Lwiindi, Jackson Phiri," OCCUPATIONAL HEALTH AND SAFETY INFORMATION MANAGEMENT SYSTEM USING DISTRICT HEALTH INFORMATION SOFTWARE".

https://ictjournal.icict.org.zm/index.php/icict/article/view/293

Lwiindi, T.M., Phiri, J. (2024). Occupational Health and Safety Information Management System. In: Silhavy, R., Silhavy, P. (eds) Software Engineering Methods in Systems and Network Systems. CoMeSySo 2023. Lecture Notes in Networks and Systems, vol 934. Springer, Cham. https://doi.org/10.1007/978-3-031-54813-0_40

Appendix 3: Source Code

Login Page <script setup> import Checkbox from '@/Components/Checkbox.vue'; import GuestLayout from '@/Layouts/GuestLayout.vue'; import InputError from '@/Components/InputError.vue'; import InputLabel from '@/Components/InputLabel.vue'; import PrimaryButton from '@/Components/PrimaryButton.vue'; import TextInput from '@/Components/TextInput.vue'; import { Head, Link, useForm } from '@inertiajs/vue3'; defineProps({ canResetPassword: { type: Boolean,

}, status: { type: String,

},

});

const form = useForm({

email: '', password: '', remember: false,

}); const submit = () => { form.post(route('login'), { onFinish: () => form.reset('password'),

});

};

</script>

<Template>

<GuestLayout>

<Head title="Log in" />

{{ status }}

<form @submit.prevent="submit">

<label class="flex items-center">

<Checkbox name="remember" v-model:checked="form.remember" />

Remember me

</label>

<Link style="color: white !important;" v-if="canResetPassword" :href="route('password.request')" class="underline text-sm text-gray-600 dark:text-gray-400 hover:text-gray-900 dark:hover:text-gray-100 rounded-md focus:outline-none focus:ring-2 focus:ring-offset-2 focus:ring-indigo-500 dark:focus:ring-offset-gray-800">

Forgot your password?

</Link>

<PrimaryButton style="color: black !important; background-color: white;" class="ml-4" :class="{ 'opacity-25': form.processing }" :disabled="form.processing">

Log in

</PrimaryButton>

</form>

</GuestLayout>

</template>

Dash Board <script setup>

import AuthenticatedLayout from '@/Layouts/AuthenticatedLayout.vue'; import BreezeNavLink from '@/Components/NavLink.vue'; import { Head } from '@inertiajs/vue3'; import { Link } from '@inertiajs/vue3';

</script>

<template>

```
<Head title="Dashboard" />
<AuthenticatedLayout>
<section> <Onboarding
v-if="$page.props.auth.user.userType == 'Client' && $page.props.auth.user.completeOnBoarding != 2" />
</section>
<template #header>
<h2 class=" font-semibold text-xl text-gray-800 dark:text-gray-200 leading-tight">{{ greeting }} {{
$page.props.auth.user.firstName
}}</h2>
</template>
<div class="py-12">
<div class="max-w-7xl mx-auto sm:px-6 lg:px-8">
<div class="overflow-hidden">
<section v-if="$page.props.auth.user.userType == 'Attendant'">
<!--<h1>Attendant Links</h1>-->
<div class="row">
<div class="col-md-4">
<div class="card-item"
:style="{ backgroundImage: `linear-gradient(45deg, #3B658F, 50%, rgba(255, 255, 0, 0)),url('0')` }">
<h3>Clients</h3>
<BreezeNavLink :href="route('register-new-client')" style="color: #000 !important;">
<br><br>
<div class="bottom d-flex justify-content-center">
```

```
                        <a-button class="btn-white">Register</a-button>
                    </div>
                </BreezeNavLink>
            </div>
        </div>
    </div>
</section>
<section v-if="$page.props.auth.user.userType == 'Client'">
    <div class="row">
        <div class="col-md-4">
            <div class="card-item"
                :style="{ backgroundImage: `linear-gradient(45deg, #3B658F, 50%, rgba(255, 255, 0, 0)),url('https://images.unsplash.com/photo-1532187863486abf9dbad1b69?ixlib=rb-4.0.3&ixid=M3wxMjA3fDB8MHxwaG90by1wYWdlfHx8fGVufDB8fHx8fA%3D%3D&auto=format&fit=crop&w=2070&q=80')` }">
                <h3>New Test Booking Application</h3>
                <BreezeNavLink :href="route('new-loan')" style="color: #000 !important;">
                    <br><br>
                    <div class="bottom d-flex justify-content-center">
                        <a-button class="btn-white">Make Test Booking</a-button>
                    </div>
                </BreezeNavLink>
            </div>
        </div>
        <div class="col-md-4">
            <div class="card-item"
```

```
                    :style="{ backgroundImage: `linear-gradient(45deg, #3B658F, 50%, rgba(255, 255, 0, 0)),url('0')` }">
                    <h3>Medical Certificate</h3>
                    <a :href="route('medicalCertificate', [$page.props.auth.user.id])" target="_blank"
                       style="color: #000 !important;">
                       <br><br>
                       <div class="bottom d-flex justify-content-center">
                          <a-button class="btn-white">View your medical certificate</abutton>
                       </div>
                    </a>
                 </div>
              </div>
              <div class="col-md-4">
                 <div class="card-item"
                    :style="{ backgroundImage: `linear-gradient(45deg, #3B658F, 50%, rgba(255, 255, 0, 0)),url('https://plus.unsplash.com/premium_photo-1664302091622322481 81a4b6?ixlib=rb-4.0.3&ixid=M3wxMjA3fDB8MHxzZWFyY2h8N3x8cmVnaXN0ZXJ8ZW58MHx8MHx8f DA%3D&auto=format&fit=crop&w=900&q=60')` }">
                    <h3>My Bookings</h3>
                    <div class="bottom d-flex justify-content-start">
                       <div>
                          <BreezeNavLink :href="route('loans')" style="color: #000 !important;">
                             <br><br>
                             <div class="bottom d-flex justify-content-center">
                                <a-button class="btn-white">View your my bookings</abutton>
                             </div>
```

```
                    </BreezeNavLink>
                </div>
            </div>
        </div>

        <div class="col-md-4">
            <div class="card-item"
                :style="{ backgroundImage: `linear-gradient(45deg, #3B658F, 50%, rgba(255, 255, 0, 0)),url(/bg.png)` }">
                <h3>My Profile</h3>
                <div class="bottom d-flex justify-content-start">
                    <div>
                        <Link :href="route('userProfile', { 'id': $page.props.auth.user.id })">
                        <br><br>
                        <div class="bottom d-flex justify-content-center">
                            <a-button class="btn-white">View your profile</a-button>
                        </div>
                        </Link>
                    </div>
                </div>
            </div>
        </div>

        <div class="col-md-4">
            <div class="card-item"
```

```
                    :style="{ backgroundImage: `linear-gradient(45deg, #3B658F, 50%, rgba(255, 255, 0, 0)),url(/bg.png)` }">
                    <h3>My Account Settings</h3>
                    <div class="bottom d-flex justify-content-start">
                        <div>
                            <BreezeNavLink :href="route('profile.edit')" style="color: #000 !important;">
                                <br><br>
                                <div class="bottom d-flex justify-content-center">
                                    <a-button class="btn-white">View your account settings</abutton>
                                </div>
                            </BreezeNavLink>
                        </div>
                    </div>
                </div>
            </div>
        </section>


    </div>
  </div>
 </AuthenticatedLayout>
</template>
```

```
<script>
import { defineAsyncComponent } from 'vue';

const Onboarding = defineAsyncComponent(() =>     import('@/Pages/Onboarding/Index.vue')
)



export default {     components: {
       Onboarding,
   },     data() {         return {             loading: false,             greeting: '',
       };
   },
   mounted() {


   },     created() {         this.greet();


   },
   methods: {
       greet() {
           const currentHour = new Date().getHours();


           if (currentHour >= 5 && currentHour < 12) {                 this.greeting = "Good morning";
           } else if (currentHour >= 12 && currentHour < 18) {             this.greeting = "Good afternoon";
           } else {
               this.greeting = "Good evening";
```

```
        }
      },

  }
};
</script>
<style> .card-item {  height: 190px !important;  background-color: #3B658F;  box-shadow: 0px 1px 5px rgba(0, 0, 0, 0.2);  cursor: pointer !important;  margin-top: 10px;  margin-bottom: 10px;  border-radius: 10px;  background-position: center top;  background-repeat: no-repeat;  padding: 0 !important;  background-size: cover;  padding: 20px !important;
}

.card-item .btn-white {  background: transparent;  border: 1px solid white;  color: white;
}

.card-item h3 {  color: white;  font-size: 32px;  font-weight: bolder;
}

.dashboard-header {  background: #f9f9f6;  padding-top: 5% !important;  padding-bottom: (42, 42, 31)
}

.dashboard-header-user {  background: white !important;  width: 96%;  margin-top: -200px !important;  z-index: 999 !important;
}

.registration-header {  background-color: white;  padding: 20px;
```

```
}
.dashboard-header .bg {
  background-image: url('/zero_state_small.png'); background-position: right; background-repeat: no-repeat; background-size: contain;
}

h1 { font-size: 28px; margin-bottom: 0;
}

h2 { font-size: 18px; margin-bottom: 0;
}

.quick-link { cursor: pointer; flex-direction: column; text-align: center; border-radius: 12px;
}

.quick-link h4 { color: rgb(11, 37, 51);
}

.btn-cta {
display: inline-flex;
  -webkit-box-orient: horizontal; -webkit-box-direction: normal; flex-direction: row; -webkit-box-align: center; align-items: center; -webkit-box-pack: center; justify-content: center; border-left-width: 0; border-top-width: 0; border-right-width: 0; border-bottom-width: 0; border-left-style: none; border-top-style: none; border-right-style: none; border-bottom-style: none; outline: none; box-shadow: none; text-decoration: none;
  -webkit-appearance: none;
```

-webkit-transition-property: background; -moz-transition-property: background; transition-property: background; transition-duration: 200ms;

transition-timing-function: cubic-bezier(0, 0, 1, 1); cursor: pointer; margin-left: 0 !important; margin-top: 12px !important; margin-right: 0 !important; margin-bottom: 0 !important;

font-size: 16px !important;

font-weight: bold !important; line-height: 20px !important; border-top-right-radius: 8px !important; border-bottom-right-radius: 8px !important; border-top-left-radius: 8px !important; border-bottom-left-radius: 8px !important; padding-top: 12px !important; padding-bottom: 30px !important; padding-left: 25px !important; padding-right: 25px !important; color: #FFFFFF !important; background-color: #000000 !important;

}

.btn-cta:hover {

background-color: #3a3a3a !important; color: #fff !important;

}

.btn-cta:disabled {

background-color: #555555 !important; color: #fff !important;

}

</style>

Bookings

<script setup>

import AuthenticatedLayout from '@/Layouts/AuthenticatedLayout.vue'; import { Head } from '@inertiajs/vue3';

</script>

<template>

<Head title="My Bookings" />

<AuthenticatedLayout>

```
    <template #header>
      <h2 class="font-semibold text-xl text-gray-800 dark:text-gray-200
leadingtight">Bookings</h2>
    </template>

    <div class="py-12">
      <div class="max-w-7xl mx-auto sm:px-6 lg:px-8">
        <div class="bg-white dark:bg-gray-800 overflow-hidden shadow-sm sm:roundedlg">
          <div class="p-6 text-gray-900 dark:text-gray-100">

            <a-table :columns="columns" :rowKey="record => record.id"
:dataSource="bookings"
              :pagination="{ pageSize: 30 }" :loading="loading"
@change="handleTableChange">

              <template slot="operation" slot-scope="text, record">
                <a-button type="primary" @click="showBooking(record)">View</abutton>
              </template>
            </a-table>

          </div>
        </div>
      </div>
    </div>
  </AuthenticatedLayout>
</template>
```

<script>

const columns = [

{ title: "Booking ID", dataIndex: "id", scopedSlots: { customRender: "id" }

}, { title: "Client", dataIndex: "clientNames", scopedSlots: { customRender: "clientNames" }

}, { title: "Test Type", dataIndex: "testType"

}, { title: "Date", dataIndex: "date"

}, { title: "Status", dataIndex: "status"

}, { title: "operation", dataIndex: "operation", scopedSlots: { customRender: "operation" } }

];

export default { data() { return { loading: false, columns, bookings: [],

};

},

mounted() { this.fetchBookings();

}, created() {

},

methods: {

handleTableChange() { }, showBooking() { }, async fetchBookings() { this.loading = true

const response = await axios.get('/booking/all-client-bookings/'); this.bookings = response.data;

```
        this.myFiles = []            this.loading = false


      }
   }
};
</script>
<style> .card-item {    height: 190px !important;    background-color: #3B658F;    box-shadow: 0px 1px 5px rgba(0, 0, 0, 0.2);    cursor: pointer !important;    margin-top: 10px;    margin-bottom: 10px;    border-radius: 10px;    background-position: center top;    background-repeat: no-repeat;    padding: 0 !important;    background-size: cover;    padding: 20px !important;
}

.card-item .btn-white {    background: transparent;    border: 1px solid white;    color: white; }
.card-item h3 {    color: white;    font-size: 32px;    font-weight: bolder;
}
</style>
```

Medical Orders

```
<script setup>
import AuthenticatedLayout from '@/Layouts/AuthenticatedLayout.vue'; import { Head } from '@inertiajs/vue3'; import InputError from '@/Components/InputError.vue';
</script>
<template>
   <Head title="Order Entry" />
   <AuthenticatedLayout>
      <template #header>
         <h2     class="font-semibold  text-xl text-gray-800  dark:text-gray-200 leadingtight">Order Entry</h2>
```

```
</template>
<div class="py-12">
  <div class="max-w-7xl mx-auto sm:px-6 lg:px-8">
    <div class="bg-white dark:bg-gray-800 overflow-hidden shadow-sm sm:roundedlg">
      <div class="p-6 text-gray-900 dark:text-gray-100">
                    <a-tabs v-model:activeKey="activeKey">
                <a-tab-pane key="1" tab="Orders">
                  <a-table :columns="columns" :rowKey="record => record.id" :dataSource="orders"
                    :pagination="{ pageSize: 30 }" :loading="loading" @change="handleTableChange">
                    <template #bodyCell="{ column, text, record }">
                      <template v-if="column.dataIndex === 'operation'">
                        <a-button type="primary" @click="viewOrder(record)">View Order</a-button>
                      </template>
                    </template>
                  </a-table>
                  <a-modal :width="1000" v-model:visible="visibleOrder" title="Order">
                    <template #footer>
                      <a-button key="back" @click="closeOrder">Return</a-button>

                    </template>
                    <a-descriptions bordered>
                      <a-descriptions-item label="Order #">{{ selectedOrder.id }}</adescriptions-item>
```

```
                        <a-descriptions-item label="Order Type">{{ selectedOrder.orderType
                        }}</a-descriptions-item>
                        <a-descriptions-item label="Client">{{ selectedOrder.clientNames
                        }}</a-descriptions-item>
                        <a-descriptions-item label="Physician">{{ selectedOrder.physicianNames
                        }}</a-descriptions-item>
                        <a-descriptions-item label="Status" :span="2">{{
selectedOrder.status
                        }}</a-descriptions-item>
                        <a-descriptions-item label="Description" :span="3">
                            {{ selectedOrder.description }}
                        </a-descriptions-item>
                    </a-descriptions>
                </a-modal>
            </a-tab-pane>
            <template #rightExtra>
                <a-button @click="openModal" type="primary">New Order</a-button>
                <a-modal v-model:visible="visible" title="New Order" @ok="submit">
                    <template #footer>
                        <a-button key="back" @click="closeModal">Return</a-button>
                        <a-button key="submit" type="primary" :loading="loading"
@click="submit">Make
                            Order</a-button>
                    </template>
                    <div>
                        <label for="amount">Order Type</label>
```

```
<a-select
  class="mt-2 block w-full focus:border-black focus:ring-1
focus:ring-black focus:ring-opacity-100 focus:outline-none placeholder-gray-400 placeholdersm"
  ref="select" v-model:value="form.orderType" size="large"
@focus="focus"
  @change="handleChange">

  <a-select-option value="Medication">Medication Order</aselect-
option>
  <a-select-option value="Laboratory">Laboratory Test</a-selectoption>
  <a-select-option value="Imaging">Imaging Order</a-selectoption>
  <a-select-option value="Consultation">Consultation Order</aselect-
option>
  <a-select-option value="Procedure">Procedure Order</a-selectoption>
  <a-select-option value="Nutrition">Nutrition Order</a-select-
option>
  <a-select-option value="Activity">Activity Order</a-select-
option>
  <a-select-option value="Nursing">Nursing Order</a-select-
option>
  <a-select-option value="Respiratory">Respiratory Order</a-
select-option>
  <a-select-option value="Discharge">Discharge Order</a-selectoption>
  <a-select-option value="Diagnostic">Diagnostic Order</a-selectoption>
  <a-select-option value="BloodProduct">Blood Product Order</aselect-
option>
  <a-select-option value="Rehabilitation">Rehabilitation Order</aselect-
option>
```

```
                    @change="handleChange">

                      <a-select-option v-for="(client, index) in clients" :key="index"
                        :value="client.id">{{ client.firstName }} {{ client.lastName
                        }}</a-select-option>
                    </a-select>
                  <br>
                </a-modal>
              </template>
            </a-tabs>
          </div>
        </div>
      </div>
    </AuthenticatedLayout>
</template>
<script> const columns = [
    {       title: "Booking ID",       dataIndex: "id",       scopedSlots: { customRender: "id" }
    },    {       title: "Test Type",       dataIndex: "orderType"
    },    {       title: "Description",       dataIndex: "description"
    },    {       title: "Client",       dataIndex: "clientNames"
    },
    {       title: "Physician Names",       dataIndex: "physicianNames"
    },    {       title: "Status",       dataIndex: "status"    },    {       title: "operation",       dataIndex:
"operation",       scopedSlots: { customRender: "operation" }
    }
```

```
];

export default {  data() {  return {  loading: false,  visible: false,  visibleOrder: false,  selectedOrder: [],  columns,  clients: [],  orders: [],  form: { orderType: '',  client_id: '',  description: '',  physician_id: '',  errors: [],
        }
    };
  },
  mounted() {  this.fetchOrders();  this.fetchClients();
  },  created() {
  },
  methods: {  handleChange() { },  handleTableChange() { },  showLoan() { },  viewOrder(record) {  this.selectedOrder = record;  this.visibleOrder = true
    },
    closeOrder() {  this.selectedOrder = []  this.visibleOrder = false
    },
    openModal() { this.visible = true },  closeModal() { this.visible = false },  submit() { this.form.physician_id = this.$page.props.auth.user.id;  this.loading = true;  axios
        .post("orders/new-entry", this.form)
        .then(res => {  this.visible = false;  this.loading = false  this.$message.success('Order Saved.', 5,);

        })
        .catch(error => {
          //this.errors = error.data;
```

```
                //this.form.errors = error.response.data.errors;                this.$message.error('Error.', 3,);                this.loading = false

            });

        },

        async fetchClients() {                //this.loading = true                const response = await axios.get('/users/all/');            this.clients = response.data;            this.loading = false

        },

        async fetchOrders() {                this.loading = true                const response = await axios.get('/orders/all');            this.orders = response.data;            this.myFiles = []            this.loading = false


        }

    }

};

</script>

<style> .card-item {     height: 190px !important;     background-color: #3B658F;     box-shadow: 0px 1px 5px rgba(0, 0, 0, 0.2);     cursor: pointer !important;     margin-top: 10px;     margin-bottom: 10px;     border-radius: 10px;     background-position: center top;     background-repeat: no-repeat;     padding: 0 !important;     background-size: cover;     padding: 20px !important;

}

.card-item .btn-white {     background: transparent;     border: 1px solid white;     color: white; }

.card-item h3 {     color: white;     font-size: 32px;     font-weight: bolder; }

</style>
```