PATIENTS' ATTITUDE AND EXPERIENCES TOWARDS AUTOMATED PHARMACY DISPENSING UNITS IN JOHANNESBURG, SOUTH AFRICA

by

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DISSERTATION

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DEDICATION

“We all have dreams. But in order to make dreams come into reality, it takes an awful lot of determination, dedication, self-discipline and effort” ~ Jesse Owens.

Dedication is belief transitioned into action which is transformed into change ~Byron Pulsifer.

This study is dedicated to my family: my mum, dad, mother in-law (my second mum), my brother and sister. I am so appreciative to have the loyal, supportive and caring family that I do. Thank you for your constant support and encouragement. Thank you for allowing me to study further and grow as a person.

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DECLARATION

I declare that **PATIENTS' ATTITUDE AND EXPERIENCES TOWARDS AUTOMATED PHARMACY DISPENSING UNITS IN JOHANNESBURG, SOUTH AFRICA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at the University of Limpopo or any other institution.

Chouhan, H (Mrs) 23-04-2022

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DEFINITION OF KEY CONCEPTS

Attitude

A mental disposition or mind set. Attitude is a tendency, based on one's beliefs and experience, to react to events in certain ways and approach or avoid events that confirm or challenge personal values (TheFreeDictionary.com, 2018). In this study, attitude refers to the way in which participants feel and react towards the automated pharmacy dispensing unit.

Experiences

The acts or processes of directly perceiving events or reality and direct observations of or participation in events as a basis of knowledge (Merriam-Webster, 2017). In this study, experiences refer to the encounters the participants have had with using the pharmacy dispensing units.

Chronic care

Chronic care is providing or concerned with long-term medical care lasting usually more than 90 days especially for individuals with chronic physical or mental impairment (Merriam-Webster, 2018). In this study, chronic care refers to promotion of independence of patients with chronic illness through provision of treatment from the pharmacy dispensing units.

Automated Dispensing Systems

Automated Dispensing Systems can be defined as "robotic devices that allow medications to be stored and dispensed in a safe and controlled manner near the point of care, while controlling and tracking drug distribution" (Chowles, 2018). In this study, automated dispensing systems will be referred to for all types of automated dispensing machines in and out of Gauteng.

Pharmacy Dispensing Units

The Pharmacy Dispensing Unit (PDU) is an Automated Teller Machine-like innovation which uses electronic and robotic technology to dispense medicines to patients upon presentation of a personal smartcard. It is similar to an ATM, however medication is given through the machine instead of money (Right to care, 2017). In this study, research will be conducted on patients' attitude and experiences towards automated pharmacy dispensing units, specifically in South Africa, as the pharmacy dispensing unit is only operational in South Africa.

Automation

Automation means using computer software, machines or other technology to carry out a task which would otherwise be done by a human worker. There are many types of automation, ranging from the fully mechanical to the fully virtual; and from the very simple to the mind-blowingly complex (Owen-Hill, 2017). In this study, automation refers to the Pharmacy Dispensing Unit which operates and dispenses medication without the use of human power.

LIST OF ABBREVIATIONS

ADD	Automated Dose Dispensing
ADM	Automated Dispensing Machine
AMDS	Automated Medicine Dispensing Services
ART	Anti-Retroviral Therapy
ATM	Automatic Teller Machine
CCMDD	Centralised Chronic Medication Dispensing and Distribution
CDU	Chronic Dispensing Unit
CHC	Community Health Centre
CSIR	Council for Scientific and Industrial Research
DHIS	District Health Information System
eTAG	eHealth Technical Advisory Group
GOe	Global Observatory for eHealth
GPP	Good Pharmacy Practice
HIS	Health Information Systems
HIV	Human Immunodeficiency Virus
NHI	National Health Insurance
NHRD	National Health Research Database
NDoH	National Department of Health
PDU	Pharmacy Dispensing Unit
PHC	Primary Healthcare Clinic
PMP	Patient Medicine Parcel
PuP	Pick up Point
RADU	Remote Automated Dispensing Unit
ReP	Right ePharmacy

RTC	Right to Care
SPSS	Statistical Product and Service Solutions
SREC	School Research and Ethics Committee
Stats SA	Statistics South Africa
TREC	Turfloop Research Ethics Committee
UNAIDS	United Nations Acquired Immunodeficiency Syndrome
WHO	World Health Organisation

ABSTRACT

Introduction

Pharmacy Dispensing Units (PDUs) are automated medicine dispensing systems, which are the first of its kind in South Africa and are operational in the public healthcare sector. At present, the application of automated dispensing technology is still evolving, and it is uncertain how it will impact on pharmacy services and be integrated into different healthcare systems.

Aim

To determine the attitude and experiences of patients collecting their chronic care medications at various Pharmacy Dispensing Units.

Methods

A cross-sectional quantitative design using a structured self-administered questionnaire was used to collect data from the participants at three PDU sites; Alexandra Plaza, Ndofaya Mall and Bara Mall. The study encompassed chronic stable patients. Participants were selected based on a simple random sampling method and included 624 participants. The study period was over two months. The researcher recorded the information that was present in the study population, and no variables were manipulated. Data was analysed using the SPSS version 27.0.0. Chi Square Tests, One-way Anova Tests and Microsoft Excel were used to analyze the data.

Results

Since $p<0.05$, the results showed that there was an association between responses and demographic information. The difference in distribution of responses seen across the participants at the different PDUs was significant. Most participants (85,4%) found the ATM easy to use as it was a simple system. Majority of the participants (99,6%) were content with the overall service received at the PDU, and 99,3% were pleased with the experience they had speaking through the PDU telephonic system. In comparison to the clinic, 99% of the participants felt they preferred to use the PDU and 99,7% found the PDU system easier to collect their medication from and follow their treatment plan. A few participants (2,7%) did have some negative experiences such as the system being down, network issues, technical challenges, delivery problems and the PDU being too busy. However, all of the respondents stated that they would recommend the PDU to other patients, as well as continue to collect their medicines at the PDU.

Conclusion

Overall patients had a positive attitude and experience towards the PDU. This research will assist in ensuring pharmacies continue to shift their focus to providing a more holistic approach to healthcare. It will allow for engagement with National and Provincial Departments of Health and NGOs to expand the number of PDUs. Furthermore, it might also help to develop new services and allow for changes to be made within the current models. This study will contribute to the overall improvement in the health sector and prepare for implementation of NHI.

Keywords: Pharmacy Dispensing Units, public healthcare sector, chronic care medications, attitude, experiences, impact.

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION AND BACKGROUND

“Access to medicines” is a fundamental part of primary healthcare. According to the World Health Organization (2018), it is supported by four main factors which include, rational selection and use of medicines, affordable prices, sustainable financing, reliable health and supply systems. Pharmacists are an important part of these elements especially with regards to a reliable supply system. In most countries, the majority of the pharmacy workforce is in community pharmacies where they are compensated to dispense or supply medicines under either private or public financing arrangements. This forms the basis of the pharmacy’s income and demands much of the pharmacist’s productive time (WHO, 2018).

The lack of pharmaceutical employees in South Africa has had a substantial impact on pharmaceutical service delivery. This has affected the capability of continuously supplying medications in the public sector (Gray, Riddin and Jugathpal, 2016). In addition to staff shortages in the public sector, there are many other factors which are compromising pharmacy service delivery. These include the staff having stressful working environments, less counselling time with patients and the intermittent availability of medicines for patients. This has resulted in patients receiving a lower quality of care, not always getting their medications and also having to wait in long queues for hours at the Primary Healthcare Clinics (PHCs) to collect their medications. Patients also spend an extensive amount of time travelling to and from the PHCs (NDoH, 2017).

In contrast to the private sector, the public sector is more dependent on manual systems. South Africa has the largest number of people living with HIV (7.7 million) in the world as well as the largest antiretroviral treatment programme (almost 5 million patients on treatment). In addition, 20.4% of adults aged between

15 to 49 years old are suffering from HIV and 71 000 people have died from an AIDS related illness in 2018, which was a 50% reduction since 2010 (UNAIDS Data, 2018). Scaling up access to antiretroviral therapy from the current level of 4.7 million patients to the required 7.7 million patients requires a step-change in medicine supply-chain management. There are also a large number of people living with Non-Communicable Diseases (NCDs) in South Africa. According to Stats SA (2020), NCDs caused more than half of SA's 460 236 registered deaths in 2015. This large number of deaths is due to lack of resources and effective health services which has led to late diagnoses and poor management which impacts on mortality and morbidity (StatsSA, 2015). Innovative strategies are therefore needed to maximize the availability of medicines and improve dispensing services like the Automated Medicine Dispensing Services (AMDS).

Technological changes have had a huge impact on all industries, especially healthcare. Automated Dispensing Systems have been available to the pharmacy globally for over a decade mostly at a local level such as in hospital pharmacies and single-site community pharmacies (Spinks, Jackson, Kirkpatrick and Wheeler, 2016). Pharmacy automation is proven to enhance the delivery of medication services for patients as well as ensure the availability of medicine (Chowles, 2018).

Pharmacy Dispensing Units (PDUs) are the automated medicine dispensing systems, which are the first of its kind in South Africa. They are used for long-term care, whereby they serve patients who suffer from chronic illnesses and are stable on their medications i.e. taking the same chronic medications for the past twelve months (Knowledge hub, 2021). They are currently operational in the South African public healthcare sector. The first PDU became operational in May 2017 at Alex Plaza in the township of Alexandra. This site has 4 PDU machines which serve patients from 7 different referral clinics. The other two PDUs started in January 2018, at Ndofaya Mall and Bara Mall, both situated in Soweto. Ndofaya Mall has 5 PDU machines and Bara Mall has 3 PDU machines, with both sites serving 42 referral clinics. The fourth PDU at Bambanani Mall, situated in

Diepsloot became operational in June 2018. This site has 4 PDU machines and serves 5 different referral clinics (Strydom, Hendricksz and Banoo, 2018). The fifth PDU site is at Twin City Mall, Mangaung, Bloemfontein and became operational in 2018 (Right to Care, 2020).

At present, the application of automated dispensing technology is still evolving, and it is uncertain how it will impact on pharmacy dispensing services and be integrated into different healthcare systems. It was behind this background that the study sought to determine the patients' attitude and experiences towards the automated pharmacy dispensing units provided at the PDU sites.

1.2 PROBLEM STATEMENT

There is a rising burden of chronic diseases including HIV in South Africa which is a major challenge being faced in the delivery of pharmaceutical services at Primary Health Care Clinics and Community Healthcare Centres (Li, 2018). In addition, there is a shortage of pharmacy staff and the use of manual systems for dispensing of medication have had a huge impact on chronic patients actually going to collect their medications and thus resulting in non-adherence to treatment (Gray *et al*., 2016). The PHCs and CHCs also have inflexible operating hours and thus patients have to take time off work to wait in the queue and spend large amounts of money on travelling to and from the clinics. Patients are therefore dissatisfied with the service they are receiving at the PHCs and CHCs (Chowles, 2018).

As part of National Department of Health's National Adherence Strategy, a non-governmental organisation Right ePharmacy together with its local and international partners piloted Remote Automated Dispensing Units (RADUs), also called Pharmacy Dispensing Units (PDUs) as part of a decentralization programme. The PDU sites were introduced with the goal of enhancing delivery and access to medication services, easing overcrowding at facilities in the publis sector with high patient volumes, reduce patient waiting times, which has the potential to improve medication adherence and retention in care. Since the

introduction of the PDU in South Africa, there are no studies conducted to understand the patients' attitude and experiences towards the PDU, and thus there is no information available on recommendations on how to improve service delivery. There has also been limited assessment conducted on the impact of pharmacy automation on the pharmacy workforce as well as to the patients particularly in the South African Healthcare set-up (Strydom *et al*., 2018). Thus, it would be interesting and beneficial to find out the attitude and experiences of patients towards the PDU and to assess what impact the PDUs have had towards patients.

1.3 RESEARCH QUESTIONS

The research questions were:

- What are the attitudes of patients towards collecting their chronic care medication through the automated Pharmacy Dispensing Units?
- What are the experiences of patients towards collecting their chronic care medication through the automated Pharmacy Dispensing Units?

1.4 PURPOSE OF THE STUDY

1.4.1 Aim

This study aimed to determine the attitude and experiences of patients collecting their chronic care medications at various automated Pharmacy Dispensing Units located in Johannesburg, South Africa.

1.4.2 Objectives

The aim of the study was achieved through the following objectives:

- To describe the attitude of patients towards collecting chronic care medication at automated pharmacy dispensing units.
- To explore the experiences of patients towards the automated pharmacy dispensing units.

- To observe the correlation between the Demographic information, attitude and experiences of patients towards the automated pharmacy dispensing units.
- To compare and correlate the different attitude and experiences between patients at the three PDUs.

1.5 SIGNIFICANCE OF PROPOSED RESEARCH

This research using patients' attitude and experiences towards automated pharmacy dispensing units, has contributed to the body of knowledge on pharmacy automation services. It has also helped to find out about the benefits and challenges of the automated pharmacy dispensing units and what changes might be implemented in the future to improve pharmaceutical service delivery to ensure that it is patient-centred. It has contributed in finding out about the current patient experiences and attitude towards the pharmacy dispensing units, and whether patients will recommend the PDU to the other patients as well as whether patients will continue using the PDU services. This research will assist in ensuring pharmacies continue to shift their focus to providing a more holistic approach to healthcare. It will also allow for engagement with National and Provincial Departments of Health as well as the NGOs to expand the number of PDUs to benefit patients. This study might also help to develop and support other services such as TB and HIV screening, Condom dispensing and allow for changes to be made within the current models. In addition, this study will contribute to the overall improvement in the South African health sector by understanding the importance of an alternative model of delivery of medication and thus prepare for the implementation of the NHI. On a global scale, it can assist other countries in looking at implementing this type of model or similar models.

1.6 DISSERTATION OUTLINE

The dissertation is provided as five chapters. Chapter 1 serves to introduce the reader to the study and provides the research problem to show why there was a need for the research, and provides the reader with the research questions, aims, objectives and significance of the study. Chapter 2 consists of an in-depth

literature review on the research topic and includes previous research studies that have been conducted. Chapter 3 contains an accurate reporting of the research methodology and design, study setting, population and sampling, inclusion and exclusion criteria, the data collection process, data analysis, pilot study, reliability and validity, bias and ethical considerations. Chapter 4 presents the exact results obtained after analysing the data and a discussion of the research findings. The final chapter 5 comprises the conclusion to the dissertation, limitations to the study and future recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Chapter 1 presented an overview of the study. This chapter discusses an in-depth review of the literature. According to Boote and Beile (2005), a literature review is an evaluative report of studies found in the literature in relation to the selected area of study. The purpose of the review is to describe, summarize, evaluate and clarify the literature. The literature review was done during the proposal of the study and updated during the final phase of the study. The literature review assisted the researcher with providing a context of the research, justifying the research, identifying what other researchers have done, relating the research with the existing knowledge, identifying flaws and gaps with the previous research and showing how the current research added value and knowledge to the field of study.

2.2 EVOLUTION OF eHEALTH

The World Health Organization (WHO) has adopted eHealth as a major priority since 2005 and defines it in the following statement, “eHealth is the cost-effective and secure use of information communication technologies (ICTs) in support of health and health related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research” (WHO, 2018).

The term eHealth became popular in the late 1990s and was used to describe everything related to internet medicine and computers. Words such as e-commerce, e-business and e-solutions also started to come about to portray different areas of health care. EHealth has progressed for greater than a century and is supported by policies and regulations, medical developments and advancements in communication technology (Meier, Fitzgerald and Smith, 2013).

The invention of the telephone in 1876 was a major stepping stone for telemedicine and lead to the principal research on how to fill the gap between patients and healthcare workers (Nwagwu and Onyancha, 2020). The ATS-1 satellite was one of the first telemedicine satellite projects in 1966 created by NASA which was used for civic purposes such as education (Latifi, 2011). In 1968, the first electronic medical record called TMR was developed at Duke University, which was used as a prototype for other electronic medical records (Duke Center for Health Informatics, 2009). The world's first successful implementation of a Computerized Physician Order Entry occurred in a hospital in California in 1971. This system allowed nurses and doctors to order medications quickly through a computer (Thomson, 2006). In 1992, Internet Registration began for .com, .net, .org, .edu and .gov addresses and allowed the internet to take off (Leiner *et al.,* 2009). WebMD a public internet site was launched in 1996 and provided information on health, diseases, medications and physicians' blogs for people to read (Pederson, 2004).

The Passage of World Health Organization Resolution (WHA58.28) was marked in 1998, which allowed for cross-border advertising, promotion and sale of medical products through the internet. In 2005, this eHealth resolution was approved by the ministers of health of the 192 member states of the United Nations Organization and the Global Observatory for eHealth was established (WHO, 2012).

In 2008, Google Health was introduced which allowed for google users to provide their health records on the platform, Google Health would then give feedback in the form of a complete medical health record which included possible diagnoses, medications and allergies. In 2010, internet usage reached over 1.9 billion users worldwide (Silicon Valley Historical Association, 2012). By 2017, 325 000 mobile health apps were available worldwide for people to access through their phones (Van der Kleij *et al.,* 2019). In 2019, medical drones were developed for transporting medications, blood and organs around the world. These drones will be used in the future between various countries (KPMG, 2021). These are just a

few examples of eHealth developments throughout history. Table 2.1 below, shows the developments of eHealth throughout different years (Meier *et al.,* 2013).

Table 2.1: Timeline of eHealth

YEAR	DEVELOPMENT
1858	Creation of a telemedical device called a sphygmosphone.
1876	Invention of the telephone.
1905	Wireless transmission of Electrocardiography (ECG) Waves.
1949	Use of Binary for Digital Transmission.
1955	• Founding of the Nebraska Psychiatric Program. • The Logic Theorist, the first artificial intelligence program was developed.
1966	Approval of ATS-1 Satellite for Telemedicine use by NASA.
1960	Development of health informatics in the United States of America.
1967	Establishment of the Massachusetts General Hospital (MGH) Telemedicine Program
1968	• Introduction of the New Hampshire-Vermont Program. • Development of the Computer Stored Ambulatory Record (COSTAR). • Creation of the Medical Record (TMR) at Duke University.
1969	Advanced Research Projects Agency Network (ARPANET) Connection.
1970	Since the 1970s, computational data approaches have accompanied biological research and resulted in scientific disciplines such as bioinformatics, systems biology and computational genomics.
1971	• Demonstration of Alaska ATS-6 Satellite Biomedical. • Implementation of Computerized Physician Order Entry (CPOE).
1972	• Introduction of Regenstrief Medical Record System (RMRS) • Implementation of NASA's Space Technology Applied to Rural Papago Advanced Healthcare (STARPAHC). • Funding by Health Care Technology Division of the US Department of Health, Education and Welfare (HEW) of Seven Telemedicine

	Projects.
1974	Launch of ATS-6 Satellite.
1977	• Beginning of Telehealth in Canada. • Seamless End-to End Transmission over Mobile Radio • Arrival of the First Commercial Network. • Creation of an Automated System to Perform Writing of Prescriptions. • Denmark established a National Patient Registry which laid the foundation for electronic health records by putting in place centralized record keeping.
1980	Development of Diagnostic Decision Support System at MGH.
1984	Creation of the North-West Telemedicine Project.
1989	• US-USSR Telemedicine Consultation Spacebridge to Armenia and Ufa. • Formation of the American Medical Informatics Association (AMIA).
1990	• Concept of eHealth emerged and was seen by most developed countries as fundamental to providing high quality patient-centred care. • Hartford Foundation Funding of Community Health Management Information Systems.
1991	Creation of Stanford Linear Accelerator (SLAC), the First Web Server on the Internet.
1992	Beginning of Internet Registration.
1993	Creation of the American Telemedicine Association (ATA).
1995	Formation of National Research Council Committee on Maintaining Privacy and Security in Healthcare Applications.
1996	• Enactment of Health Insurance Portability and Accountability Act (HIPAA). • Launch of WebMD. • Denmark, the shining example of eHealth advances, implemented eHealth and had four Danish eHealth strategies in place.
1997	Development of the First Telephony System by Lucent Technology (a Spin-Off of AT&T).

1998	Passage of World Health Organization Resolution WHA58.28.
1999	Expansion of the Internet.
2000	Creation of Regional Health Information Organizations (RHIOs).
2002	Beginning of Robert Wood Johnson Foundation (RWJF) Health e-Technologies Initiative.
2003	• Release of Institute of Medicine (IOM) Data Standards for Patient Safety. • E-Prescribing Encouraged by Medicare Modernization Act (MMA).
2004	Formation of Office of the National Coordinator for Health Information Technology (ONC).
2005	• Formation of American Health Information Community (AHIC). • Formation of Health Information Technology Standards Panel (HITSP). • Passage of WHO eHealth Resolution. • Introduction of the electronic health insurance card (e-Card) for all persons covered by health insuranvce in Europe. • Denmark launches the national eHealth portal which provided a single access point to healthcare services for citizens and health professionals.
2007	• Release of Microsoft HealthVault. • Countries across the European Union started the procedure of implementing national eHealth infrastructure to connect all actors in the health sector.
2008	AHIC, The Next Generation: Formation of National eHealth Collaborative. Introduction of Google Health.
2009	• Enactment of the Health Information Technology for Economic and Clinical Health (HITECH) Act. • According to the European eHealth report it was established that 89% (32 countries) now had a national eHealth policy/strategy. • National eHealth plan was developed in USA. • E-prescribing was implemented in countries such as the USA, Denmark, Estonia, Iceland, Sweden, Norway, Netherlands, Greece, England, Scotland, Wales and Northern Ireland.

2010	• Web use hits 1.9 billion users. • Assurance by ONC that data remains private. • Authorization by ONC of Testing and Certification Bodies. • Sharing of patient EHRs by Kaiser and the US Department of Veteran Affairs.
2011	• Introduction of IBM's Watson for use in health care. • Development of MojTermin (My Time) in the former Yugoslav Republic of Macedonia to improve scheduling of clinical appointments and reduce waiting times. • The Moldovan government establishes a strategic programme called e-Transformation which aimed to create a unified government portal with ease of access to information and services and a shared technology platform for businesses and hospitals. • The penetration of wireless devices amongst the US population was 102%. There were more wireless devices than the total population.
2012	• Watson studies cancer. • Nordic eHealth Research Network was established to compare and develop indicators on eHealth services and outcomes in the Nordic eHealth policies. • The WHO Regional Office established the Public Health Aspects of Migration in Europe Project to improve public health capacity and to manage emergency-related migration.
2015	• According to the European eHealth report it was established that 70% (30 countries) had a national eHealth policy/strategy. • World Bank grants different types of funding for various eHealth Programmes for the member states. • The Electronic Health Record (ELGA) health information system was introduced to public hospitals in some European countries. • **E-prescribing was implemented in South Africa.**
2017	In this period, 325 000 mobile health apps were available worldwide.
2018	• ELGA and e-Medication were made available to doctors in private practices, group practices, pharmacies and outpatient clinics in

	some European countries. • Slovakia launched their eHealth System which allowed for e-prescribing and medical records to be stored online. This improved healthcare and quality of life.
2019	Medical drones are developed to deliver medicine, blood and organs to rural communities and remote areas around the world.

In the past decade, there has been a huge growth in e-healthcare due to the evolution of wireless and sensor technologies and the advent of the fourth industrial revolution (Kher, 2016). The introduction of the smartphones has assisted in building the architecture for e-healthcare making it more convenient and cost-effective (Meier, Fitzgerald and Smith, 2013). People have become more health conscious, have taken a great interest in monitoring their own health and hence are willing to use ehealth technology (Pederson, 2004). Wearable medical devices, which monitor pulse rate, blood oxygen saturation, heart rhythm and skin temperature have become more widespread. Cloud-based e-healthcare systems have also emerged, whereby a patient's health information can be sent to the cloud server of the nearest clinic or hospital. Mobile and e- healthcare systems have created a huge impact on health management and treatment of patients (Kher, 2016).

The fourth industrial revolution technologies are the most recent innovations which have transformed medicine, with quick growth in genomics, genetic engineering, nanotechnology, Artificial Intelligence, Internet of things, Robotics and many more (Kher, 2016). These scientific and technological developments have had a huge impact on healthcare and provided patients with more exact information and treatment plans on their healthcare (Mazibuko-Makena, 2020).

2.3 E-HEALTH GLOBALLY

The World Health Organization (WHO) has adopted eHealth as a major priority since 2005 and defines it in the following statement, "eHealth is the cost-effective

and secure use of information communication technologies (ICTs) in support of health and health related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research" (WHO, 2018).

In order to achieve universal health coverage around the world, eHealth needs to be implemented. The eHealth Unit which is based in the Department of Service and Delivery and Safety in the Cluster of Health Systems and Innovation, is working together with the WHO collaborating centres, NGOs, its eHealth Technical Advisory Group (eTAG) and other partners at a global, regional and country level to encourage and support the use of ICT in health development (WHO, 2020).

The incentives of eHealth is driven by the increased use of information and communication technologies (ICTs) which have been supporting healthcare in developed and developing countries since the early 2000's. eHealth plays a major role in achieving universal health coverage as it provides services such as mHealth and telehealth in remote areas and communities which do not have access to proper healthcare. In addition, it offers eLearning which will assist in educating the health workforce. Through electronic health records (EHRs), eHealth allows for early patient diagnoses and timely treatment. EHealth uses ICTs to strengthen and improve the operations and financial systems of healthcare (WHO, 2018).

There are many barriers affecting the implementation of eHealth, such as training skilled workforce in using eHealth solutions, inadequate resources such as strong governmental structures, administrative and policy support, standards and interoperability and there is insufficient funding for these programmes. Furthermore, large amounts of data are needed, which has created a major burden upon staff to collect data, and thus the data quality is of a substandard nature. In addition, there is low awareness of the benefits of eHealth, insufficient eHealth literacy and inadequate evidence with regards to cost-effectiveness, interoperability and security (Ross, Stevenson, Lau and Murray, 2018).

A third global survey on eHealth was conducted by the WHO Global Observatory for eHealth (GOe) in 2015. A total of 125 WHO member states responded to the survey. The best national experts in the fields of eHealth were selected from each country, however it was impossible to assess whether these experts had sufficient knowledge on eHealth to complete the surveys. Data was based on eight themes which included eHealth foundations, legal frameworks for eHealth, telehealth, electronic health records, use of learning in health sciences, mhealth, social media and big data. A section on social and economic structures of each country was also included (WHO, 2018).

From the global survey it was found that 58% of the World Health Organization member states have an eHealth Strategy in place. It has been found that 90% of these eHealth strategies acknowledge the importance of the objectives of Universal Health Coverage and 90% of the countries with an eHealth strategy have special funding available for it. About 50% of the countries have health internet sites supported by the government, which provide information in many different languages. In addition, 75% of the countries have organizations in place which provide training and continuous education on ICT to the health professionals, and 25% of the countries use social media to provide in-service training on health (WHO, 2018).

A good eHealth strategy should be able to provide a health system which is patient-centred and not just disease-focused, but instead deliver Universal Health Coverage. It should also encompass the provision of information to keep people healthy, support public health in communities, care and support systems in health facilities, and provide data to inform management and policy makers (WHO, 2018).

The key application areas of eHealth are Electronic Medical Records (including patient records, clinical administration systems, digital imaging and archiving systems, e-prescribing, e-booking), telemedicine and telecare services; health information networks, decision support tools and internet-based technologies and

services. It also includes virtual reality, robotics, multi-media, digital imaging, computer assisted surgery, wearable and portable monitoring systems, and health portals (Silber, 2004).

2.4 E-HEALTH IN AFRICA

During the WHO Global Observatory for eHealth ICT-related targets were included as part of the Millennium Development Goals. This involved Resolution AFR/RC56/R8 whereby the member states had to implement eHealth strategies to improve their healthcare systems. There are already a few major eHealth projects already in place, such as Telemedicine Network for Francophone African Countries, HINARI Access to Research in Health Programme, ePortuguese Network and Pan-African e-Network Project. Some African countries have already implemented telemedicine and eLearning projects, including Algeria, Benin, Burkina Faso, Burundi, Cameroon, Chad, Republic of Congo, Cote d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Mali, Mauritania, Niger, Rwanda, Senegal and South Africa. These eHealth projects are still on a small scale; however there have been vast improvements in ICT which is forcing these countries to provide ICT-associated services (African Health Observatory, 2018).

Although Africa has an eHealth Strategy and has implemented a few eHealth Projects, there are still many challenges especially in the rural areas. These include insufficient ICT infrastructure and services, and lack of skilled professionals who are able to use these systems. Also there is a lack of education on eHealth as well as poor monitoring and evaluation systems. In addition, there is very limited bandwidth in order to use these services and internet costs are very high, making it difficult for some African countries to adopt eHealth as part of their health systems. Most countries are therefore dependant on external resources and donor funding (Mars, 2012).

Africa needs to strengthen its national health systems in order to improve access to eHealth services and tools. This involves creating awareness about eHealth,

developing a long-term eHealth Framework and Strategy, developing a multidisciplinary eHealth team, strengthening infrastructure and creating eHealth services, introducing eHealth as part of training and education at health institutions, and establishing special eHealth centres which focus on specializing in eHealth. Financial resources for eHealth also need to be considered and planned for, and monitoring and evaluation systems for eHealth need to be established to monitor progress (African Health Observatory, 2018)

2.5 E-HEALTH IN SOUTH AFRICA

The South African Department of Health has defined eHealth as “Combined utilization of electronic communication and information technology to generate, transmit, store and retrieve digital data for clinical, educational and administrative purposes” (Mars and Seebregts, 2008).

In South Africa, health services are delivered across the three levels of the government: national, provincial and local authorities. According to the South African Constitution, both the national and provincial governments have the responsibility to implement service deliveries. The National Department of Health prioritises legislation, policy, norms and standards and ensures equity. At the forefront, the Provincial Department of Health is responsible for planning, budgeting and delivery of health services. The Local government is more focused on municipal health services as per the National Health Act No.61 of 2003. The Provincial Department of Health is also responsible for the delivery of eHealth services whilst the National Department of Health creates the policy and strategy development for eHealth (National Health Act, 2003).

South Africa is in the process of modifying its public healthcare sector in order to benefit all South African citizens. In 2012, the Department of Health released a National E-health Strategy. The overall aim of the eHealth strategy in South Africa is to provide a single, harmonised and comprehensive strategy which supports the medium-term priorities of the public health sector (Johnell, 2016). In addition, the

eHealth strategy needs to create a way forward for future public sector eHealth requirements and to generate the necessary foundations for the future integration and coordination of all eHealth initiatives in the country (in both public and private sector). This transformation and improvement in healthcare services as a long term vision will allow for a long and healthy life for all South Africans (National eHealth Strategy in South Africa, 2012).

According to the analysis of Health Information Systems in developing countries, there are five stages of eHealth maturity as countries move towards systems of greater scope.

Stage 1: Paper-based systems for collecting district health indicators,

Stage 2: Optimisation of paper systems through simplifying indicators and reducing duplication,

Stage 3: Migration of traditional district health information systems to electronic storage and reporting,

Stage 4: Introduction of operational ICT systems as a source of data for HIS,

Stage 5: A fully comprehensive and integrated national HIS.

Based on the availability of resources, South Africa is at stage 3 of eHealth maturity, however some provinces are still at stage 1 and 2 and others are at stage 4. They have not reached stage 5 as yet (National eHealth Strategy in South Africa, 2012).

The eHealth Strategy aims to implement eHealth with regards to electronic health records, routine health management information, vital registration, health knowledge management, mobile health, telemedicine, virtual healthcare and health research (Botha *et al.,* 2014).

Jembi Health Systems NPC is a non-profit organisation that operates in developing countries in Africa and focuses on the development of eHealth and HIS. It is based in Cape Town, South Africa and has a South African Health

Program. It aims to conduct research, design and strengthen health systems (Jembi Health Systems, 2018).

There are various projects under this initiative such as (Jembi Health Systems, 2018):

- Blood Safety Information System (BSIS): a Centre for Disease Control (CDC) funded program looking to develop an open source blood establishment computer system (WHO, 2020).
- Open Shared Health Record (OpenSHR): a global open source collaboration to strengthen national health information exchanges in low income countries (Katurura and Cilliers, 2018).
- Open Health Information Mediator (OpenHIM): manages the orchestration of all transactions to other services and enable interoperability between all components within the Rwandan Health Information Exchange (HIE) (Jembi Health Systems, 2018).
- MomConnect: Together with the South African National Department of Health and mHealth service providers, there is now a National Pregnancy Registry (NPR) whereby pregnancy data can be recorded in the public health sector (Seebregts et al., 2018).
- Redcap Research Database: to develop and strengthen the use of Redcap which is a web application that can build and manage online surveys and databases at the University of Cape (Mare, Hazelhurst, Kramer and Klipin, 2014).

In addition, Vodacom's subsidiary, Mezzanine, has been able to establish how mobile operators can assist in resolving the inadequacies in supply chain management. Mezzanine developed a Stock Visibility Solution (SVS) which allows health facilities to convert manual reporting of stock into electronic data collection and real-time reporting using a mobile device. This reporting can then be checked on a computer and allow the district pharmacies to assist healthcare facilities in the rotation and movement of stock (Mezzanine, 2020).

2.5.1 Benefits of eHealth in South Africa

The benefits of eHealth include cost savings and financial benefits for healthcare providers, as there will be less litigation costs and improved electronic record keeping (National eHealth Strategy in South Africa, 2012).There will also be health safety improvements, improvement of effectiveness and efficiency of healthcare whereby patients can receive individualised care, both professionals and patients can make better health decisions, and ensure diagnostic accuracy and treatment appropriateness. Furthermore, there will also be increased access to remote physicians, a reduction of medical errors, greater transparency and accountability of care processes and facilitating shared care across boundaries (Botha *et al.,* 2014).

A study was conducted by the Council for Scientific and Industrial Research and the Nelson Mandela Metropolitan University to see what investments had been made by the National Department of Health into eHealth. It was found that there were local benefits with existing projects such as the national electronic Primary Healthcare (ePHC) and the Stock Visibility System (SVS) which showed that progress was already being made at a primary healthcare level (NDoH, 2017). In addition, South Africa had 42 health information systems across the different provinces. The District Health information System is one of South Africa's most successful health information system funded by NDoH. The National Health Normative Standards Framework for Interoperability in eHealth in South Africa was designed to use international eHealth standards to address interoperability issues (Katuu, 2016).

South Africa has the largest telecommunications market in Africa which is controlled by the Telco (Telkom) group. The advantages seen from this is that mobile phones have helped millions of people to improve communication. Furthermore, South Africa's mHealth infrastructure has the potential to improve medical informatics, telemedicine, surveillance and healthcare education in the whole of Africa. Moreover, South Africa has established the ICD-10 coding system as the national diagnosis coding standard and HL7 as the national messaging

standard. Health Informatics programmes are also available at the University of Kwazulu Natal, Walter Sisulu University and the University of South Africa (Mars and Seebregts, 2008). These are just some of the benefits seen from the eHealth initiatives in South Africa.

2.5.2 Challenges of eHealth in South Africa

These include financial barriers, lack of IT and clinical resources, the difficulty of learning and using eHealth software, personnel costs, standardization of Health Information Systems, time challenges, the implementation of eHealth in rural areas, data privacy, interoperability, sustainability, data quality, usability and the transition from paper to electronic health records (Botha *et al.,* 2014).

According to the eHealth Strategy of South Africa the current health information systems are disunited, mismanaged, lack standardization and are not interoperable. At the primary healthcare level most systems are still paper based. From the study conducted by the CSIR and Nelson Mandela Metropolitan University, it was found that 13 of the 42 health information systems were standalone systems which did not share information locally or externally. Furthermore, more than half of these systems did not comply with national or international standards. This difference in quality showed how difficult it would be to achieve interoperability between the systems (Katuu, 2016).

It has been found that many South African health workers have not had a sufficient amount of computer training and some may have never used a computer before. Thus there is a vital requirement for capacity building for eHealth at all levels. Although South Africa has a very huge telecommunications market, they still cannot compete with international levels of e-readiness. Broadband accessibility is very low and the cost of bandwith is very high. There is also a huge shortage of trained personnel on eHealth which is affecting the complete implementation of eHealth. EHealth projects are also funded by government and NGOs and there is a lack of funding from these bodies which has also affected the

eHealth applications. Approximately 46% of the South African population are living in rural areas and do not have proper access to healthcare and cannot afford health insurance. In addition, it has been difficult to implement ehealth systems in rural areas because of network issues (Mars and Seebregts, 2008).

There are currently more challenges than benefits in South Africa, but with proper Information Communication Technologies, these challenges can be resolved and the benefits can improve. Overall, this will result in a better eHealth service delivery (Botha *et al.,* 2014).

2.6 E-HEALTH MODELS

Many eHealth initiatives do not always progress beyond pilot models. However, there are some examples of eHealth initiatives that are already part of eHealth establishments and have proven their success (Kimble, 2015).

2.6.1 Apollo Telemedicine

The Apollo Telemedicine Networking Foundation in India is a non-profit organization, which offers an efficient working model of telemedicine for the developing world. The Apollo group started their first project in Aaragonda and then expanded to other parts of India in order to improve access to unique medical support systems by connecting Apollo hospitals to centres located in rural areas. It has 150 centres in India and overseas, and provides teleconsultation and tele-education to 53 countries such as Afghanistan, Colombo, Dhaka, Maldives and various other countries. Apollo's primary goal is to offer readily available access to expert knowledge in hospitals situated in larger cities, thus reducing costs and eliminating the inconvenience of travel (Healthmarket innovations, 2020).

2.6.2 Aravind Tele-Ophthalmology

The Aravind Tele-Ophthalmology Centre in India is the largest eye-care Organization in the world which aims to eliminate blindness. They have various centres and mobile eye-screening vans fitted with a satellite in the rural areas

which can connect to hospitals through videoconferencing. The ophthalmologist can thus speak directly to the patient and diagnose the patient through transfer images from the centre or van. Aravind has several hospitals, vision centres and internet kiosks which are all linked through high-speed wireless network (Prathiba and Rema, 2011).

2.6.3 Arizona Telemedicine Program

The Arizona Telemedicine Program in the United States of America main objectives are to improve access to specialized services in rural areas and for underserved populations; to develop cost-effective telemedicine services and to expand opportunities for educating healthcare professionals living in rural areas. This program facilitates medical services to 20 communities and provides educational material for 34 communities. In addition, it helps to support the expansion of novel telemedicine projects. It assists institutions such as prisons, public schools and private hospitals with eHealth Networks and helps to decrease the cost of these networks by sourcing funding from the Arizona state government and other private donors (Krupinski and Weinstein, 2013).

2.6.4 Centro Unico di Prenotazione

The Centro Unico di Prenotazione is a central booking point in Italy which enables patients to book, reschedule, cancel and pay for visits to specialists or tests requested by doctors. The patient can do this at any of the local pharmacies. The system operates through a client-server application which uses off-the-shelf technology and a database controlled by the regional government, which also offers training and IT help desk for system users. This system aids health authorities in managing waiting times and monitoring the effectiveness of their health awareness campaigns (Ferre *et al.,* 2014).

2.6.5 Myca Nutrition

Myca Nutrition in Canada is a web and mobile communications board which connects nutritionists with their clients. The nutritionist is able to perform a

consultation through videoconferencing, instant messaging, telephone, secure email or the nutritionist's own website. Myca Nutrition also has an effective billing service which can manage online payments. The system operates through standard web technology and incorporates a database which allows patients to easily find a doctor or nutritionist. Myca Nutrition has also franchised its system to other countries (Chen, Cheng and Mehta, 2013).

2.6.6 People's Liberation Army Telemedicine Network

Satellites and landlines are used to link 114 military hospitals, 97 civil hospitals and more than 300 specialists across China with the People's Liberation Army Telemedicine Network. This Telemedicine Network allows for Telecommunications and distance education learning. It accommodates for provision of healthcare in both urban and rural areas (Lian, Fu, Ning and Zhai, 2001).

2.6.7 SkyHealth

SkyHealth is a telemedicine program with nearly 1200 SkyCare centres operated by 120 female entrepreneurs, who deliver medical services in villages in India. Their main focus is female patients who require assistance with family planning. They also assist with diagnosing patient, prescribing treatment and making referrals. The SkyCare centres are connected to specialists based in New Delhi who can then refer patients to clinics or hospitals (Innovation Policy Platform, 2020).

2.6.8 Tactive Telemedicine

Tactive Telemedicine is an online service, based in the Netherlands, which offers treatment to people who are addicted to alcohol and require assistance. They have mental health services and counsellors who provide patients with cognitive behavioural therapy. This system also operates anonymously which is a huge benefit for the patients. Furthermore, Tactive Telemedicine also conducts research on addictive behaviours (Chen, Cheng and Mehta, 2013).

2.6.9 TeleMed –Escape

TeleMed-Escape is an electronic managing system based in Italy, which sends digitally signed test results directly to doctors and patients, through a computer via the eHealth unit in Italy. It can also send the results through the post. This system is beneficial to patients as they can easily have access to their results, without having to go to the hospital. It is also advantageous to the doctors, hospitals and pharmacies, because this system results in fewer errors, quicker turnaround times and decreased administrative costs (Kimble, 2015).

2.6.10 Telenor TeleDoctor

The Telenor TeleDoctor Programme based in Pakistan enables patients to directly contact a Doctor by dialling a single number. Through this 24 hour hotline system medical advice, such as a discussion of symptoms, treatment plans and general health can be given in eight different languages. It is easily accessible and patients don't have to travel to use this system (Burney, Abbas, Mahmood and Arifeen, 2013).

2.6.11 Tele-Health Project

This project is based in Africa and allows African hospital centres to link with European reference hospital centres, which are connected by Peripheral Units of Assistance. These systems are able to transmit and receive health diagnostic images and any other related health material (Jahangirian and Taylor, 2013).

2.6.12 Western Cape eHealth System

There are 50 provincial hospitals in the Western Cape, South Africa. The province wanted to establish a Hospital Information System (HIS). Clinicom, a product developed in the UK was given a tender and was customized to be used as an administrative system for these hospitals and the billing system was done locally. A centralized database was created for patients to have a unique identification system throughout all institutions. This system greatly helped to improve the number of patient master files. Furthermore, a pharmacy system was enrolled at 3

academic hospitals which has a central database and allows for these hospitals to share information on what medications were dispensed to each patient (Mars and Seebregts, 2008).

2.6.13 Tele-dermatology Service

The Nelson R. Mandela School of Medicine at the University of Kwazulu Natal in South Africa has tele-dermatology services. These services allow students to be trained in digital photography and they are then able to take pictures of patients' dermatological problems when they do their outpatient visits at hospitals. The students can then send pictures and patient information by email to a dermatologist at the medical school who can then analyse the information and provide advice (Mars and Seebregts, 2008).

From the models described above, it can be seen that all these models are trying to achieve the main objective of the WHO, which is to strive for universal health coverage. These models have been providing services to remote populations and underserved communities through telemedicine. Some of the models provided education to healthcare professionals through elearning. Through the use of electronic health records, patient diagnosis and treatment has been more accurate and by the use of information communication technologies these models have made healthcare operations more efficient. There are many other eHealth models in other countries (Kimble, 2015). The above were just a few examples of such models. Pharmacy automation also forms a part of an eHealth model.

2.7 PHARMACY AUTOMATION

Automated Pharmacy Dispensing systems were created for centralized dispensing of patient prescriptions, unit-dose medication orders and decentralized dispensing. They have been utilized in hospital patient care units, surgical units, emergency rooms, chronic care facilities, pharmacies and physicians' offices (Brookins *et al.,* 2010).

2.8 CURRENT AUTOMATION MODELS

There are three different models of automated dispensing systems that include; automated multi-dose drug dispensing system, the Hub and Spoke Model and Pharmacy dispensing Unit (Spinks *et al.,* 2016)**.**

2.8.1 Automated Multi-Dose Drug Dispensing System

This is a centralized automated multi-dose drug dispensing system for elderly consumers found in Australia, Scandinavia and Netherlands. This system involves automated repackaging of medicines into dose administration aids or single dose disposable sachets, and then labelled with the contents contained. This method provides enhanced accuracy and safety as compared to manual repackaging which can be tiresome and increases the chance of errors occurring. The increase in capital costs has resulted in this system being implemented at central locations and distributed to the consumer or local pharmacy for collection (Johnell and Fastbom, 2008).

A study was conducted in Denmark to test the impact of an Automated Dose Dispensing System on user compliance, medication understanding and medication stockpiles. It was found that the ADD alone did not eliminate noncompliance, it did not provide an improved medication understanding for patients and did not automatically do away with the accumulation of old medications of patients at their homes. This study proved that there is a gap between the perceptions of patients and healthcare professionals towards the benefits of automated dose dispensing, which needs to be taken into account when developing future automation models (Larsen and Haugbølle, 2007).

Another study was conducted by a literature review using various databases which aimed to assess the evidence for ADDs influence on the appropriateness of medication use, medication safety and costs in primary healthcare settings of European countries. It was found that ADDs impact on correct medication use and safety was very limited and there was a lack of information on costs. It was found that patients had more incorrect medications in their regimens and ADDs only

improve medication safety in terms of more accurate record keeping (Sinnemäki *et al.,* 2013).

2.8.2 Hub and Spoke Model

The ‘Hub and Spoke’ model is currently being discussed in the UK. This model is provided through the private sector and accounts for two thirds of England’s prescriptions. In this system, a central ‘hub’ dispenses medication from an electronic prescription which is then supplied to the pharmacy ‘spoke’ for collection by the consumer. The ‘Hub and Spoke’ model was designed to increase efficiency, decrease costs, enhance service delivery, provide quality care towards patients and reduce dispensing errors. Presently, this model can only be utilized within pharmacy chains or large groups which belong to the same legal entity (National Pharmacy Association UK, 2015).

There are many countries in Europe such as the Nordic countries and Netherlands that have used the “Hub and Spoke” model similar to the one in the UK. From their experiences, it was found that there has been a lack of evidence on the impact concerning patient safety, adherence to medication and its financial implications. In Finland, it was found that there was a decrease in collective medication usage, an improvement in medication adherence, but there was an overall increase in inappropriate medication usage with less changes in drug regimens (Rechel, 2019).

2.8.3 Pharmacy Dispensing Unit

The Pharmacy Dispensing Unit (PDU) or Remote Automated Dispensing Unit (RADU) is an ATM-like innovation which uses electronic and robotic technology. It is designed to dispense medication to a patient upon presentation of a personal smartcard. It is similar to an ATM; however medication is given through the machine instead of money.

As shown in Figure 2.1 the patient first arrives at the clinic for the 6 months check up and receives the first 2 months supply of medication. The patient prescription then gets sent to the CDU for electronic capturing through a cloud based system and bulk packaging of medication. Once the bulk medication is ready for all the patients, it gets delivered to the PDU. The PDU then sorts and packs the medication according to classification (Right to Care, 2020).

Once medications are packed into the machine, through the cloud based system an SMS is sent out to the patient, five days prior to the scheduled pick up day. This provides the patient with sufficient time to plan his/her trip for collection. Once the patient arrives at the PDU, he/she inserts the smartcard into the ATM (Figure 2.2 a) and inputs the assigned unique PIN code. The computer system is able to read the smart card. The patient then chooses the script that needs to be dispensed. The PDU machine at the back (Figure 2.2 b) then picks the correct medication and labels it accordingly. Once the medication is picked, the ADM dispenses the medication and patient collects the medication from the ATM-dispenser of the PDU. The call centre is linked to the PDU system, and the patient is able to consult with a pharmacist through an audio-video link. The call centre can assist patients with any queries such as side effects or drug-interactions of medications (Right to Care, 2017).

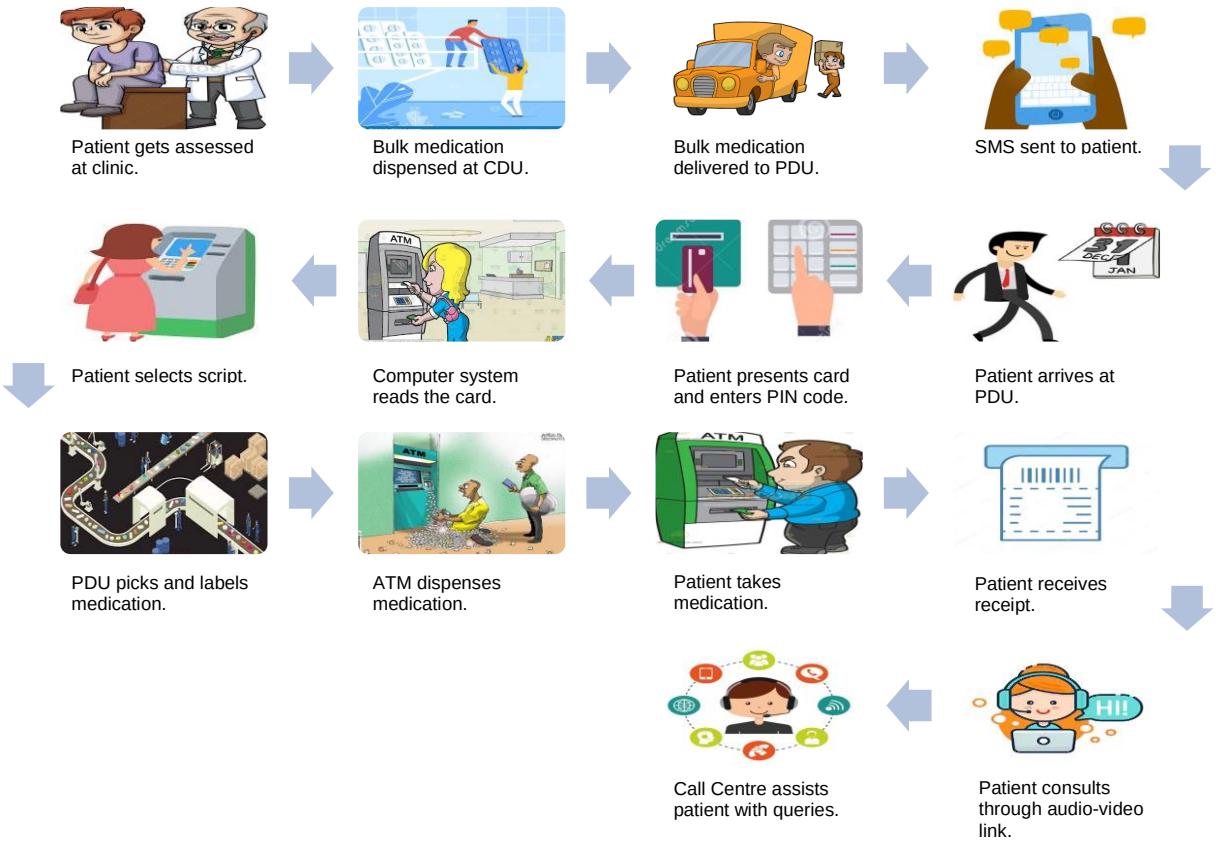

Figure 2.1: Schematic Diagram of PDU Process

(a) **(b)**

Figure 2.2: The Pharmacy Dispensing Unit: (a) from a patient's view, (b) robotic dispensing system

Currently PDUs are only operational in the public sector as regulated by the South African Pharmacy Council's Minimum Standards for RADUs under Rule 1.10 of the Good Pharmacy Practice (GPP, 2016). "Pharmacies in the public sector may use the Remote Automated Dispensing Unit (RADU) for purposes of dispensing medicine and devices for long term therapy (Chronic) in order to improve access

to medicines and to alleviate the patient burden on public facilities" (Strydom *et al.,* 2018). This in line with the Department of Health's strategy to improve public health by allowing for service delivery outside of public healthcare facilities for chronic stable patients (NDoH, 2017).

Previously according to the South African Pharmacy Council's Rule 1.9 Automated Dispensing Units (ADUs) were allowed to operate in community pharmacies, institutional pharmacies, dispensaries in PHCs and in the medicine rooms of licensed dispensers. ADUs have also been referred to as Automated Dispensing Cabinets (ADCs), Automated Dispensing Devices (ADDs), Automated Dispensing Machines (ADMs), Automated Pharmacy Systems (APSs) or Unit-Based Cabinets (UBCs) in developed countries and have been operational in hospital pharmacies (Strydom *et al*., 2018).

Only chronic patients who have been stable on their medications for one year or more are able to use the PDU system. Clinicians have to first assess the patients, before referring them to the PDU. As per the National Adherence Strategy, patients can collect two months' supply of their medications from the PDU sites of their choice. After every six months, patients have to return to their clinics according to their return date, whereby they have to undergo blood tests and re-evaluation by the clinician, and receive a new chronic prescription. This is in line with the National Adherence Strategy set out by the National Department of Health (Knowledge hub, 2021).

2.9 BENEFITS OF AUTOMATION IN PHARMACY

Theoretical benefits of automation include efficiencies in pharmacy workflow such as increased activity and making better use of staff skills (James *et al*., 2013). Pharmacy personnel will be able to spend more time counselling and monitoring patients. They can also work in other areas such as wards, where they can provide more effective patient care and management (Chowles, 2018). Pharmacy automation also ensures the availability of medicine by improving storage capacity

and stock control. The system can accurately monitor and track stock levels and predict how much stock is needed in advance. Medications can therefore be ordered from the bulk pharmacy, and if there are any shortages, a strategy can be put into place to borrow stock from elsewhere (Temple and Ludwig, 2010). Automation enhances safety through the reduction of dispensing errors by preventing human errors such as misreading of prescriptions or drug labels (Strydom *et al*., 2018). There will also be reduction in dispensing times improved management reporting and the pharmacy will be able to keep pace with change (Anacleto, Perini, Rosa and Cesar, 2005). The medications are also packed well in time before the patient arrives to collect, thus reducing patient waiting times and ensuring a good pharmaceutical service delivery is maintained (Donyai *et al*., 2008).

Benefits of automation in hospital settings include secure medication storage on patient care units as well as electronic tracking of scheduled drugs such as narcotics. Previously manual systems provided minimised control over stock inventory, which included under or overstocking, as well as missing or incorrect drug charges. Automated dispensing machines (ADMs) are also able to track, monitor and report on drug consumption, which is especially beneficial for expensive drugs. ADMs allow for first-dose availability which ensures that patients receive their medications on time. This is fundamental in emergency departments and intensive care units, whereby physicians can still treat their patients even after the pharmacy has been closed. ADMs have single-access drawers which ensures that only one medication at a time can be picked, and thus preventing any mix-ups from occurring (Fung *et al.,* 2009).

A study was conducted at a private tertiary hospital in Brazil, which looked at the impact of an automated drug dispensing system. This study analysed the time and cost of personnel, the number of adverse events, audit adjustments to patient bills, and urgent requests and returns of medications to the central pharmacy. It was found that the number of adverse events occurring after the implementation of the ADD was less than pre-implementation. In addition, it was observed that there was

an overall reduction in human resource costs, a decrease in audit adjustments and a lower number of urgent requests and product returns to the central pharmacy. There was also a reduction in human resource time because of the decrease in nursing time and activities performed (De-Carvalho, Alvim-Borges and Toscano, 2017).

A cross-sectional comparative study was conducted at a pharmacy of a tertiary care hospital in Mumbai, India. A structured, bilingual questionnaire was given to the patients, and the respondents were chosen by a 'convenient sampling' method. This study aimed to find out the perceptions of the patients and the hospital on various parameters. It compared the patients' perceptions of the pharmacy service and the hospital observer who judged the pharmacy's services to determine the level of patient satisfaction. This study found that a huge number of respondents were satisfied with the clarity and brevity of the information received from the pharmacy staff. They were also happy that the pharmacist was available for consultation, and that their medications prescribed were also available. About 50% of the patients who responded felt satisfied by the explanation of the dose, frequency and duration of the medication prescribed, in the language that they understand (Bajpai and Gurbani, 2014).

An observational study was conducted in North Carolina, USA to compare the workload productivity, workflow efficiency and pharmacist-patient interaction in automated and non-automated community pharmacies. It was found that the patient satisfaction rate was the same for both the automated and non-automated pharmacies. However, for the automated pharmacy, the technical competence of the pharmacy staff had a higher rating. But, it was found that at the automated site, the staff was more willing to counsel the patients. The automated site also proved to have a greater amount of prescriptions dispensed per full-time equivalent pharmacist, as well as lesser technical dispensing tasks completed by the pharmacists (Angelo, Christensen and Ferreri,2005).

In addition, during the Coronavirus 2019 (COVID-19) pandemic the healthcare industry including pharmacies have had to adjust very quickly to the changing times. Pharmaceutical services were an essential service and had to operate throughout the pandemic as they provided direct access to their patients and clients. Technology has served to be very beneficial during these times especially with the availability of automation pharmacy (Pharmacy Times, 2020).

Other benefits of pharmacy automation were also experienced during Covid19. These included touch free packaging and verification, for example with the use of multi-dose medication packaging machines which pack medications automatically and verify medications according to the size, shape, colour and amount of each pill in each pouch. Multi-dose medication packaging systems also decreased the amount of time that would have been spent during the manual processes. Pharmacy automation has assisted pharmacies and patients to observe the social distancing guidelines set out by the WHO for Covid-19, as many people didn't have to be in a confined space at the same time. There has been improved patient adherence through medication synchronization whereby patients' prescriptions were refilled on the same day of the month which can be planned with patients for collections or deliveries. Besides, pharmacy automation overall has provided operational efficiencies such as cost savings and an increase in the number of patients using pharmacy automation services (Pharmacy Times, 2020).

2.10 DRAWBACKS OF AUTOMATION IN PHARMACY

There are several disadvantages to using automation in pharmacy. These include the fact that there are many different types of automated dispensing machines, which have unique operating procedures. The older machines are less reliable whereas the newer machines may have a complicated interface. ADMs are still prone to errors, such as if the incorrect drug is loaded into the machine, the wrong medication will be dispensed to the patient. To reduce human error, only a certain number of staff personnel can be trained on operating the machine. This may result in delays when the machine needs to be serviced or has malfunctioned, or needs to be reloaded. Furthermore, machines are driven by computer programs

which can have software problems. One of the major drawbacks of pharmacy automation is the enormous cost of implementation, especially in a country like South Africa, which is a lower middle-income country and is thus dependent on donor funding (Assad, 2018).

According to a report from the Canadian Agency for Drugs and Technologies in Health, it was found that studies were done on automated dispensing machines which were no longer in use, or only found in Europe. Some studies were also based only on the area that the ADM was used, and the studies were uncontrolled "before and after" studies. Also, it was not 100% certain that automation resulted in the workplace changes, but could have been contributed by other factors (Fung *et al.,* 2009).

From the study conducted at the hospital in Brazil on the impact of the automated drug dispensing system pre- and post-implementation of the ADD, it was found that although the adverse events decreased, the value was not significant enough to perform a comparative analysis of the two periods. There was also an increase in the amount of work time for pharmacy assistants (De-Carvalho *et al*., 2017).

From the study conducted in Mumbai, which aimed to find out the perceptions of the patients and the hospital on various parameters, it was found that the respondents were dissatisfied by the amount of time they had to wait for collecting their medications. In addition, a difference was found between the perceptions of the patients and the hospital in terms of accessibility and location of the pharmacy, whereby the hospital thought that the patients felt satisfied, whereas the patients were actually dissatisfied by this factor (Bajpai and Gurbani, 2014).

From the observational study done in North Carolina, USA that compared the workload productivity, workflow efficiency and pharmacist-patient interaction in automated and non-automated community pharmacies, no difference between the patient counselling and prescription workload at both sites (Angelo *et al*., 2005).

As can be seen from the literature, ADMs still have the potential for errors to occur. However, these can be minimised with proper training on systems, proper workflow systems, optimization of the medication distribution model, use of barcode technology to prevent administration errors, proper operating policies and constant multi-disciplinary reviews (Silverstein, 2010).

2.11 PATIENTS' ATTITUDE AND EXPERIENCES TOWARDS AUTOMATION

In 2012, the Swedish Government assigned the Medical Products Agency to conduct an investigation on the patients' perceptions on Automated Multi-Dose Drug Dispensing. The study involved 40 municipalities, whereby a questionnaire was given to patients that use the Automated Drug-Dose Dispensing at the pharmacies in these municipalities. Data was collected over a two-month period (Bardage and Ring, 2016).

Overall 33% of the patients responded to the questionnaire. Some patients felt that ADD helped them to correct dosing, to recognize the medicine and enabled them to feel more involved in the decision-making about their treatment. The majority of patients generally felt satisfied and secure with ADDs, but it was found that 19% of the patients felt confused to have their medications in both sachets and manufacturers' packaging (Bardage and Ring, 2016).

More than one-third of the patients felt that because of the generic substitution it was a challenge to recognise the medications available in the sachets. Around 40% of the respondents felt that they required better information regarding their treatment purpose and goal and 25% of patients wanted better information when their drug treatment changed. Furthermore, this study found that the medication adherence, safety issues and information about sachets contents need to be further investigated (Bardage and Ring, 2016).

A study was conducted in Netherlands to explore patients' experiences with the initiation and use of multidose drug dispensing systems. A semi-stuctured interview protocol was used in this study. It was found that 90% of the participants

felt that multidose drug dispensing assisted them with their medication management, 59% felt that there was an improvement in medication adherence and medication safety and 40% felt that it was a convenient system. There were some disdvantages identified; 24% of the participants encountered problems with opening the bags or outer packaging and 13% found that the printed writing on the bag was illegible. Overall, patients were very satisified with using this system (Mertens, Kwint, Van Marum and Bouvy, 2019). Other studies have been done to assess the impact of automation on patient waiting times (Furushima *et al.,* 2018)**,** and the impact automation has had on the pharmacy workforce (Spinks *et al.,* 2016)**.**

At the three PDU sites, Alexandra Plaza, Bara Mall and Ndofaya Mall, there was an initial low collection rate because this was a new process of collection of medicines for the patients. However, after site agents were placed at the PDU sites to assist patients, there was a dramatic increase in the rate of collection of medicines. On average, it took patients 3 minutes to collect their medications from the PDU. Majority of the patients who used the PDUs were female. At the PDU in Alex Plaza, the patients preferred to collect their medications during the weekday mornings. This is perhaps because not all patients were completely aware of the extended operating hours (Strydom *et al*., 2018). From the literature, it can be seen that limited studies have been conducted on patients' attitude and experiences towards pharmacy automation.

2.12 ALTERNATIVE DECANTING MODELS IN SOUTH AFRICA

There are many different models of care within the South African healthcare sector which aim to improve patient access to medication. The Department of Health has created a National Adherence Strategy which outlines the various decanting models whereby patients can collect their chronic medications from. These models include the Pharmacy Dispensing Unit, the Repeat Prescription Collection Strategy, the Chronic Dispensing Unit (CDU), Centralised Chronic Medicines Dispensing and Distribution (CCMDD) and the Collect & Go ™ Smart Lockers (Knowledge hub, 2021).

2.12.1 Repeat Prescription Collection Strategy/ Space Fast Lane Option

In this model, patients are given the option of collecting their medications at the facility. Patients have to be chronic stable patients who have been taking their medications for the past 6 months. The facility can pre-pack medications in advance, or the patient parcels can come from the CDU or CCMDD. Patients can collect their medications at the space fast lane at the pharmacy or a room or designated area assigned for patient medicine parcel collections (NDoH, 2017).

2.12.2 Chronic Dispensing Unit

The Chronic Dispensing Unit is a centralized unit which receives prescriptions from chronic stable patients, which are sent from various public health care facilities. Once these prescriptions are received, they are evaluated for compliance with legal requirements as per Good Pharmacy Practice Standards and Department of Health Protocols. The prescriptions are then captured electronically and sent for picking. Medications are picked as per the prescription, labelled and packed individually into patient medicine parcels. The parcels are then delivered to the health care facilities where patients come to collect their medications (Du Plessis, 2018). The benefits of the CDU included decreased patient waiting times, improved patient experiences, more time spent on patient counselling and an increase in the number of patients attended to before the CDU was implemented. The disadvantages of the CDU were increased workload for pharmacists in terms of managerial and administrative tasks, a higher patient base to accommodate and patients still complained of travel costs to the healthcare facilities (Magadzire, Marchal and Ward, 2015).

2.12.3 Centralised Chronic Medicines Dispensing and Distribution

The Centralised Chronic Medicines Dispensing and Distribution System was introduced by the Department of Health in February 2014. This system operates through both public and private service providers who are responsible for the ordering, warehousing, pre-packing, labelling and distribution of chronic medications. The private service providers are Pharmacy Direct, DSV and

Medirite, each operating in different provinces. This system was created to maintain an efficient medicine supply to chronic stable patients suffering from conditions such as HIV, diabetes, hypertension and other chronic conditions. This model involves healthcare facilities sending patient prescriptions to the CCMDD either manually or electronically via e-prescribing through a programme called SYNCH (Du Toit, 2017).

The CCMDD then processes the prescriptions and uses an automated system to pick and package the patient medicine parcels individually. The Patient Medicine Parcels are delivered to the healthcare facilities or Pick up Points of the patient's choice, whereby they can conveniently go to collect their medications. Pick up Points include Clicks, Dischem, Medirite pharmacies, private pharmacies, community halls, private practitioners' practices and post offices. An SMS is sent to patients when their PMP is ready for collection. This system helps to decongest healthcare facilities as well as reduce pharmacists and pharmacist assistant's time with regards to repetitive administrative tasks and time-consuming tasks (Du Toit, 2017).

2.12.4 Collect & Go ™ Smart Lockers

Right ePharmacy, has launched a new product in May 2020 called Collect & Go ™ Smart Lockers. The Smart Lockers have been placed at a few public healthcare facilities and some private pick up locations. These lockers are also linked to the CCMDD programme. Collect & Go ™ Smart lockers are temperature controlled, can function without the internet and can update the patient medicine parcel database after patients have collected their medicines. These lockers are loaded by the CCMDD service provider, who then sends an SMS to the patient containing the date of collection and a one-time-Pin (OTP). Once the patients come to their locker site, they have to enter the OTP on the keypad of the locker, and the specific locker door containing the patient medicine parcel will open up. The patient can then take their parcel from the locker (Right ePharmacy, 2020).

The benefits of this collection system are: no support staff is required. However, there is a call centre which the patients can contact should they require any assistance. In addition, no patient is queuing, resulting in decreased waiting times, and this system is COVID-19 friendly, as patients can maintain social distancing and there is no contact with the public facility staff (Right to Care, 2020)

2.13 CONCLUSION

Chapter 2 focused on reviewing the literature regarding the evolution of eHealth, eHealth on a global scale, in Africa and South Africa, the benefits and challenges of eHealth, various eHealth Models, pharmacy automation, pharmacy automation models, benefits and drawbacks of automation in pharmacy, patients' attitude and experiences towards automation and alternative decanting models in South Africa. The next chapter will look at the Research Methodology used in the study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter focuses on the research methodology used in this study and comprises of the research design, research method, study setting, population and sampling, inclusion and exclusion criteria, data collection, data analysis, pilot study, reliability and validity measures, bias and ethical considerations.

3.2 RESEARCH DESIGN

A cross-sectional quantitative design was used to determine the attitude and experiences of patients collecting their chronic care medications at the PDU's located in Johannesburg, South Africa. A cross-sectional study design is an observational study design, whereby the researcher measures the outcome and exposures in the study participants at one specific period in time. The participants were selected based on the inclusion and exclusion criteria (Setia, 2016).

A quantitative design emphasizes objective measurements and the statistical, mathematical or numerical analysis of data collected through polls, questionnaires and surveys, or by manipulating pre-existing statistical data using computational techniques. A quantitative design focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon. It can be either descriptive (subjects are usually measured once) or experimental (subjects measured before and after treatment) (Creswell and Creswell, 2017).

3.3 RESEARCH METHOD

The study was conducted using a structured researcher-designed self-administered questionnaire (APPENDICES 5, 7 and 9) that was given to all the participants from three PDU sites. Each participant had to consent prior to taking part in the study. A consent form (APPENDICES 4, 6 and 8) was given to each

participant. Participants were only allowed to start the questionnaire once the researcher informed them about the details of the study and once they gave their consent to participate. Any uncompleted questionnaires were considered unusable and excluded from the study. The study period was over two months. The researcher recorded the information that was present in the study population, and no variables were manipulated.

3.4 STUDY SETTING

This study took place at three different PDU sites located in Johannesburg, Gauteng Province, South Africa. The first site was located at Alexandra Plaza (3rd street, Wynberg, Sandton, 2090) in the township of Alexandra. The second site was at Ndofaya Mall in Soweto (Hekroodt Circle, Meadowlands, Johannesburg, 1852). The third site was at Bara Mall, (Nicholas Street, Diepkloof, Soweto, 1814) also in Soweto. The Bambanani site could not be used as the PDU was not yet operational during the time of the study, and the site at Twin City Mall could not be used as it was situated in Bloemfonetin. Hence, the three PDU sites chosen were based on suitability and convenience towards the study.

3.5 POPULATION AND SAMPLING

3.5.1 Population

A population is defined as any group of individuals who have one or more characteristics in common that are of interest to the researcher (Brink, Van der Walt and Van Rensburg, 2017). The study population included patients that were collecting their chronic care medication at the three PDU sites, Alexandra Plaza, Ndofaya Mall and Bara Mall. The patients were chronic stable patients, which forms part of the criteria of collecting medications at the PDU. All patients were of age 18 or above, as this is a fundamental factor of being on the PDU Programme. Table 3.1 indicates the number of patients registered at each PDU site for collecting the medication.

Table 3.1: The number of patients registered at each PDU site (Right epharmacy eRx Solutions Programme, 2018)

Name of PDU	Number of patients
Alex Plaza	7430
Ndofaya Mall	492
Bara Mall	1783
Total	**9705**

3.5.2 Sampling

Sampling refers to the process or procedure of selecting a smaller group, called a sample from within a defined population to represent that population (Lancaster and Crowther, 2014). The participants were selected based on a simple random sampling method. Simple random sampling is a method of selection of a sample comprising of *n* number of sampling units out of the population having *N* number of sampling units such that every sampling unit has an equal chance of being chosen. A minimum sample size of 844 was required for the study, which was calculated based on a population size of 9705 (Table 1), sampling error of 5%, 10% non-response rate and a design effect of 2. The formula below was used for calculation (Yamane, 1967):

$$n = \frac{N}{1 + N(e)^2}$$

Where;

- n is the sample size
- N is the population size of patients lost to follow-up
- e is the sampling error (5%)

The sample was distributed proportionally to the population size in each site (Table 3.2).

Table 3.2: Sample size distribution

	N	n
Alex	7430	646
Ndofaya Mall	492	43
Bara	1783	155
Total	**9705**	**844**

3.6 INCLUSION AND EXCLUSION CRITERIA

3.6.1 Inclusion Criteria

The study included chronically stable patients who have been stable on their medications for one year or more, compliant in taking their medications as well as not experiencing any side effects. In addition, during Adherence Monitoring their blood test results were within the normal range as per the Adherence Guidelines for HIV, TB and NCDs (Knowledge hub, 2021). This includes, patients who are classified under the NCDs category such as hypertension, diabetes, asthma, epilepsy and hyperlipidaemia. ART patients were also included in this study. All participants had to be over the age of 18 years. The reason for participants being over the age of 18 was that they are considered to be of legal age to consent. Participants who were willing to participate in the study and answer the questionnaire were included in the study.

3.6.2 Exclusion Criteria

The study excluded participants who were less than 18 years of age, mental healthcare users and the other non-communicable diseases not listed under the inclusion criteria, as the PDUs were not supplying medications to these patients at the time of the study, and those who did not consent to participate in the study.

The exclusion of mental healthcare users was because these patients were not considered to be stable patients, as per the Adherence Guidelines (Knowledge hub, 2021).

3.7 DATA COLLECTION

A review of the literature indicated that no existing instrument measured the specific objectives of this study. Therefore, a new questionnaire was created. Data was collected through this self-administered questionnaire from participants that fulfilled the inclusion criteria. Consent forms were signed before participation. The questionnaire was in English. The English questionnaire was then translated by an accredited translator into isiZulu and Setswana. These two languages were selected as they are the most widely spoken languages in the areas in which the study took place. The researcher administered the questionnaire in case of participants having problems with self-administration.

The questionnaire included 39 questions and was divided into four sections, Section A, B, C and Section D. Section A comprised socio-demographic information; such as age, gender, race and level of education. Section B included questions related to transport such as mode of transport, travel time and PDU used. Section C consisted of questions relating to experiences of participants about the use of automated PDUs, collecting chronic medication, and Section D related to patients' attitude with regards to the pharmacy dispensing unit.

Five-Point Likert-scales were used in section D of the Questionnaire to measure whether the participants had a positive or negative attitude towards the statement in the questionnaire. Likert Scales are used to allow participants to express how much they agree or disagree with a particular statement (McLeod, 2018). In this study, the Five-Point Likert Scales had points 1 to 5 which could be selected, 1 - Dissatisfied, 2 - Not satisfied, 3 - Satisfied, 4 - Very Satisfied and 5 – Extremely Satisfied. Points 1 to 2 indicated that participants had a negative attitude, with 1 meaning participants felt very strongly about not being happy at all and 2 meaning participants were somewhat not content. Points 3 to 5 indicated that participants

had a positive attitude, 3 being the lower rank of satisfaction, 4 slightly higher and 5 meaning participants were very content and experienced no issues at all.

Data from the participants attending at a particular PDU were collected in 60 days to avoid repetition of the same participants. This is because patients collect their medicines every two months. Once all completed questionnaires were collected, they were back translated to the original language by the accredited translator.

3.8 DATA ANALYSIS

All the raw data collected in this study was captured into a Microsoft Excel® 2013 spread sheet. Data capturing was verified and validity checks were performed as part of the data cleaning process. Any incomplete questionnaires were not included and not captured on the spread sheet. Each data set was assigned a code using numbers 1, 2, 3, 4, 5 based on how many categories there were per question. Descriptive and missing values analyses were performed for all the items in the questionnaire. Data analysis was done in consultation with the statistician. SPSS (Statistical Product and Service Solutions) software Version 25.0.0 was used for data analysis to obtain descriptive statistics and inferential statistics. Descriptive statistics uses the data to provide descriptions of the population, either through numerical calculations or graphs or tables. Inferential statistics make inferences and predictions about a population based on a sample of data taken from the population in question (Study.com, 2018).

A Chi-Square Test was used to determine if there was a significant relationship between two nominal (categorical) values. One-Way analysis of variance (ANOVA) test was also used to check if there were any statistically significant differences between the means of the different categories. The Chi-Square Test was used in this study to compare the participants' responses from the Questionnaire with the expected answers to assess the statistical significance. The One-Way ANOVA Test was used to test the differences between the three PDUs. The data was then appropriately presented in graphs and tables as presented in the results section of the dissertation.

3.9 PILOT STUDY

To test if the research methodology would work, a pilot study was initially conducted on 10% of the total sample size. The pilot study was done to test the feasibility and understanding of the questionnaire. The pilot study was self-administered and conducted at Alex Plaza, because this was the PDU site that had the highest number of patients attending and it was the first PDU site that was launched in Gauteng. The study was piloted for timing and ambiguities and adjustment of the questionnaire to check if the data collection would collect information that is required for the main study. Adjustments were done based on the findings of the pilot study before data collection of the main study. The results of the pilot study have not been included in the main study.

3.10 RELIABILITY AND VALIDITY

3.10.1 Reliability

Reliability refers to the degree to which an assessment tool produces stable and consistent results, whilst validity refers to how well a test measures what is purported to measure (Phelan and Wren, 2006). To ensure reliability or generalizability of the study, a well-detailed questionnaire was used. The questions in the questionnaire for patients were adapted from various literature studies such as “Do Automated Dispensing Machines Improve Patient Safety” (Fung *et al*., 2009), “Pharmacists’ Attitude to the Introduction of Automated Techniques in the Delivery of Pharmaceutical Services in Selected Nigerian Teaching Hospitals” (Olubunmi Afolabi and Oyedepo Oyebisi, 2007) and ASHP Guidelines on the Safe Use of Automated Dispensing Devices (Brookins *et al.,* 2010).

Reliability was ensured by collecting the data in 60 days to avoid repetition of the same participants. Repetition was avoided because participants only come to collect their medications at the PDU after every two months, thus they would not be coming to the PDU again within the 60 day collection period. Furthermore, only one researcher was used for data entry to improve reproducibility. The reliability of the study was improved by conducting a pilot study.

3.10.2 Validity

Validity refers to whether or not a study is well designed and provides results that are appropriate to be generalized to the population of interest (Phelan and Wren, 2006). The validity of a study also refers to the degree to which a study answered the questions it was intended to answer (Gravetter and Forzano, 2011).

3.10.2.1 Internal validity

Internal validity is defined as the degree to which one can conclude that the independent variables, not extraneous variables, produced changes in the dependant variable (Schmidt and Brown, 2012). In this study, the researcher used a stratified random sampling technique which was an effective way of controlling extraneous variables such as patient demographics and demand characteristics, therefore, achieving validity. The researcher also used inclusion criteria which brought about elements of the same characteristics into the study.

3.10.2.2 External validity

External validity is defined as the degree to which the results can be generalised to other subjects, settings and times (Schmidt and Brown, 2012). In this study, results were generalised to patients being treated for non-communicable diseases or HIV at the PDU's, because stratified random sampling was used, a strong technique that allows generalizability.

3.10.2.3 Construct validity

Construct validity "examines the fit between conceptual and operational definitions of variables and determines whether the instrument measures the theoretical construct that it purports to measure" (Burns and Grove, 2005). In this study, a pilot study was done to check if the questionnaire was comprehensive to achieve the research objectives, which ensured the construct validity. The questions in the questionnaire for patients were adapted from various literature studies. The questionnaire was generated based on content, face, and construct validity,

internal consistency, test re-test reliability, and discriminative validity procedures (Schmidt and Brown, 2012) .

3.11 BIAS

In research, bias occurs when “systematic error is introduced into sampling or testing by selecting or encouraging one outcome or answer over others (Merriam-Webster, 2017). Bias can occur at any phase of research, including study design or data collection, as well as in the process of data analysis and publication. Bias is not a dichotomous variable. Interpretation of bias cannot be limited to a simple inquisition: is bias present or not? Instead, reviewers of the literature must consider the degree to which bias was prevented by proper study design and implementation (Pannucci and Wilkins, 2010).

3.11.1 Selection Bias

The selection bias is a statistical bias in which there is an error in choosing the individuals or groups to take part in a scientific study. Most often, it refers to the distortion of a statistical analysis, resulting from the method of collecting samples. To minimize this bias, the researcher selected eligible NCD and HIV patients registered at the PDU’s using a stratified random sampling method.

3.11.2 Translation Bias

The use of English questionnaires (for the patients) only could lead to miscommunication and misunderstanding of some respondents who do not understand English, and their answers to the questionnaire could have also been affected. To minimize this bias, the researcher used English, an isiZulu and a Setswana questionnaire, which was translated by an accredited translator to accommodate patients who preferred using isiZulu or Setswana. This is because isiZulu is one of the most widely spoken languages in South Africa and Setswana is also spoken widely in the PDU site areas. In addition, once the completed questionnaires were collected, they were back translated to the original language to ensure and confirm the accuracy of the translation.

3.11.3 Respondent Bias

Some respondents could answer favourably to please the interviewers or to hide any lack of knowledge. To minimize this bias, the questionnaires were completed anonymously as participants were not required to provide their names and were not asked for their names by the investigator.

3.12 ETHICAL CONSIDERATIONS

Research ethics involves the ethics of planning, conducting and reporting on research. Research ethics govern the standards of conduct for scientific researchers. It is fundamental to follow ethical principles to protect the dignity, rights and welfare of research participants. Research which involves humans needs to be reviewed by an ethics committee to ensure that ethical standards are adhered to (WHO, 2015).

The following ethical standards were adhered to throughout the study:

3.12.1 Approval

The research proposal was submitted to the School Research and Ethics committee (SREC) for approval. After approval by the SREC, it was then submitted to the Faculty Higher Degrees Committee for further approval and then to the Turfloop Research Ethics Committee (TREC) for an ethical clearance certificate. Once the ethical clearance certificate (APPENDIX 1) was obtained from the University of Limpopo, together with the research proposal, authorisation was sought from the Provincial Department of Health Research Committee to conduct the research (APPENDIX 2). Once approval was granted by the District Research Committee from the Provincial Department of Health (APPENDIX 3), the data collection could then commence at the three PDU sites.

3.12.2 Informed Consent And Voluntary Participation

The researcher provided participants with a verbal overview of the study. Participants were given informed consent forms to sign as an agreement that they understood what the study was all about and are voluntarily participating in the

research study. Participation was voluntary and participants had the right to withdraw at any time without any penalty. Participants also had the right to not participate in the study, they were not forced to, and they had the right to not answer any questions that they were uncomfortable with. Only signed consent forms were used in the study. Therefore, no participants formed part of the study unless they had fairly consented (APPENDICES 4, 6 and 8).

3.12.3 Anonymity And Confidentiality

The researcher assured participants of the confidentiality of the study. No participant who took part in the study was required to furnish their names or identity. The questionnaires were completed anonymously. The questionnaires were collected by the researcher and were not shared with any of the other participants or any other individuals. Only the researcher had access to this information. The information obtained was not used for any other purposes other than for research purposes. The data collected from the study was then submitted to the University of Limpopo pharmacy archives department to be stored for no less than five years. After five years, the data will then be destroyed by shredding the paper records and recycling them so that there is no possibility for reconstruction of information.

3.12.4 Benefits And Risks To Participants

There were no direct individual benefits for any participants in this study. The potential benefits from this study included obtaining information that will contribute to the overall improvement of the South African Healthcare sector and preparing for the implementation of NHI. The risks associated with participation in this study were no greater than those encountered in daily life, there was however the inconvenience of the time and effort taken to complete the questionnaire. There were no financial costs involved for any participants and they did not receive anything for taking part in this study.

3.13 CONCLUSION

This chapter focused on the research methodology used for the study of patients' attitude and experiences towards automated pharmacy dispensing units in Johannesburg, South Africa. A quantitative research approach was utilised in the study. Population, sampling, inclusion and exclusion criteria were described. The data collection and data analysis procedures were explained. Reliability and validity measures were defined. The different types of bias were looked at and an explanation of how to avoid bias into the study was explained. Finally, ethical considerations were clarified. The next chapter focuses on the results and discussion of the actual study that occurred.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

Chapter 4 encompasses the results and discussion based on the data analysis done from the completed questionnaires. Data Analysis was done in consultation with the statistician, using SPSS Software Version 27.0.0 to obtain descriptive and inferential statistics. The results are presented as frequencies and percentages in tables, charts and graphs. Chi-Square Tests were used to determine if there was a significant relationship between two nominal (categorical) values, such as comparing the participants' responses from the questionnaire with the expected answers. A One-Way Analysis of Variance (ANOVA) test was used to test if there were any statistically significant differences between means of the different categories, such as the differences amongst the three PDUs.

4.2 SOCIO-DEMOGRAPHIC INFORMATION

This section presents information about participants' demographic characteristics obtained through questions in the demographic section of the questionnaire. These included participants' gender, age, race, marital status, residential area, educational status and employment status. A total of 624 respondents participated in this study. At Ndofaya Mall there were 48 respondents, 165 at Bara Mall and 411 respondents at Alex Plaza. The Table 4.1 below, summarises the socio-demographic information of all the partcipants.

Table 4.1: Socio-demographic Profile of Respondents from all 3 PDUs

Variables n = 624		**F**	**%**
GENDER	MALES	183	29.3
	FEMALES	441	70.7
AGE GROUP (YEARS)	18 – 30	89	14.3
	31 – 40	261	41.8
	41 – 50	154	24.7
	51 – 60	86	13.8
	60+	34	5.4
RACE	BLACK	619	99.2
	COLOURED	05	0.8
MARITAL STATUS	NEVER MARRIED	366	58.7
	MARRIED/COHABITATING	206	33.0
	DIVORCED	14	2.2
	WIDOWED	38	6.1
RESIDENTIAL AREA	SOWETO	213	34.1
	ALEXANDRA	393	63.0
	OTHER AREAS NEAR ALEXANDRA	18	2.9
EDUCATION STATUS	PRIMARY	57	9.1
	SECONDARY	366	58.7
	TERTIARY	193	30.9
	DID NOT ATTEND	08	1.3
EMPLOYMENT	EMPLOYED	304	48.7
	UNEMPLOYED	223	35.7
	SELF EMPLOYED	32	5.1
	PART TIME WORK	25	4.0
	RETIRED	26	4.2
	STUDENT	14	2.2

According to Stats SA (2020), South Africa's current population is 59.62 million people, of which total female population was reported to be 51.2%. Majority (70.7%) of the respondents at all 3 sites were female and 29.3% were male. Majority (42.05%) of the population in South Africa falls within the age group 25 to 54 years old (South Africa Age structure, 2020). From the study, most

respondents at all 3 sites were of the age group 31 to 40 years which corresponds with the national statistics.

Most (79.4%) of the South African population are black people living in the cities and in poor rural areas and 8.8% are of coloured race (Stats SA, 2020). In this study, 99.2% of the participants were of black race and 0.8% was of coloured race. According to a census carried out in Alexandra, it was found that 98.95% of the population is made up of black African people, 0.43% were of coloured race and 0.44% of other race (Census2011, 2020). Majority of the participants in this study were from Alexandra which explains the deviation in the population. According to Stats SA, 45.9% of the female population in South Africa is unmarried and 51.8% of the male population is not married (Stats SA, 2020). According to the study, most participants (58.7%) had never been married. It was found that most of the respondents lived near the PDU sites either in the same area such as Alexandra or Soweto or nearby areas; hence the PDUs were a convenient location for the patients to collect their medications.

According to Stats SA, 55.1% of the South African population has completed a secondary level of education and 34.1% have completed a tertiary level of education (Stats SA, 2020). The majority (58.7%) of the respondents at all 3 sites had a secondary level of education followed by those (30.9%) that had gone to a tertiary institution. Education has been found to influence the patient's attitude towards using the PDU services, people who have received a good education are expected to know the importance of utilizing good convenient healthcare services such as the PDU. In addition, it was found that education status ($p<0.001$) was significantly associated with the ADM being easy to use in order to receive medications. Patients who were educated found the ADM easy to use as it was easier for them to remember the demonstrations given by healthcare professionals initially on how to use the ADM.

The statistics show that there are 16.37 million people in South Africa who are employed, whilst 5.98 million people are unemployed. The unemployment rate of black Africans in South Africa is 33.8% which has increased by 2.7% from last

year (Stats SA, 2020). Majority (48.7%) of the respondents from the study were employed followed by 35.7% who were unemployed. Employment status is also an important factor in determining a patient's attitude towards using the PDU, as people who are employed understand how the PDU's convenient operating hours is beneficial to them as they can collect their medication before, after or in-between their working hours and on weekends. From the initial study that was conducted at the PDU sites, it was found that PDUs are beneficial in urban and peri-urban settings because of the working class. Initially, employed patients were collecting their medications during weekday mornings when the PDUs first opened, but with the increased awareness of the extended operating hours through the PDU site agents, PDU staff and social media there was an increase in usage of the PDUs on the weekends and other times (Strydom *et al*., 2018).

Figure 4.1 below, shows the current chronic profile of participants. The HIV prevalence rate amongst the South African general population is high at 20.4% (UNAIDS Data, 2018). There is a huge difference in HIV prevalence amongst different racial groups, 19.9% for black Africans, 3.2% for coloureds and 0.5% amongst whites (Kenyon and Zondo, 2011). Majority of the participants (72.8%) HIV positive; 10.6% had hypertension; 1.3% had diabetes; 0.6% had asthma and the rest of the participants had co-morbidities i.e. more than one medical condition. This shows the PDU was accommodating medications for the main chronic conditions mentioned under the inclusion criteria.

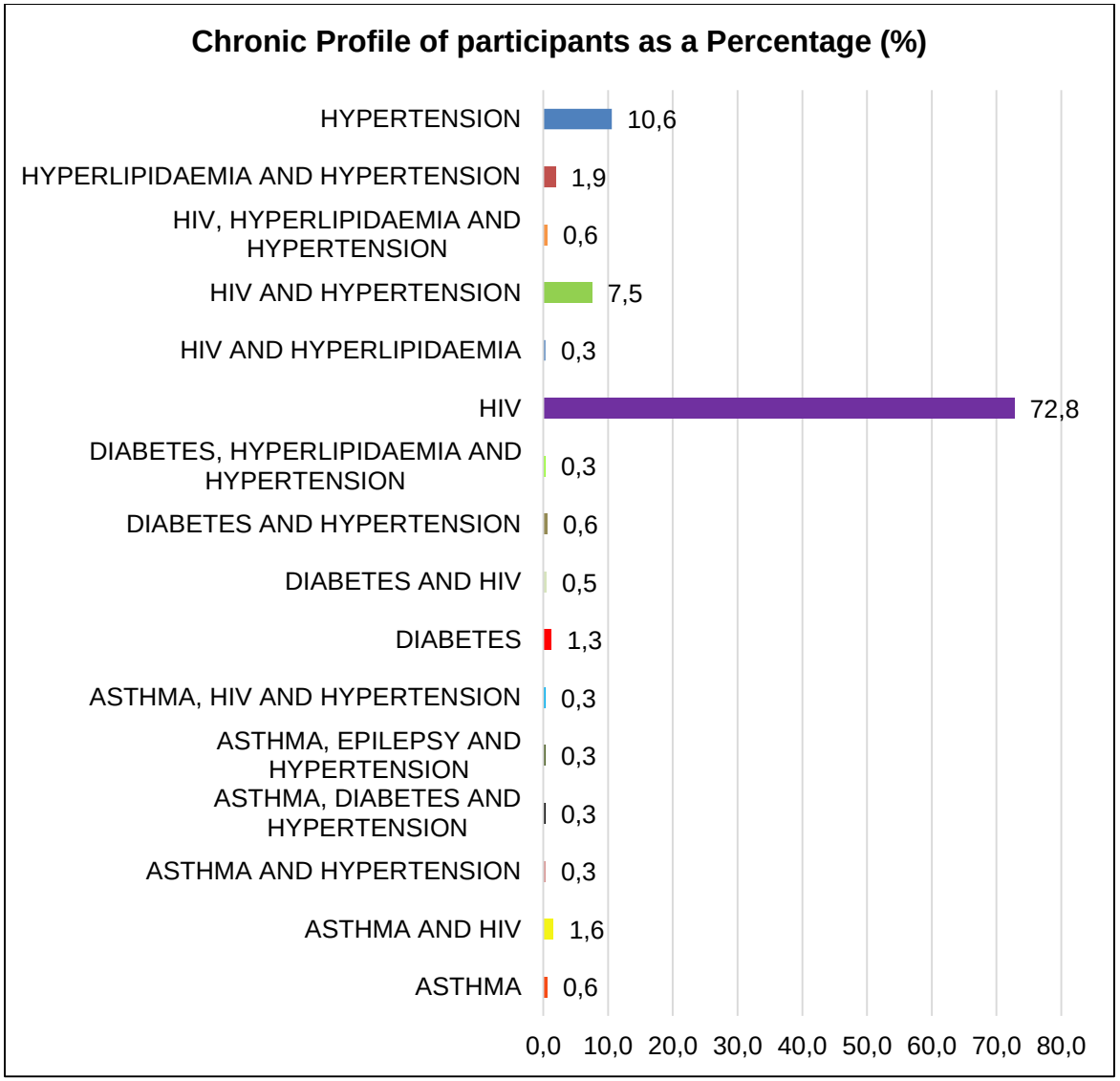

Figure 4.1: Chronic Profile

Figure 4.2 below shows the number of years that participants had been diagnosed with their chronic conditions. Most participants (36.5%) had been diagnosed with their chronic conditions between 2 to 4 years; followed by 34.6% between 5 to 7 years; 18.3% had been diagnosed between 8 to 10 years; 8.7% greater than 10 years and 1.9% had been diagnosed with their chronic condition for 1 year.

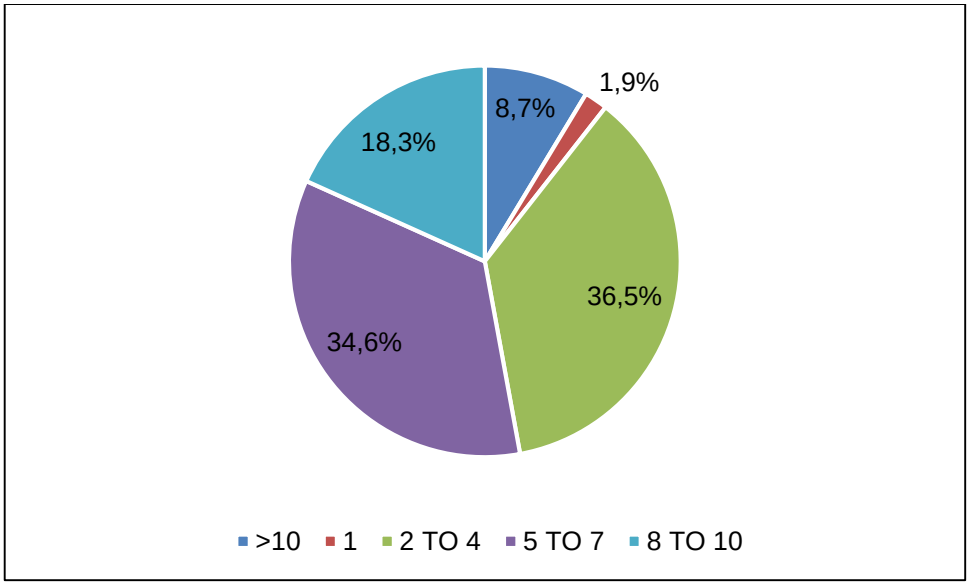

Figure 4.2: Number of Years of Diagnosis

Figure 4.3 shows how participants rated their current health status. Majority of the participants (55%) said their health status was very good and 40.2% said theirs was good. This indicates the patients' level of stability and well-being and hence their reason for choosing the PDU as their point of collection.

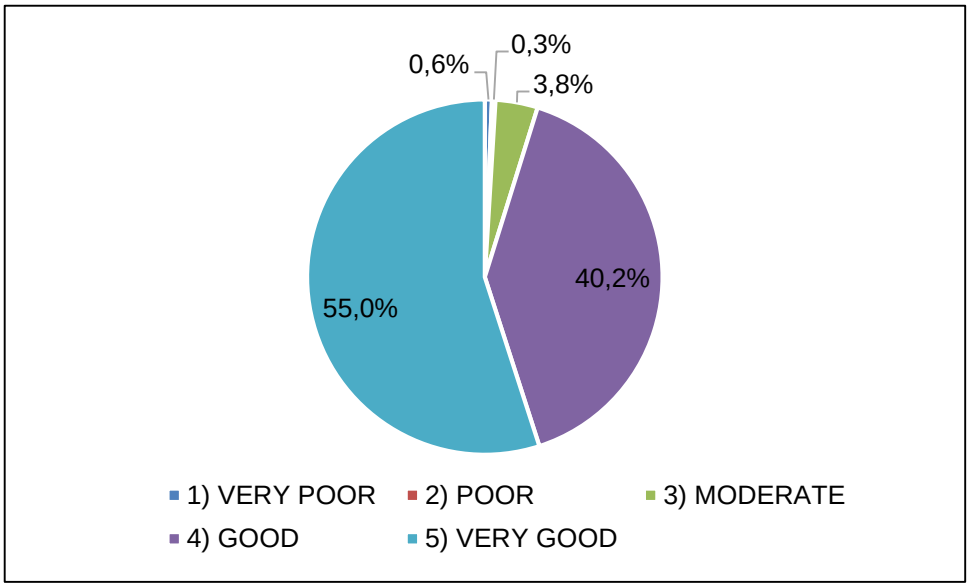

Figure 4.3: Current Health Status

As seen in table 4.2 below patients' current health status was influenced by socio demographic factors such as age (p=0.015), education status (p=0.049) and

employment status (p=0.038). It was found that people in the younger age category between 18 to 40 years had a very good health status, followed by the middle age participants who had a good health status and in contrast the much older participants who were greater than 60 years old had a poor health status. This is in line with a study that was done in Tehran which aimed to explore the socio-demographic factors associated with health-related quality of life. It was found that younger people scored the highest in terms of having the best health-related quality of life, followed by the middle age and lastly the elderly people (Jalali-Farahani *et al.,* 2017).

In the PDU study done it was also found that participants who had received a secondary or tertiary education and those who were employed had a very good or good health status in comparison to those who hadn't been educated and were unemployed. The study done in Tehran displayed similar results whereby the mean scores of physical health-related quality of life had an increasing trend according to level of education and employment status (Jalali-Farahani *et al.,* 2017).

Table 4.2: Current Health Status vs. Socio-Demographic Information

Category	Total (N)	Sig. (2-tailed)	Pearson Correlation
Age (Yrs)	624	0.703	p=0.015
Education Status	624	0.224	p=0.049
Employment Status	624	0.348	p=0.038

Figure 4.4 shows how long participants were collecting their medications at the PDU. It was found that most participants (64.4%) had been collecting their medications from the PDU between 1 to 2 years; followed by 25.8% for less than 1 year; 7.7% for greater than 2 years and only 2.1% were collecting their medications at the PDU for the very first time. Majority of the respondents were very familiar with the existing services and the benefits offered by the PDU. This is in congruence with the inclusion criteria whereby chronically stable patients who had been stable on their medications for one year or more were collecting their medications at the PDU and were thus included in the study. Only a few

participants had been collecting their medicines for greater than 2 years because the PDU system was a fairly new system, people were still finding out about the PDUs and being recruited onto the programme. In addition, many patients have also been put onto or switched to the CCMDD programme.

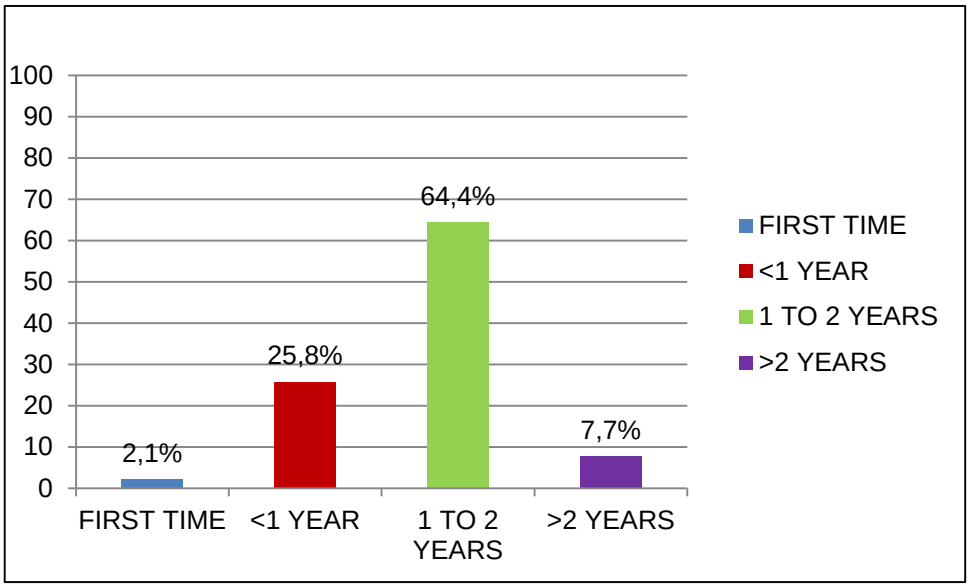

Figure 4.4: Period of Collection at PDU

4.3 TRANSPORT INFORMATION OF RESPONDENTS

In looking at the transport information of the respondents, various attributes were analysed, such as: the mode of travel, travel time to the PDU, PDU location, whether participants came to the mall for other reasons besides collecting medication and whether participants had to take time off from work to collect their medication.

4.3.1 Mode of Transportation

Respondents were asked about the mode of transportation used to reach the PDU sites, it was found that most participants (50.0%) used a taxi; 46.2% were able to walk to the PDU; 3.7% used a private vehicle and 0.2% (Figure 4.5), used a bus to get to the PDU. These results correlate to a study that was done to investigate the accessibility and utilization of the primary health care services in three community health care centres in the Tshwane region of Gauteng province, South Africa. It was found that 47% of the 134 participants used a taxi to travel to the clinic, 43.2%

walked to the clinic, 9.1% used their own transport and only 2 people used a bus. According to this study it was established that access to efficient healthcare services is fundamental to the growth and development of healthcare. Majority of the governements want patients to have equal access to good healthcare services (Nteta, Mokgatle-Nthabu and Oguntibeju, 2010).

The PDUs were conveniently located near the clinics where the patients were already collecting their medications from and near patients' residential areas. Due to the ease of access to the PDUs patients can easily travel to them to collect their medications resulting in improved adherence to treatment.

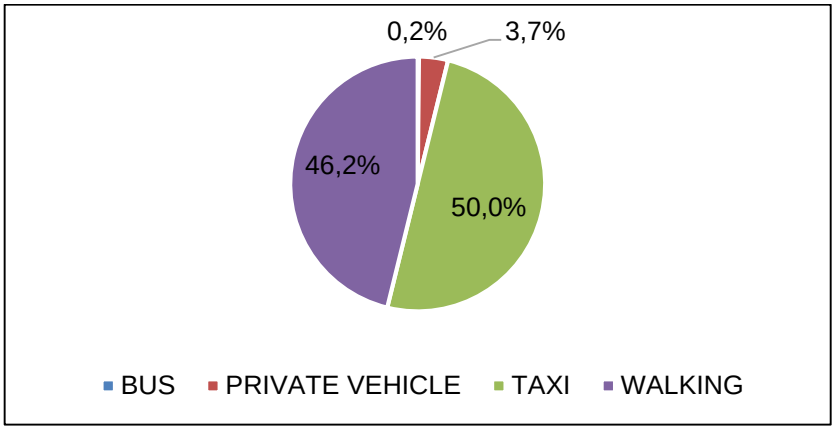

Figure 4.5: Mode of Travel

4.3.2 Travelling Time

Figure 4.6 below, shows how long it took for the participants to travel to the PDU. It was found that majority of the participants (64.7%) spent less than 30 minutes to travel to the PDU; followed by 32.9% who took between 30 minutes to 1 hour; 1.9% took between 1 to 2 hours and only 0.5% travelled for greater than 2 hours to get to the PDU. These results are similar to the results from the study done at the community healthcare centres in Tshwane, whereby 70.9% of the respondents travelled for less than 30 minutes to the clinic, 24.2% travelled for 30 minutes to 1 hour and only 5% spent more than 1 hour on travel (Nteta *et al.,* 2010).

The availability of transport, the physical distance of a healthcare facility and the time taken to travel to a facility are vital factors in determining the choice of

healthcare services (Nteta *et al.,* 2010). The current study proved that the PDUs are located in close proximity to patients and hence most patients used a taxi or walked to the PDU. Furthermore, these factors have influenced the collection rate, as most patients have been collecting their medications for 1 to 2 years.

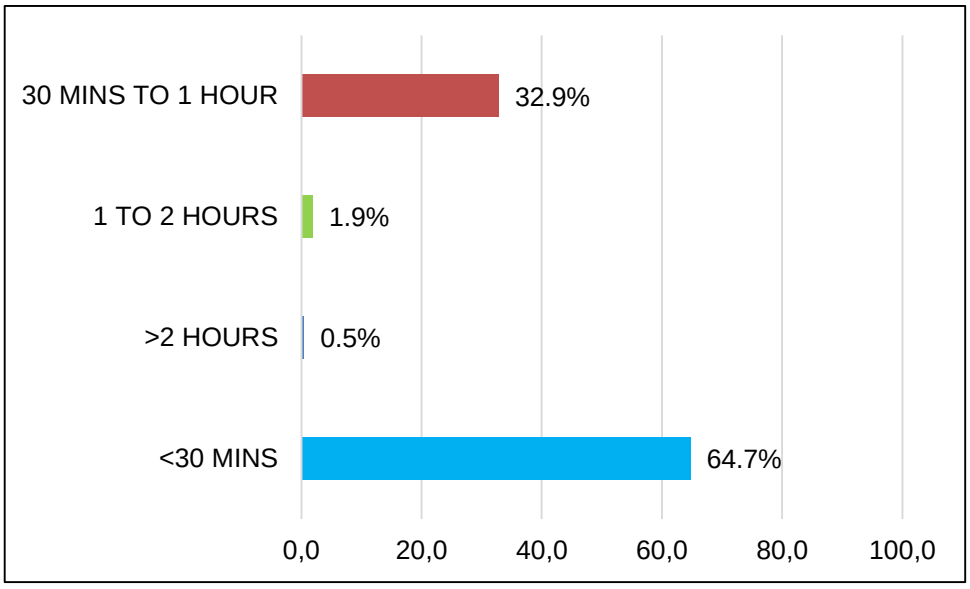

Figure 4.6: Travel time to PDU

4.3.3 PDU Location

As shown in Figure 4.7, majority of the participants (81.6%) said they would have come to the mall for other reasons, whereas 18.4% of the participants said they would not have come to the mall for other reasons besides for collecting their medications. A study was conducted which analysed the impact of shopping mall development on the survival of small formal and informal retailers located in the township areas such as Soweto and Alexandra in South Africa. It was concluded that the retail sector played an essential role in the community's economic and social welfare. It provides people with important services which have improved the overall GDP of the country (Ligthelm, 2012).

There has been a quick increase in the growth of income for township residents since 1994 which has lead to considerable growth in consumer expenditure in these areas and has resulted in a positive impact on the economy (Ligthelm,

2012). Having the PDUs located in a mall is beneficial for the South African economy as patients can use the mall for other purposes besides collecting their medications, such as for their daily shopping needs and the banking services.

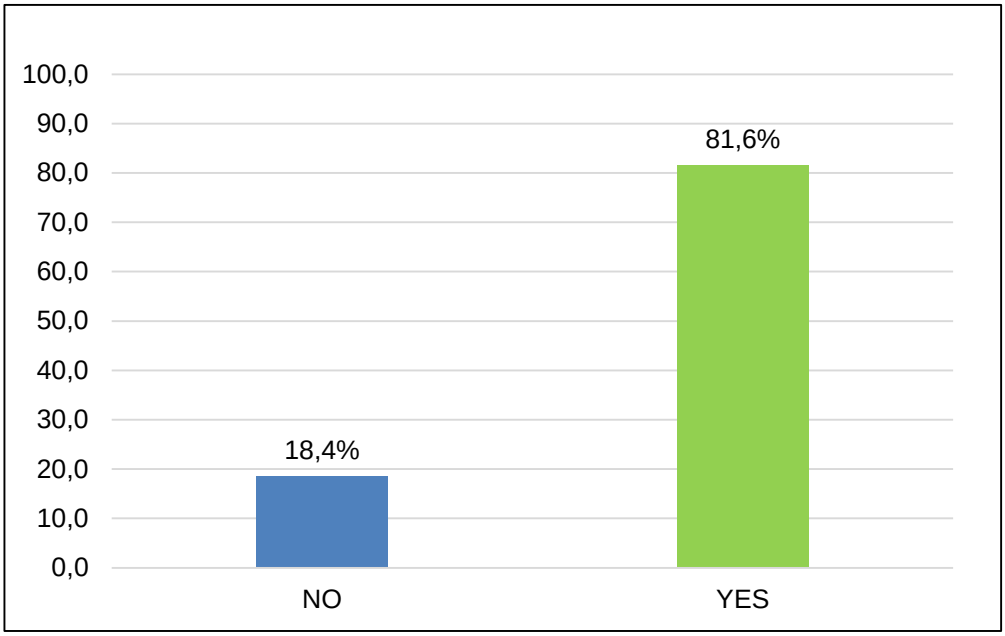

Figure 4.7: Other Uses of Mall

Table 4.3 below, depicts cross tabulation other uses of mall vs socio-demographic information. The results imply that age (p=0.012) and period of collection at PDU (p=0.006), were significantly associated with other uses of the mall besides collecting medication at the PDU. It was found that patients who were between the age groups 31 to 50 years old were more likely to use the mall for other uses, possibly because they would have more errands to run, they also fall more under the working category and hence would have to use banking services and do shopping. Participants who had been collecting their medication for a longer period of time had probably discovered the other uses of the mall and hence were able to use the other services.

A study was done in the City os Tshwane, South Africa, to understand which attributes attract shopping mall visitors. From this study, it was observed that factors such as the assortment of stores available and the variety of services offered were ranked the highest at influencing people to come visit the mall

(Makgopa, 2016). This is in line with the PDU malls, as they have a number of stores available and they provide services such as banking and the PDUs for collecting medications, which attracts customers to utilize them.

Table 4.3: Other uses of mall vs. Socio-Demographic Information

			Pearson Chi-Square Test		
Category		**TOTAL**	**VALUE**	**Df**	**Asymptomatic significance (2-sided)**
Age (Yrs)	18 TO 30	74	12.932[a]	4	P = 0.012
	31 TO 40	219			
	41 TO 50	112			
	51 TO 60	72			
	>60	32			
Period collection at PDU	FIRST TIME	7	52.733[a]	30	P = 0.006
	<1 YEAR	125			
	1 TO 2 YEARS	331			
	>2 YEARS	46			

4.3.4 Time-Off from Work

Figure 4.8 below, shows that most of the study participants (60.1%) said that they did not have to take time off from work, whereas 39.9% agreed that they did have to take time off from work. Improving access to healthcare is a major priority of the National Department of Health (Egbujie *et al.,* 2018). It has been found that socio-demographic factors such as poverty, lack of insurance and residents living in rural areas have presented as major challenges to accessing healthcare in South Africa. In addition, patients have to travel far to get to a clinic which requires taking time off from work and paying transportation costs. Furthermore patients have to wait in long queues at the PHCs (Bogart *et al.,*2013).

In line with National Department's Health objective of improving access to care (NDoH, 2017), the PDUs are conveniently located and offer extended operating hours. These factors should eliminate the challenges faced by patients collecting at clinics. However some patients still took time off from work perhaps because

they may not yet have been familiar with the extended operating hours and hence felt the need to take time off from work.

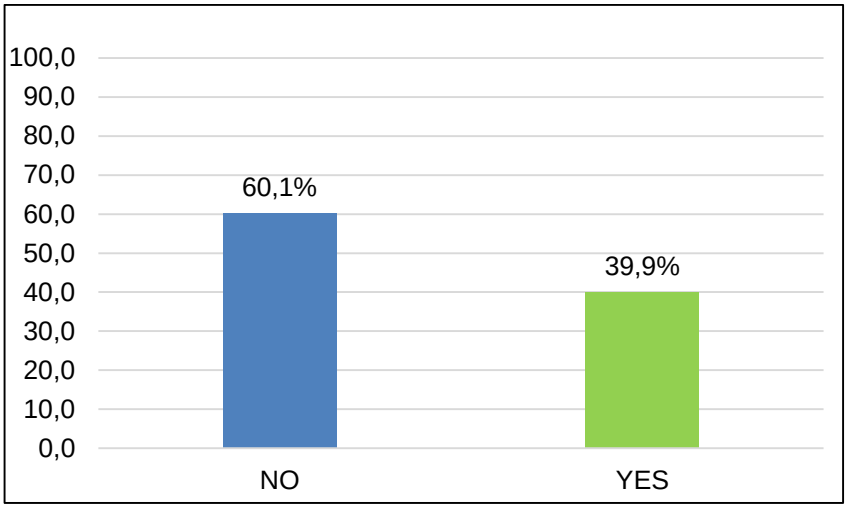

Figure 4.8: Time off Work

Table 4.4 below, shows cross tabulation time off work vs. socio-demographic information. The results infer that age ($p=0.015$) and employment status ($p<0.001$) were significantly associated with taking time off from work to collect medication. Most participants were between ages 31 to 50 years which falls under the working class. Most participants who were employed or self-employed did not have to take time off from their jobs. Participants did not have to take time off from work because they have been collecting their medications for long and hence are aware and used to the flexible operating hours of the PDUs.

The study that was initially done at the Alexandra Plaza PDU site showed a very low collection rate. However, after the placement of site agents at the clinics, the collection rate increased from 64% to 95%. The site agents engaged with the patients and informed them about the flexibile operating hours and hence patients became aware of the operating hours (Strydom et al., 2018). This explains why the participants in the PDU study did not take time off from work, as they were already made aware of the operating times.

Table 4.4: Time off work vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**df**	**Asymptomatic significance (2-sided)**
AGE (YRS)	18 TO 30	62	12.319[a]	4	P = 0.015
	31 TO 40	137			
	41 TO 50	98			
	51 TO 60	54			
	>60	24			
EMPLOYMENT STATUS	EMPLOYED	122	103.330[a]	5	P = 0.001
	PART TIME WORK	16			
	RETIRED	22			
	SELF-EMPLOYED	24			
	STUDENT	9			

4.4 INFORMATION ON PATIENTS' EXPERIENCES

In order to determine patients' experiences, various attributes were looked at, such as: whether the PDU waiting area was suitable, level of satisfaction with the operating hours, whether the PDU operates on a first come first serve basis, waiting times, receiving communication on time, whether the ADM language was understandable, preference of engagement with the healthcare professional, whether patients received medication as prescribed and on the correct collection date, if medication was clearly labelled, whether patients had not received medication and if they had any negative experiences at the PDU. Figure 4.9 below depicts a few of these attributes.

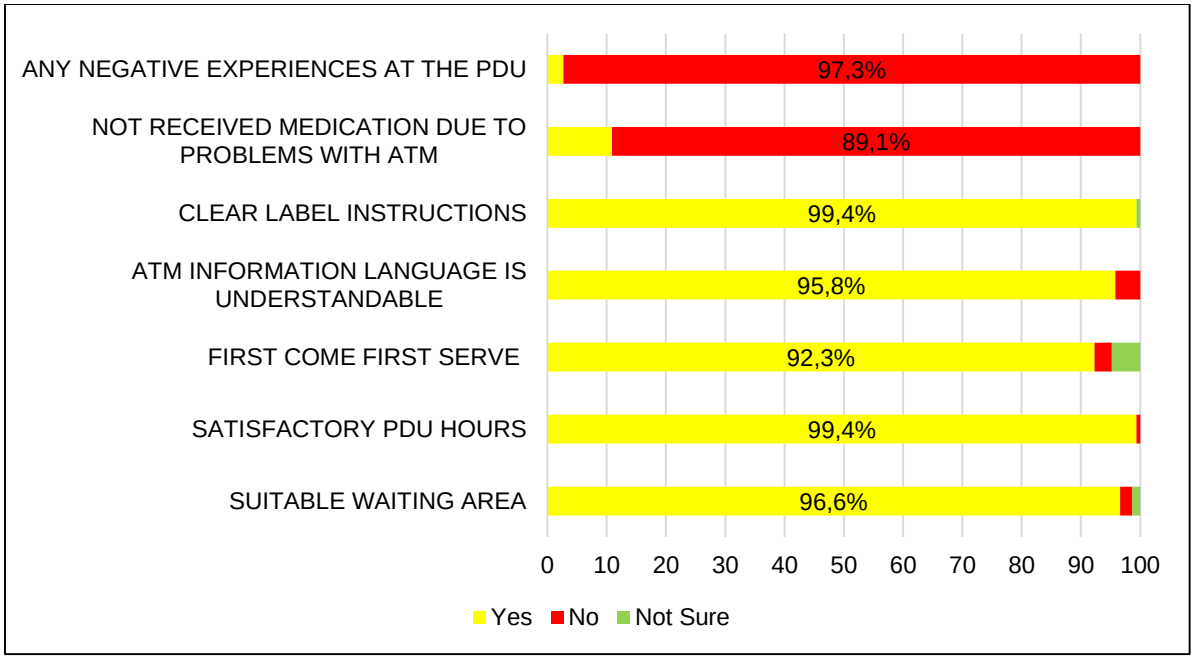

Figure 4.9: Patients' Experiences at the PDU

4.4.1 Patients' Experiences with Waiting Area and Operating Hours

In looking at patients' experiences, Figure 4.9 shows that 96.6% of the participants found the PDU to have a suitable waiting area, whilst only 2.1% found the waiting area unsuitable. In addition, 99.4% of the participants were satisfied with the PDU operating hours, whilst 0.6% was not.

The cross-tabulation for satisfactory PDU hours vs. socio demographic information below (Table 4.5), indicates that the number of years of diagnosis (p=0.001) was significantly associated with satisfactory PDU hours. Participants who had been diagnosed with their chronic condition for 2 years or greater were more likely to be familiar with the different types of health services and the operating hours due to their experience with various pharmacy services. The PDUs offer flexible operating hours compared to the PHCs and CHCs and hence the PDUs would be more suitable.

Table 4.5: Satisfactory PDU Hours vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**Df**	**Asymptomatic significance (2-sided)**
No. of years of Diagnosis	1 year	12	18.010[a]	4	P = 0.001
	2 to 4 years	228			
	5 to 7 years	216			
	8 to 10 years	110			
	>10 years	54			

4.4.2 Patients' Perception on First come first serve

According to Figure 4.9, majority of the participants (92.3%) felt that the PDU operates on a first come first serve basis, 2.9% felt that it did not and 4.8% felt unsure whether it did. The cross-tabulation (Table 4.6) first come first serve vs socio-demographic information indicates that education status (p=0.004) was significantly associated with the PDU operating on a first come first serve basis. It was found that most participants who had some form of education felt the PDU operated on a first come first serve basis, possibly because they understood the concept of first come first serve better.

A study was done at a hospital in Saudia Arabia to measure the efficiency of waiting time in the outpatient pharmacy. From this study it was seen that by using an automated waiting system with automated prescriptions, and by patient categorization, for example having different windows for different categories of patients such as special needs patients who require more time, the refill patient service and the normal window for patients who come to the pharmacy first be served first. All these factors helped to reduce patient waiting time and lead to increased patient satisfaction (Alodan et al., 2020). From the study conducted in Saudia Arabia, the same deduction can be made for the PDU whereby the concept of first come first serve is important in terms of understanding patient experience and patient satisfaction.

Table 4.6: First come first serve vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**Df**	**Asymptomatic significance (2-sided)**
EDUCATION STATUS	PRIMARY	55	19.349[a]	6	P = 0.004
	SECONDARY	340			
	TERTIARY	173			
	DID NOT ATTEND	8			

4.4.3 Understanding of ATM language

Majority of the participants (95.8%) across all three PDUs also said the ATMs provide information in a language that is understandable to them, whilst 4.2% felt that they could not understand the ATM language (Figure 4.9). Table 4.7 below depicts cross-tabulation ATM is in an understandable language vs. socio-demographic information. The results portray that education status (p=0.019) and current health status (p<0.001) were significantly associated with the ATM providing information in a language that is understandable. Most participants who had received some form of education were able to understand the ATM language better. In addition, patients who had a very good or good health status were also able to understand the ATM language better. These patients have been managing their health well, are compliant with taking their medications and follow instructions and medical advice correctly, hence they would also easily understand the ATM language as they are used to following instructions correctly.

Table 4.7: ATM is in an understandable language vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**df**	**Asymptomatic significance (2-sided)**
EDUCATION STATUS	PRIMARY	55	9.978[a]	3	P = 0.019
	SECONDARY	354			
	TERTIARY	183			
	DIID NOT ATTEND	6			
CURRENT HEALTH STATUS	VERY GOOD	333	27.714[a]	4	P = 0.000
	GOOD	241			
	MODERATE	18			
	POOR	2			
	VERY POOR	4			

4.4.4 Quality of Medication labels

Most respondents (99.4%) said that their medications were always clearly labelled with the directions of use, whilst the other 0.6% felt unsure about this. This could be due to patients not completely understanding the medication labels. Table 4.8 below portrays cross-tabulation clear label instructions vs. socio-demographic information. From the results it can be deduced that the number of years of diagnosis (p=0.001) and the period of collection at the PDU (p=0.050) were significantly associated with the medications being clearly labelled with directions of use.

Patients who had been diagnosed for greater than 2 years and patients who had been collecting their medications for 1 year or greater found the label instructions to be clear, this is because they were more familiar with their medications and how they are labelled as they are used to taking them and following the correct label instructions. Although no correlation was found between education status (p=0.815) and medications being clearly labelled, it can be seen from the results that education status did play an important role in determining whether

participants found the medications clearly labelled. Participants who had received a secondary education (59%) and those who had received a tertiary education (31%) found the medications correctly labelled as they could understand the label instructions correctly.

Table 4.8: Clear label Instructions vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**df**	**Asymptomatic significance (2-sided)**
No. YEARS DIAGNOSIS	1 YEAR	12	18.010[a]	4	P = 0.001
	2 TO 4 YEARS	228			
	5 TO 7 YEARS	216			
	8 TO 10 YEARS	110			
	>10 YEARS	54			
PERIOD COLLECTION AT PDU	FIRST TIME	12	43.810[a]	30	P = 0.050
	<1 YEAR	156			
	1 TO 2 YEARS	401			
	>2 YEARS	51			
EDUCATION STATUS	PRIMARY	57	0.944[a]	3	0.815
	SECONDARY	364			
	TERTIARY	191			
	DID NOT ATTEND	8			

4.4.5 Problems and Negative Experiences at the PDU

When participants were asked if they have not received their medication from the PDU due to a problem with the ATM or any other issues, Figure 4.9 shows that 89.1% of them said they always receive their medication and have never had any issues, whilst the other 10.9% said yes they have not always received their medication from the PDU at times due to problems such as: system issues, network issues, issues with the call centre dispensing medicines through the ATM, medicines not being captured on the electronic system on time, medicines not being delivered to the PDU on time, the PDU being unable to receive orders and technical issues with the ATM machines. Participants were then asked if they have had any negative experiences at the PDU, 97.3% reported they have not and

2.7% reported that they had some negative experiences such as the PDU being too busy and the system being down. It is not surprising that a few participants did have problems and negative experiences, as some of the drawbacks of pharmacy automation are delays when the machine needs to be serviced or has malfunctioned, or needs to be reloaded and machines can also have software issues (Assad, 2018).

4.4.6 Patients' Experiences with Communication

Figure 4.10. below shows patients' experiences with regards to communication and medication. When participants were asked if they receive communication on time of when to collect their medication, the majority being 86.1% said they always do, 9.9% said they sometimes do, 1% said they rarely do and only 3% said they never do. Participants were then asked if they receive communication for not collecting their medications on the collection date, 80.8% said they always do, 8.2% said they sometimes do, 1.1% said they rarely do and 9.9% said they never do. Not receiving communication on time could be due to network issues, incorrect cell phone numbers being given initially, change in contact numbers or perhaps issues with the PDU call centre sending out SMSs on time. Overall, patients were generally happy with the communication services offered by the PDU.

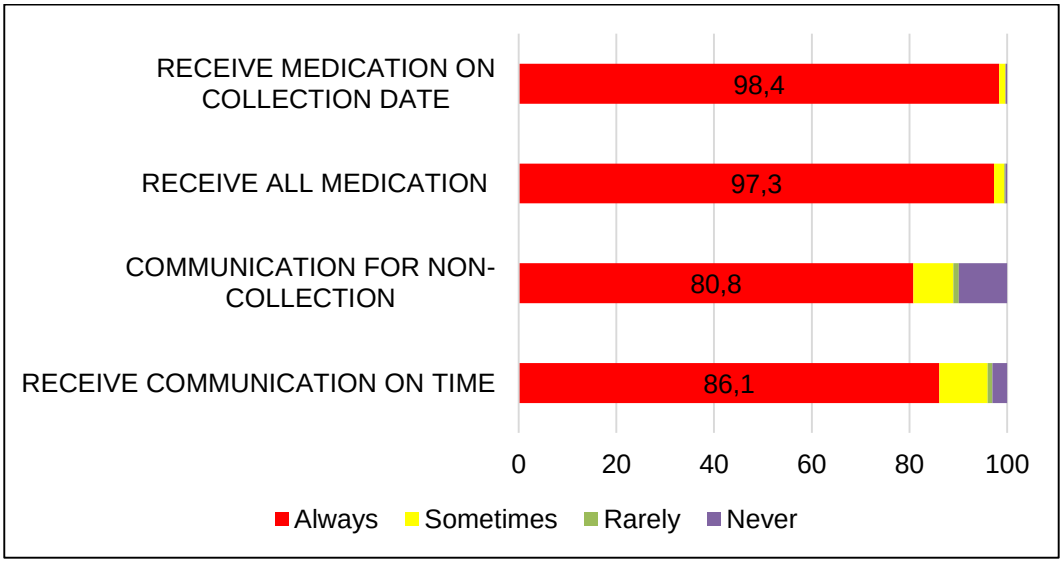

Figure 4.10: Patients' Experiences with Communication and Medication at the PDU

4.4.7 Patients' Experiences on Receiving Medication

In terms of receiving medication as prescribed by the doctor or nurse, 97.3% of the participants said that they always do, 2.1% said they sometimes do, 0.3% said they rarely do and 0.3% said they never do. This could be explained by the fact that errors in prescription capturing on the system could have occurred and thus the PDU dispenses the incorrect medication. Some patients also do not know the different generics available and hence could be confused if they receive a medication with a different brand name and with different packaging.

Most participants (98.4%) at all 3 sites said they always receive their medication on time as per their collection date, 1.3% said they sometimes do and only 0.3% said they never do. This could be because prescriptions are not always sent on time from the clinics to the PDUs, resulting in delays in capturing on the system and hence SMSs being sent out late to patients and patients then collect their medications on a date later than their original collection date as per their appointment cards. However, it is also possible that patients forget their collection date or lose their appointment cards and collect their medications later than their actual collection date.

4.4.8 Waiting Times

Figure 4.11. shows patients' waiting times at the PDU. Most participants (97.1%) waited for less than 30 minutes when collecting their medications at the PDU, which indicates that the PDU service is very efficient, patients have a low waiting time and there is no/ reduced amount of congestion. Long waiting times at public healthcare facilities have created plenty of dissatisfaction amongst patients attending at these facilities. The National Department of Health has identified waiting time as one of the six priority areas for improvement (NDoH, 2017).

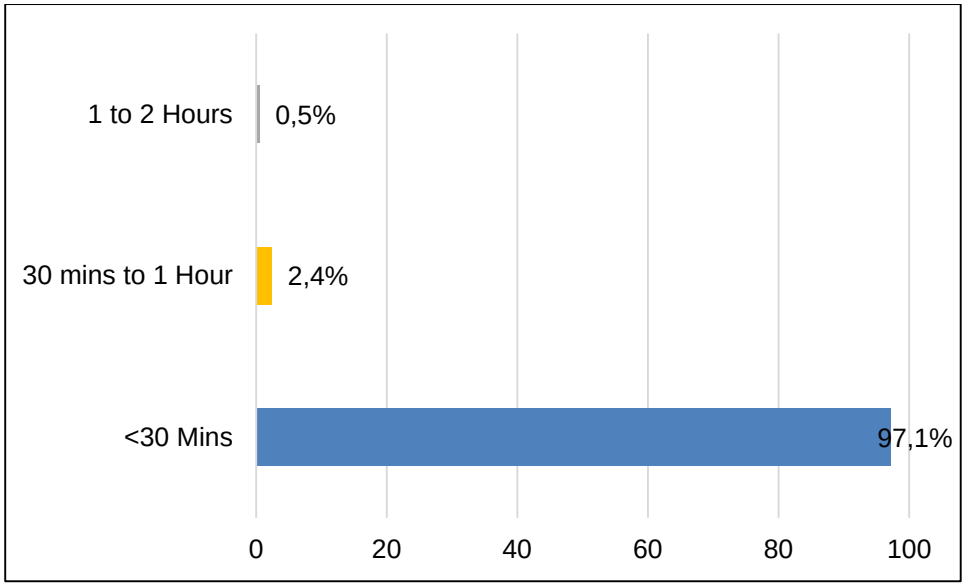

Figure 4.11: Patients' Waiting Times

Health System-Strengthening interventions have been implemented as part of the "Ideal Clinic Model" at public healthcare facilities such as in Amajuba District Kwazulu Natal Province, South Africa. The national threshold waiting time is 3 hours, in this study it was found that patients generally wait for approximately 122 minutes on average, but after implementation of the Ideal Clinic Model patients waited about 116 minutes in total. A further reduction in patient waiting time is still required with proper interventions and measurement strategies as well as an urgent scale-up of clinic appointment systems (Egbujie et al*.,* 2018). In line with this Ideal Clinic Model the PDU offers extended operating hours which has helped to improve patient waiting times, resulting in decongestion and reducing the amount of people having to take time off from work.

From the PDU study only 2.4% said they had to wait between 30 minutes to 1 hour and 0.5% said they had to wait between 1 to 2 hours to receive their medications. This difference in waiting time could be due to the fact that the PDU does experience technical issues such as systems being offline, slow response and maintenance issues from time to time which have had an impact on how long patients wait for.

4.4.9 Preferred Method of Engagement

Figure 4.12. shows patients' preference with regards to engaging with the healthcare professional. It can be deduced that 70.7% preferred the PDU telephonic system and 29.3% felt that they would rather talk to a healthcare professional directly in person. This difference in opinion is perhaps because some patients are used to dealing with healthcare professionals in person such as when they used to collect their medications at the clinic and hence still prefer face to face interactions. The majority who preferred the PDU telephonic system have become used to the new way of interacting and hence appreciate the benefit of this system rather than spending more time talking to the healthcare professional directly.

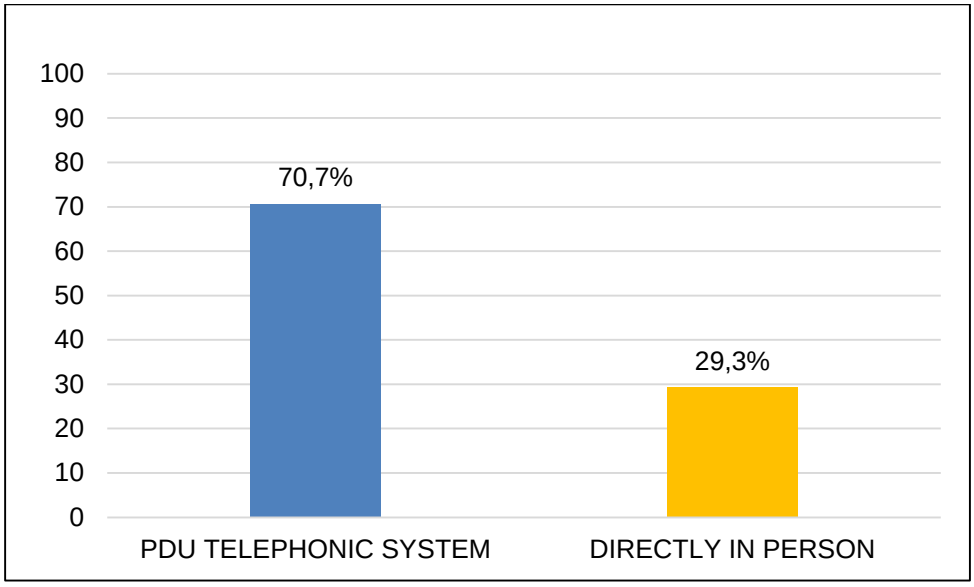

Figure 4.12: Prefer Engaging with Healthcare Professional

Table 4.9 below displays cross-tabulation prefer engaging via PDU telephonic system vs. socio demographic information. It can be deduced that current health status (p=0.005) and gender (p=0.014) predicted a significant proportion of the total variation of preferring to engage with the healthcare professional through the PDU telephonic system. Most participants who had a very good or good health status preferred engaging with the healthcare professional through the PDU telephonic system; because they are managing their health well and are well

informed of their health status already and hence would not find the need to speak to a healthcare professional directly.

Table 4.9: Prefer engaging via PDU Telephonic System vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**df**	**Asymptomatic significance (2-sided)**
CURRENT HEALTH STATUS	VERY GOOD	224	14.688[a]	4	P = 0.005
	GOOD	196			
	MODERATE	15			
	POOR	2			
	VERY POOR	4			
GENDER	FEMALE	299	14.688[a]	1	P = 0.014
	MALE	142			
EDUCATION STATUS	PRIMARY	34	4.200[a]	3	P = 0.241
	SECONDARY	259			
	TERTIARY	142			
	DID NOT ATTEND	6			

A study done at the Southeastern University in Florida, USA aimed to conduct a contemporary examination of gender differences in mediated communication use. Participants were asked about their experiences with different forms of communication including social networking, email, video calls, instant messaging, texting and phone calls. It was found that more women were connecting and using mediating technology to communicate. Additionally, it was found that women showed a greater use of online video calls and telephone calls than males (Kimbrough, Guadagno, Muscanell and Dill, 2013). These results are in correlation with the PDU study, whereby it was found that more females preferred to use the PDU telephonic system compared to males.

No correlation was found between education status (p=0.241) and preferring to engage via the PDU telephonic system. However, according to studies it has been found that education is fundamental towards human development, as well as

development of other factors, such as: infrastructure, innovative techniques and methods, organizations, rural development, healthcare, medical and communication. In addition, when people are enrolled in higher educational institutions they are able to amplify their skills and development (Kapur, 2018). In the PDU study it was found that participants who had a secondary education (259) or a tertiary education (142) preferred engaging through the PDU telephonic system as they could easily understand the healthcare professional through the audio-video link.

4.5 Information on Patients' Attitude towards the PDU

In assessing patients' attitude, the following attributes were considered: safety at PDU, sufficient amount of privacy, ease of use of ATM, availability of healthcare providers, experience with speaking to healthcare professional through the PDU telephonic system, service received, preference of PDU or clinic, ease of use of PDU system, recommendation of PDU to other patients and continuation of use of PDU. Figure 4.13 below depicts patients' attitude in terms of satisfaction towards PDU using some of the above attributes.

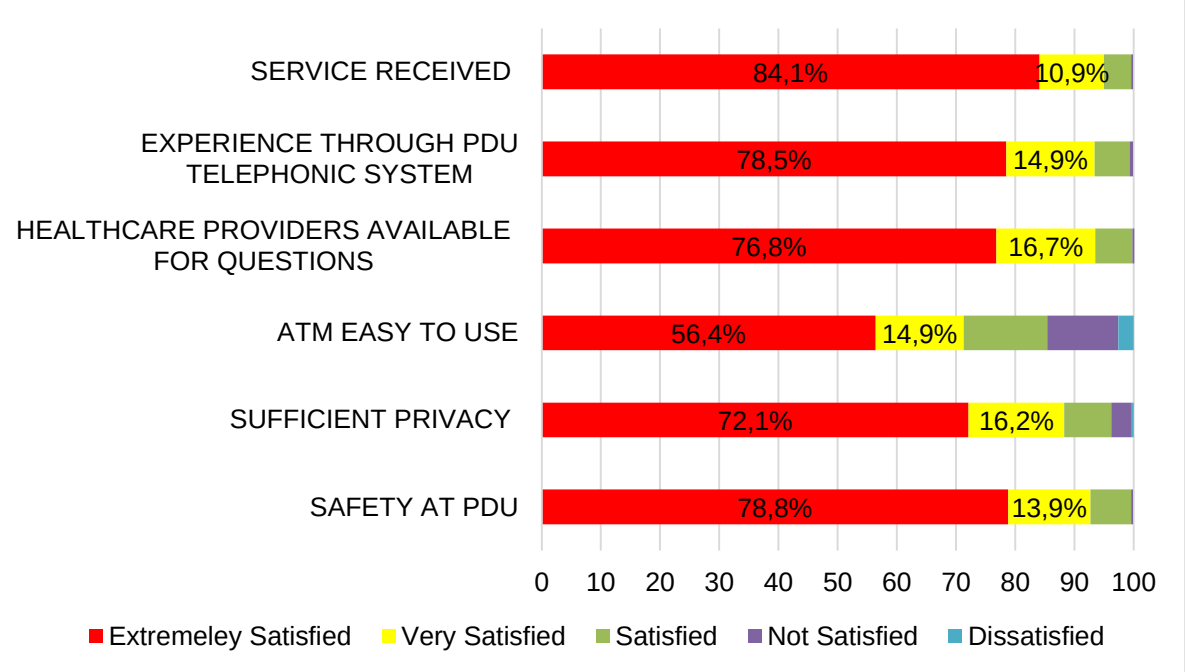

Figure 4.13: Patients' Attitude in terms of Satisfaction towards PDU

4.5.1 Safety at PDU

In looking at patient's attitude, (Figure 4.13) shows 78.8% of the participants felt extremely satisfied in terms of safety when collecting their medication at the PDU, 13.9% felt very satisfied, 6.9% felt satisfied and only 0.3% did not feel satisfied by the safety aspect. This is perhaps because the PDU system is still new to some patients; there are also less people at the PDU at one time compared to the clinic which could be affecting the patient's perception of safety.

Table 4.10 below represents cross-tabulation safety at PDU vs. socio-demographic information. It can be seen that period of collection at the PDU ($p<0.001$) was significantly associated with feeling safe when collecting medication at the PDU. Patients who had been collecting for a longer period of time felt safe when collecting their medications at the PDU, because they were used to collecting their medications and had most likely never encountered any problems at the PDUs or mall. They also know the security level at the PDU is good.

Table 4.10: Safety at PDU vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**df**	**Asymptomatic significance (2-sided)**
PERIOD COLLECTION AT PDU	FIRST TIME	6	173.982[a]	90	P = 0.0010
	<1 YEAR	126			
	1 TO 2 YEARS	336			
	>2 YEARS	24			

4.5.2 Privacy at PDU

In terms of sufficient privacy at the PDU, according to Figure 4.13, 72.1% of the participants felt extremely satisfied, 16.2% felt very satisfied, 7.9% felt satisfied, 3.5% were not satisfied and 0.3% was dissatisfied. Patients who weren't satisfied might've been used to going into a consultation room and dealing with a

healthcare professional privately as compared to using the ATM system which is surrounded by a vestibule and is next to other ATMs which other patients are using.

4.5.3 Use of ATM

As depicted in Figure 4.13, most participants at all 3 PDUs felt the ATM was easy to use, 56.4% were extremely satisfied, 14.9% felt very satisfied and 14.1% felt satisfied. It was found that 12% did not feel satisfied and 2.6% felt dissatisfied about the ease of use of the ATM and required assistance from the PDU personnel to use the ATM. Participants who were not content with the ease of use of the ATM, were probably not technology savvy, the ATM system is also a fairly new system of dispensing medicines and hence they first have to get used to using the machines; and some participants may have been using the ATM for the first time.

Table 4.11 below conveys cross-tabulation ATM is easy to use vs. Socio Demographic information. The results demonstrate that education status ($p<0.001$) and period of collection at the PDU ($p=0.002$) were significantly associated with the ATM being easy to use in order to receive medications. Patients who were educated found the ATM easy to use as it was easier for them to remember the demonstrations given by healthcare professionals initially on how to use the ATM. Participants who had been collecting their medications for longer were now more used to the system and hence found it easy to use.

Table 4.11: ATM is easy to use vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**df**	**Asymptomatic significance (2-sided)**
EDUCATION STATUS	PRIMARY	37	84.364[a]	12	P = 0.000
	SECONDARY	211			
	TERTIARY	102			
	DID NOT ATTEND	2			
PERIOD COLLECTION AT PDU	FIRST TIME	6	170.165[a]	120	P = 0.002
	<1 YEAR	93			
	1 TO 2 YEARS	225			
	>2 YEARS	28			

4.5.4 Availability of Healthcare Providers

Participants were asked if they have any questions regarding their medicine or health, the healthcare providers are available to talk to. Figure 4.13 shows that 76.8% were extremely satisfied by the availability, 16.7% felt very satisfied and 6.3% felt satisfied. However, a very small portion (0.3%) did not feel satisfied by the availability of healthcare professionals. This could be due to the system being down or problems with the ATM system when they come to collect their medications, hence the call centre could have been offline, and the healthcare professionals on site could have been attending to other patients.

4.5.5 Experience through PDU Telephonic System

Participants were then asked to rate the experience they've had with speaking to the healthcare professional through the PDU telephonic system (Figure 4.13), 78.5% felt extremely satisfied, 14.9% felt very satisfied, 5.9% felt satisfied and 0.6% were not satisfied by their experience. The participants who were not content might have preferred dealing with a healthcare professional directly in person as compared to using the telephonic system.

4.5.6 Service at PDU

Participants were asked to rate the service they receive at the PDU, Figure 4.13 presents that 84.1% were extremely satisfied by the PDU service, 10.9% were very satisfied, 4.6% were satisfied and 0.3% were not satisfied by the service received at the PDU. Participants who were not happy with the service may have had a negative experience at the PDU such as the system being down, PDU being too busy or healthcare professionals not being available to talk to.

4.5.7 Patients' Attitude towards using the PDU

Figure 4.14 below depicts patients' attitude towards using the PDU. Most participants (99%) at all 3 PDU sites said they prefer using the PDU compared to the clinic, but a small proportion (1%) said they felt unsure as to what they preferred. This is perhaps because they may have just started using the PDU services and were still getting used to the system. Patients may also feel anxious, nervous or worried about using a new service such as the PDU.

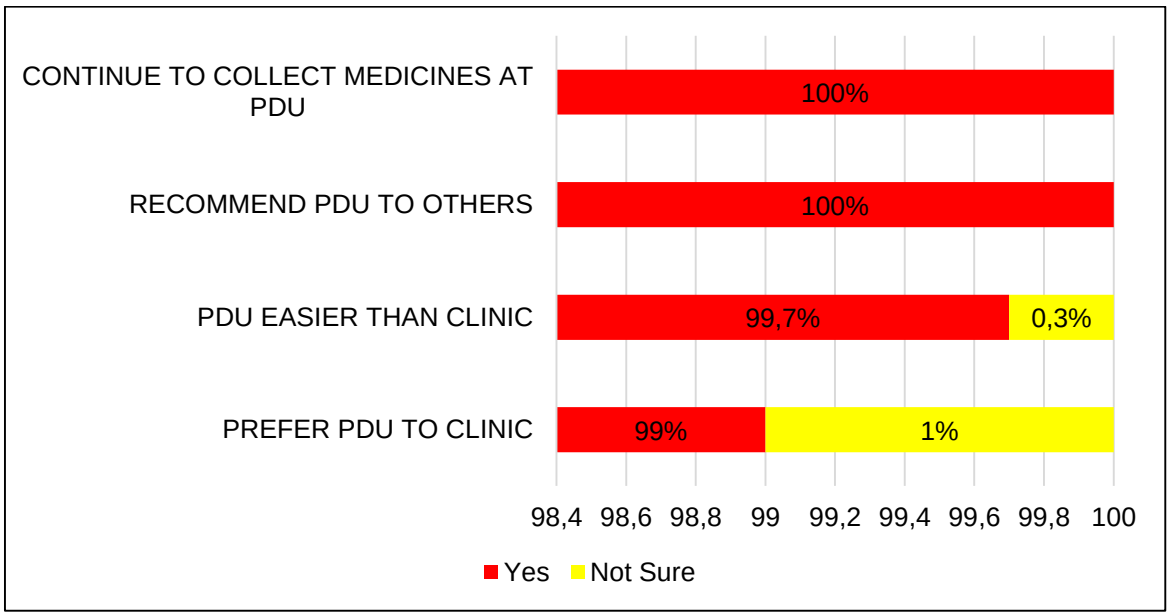

Figure 4.14: Patients' Attitude towards Using PDU

4.5.8 Preference of PDU to Clinic

Table 4.12 below displays cross-tabulation prefer PDU to clinic vs. socio-demographic information. The results prove that employment (p=0.054) was marginally associated with preferring to use the PDU. For patients who are employed the PDU is ideal because of the flexible operating hours, hence they can go before, after, in-between or even on weekends to collect their medications. For patients who are unemployed the PDU is also more preferable, as they have more time to do other things such as searching for jobs and going for interviews without having to spend a whole day at the clinic.

It was found that the number of years of diagnoses (p<0.001) was also significantly associated with preferring to use the PDU compared to the clinic. For participants who had been diagnosed with their chronic condition for 2 years or greater have had more experience with using the PHCs and CHCs and hence understand the difference between using these services compared to the PDU. They have realised that the PDU service is very quick and efficient, as well as the fact that they don't have to wait in a long queue to collect medications.

Table 4.12: Prefer PDU to clinic vs. Socio-Demographic Information

			PEARSON CHI-SQUARE TEST		
CATEGORY		**TOTAL**	**VALUE**	**df**	**Asymptomatic significance (2-sided)**
EMPLOYMENT	EMPLOYED	304	10.894[a]	5	P = 0.054
	UNEMPLOYED	217			
	SELF EMPLOYED	32			
	PART TIME WORK	25			
	STUDENT	14			
	RETIRED	26			
No. YEARS DIAGNOSIS	1 YEAR	10	34.472[a]	4	P = 0.001
	2 TO 4 YEARS	226			
	5 TO 7 YEARS	216			
	8 TO 10 YEARS	112			
	>10 YEARS	54			

Additionally, 99.7% of the participants said the PDU system makes it easier for them to collect their medication and follow their treatment compared to the clinic. A few participants (0.3%) felt unsure about this, possibly because they were still new to the PDU system and hence were still indecisive as to which service they preferred.

Furthermore, all the participants from all 3 PDU sites said that they would recommend the PDU to other patients and that they will continue to collect their medicines at the PDU. Overall, it can be deduced that most of the participants had a positive attitude towards the PDU and the services offered.

4.6 SUMMARY

In summary, it can be concluded that overall patients had a positive attitude and experiences towards the automated pharmacy dispensing units. Patients were generally happy with the PDU services, preferred using the PDU compared to the clinic, found the PDU system easier to use to collect their medications and hence said they would recommend the PDU to other patients and would continue collecting their medicines at the PDU.

CHAPTER 5

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The previous chapter outlined the data analysis, results and discussion based on the completed questionnaires on patients' attitude and experiences towards automated Pharmacy Dispensing Units in Johannesburg, South Africa. The objective of the final chapter is to reconcile the findings from the study with the research questions. In addition, limitations and recommendations for future studies are provided.

5.2 CONCLUSION

The research questions of the study were:

- What are the experiences of patients towards collecting their chronic care medication through the automated Pharmacy Dispensing Units?
- What are the attitudes of patients towards collecting their chronic care medication through the automated Pharmacy Dispensing Units?

In determining patients' experiences towards the PDU, various factors were analysed. Firstly, majority of the participants (96,6%) found the PDU waiting area to be suitable. The PDU had sufficient space and chairs for patients to wait before collecting their medication at the ATM. The bulk of the participants (99,4%) were happy with the PDU operating hours as the PDU offered flexible times of operations which allowed patients to collect their medications as per their own convenience. Most participants (92,3%) agreed that the PDU operated on a first come first serve basis, as whenever they went to collect their medication, they found the PDU operated in a fair and orderly manner. Furthermore 97,1% of the participants stated that they wait for less than 30 mintues to collect their medication, indicating the PDU service is very quick and efficient.

With regards to communication 86,1% of the participants indicated that they always receive communication on time of when to collect their medications and 80,8% said they always receive communication when they do not collect their medication on time. This proves that the PDU communication service is quite good as majority of the patients do receive communication, however there is still a need for improvement from the PDU with regards to communication. With respect to preference of engagement, more than half of the participants (70,7%) preferred engaging with healthcare professionals through the PDU telephonic system which showed that participants were getting used to the new way of communicating and understood the benefits of this feature. Additionally, 95,8% found the ATM to provide information in a language that was understandable to them. This was advantageous especially for patients who could not communicate in or understand English.

In terms of receiving medication, 97,3% of the participants said they always receive the correct medication, 98,4% said always receive their medication on the correct collection date and 99,4% of the respondents said their medications were always clearly labelled with directions of use . This implies that the PDU system is very competent. With regards to not receiving medication and having any negative experiences, only a few participants experienced problems at the PDU because of the system being down, network issues, technical challenges, delivery problems and the PDU being too busy.

In assessing patients' attitude towards the PDU, it can be established that 99,6% of the respondents found the PDU to be safe and 96,2% found the PDU to offer sufficient privacy. Participants were overall content because the PDU had good security measures and offered enough privacy as only one patient was allowed to use the ATM at a time and other patients could not see what medications a patient took from the ATM.

Most participants (85,4%) found the ATM easy to use as it was a simple system with clear instructions as well as the availability of on-site support staff. With regards to availability of healthcare providers, 99,8% of the participants felt the support from on site pharmacists and assistants as well as from the call centre through the audio-visual link. Furthermore, 99,3% were pleased with the experience they had speaking to the healthcare professional through the PDU telephonic system and 99,6% were content with the overall service received at the PDU. From these factors, it can be ascertained that most participants had a very positive attitude towards the PDU system and the services offered.

In comparison to the clinic, 99% of the participants felt they preferred to use the PDU and 99,7% found the PDU system easier to collect their medication from and follow their treatment plan. All of the respondents stated that they would recommend the PDU to other patients, as well as continue to collect their medicines at the PDU.

It can be deduced that this study provided some very valuable results. The aim of this study was to determine the attitude and experiences of patients collecting their chronic care medications at various automated Pharmacy Dispensing Units located in Johannesburg, South Africa. As seen from the results and discussion, it can be concluded that overall patients had a positive attitude and experiences towards the automated pharmacy dispensing units.

5.3 LIMITATIONS OF THE STUDY

The study did have some limitations. The study was only conducted at three PDU sites: Bara Mall, Ndofaya Mall and Alex Plaza in Johannesburg. The study did not include Bambanani Mall, as this site was still under construction during the planning phase of the study, and Twin City Mall in Mangaung, Bloemfontein was not included due to the location. Thus the results of the study cannot be generalised to the entire nation as findings may differ between different provinces. There were also a number of neutral responses from the participants which may have affected the scores either positively or negatively. Due to COVID-19 not all

people were willing to participate in the study, as they wanted to maintain social distancing guidelines and they did not want to touch the questionnaires. This resulted in a decreased number of participants from Alex Plaza compared to the target population planned for the study. Moreover, not all patients came to collect their medications on time due to COVID-19 and the lockdown being implemented, and data had to be collected within a certain time period hence resulting in time constraints to collect as much data as possible. Access to literature was also a limitation as there was not much information available on the Pharmacy Dispensing Units in South Africa.

5.4 RECOMMENDATIONS

- Future studies can be done to include all the PDUs including Bambanani Mall and the one in Bloemfontein.
- The data collection process could be done through patient interviews directly or telephonically to ascertain an in depth knowledge of how patients feel about the PDU. Telephonic interviews would be ideal especially since COVID-19 started, eliminating the need for paper and social distancing will also be maintained as patients will be in their own environment and hence feel safer to answer the questions.
- Further research is recommended on automated Pharmacy Dispensing Units, including comparative studies between different decongestion models and the PDU, operational research of the efficiency of the ATM systems, staff attitude towards the automated systems and professional opinions on pharmacy automation.
- The PDUs should provide 24 hour services which will allow patients to come collect their medications at any time. Other services such as general clinical check-ups can also be offered at the PDUs which will also be useful if the PDUs operate on a 24 hour basis.
- It is fundamental for pharmaceutical services and the Department of health to assess patients' perceptions of different pharmacy services such as the PDU, CCMDD, CDU, PHC and CHC services and private pharmacies to see if patients find their services valuable and which services do patients prefer. If the patients find these services valuable or prefer a specific type of

service then more of these services can be implemented and marketed to patients.

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APPENDIX 1: Ethical Clearance Certificate from the Turfloop Research Ethics Committee

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING:	**06 March 2019**
PROJECT NUMBER:	**TREC/21/2019: PG**
PROJECT:	
Title:	Patients' attitude and experiences towards automated Pharmacy Dispensing Units in Johannesburg, South Africa
Researcher:	H Chouhan
Supervisor:	Mr MS Poka
Co-Supervisor/s:	Prof TM Mothiba Prof PH Demana
School:	Health Care Sciences
Degree:	Master of Pharmacy in Pharmacology

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

APPENDIX 2: Application Letter to Provincial Department of Health

APPENDIX 4: APPLICATION LETTER TO DEPARTMENT OF HEALTH

Department of Pharmacy

University of Limpopo

Private Bag X1106

Sovenga

0727

The Department of Health

78 Fox Street, Marshalltown

Johannesburg

2107

South Africa

Dear Sir/Madam

LETTER REQUESTING PERMISSION TO CONDUCT RESEARCH IN FULFILLMENT OF A MASTERS POSTGRADUATE STUDIES

My name is Hethel Chouhan and I'm a Masters student at the University of Limpopo in the Faculty of Health Care Science in the Pharmacy Department under the Supervision Mr. M.S Poka and Prof. T Mothiba.

I hereby request permission to conduct research at the three Pharmacy Dispensing Unit sites located in Alex Plaza, Bara Mall and Ndo'faya Mall. The study will initially be piloted at the Alex Plaza Mall. The research will be conducted at the Pharmacy Dispensing Units during the period 1st November 2018 to 31st March 2018.

The title of the research is: Patients' attitude and experiences towards automated Pharmacy Dispensing Units, Johannesburg, South Africa.

I hope my request is taken into consideration.

Yours Sincerely,

Hethel Chouhan (201834636)

.....

APPENDIX 3: Approval Letter from NHRD

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Joburg
a world class African city

JOHANNESBURG HEALTH DISTRICT

UL - University of Limpopo
Turfloop Research Ethics Committee (TREC),
State University of Limpopo
hethelcho@hotmail.com

Enquiries: Dr EM Ohaju
Tel: 011 694 3888 Cell: 076 8831659
Email: Elizabeth.Ohaju@gauteng.gov.za

Hillbrow CHC: Administration Building
Cr Smith Str. & Klein Street
Private Bag X21, Johannesburg
South Africa, 2017

DRC Ref: 2019-04-001

NHRD Ref no: GP_201903_043

Dear: Ms Hethel Chouhan

TITLE: ***PATIENTS' ATTITUDE AND EXPERIENCES TOWARDS AUTOMATED PHARMACY DISPENSING UNITS IN JOHANNESBURG, SOUTH AFRICA***

Your application for research approval refers.

The District Research Committee has reviewed your application. This letter serves as an in-principle approval to access the Districts Health facilities (mentioned below) for the above project subject to following conditions:

- The facilities to be visited: Alexandra plaza, Bara mall and Ndofaya mall.
- This facilities will be visited from **14/05/2019 to 14/05/2020.**
- The research can only commence after you submit an ethics clearance certificate from a recognized institution.
- You will report to the Facility Manager before initiating the study.

Region	Regional Health Manager	Contact No.	Cell phone
	Thato Mathabathe	073 846 0015	073 846 0015
	Belinda Strydom	072 369 5430	072 369 5430

The following conditions must be observed:

- Participants' rights and confidentiality will be maintained all the time.
- No resources (Financial, material and human resources) from the above facilities will be used for the study. Neither the District nor the facility will incur any additional cost for this study.
- The study will comply with **Publicly Financed Research and Development Act, 2008 (Act 51 of 2008) and its related Regulations**.
- You will submit a copy (electronic and hard copy) of your final report. In addition, you will submit a six-monthly progress report to the District Research Committee.

- Your supervisor and University of Limpopo will ensure that these reports are being submitted timeously to the District Research Committee.
- The District must be acknowledged in all the reports/publications generated from the research and a copy of these reports/publications must be submitted to the District Research Committee.

We reserve our right to withdraw our approval, if you breach any of the conditions mentioned above.

Please feel free to contact us, if you have any further queries. On behalf of the District Research Committee, we would like to thank you for choosing our District to conduct such an important study.

Regards,

Dr E.M Ohaju
Chairperson: District Research Committee
Johannesburg Health District
Date 13/06/2019

Mrs M.L Morewane
Chief Director
Johannesburg Health District
Date: 13/06/2019

Acting

Dr R Bismilla
Executive Director
Johannesburg Health District
Date: 14/6/19

APPENDIX 4: CONSENT FORM (IN ENGLISH)

PROJECT TITLE: Patients' attitude and experiences towards automated Pharmacy Dispensing Units, Johannesburg, South Africa.

SUPERVISOR: Mr M.S Poka

I, …….. hereby voluntarily consent to participate in the above-mentioned project. I have been invited to participate in the study. I have had the opportunity to ask additional questions and have been answered satisfactorily. I have been given enough time to decide about participation.

I understand that:

1. The study deals with the investigation of how patients feel towards automated pharmacy dispensing units.

2. The Turfloop Research Ethics Committee has approved that individuals may be approached to participate in the study.

3. The research project, i.e. the extent, aims and methods of the research, have been explained to me. Any questions that I may have regarding the research, or related matters, will be answered by the researcher/s.

4. Participation in this research is voluntary and I can withdraw my participation at any stage. I have been assured that the information obtained from me will remain anonymous and confidential and to be solely used for the purpose of this research.

SIGNATURE OF PARTICIPANT…….

SIGNATURE OF WITNESS…….

SIGNATURE OF INVESTIGATOR …….

Signed at_____ this ____ day of _____ 20_

APPENDIX 5: QUESTIONAIRRE (IN ENGLISH)

SECTION A: DEMOGRAPHIC INFORMATION (Tick the appropriate box)

1) Gender

Male	Female

2) Age

18-30 Years	31-40 Years	41-50 Years	51-60 Years	60+ Years

3) Race

Black	White	Indian	Coloured	Asian

4) Marital Status

Never Married	Married/Cohabitating	Divorced	Widowed

5) What suburb/area/extension do you live in?

_____

6) Education Status

Primary	Secondary	Tertiary	Did not attend

7) Current Employment Status

Employed	Unemployed	Self Employed	Part Time Work	Retired	Student

8) Current Chronic Profile

Asthma	
Diabetes	
Epilepsy	
HIV	
Hyperlipidemia/ Cholesterol Problems	
Hypertension/ High Blood Pressure	

9) How many years has it been since you were diagnosed with your chronic condition?

1 year	2 to 4 years	5 to 7 years	8 to 10 years	>10 years

10) On a scale of 1 to 5 please rate you current health status.

1 (very poor)	2 (poor)	3 (moderate)	4 (good)	5 (very good)

11) For how long have you been collecting your medication at the PDU?

_____

SECTION B: TRANSPORT (Tick the appropriate box)

12) What mode of transport did you use to travel to your PDU today?

Walking	Taxi	Bus	Train	Private Vehicle

13) How long did it take you to travel to the PDU?

Less than 30 min	30 minutes to 1 hour	1 hour to 2 hours	Greater than 2 hours

14) Which PDU mall do you use to collect your medication from?

Alex Plaza	Bara Mall	Ndofaya Mall

15) Would you have come to this mall today for other reasons like shopping or banking besides collecting medication from the PDU?

Yes	No

16) Did you have to take time off from work today to collect you medication?

Yes	No

SECTION C: PATIENT EXPERIENCES (Tick the appropriate box)

17) Is the waiting area at the PDU suitable?

Yes	No	Not Sure

18) Are you satisfied with the PDU operating hours for medicine collection?

Yes	No	Not Sure

19) Does the PDU operate on a first come first serve basis?

Yes	No	Not Sure

20) How long do you wait for when collecting medication at the PDU?

Less than 30 minutes	30 minutes to 1 hour	1 hour to 2 hours	Greater than 2 hours

21) Do you receive communication on time of when to collect your medication?

Always	Sometimes	Rarely	Never

22) Do you receive communication from the PDU if you do not go to collect your medication on the date of collection?

Always	Sometimes	Rarely	Never

23) Does the ATM provide information in a language that is understandable?

Yes	No

24) Do you prefer to engage with the healthcare professional (either/or)?

Through the PDU telephonic system	Directly in person

25) Do you usually receive ALL your medication from the PDU as prescribed by the doctor/nurse?

Always	Sometimes	Rarely	Never

26) Do you receive your medication on time as per your collection date?

Always	Sometimes	Rarely	Never

27) Is the medication clearly labelled with directions of use?

Yes	No	Not Sure

28) Have you ever not received your medication from the PDU due to a problem with the ATM or any other issue?

Yes	No

If yes, please BRIEFLY INDICATE WHAT WAS THE PROBLEM.

_____
_____
_____
_____

29) Have you ever had any negative experiences at the PDU?

Yes	No

If yes, please BRIEFLY INDICATE WHAT WAS THE NEGATIVE EXPERIENCE.

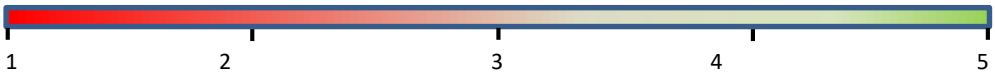
_____
_____
_____
_____

SECTION D: PATIENTS' ATTITUDE

Using the scale of 1 – 5 please rate the statements which follow by circling the appropriate choice.

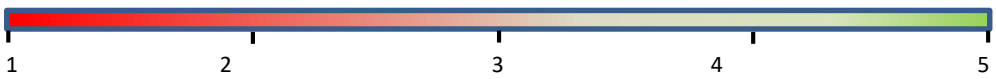
1 is Dissatisfied
2 is Not Satisfied
3 is Satisfied
4 is Very Satisfied
5 is Extremely Satisfied

30) I feel safe when collecting my medication at the PDU.



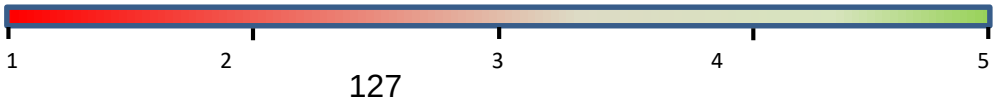
Dissatisfied *Extremely satisfied*

31) There is sufficient amount of privacy when I pick up my medications from the PDU.



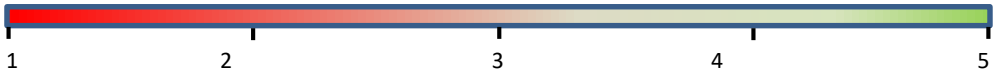
Dissatisfied *Extremely satisfied*

32) The ATM machine is easy to use in order to receive my medications.



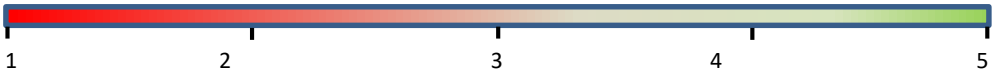
Dissatisfied *Extremely satisfied*

33) If I have any questions regarding my medicine or health, the healthcare providers are available for me to talk to.



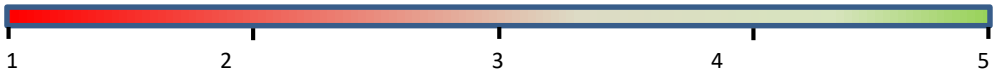
Dissatisfied *Extremely satisfied*

34) Rate the experience you have had with speaking to the healthcare professional through the PDU telephonic system.



Dissatisfied *Extremely satisfied*

35) Rate the service that you receive at the PDU.



Dissatisfied *Extremely satisfied*

36) I prefer to use the PDU compared to the clinic.

Yes	No	Not sure

37) The PDU system makes it easier for me to collect my medication and follow my treatment compared to the clinic.

Yes	No	Not sure

38) Would you recommend the PDU to other patients?

Yes	No	Not sure

39) Will you continue to collect your medicines at the PDU?

Yes	No	Not sure

APPENDIX 6: CONSENT FORM (IN ZULU)

ISITHASISELO 6: IFOMU LEMVUME

ISIHLOKO SEPHROJEKTHI: Umuzwa weziguli kanye nalokho okwenzeke kuzo ngokuphathelene Nemishini Ekhipha Imithi (Pharmacy Dispensing Units, eGoli, eNingizimu Afrika).

INDUNA (SUPERVISOR): UMnu. M.S Poka

Mina, …….. lapha ngivuma ngokuzithandela ukubamba iqhaza kule phrojekthi eshiwo ngenhla. Ngimenywe ukuthi ngibambe iqhaza ocwaningweni. Ngibe nethuba lokubuza imibuzo eyengeziwe futhi iphendulwe ngendlela engigculisayo. Nginikwe isikhathi esanele ukuthi nginqume mayelana nokubamba iqhaza.

Ngiyaqonda ukuthi:

1. Ucwaningo lumayelana nokuphenya ukuthi iziguli zizizwa kanjani ngokuphathelene nemishini ekhipha imithi.

2. I-Turfloop Research Ethics Committee seyigunyaze ukuthi kungakhulunywa nabantu ngabodwana ukuze babambe iqhaza ocwaningweni.

3. Iphrojekthi yocwaningo, lokhu kuchaza umklamo, izinhloso kanye nezindlela zocwaningo, ngizichazelwe. Nanoma yimiphi imibuzo engingaba nayo ngokuphathelene nocwaningo, noma izindaba eziphathelene nalezo, zizophendulwa umcwaningi/abacwaningi.

4. Ukubamba iqhaza kulolu cwaningo kungokuzithandela futhi ngingahoxisa ukubamba kwami iqhaza noma ngasiphi isigaba. Ngiqinisekisiwe ukuthi ulwazi olutholakale kimi luzogcinwa lungaziwa ukuthi olukabani futhi luyimfihlo futhi luzosetshenziselwa kuphela izinhloso zalolu cwaningo.

ISIGINISHA YOMBAMBIQHAZA…….

ISIGINISHA KAFAKAZI…….

ISIGINISHA YOMPHENYI …….

Isayinwe e_____ ngalolu ____ suku ku _____ 20_

APPENDIX 7: QUESTIONNAIRE (IN ZULU)

ISITHASISELO 7: IPHEPHAMBUZO

ISIGABA A: IMININGWANE NGOKUPHATHELENE NOKWEHLUKAHLUKA KWABANTU (Beka uqhwishi ebhokisini elifanele)

1) Ubulili

Owesilisa	Owesifazane

2) Iminyaka yobudala

Iminyaka eyi-18-30	Iminyaka eyi-31-40	Iminyaka eyi-41-50	Iminyaka eyi-51-60	Iminyaka eyi-60+

3) Uhlanga

Umnyama	Umhlophe	Ungowomdabu waseNdiya	Uyikhaladi	Ungowomdabu wase-Asia

4) Isimo Ngokuphathelene Nomshado

Awukaze Washada	Ushadile/Uhlala nomuntu ongashadile naye	Udivosile	Ushonelwe oshade naye

5) Uhlala kuyiphi i-suburb/indawo/i-extension?

_____

6) Isimo Ngokuphathelene Nemfundo

Imfundo Yamabanga Aphansi	Imfundo Yamabanga Aphezulu	Imfundo Yamabanga Aphakeme	Angifundanga

7) Isimo Samanje Ngokuphathelene Nokuqashwa

Uqashiwe	Awusebenzi	Uyazisebenza	Awusebenzi Ngokugcwele	Uthathe Umhlalaphansi	Uyisitshudeni

8) Isimo Samanje Ngokuphathelene Nezifo Ezingamahlalakhona

Isifuba somoya	
Isifo sikashukela	
Isithuthwane	
Igciwane Lesandulela Ngculazi	

I-Hyperlipidaemia/ Izinkinga ze-Cholesterol	
I-Hypertension/ Ukuphakama Komfutho Wegazi	

9) Sekube neminyaka emingaki kusukela mhla ugcina ukutholakala nesifo esingamahlala khona?

Unyaka o-1	Iminyaka emi-2 ukuya kwemi-4	Iminyaka emi-5 ukuya kweyi-7	Iminyaka eyi-8 ukuya kweyi-10	Ngaphezu kweminyaka eyi-10

10) Esikalini sika-1 ukuya ku-5 sicela unike amaphuzu isimo sakho sezempilo samanje.

1 (sibi kakhulu)	2 (sibi)	3 (siphakathi nendawo)	4 (sihle)	5 (sihle kakhulu)

11) Ngabe sesiside kangakanani isikhathi ulanda imithi e-PDU?

_____

<u>ISIGABA B: INSIZA YOKUHAMBA</u> (Beka uqhwishi ebhokisini elifanele)

12) Ngabe usebenzise eyiphi insiza yokuhamba ukuze uze e-PDU namhlanje?

Ukuhamba	Itekisi	Ibhasi	Isitimela	Imoto Yomuntu Othile

13) Ngabe kukuthathe isikhathi esingakanani ukuya e-PDU?

Ngaphansi kwemizuzu engama-30	Imizuzu engama-30 ukuya ehoreni eli-1	Ihora eli-1 ukuya emahoreni ama-2	Ngaphezu kwamahora ama-2

14) Ngabe usebenzisa yiphi inxanxathela yezitolo ye-PDU ukuze uyothatha imithi kuyo?

Alex Plaza	Bara Mall	Ndo'faya Mall

15) Ngabe ubuzoza kule nxanxathela yezitolo ngenxa yanoma yiziphi ezinye izizathu namhlanje ezifana nokuzothenga noma ukusebenzisa ibhange ngaphandle kokulanda imithi yakho yakho e-PDU?

Yebo	Cha

16) Ngabe kudingeke ukuthi ungayi emsebenzini namhlanje ukuze utholanda imithi yakho?

Yebo	Cha

ISIGABA C: LOKHO OKWENZEKE ESIGULINI(Beka uqhwishi ebhokisini elifanele)

17) Ngabe le ndawo okulindwa kuyo e-PDU ingefanele?

Yebo	Cha	Angazi

18) Ngabe wenelisekile ngamahora okusebenza kwe-PDU ngokuphathelene nokulanda imithi?

Yebo	Cha	Angazi

19) Ngabe i-PDU isiza abantu ngokulandela ukuthi ubani ofike kuqala?

Yebo	Cha	Angazi

20) Ulinda isikhathi esingakanani uma uzolanda imithi e-PDU?

Ngaphansi kwemizuzu engama-30	Imizuzu engama-30 ukuya ehoreni eli-1	Ihora eli-1 ukuya emahoreni ama-2	Ngaphezu kwamahora ama-2

21) Ngabe uthintwa kusenesikhathi ngokuphathelene nokuthi uyilande nini imithi yakho?

Njalo	Ngesinye isikhathi	Akuvamile	Akukaze kwenzeke

22) Ngabe uyathintwa yi-PDU uma ungazange uyothatha imithi yakho ngosuku lokuthatha imithi?

Njalo	Ngesinye isikhathi	Akuvamile	Akukaze kwenzeke

23) Ngabe i-ATM ihlinzeka ulwazi ngolimi oluqondakalayo?

Yebo	Cha

24) Ngabe ukhetha ukuthintana nomsebenzi wokunakekela wezempilo (ngokukodwa phakathi kwalokhu/noma)?

Ngohlelo lwezingcingo lwe-PDU	Nomuntu ngqo

25) Ngabe ujwayele ukuthola YONKE imithi yakho e-PDU njengoba ubhalelwe ukuthi uyithole udokotela/unesi?

Njalo	Ngesinye isikhathi	Akuvamile	Akukaze kwenzeke

26) Ngabe uthola imithi yakho ngesikhathi ngokuphathelene nosuku lwakho lokuyilanda?

Njalo	Ngesinye isikhathi	Akuvamile	Akukaze kwenzeke

27) Ngabe le mithi ibhalwe ngokucacile ukuthi uyisebenzise kanjani?

Yebo	Cha	Angazi

28) Ngabe uke wangayitholi imithi yakho e-PDU ngenxa yezinkinga ku-ATM noma nanoma iyiphi enye inkinga?

Yebo	Cha

Uma uthi yebo, sicela UCHAZE KANCANE UKUTHI BEKUYINI INKINGA.

_____
_____
_____
_____

29) Ngabe uke waba nanoma yikuphi okungazange kuhambe kahle e-PDU?

Yebo	Cha

Uma uthi yebo, SICELA UCHAZE KAFUSHANE NGALOKHO OKUNGAZANGE KUHAMBE KAHLE.

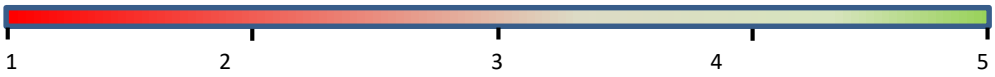
_____
_____
_____
_____

ISIGABA D: UMUZWA WESIGULI

Ngokusebenzisa isikali sika-1-5 sicela unike amaphuzu izitatimende ezilandelayo ngokukokelezela okukhethayo okufanele.

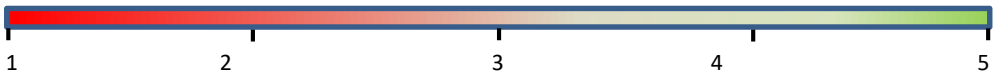
U-1 usho ukuthi Awenelisekile kakhulu
U-2 usho ukuthi Awenelisekile
U-3 usho ukuthi Wenelisekile
U-4 usho ukuthi Weneliseke Kakhulu
U-5 usho ukuthi Weneliseke Ngokwedlulele

30) Ngizizwa ngiphephile uma ngilanda imithi yami e-PDU.



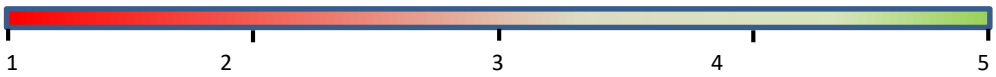
Awenelisekile kakhulu *Weneliseke ngokwedlulele*

31) Kukhona inani elanele lokungavuleleki kunoma ubani kwezinto zami uma ngilanda noma imiphi imithi e-PDU.



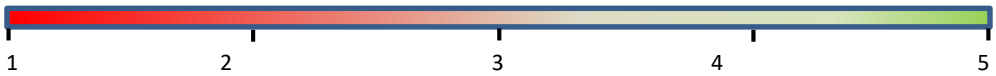
Awenelisekile kakhulu *Weneliseke ngokwedlulele*

32) Kulula ukusebenzisa umshini we-ATM ukuze ngithole imithi yami.



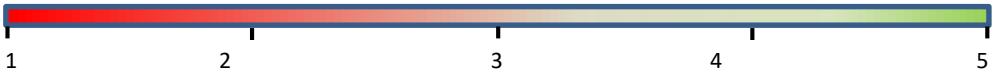
Awenelisekile kakhulu *Weneliseke ngokwedlulele*

33) Uma kukhona nanoma yimiphi imibuzo enginayo ngokuphathelenenemithi noma impilo yami, kukhona abahlinzeka ngezinsiza zezokwelapha abatholakalayo ukuze ngikhulume nabo.



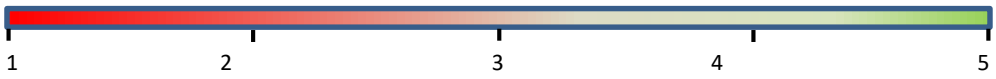
Awenelisekile kakhulu *Weneliseke ngokwedlulele*

34) Nika amaphuzu okwenzeke kuwe ngokuphathelene nokukhuluma nomsebenzi wokunakekelwa kwezempilo oqeqeshiwe ngohlelo lwezingcingo lwe-PDU.



Awenelisekile kakhulu *Weneliseke ngokwedlulele*

35) Nika amaphuzu insiza oyithola e-PDU.



Awenelisekile kakhulu *Weneliseke ngokwedlulele*

36) Ngincamela ukusebenzisa i-PDU uma kuqhathaniswa nomtholampilo.

Yebo	Cha	Angazi

37) Uhlelo lwe-PDU lwenza kube lula kimina ukulanda imithi yami kanye nokulandela ukwelashwa kwami uma kuqhathaniswa nomtholampilo.

Yebo	Cha	Angazi

38) Ngabe ungancomela ezinye iziguli i-PDU?

Yebo	Cha	Angazi

39) Ngabe uzoqhubeka nokulanda imithi yakho e-PDU?

Yebo	Cha	Angazi

APPENDIX 8: CONSENT FORM (IN SETSWANA)

MAMETLELELO 8: FOROMO YA TUMELELO

SETLHOGO SA POROJEKE: Boikutlo le maitemogelo a balwetse ka Mafelo a go Ikamogelela Ditlhare (Pharmacy Dispensing Units), mo Johannesburg, mo Aforika Borwa.

MOOKAMEDI: Rre M.S Poka

Nna, …….. ke itsise fano gore ke dumela ka bogame go tsaya karolo mo porojekeng e e umakilweng fa godimo. Ke laleditswe go tsaya karolo mo thutopatlisisong eno. Ke nnile le sebaka sa go botsa dipotso tse dingwe mme dipotso tsa me di arabilwe ka tsela e e nkgotsofatsang. Ke neilwe nako e e lekaneng go dira tshwetso malebana le go tsaya ga me karolo.

Ke tlhaloganya gore:

1. Thutopatlisiso eno e amanang le go batlisisa gore balwetse ba ikutlwa jang ka mafelo a go ikamogelela ditlhare.

2. Komiti ya Dipatlisiso ya Maitshwaro-Mantle ya Turfloop e dumetse gore batho ba bodiwe ka go tsaya karolo mo thutopatlisisong eno.

3. Ke tlhaloseditswe ka porojeke eno ya go dira dipatlisiso, ka mafoko a mangwe ke boleletswe gore ke porojeke e e kana kang, boikaelelo jwa yone ke bofe le ka mekgwa ya go dira dipatlisiso. Dipotso lefa e le dife tse nka nnang le tsone ka go patlisiso eno, kgotsa dilo tse di tshwanang le tsone, di tla arabiwa ke babatlisisi.

4. Ke tsaya karolo mo patlisisong eno ka bogame e bile nka kgona go ikgogela morago nako nngwe le nngwe mo go yone. Ke tlhomamiseditswe gore tshedimosetso e e tla bonwang mo go nna ga go na go itsiwe gore ke ya ga mang ebile e tla nna khupamarama e bile e tla dirisetswa patlisiso eno fela.

MOSAENO WA MOTSAYAKAROLO …….

MOSAENO WA MOSUPI …….

MOSAENO WA MMATLISISI …….

Saenilwe kwa _____ ka letsatsi la bo ____ la _____ 20_

APPENDIX 9: QUESTIONNAIRE (IN SETSWANA)

MAMETLELELO 9: LENAANE LA DIPOTSO

KAROLO A: TSHEDIMOSETSO KA WENA (Tshwaya lebokoso le le maleba)

1) Bong

Monna	Mosadi

2) Dingwaga

Dingwaga tse 18-30	Dingwaga tse 31-40	Dingwaga tse 41-50	Dingwaga tse 51-60	Dingwaga tse 60+

3) Lotso

Montsho	Mosweu	Moindia	Mommala	Mo-Asia

4) Boemo Jwa Nyalo

Ga ke Ise ke Nyale	Ke mo Lenyalong/Ke na Le yo Ke Nnang Nae	Le Tlhadile	Motlholagadi/Moswagadi

5) O nna mo karolong/kgaolong/lefelong lefe?

_____

6) Boemo Jwa Thuto

Poraemari	Sekontari	Thuto e e kwa godimo	Ga ke a ya sekolong

7) Boemo Jwa Tiro ga Jaana

Ke a Dira	Ga ke Dire	Ke a Ipereka	Ke Dira Tiro ya Nakwana	Ke Rotse Tiro	Ke Moithuti

8) Bolwetse Jwa Gago Jwa ga Jaana Jo bo Sa Foleng

Asema	
Bolwetse jwa sukiri	
Kidibalo	
HIV	
Mafura a Mantsi mo Mading/ Mathata a Kholeseterole	
Haebolate/ Kgatelelo e e Kwa Godimo	

ya Madi	

9) Go fetile dingwaga tse kae fa e sale go lemogwa gore o na le bolwetse jono jo bo sa foleng?

Ngwaga o le 1	Dingwaga tse 2 go ya go tse 4	Dingwaga tse 5 go ya go tse 7	Dingwaga tse 8 go ya go tse 10	>Dingwaga di le 10

10) Ka selekanyo sa 1 go ya go 5 re kopa o re bolelele gore o baya kae botsogo jwa gago.

1 (bo maswe thata)	2 (bo maswe)	3 (bo magareng)	4 (bo bontle)	5 (bo bontle thata)

11) O na le lobaka lo lo kana kang o tsaya ditlhare kwa PDU?

_____

KAROLO B: SEPALANGWA (Tshwaya lebokoso le le maleba)

12) O dirisitse sepalangwa sa mofuta mang go ya kwa PDU ya gaeno gompieno?

Maoto	Tekesi	Bese	Terena	Koloi ya Me

13) Go go tsere lobaka lo lo kana kang go ya PDU?

Kwa tlase ga metsotso e le 30	Metsotso e le 30 go ya go ura e le 1	Ura e le 1 go ya go tse 2	Go feta diura di le 2

14) O tsaya ditlhare tsa gago kwa mmolong wa PDU efe?

Plaza ya Alex	Mmolo wa Bara	Mmolo wa Ndo'faya

15) Fa e ne e se ka ntlha ya go tla go tsaya ditlhare mo PDU, a o ka bo o tlile mo mmolong ono o tlela lebaka le lengwe le le tshwanang le go tla go reka kgotsa go tla bankeng?

Ee	Nnyaa

16) A o tshwanelwa ke go kopa go newa nakonyana kwa tirong gompieno gore o tle go tsaya ditlhare tsa gago?

Ee	Nnyaa

KAROLO C: MAITEMOGELO A MOLWETSE (Tshwaya lebokoso le le maleba)

17) A lefelo le o letang mo go lone kwa PDU le tshwanetse?

Ee	Nnyaa	Ga ke itse

18) A o kgotsofetse ka diura tsa PDU tsa go tla go tsaya ditlhare?

Ee	Nnyaa	Ga ke itse

19) A PDU e thusa batho go ya ka gore go tlile mang pele?

Ee	Nnyaa	Ga ke itse

20) O leta lobaka lo lo kana kang fa o ile go tsaya ditlhare kwa PDU?

Lobaka lo lo kwa tlase ga metsotso e le 30	Metsotso e le 30 go ya go ura e le 1	Ura e le 1 go ya go tse 2	Go feta diura di le 2

21) A o bolelelwa ka nako gore o tle go tsaya leng ditlhare tsa gago?

Ka metlha	Ka dinako dingwe	Sewelo	Ga go ke go direga

22) A PDU e ikgolaganya le wena fa o sa ya go tsaya ditlhare tsa gago ka letlha le o neng o tshwanetse go di tsaya ka lone?

Ka metlha	Ka dinako dingwe	Sewelo	Ga go ke go direga

23) A ATM e go naya tshedimosetso ka puo e o e tlhaloganyang?

Ee	Nnyaa

24) A o ka rata gore o bue le motlamedi wa tlhokomelo ya botsogo (kgotsa)?

Go dira ka thulaganyo ya founo ya PDU	Go bua le motho ka tlhamalalo

25) A gantsi o bona ditlhare TSOTLHE tsa gago kwa PDU jaaka fa o di neilwe ke ngaka/mooki?

Ka metlha	Ka dinako dingwe	Sewelo	Ga go ke go direga

26) A o amogela ditlhare tsa gago ka nako ka letlha la go ya go di tsaya?

Ka metlha	Ka dinako dingwe	Sewelo	Ga go ke go direga

27) A ditlhare tseno di kwadilwe sentle gore di dirisiwe jang?

Ee	Nnyaa	Ga ke itse

28) A go kile ga direga gore o se ka wa bona ditlhare tsa gago kwa PDU ka gonne go nnile le mathata mangwe kwa ATM kgotsa go nnile le bothata bongwe?

Ee	Nnyaa

Fa o rile ee, tsweetswee KWALA KA BOKHUTSHWANE GORE BOTHATA E NE E LE ENG.

_____
_____
_____
_____

29) A o kile wa nna le boitemogelo bongwe jo bo seng bontle kwa PDU?

Ee	Nnyaa

Fa o rile ee, tsweetswee KWALA KA BOKHUTSHWANE GORE BOITEMOGELO JO BO SENG BONTLE JOO E NE E LE ENG.

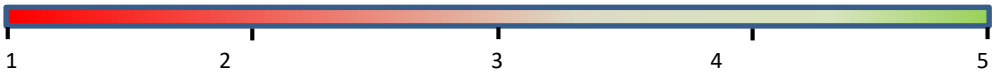
_____
_____
_____
_____

KAROLO D: BOIKUTLO JWA MOLWETSE

Ka selekanyo sa 1 – 5 re kopa gore o lekanyetse dipolelo tse di latelang ka go thala sediko mo nomorong e e maleba.

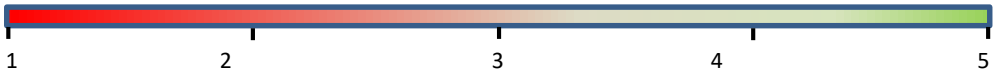
1 ke Ke a Ngongorega
2 ke Ga ke A Kgotsofala
3 ke Ke Kgotsofetse
4 ke Ke Kgotsofetse Tota
5 ke Ke Kgotsofetse Fela Thata

30) Ke ikutlwa ke sireletsegile fa ke ile go tsaya ditlhare kwa PDU.



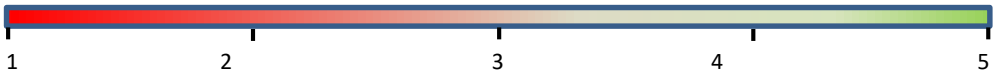
Ke a Ngongorega *Ke Kgotsofetse Fela Thata*

31) Go na le selekanyo se se lekaneng sa go boloka dilo tsa me e le khupamarama fa ke ile go tsaya ditlhare tsa me kwa PDU.



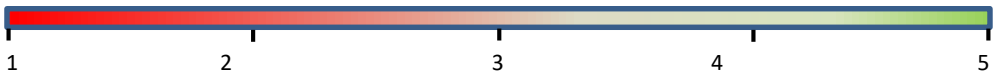
Ke a Ngongorega *Ke Kgotsofetse Fela Thata*

32) Motšhine wa ATM go bonolo go o dirisa gore ke bone ditlhare tsa me.



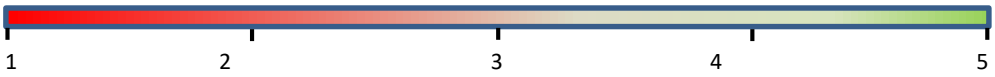
Ke a Ngongorega *Ke Kgotsofetse Fela Thata*

33) Fa ke na le dipotso dingwe ka ditlhare tsa me kgotsa ka botsogo jwa me, batlamela ka tlhokomelo ya botsogo ba teng gore nka kgona go bua le bone.



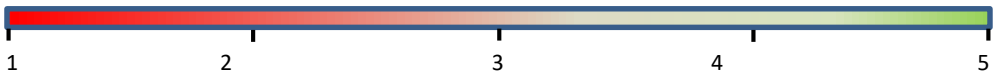
Ke a Ngongorega *Ke Kgotsofetse Fela Thata*

34) Tlhalosa boitemogelo jwa gago fa o ne o bua le motlamela ka tlhokomelo ya botsogo ka thulaganyo ya founo ya PDU.



Ke a Ngongorega *Ke Kgotsofetse Fela Thata*

35) Tlhalosa tirelo e o neng wa e newa kwa PDU.



Ke a Ngongorega Thata

Ke Kgotsofetse Fela

36) Ke tlhopha go dirisa PDU go na le go ya tliliniking.

Ee	Nnyaa	Ga ke itse

37) Thulaganyo ya PDU e dira gore go nne bonolo go ya go tsaya ditlhare tsa me le go bona kalafi go feta go ya kwa tliliniking.

Ee	Nnyaa	Ga ke itse

38) A o ka buelela PDU mo balwetseng ba bangwe?

Ee	Nnyaa	Ga ke itse

39) A o tla tswelela go tsaya ditlhare tsa gago kwa PDU?

Ee	Nnyaa	Ga ke itse