# INVENTORY MANAGEMENT OF MEDICINES USED TO TREAT NON-COMMUNICABLE CHRONIC DISEASES IN PUBLIC HEALTH CLINICS AT DIKGALE COMMUNITY, LIMPOPO PROVINCE

by

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DISSERTATION

Submitted in fulfilment of the requirements for the degree of

**MASTER OF PHARMACY**

In

**Pharmacy practice**

In the

**FACULTY OF HEALTH SCIENCES**

**(School of Health Care Sciences)**

**Department of Pharmacy**

at the

**UNIVERSITY OF LIMPOPO**

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**2020**

## DECLARATION

I, Molope Raesetja Engelina declare that "**Inventory management of medicines used to treat non-communicable chronic diseases in public health clinics at Dikgale community, Limpopo province**" is my own work and has not been submitted in another University for any degree. All the sources used have been quoted and referenced in the order they have been used.

21 December 2020

Signed

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## DEDICATION

This body of work is dedicated to my beloved son Masego Ramoba, for allowing time to “work on my computer” during moments when you wanted to play with me and I couldn’t. I truly appreciate it kid.

Also dedicating this work to my family as well, for always encouraging me to study further

And to myself as well, for being brave enough to pursue this journey as the wise Koko Putuma said “you owe your dreams your courage”

## ACKNOWLEDGEMENTS

I would like to acknowledge my supervisor Mr Poka MS for his relentless dedication and unwavering support throughout this whole project, without which I would not have the strength to pull through thus far.

Mr Nyamazema T for assisting me with statistics and navigating through SPSS together.

The VLIR team for their financial assistance, it gave me peace of mind having the finances taken care of.

My family and friends for always motivating me to go on and helping me to look after my child while I embark on an academic journey

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## DEFINITION OF KEY CONCEPTS

**Essential Medicines:** Are those that satisfy the health care needs of the population. They are intended to be available within the context of functioning health systems at all times in adequate quantities, in the appropriate dosage forms and, at a price the individual and community can afford (STG & EML, 2014).

**Lead Time**: Length of time that elapses between the time the order is placed and the time the order is received by the facility placing the order (Quick *et al*., 2013).

**Non-Communicable Chronic Disease**: World Health Organisation describes it as a disease that persists for a long time; the chronic illness is one lasting three months or more. It generally cannot be prevented by vaccines or cured by medication nor, do they just disappear (WHO, 2012). Four main types of non-communicable diseases form part of this study: Cardiovascular (Hypertension, heart attacks, and strokes), Epilepsy, Mental health conditions, Chronic Respiratory diseases (Chronic Obstructed Pulmonary Disease and Asthma), and Diabetes Mellitus.

**Stock Card**: A form on which all transactions on stock movement are recorded manually (Also known as Bin card). Transactions made include Stock received, ordered, issued, weekly stock balancing, and an indication of minimum and maximum and re-order level (MDS, 2012).

**Safety Stock:** Is the level of extra stock that is maintained to avoid having stock-outs. Safety stock is one of the main drivers of inventory; it protects against increasing the stretch in the breaking points of the supply chain, which in turn can result in a possible reduction of stock (Amirjabbari & Bhuiyan, 2014).

**Re-order level (ROL)**: is the inventory level at which a facility should place an order to replenish the amount on hand (Rim & Park, 2008). It is also known as Minimum stock.

**Nursing personnel** - According to the Nursing Act, no. 50, 1978 as amended, refers to a person registered with the South African Nursing Council (SANC) in either one of the following categories; professional nurse, enrolled nurse, enrolled nursing assistant, or nursing student.

**Pharmacist**- According to the Pharmacy Act 53 of 1974 as amended, a pharmacist is a person registered with the South African Pharmacy Council (SAPC) as such.

## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| ARV | - | Anti-Retrovirals |
| CVD | - | Cardiovascular Disease |
| EML | - | Essential Medicines List |
| MSM | - | Medicine Supply Management |
| FEFO | - | First Expiry First Out |
| FIFO | - | First in First Out |
| GPP | - | Good Pharmacy Practice |
| NCD | - | Non-Communicable Chronic Disease |
| NHI | | National Health Insurance |
| PHC | - | Primary Health Care |
| ROL | - | Re-Order Level |
| SCM | - | Supply Chain Management |
| SOP | | Standard Operating Procedure |
| TB | - | Tuberculosis |
| WHO | - | World Health Organisation |

# ABSTRACT

**Background:** Non-communicable chronic disease contributes to premature mortality in SA, threatening the socio-economic development of the country. The efficient management of essential medicines supply at the clinic level is vital as stock-outs of the medicines increase morbidity and mortality.

**Objectives:** The study aimed to identify and determine the challenges in the inventory management of medicine for the treatment of non-communicable chronic diseases at public health clinics in the Dikgale community of Limpopo province.

**Methods:** The study used a cross-sectional quantitative research design; the purposive sampling technique was used, as it requires people with specific skills, knowledge, and expertise. A Pre-validated questionnaire was used to collect data from pharmacists, professional nurses, and transport personnel. Stock card utilization review and checklist were used to verify the answers obtained from the participants. Descriptive and inferential statistics were used to analyse the data collected. All these processes ensure that stock is always available and at optimal levels. The availability of stock at optimal levels is dependent on the personnel following SOPs.

**Results:** In total**,** 40% of pharmacists indicated to have never trained nursing personnel on stock management, and 66.7% which, is the majority of nursing personnel, reported they have never been trained on stock management. Only 26.67% of medicines used for NCDs did not have stock cards. The study further found that the stock-card was not used every time a transaction was made. Thirty-nine (39%) percent of the respondents did not know how to quantify order quantities; this factor contributes to stock-outs experienced at clinics. All the clinics did not have a secure dedicated area. Deliveries are offloaded outside the medicine room.

**Conclusions:**

There is a training gap that needs to be closed to meet the minimum requirements as per GPP guidelines and also help to reduce medicine stock-outs as personnel will be well equipped to handle stock. In terms of inventory management and stock control systems, all primary healthcare sectors used a manual/paper-based inventory management system. Stock control systems are in place but were not always utilised and, processes are not consistent among staff members across clinics. With distribution, it would work better if nursing personnel dedicated a person to place and receive orders as discrepancies will be picked up sooner, and quantities will be sufficient to last until the next ordering date. None of the clinics complied with “Ideal Clinic” standards for infrastructure, storage, and inventory management.



**Keywords:** Inventory management, Stock-outs, Non-communicable diseases, Medicine supply

# CHAPTER 1

# INTRODUCTION AND BACKGROUND

## 1.1 INTRODUCTION

National trends in age-standardised death rates for non-communicable diseases in South Africa (SA) were found to be 38.9% between 1997 and 2010. For every 100 000 deaths recorded, 287 due to cardiovascular diseases (CVDs), 114 due to cancers (malignant neoplasms), 58 for chronic respiratory conditions, and 52 for diabetes mellitus. Non-communicable chronic disease (NCD) further contributes to premature mortality in SA, threatening socio-economic development (Nojilana *et al.*, 2016).

The right to access health care services is among a list of rights in the Bill of rights of the Republic of South Africa (1994) which, is the cornerstone of the Constitution of the Republic. It is guided by the two most important principles which are: A commitment to improving the health status of the population and a commitment to achieving equitable access to Primary Health Care (PHC) (Constitution, 1996).

The National Drug Policy was formed to improve access to health services by ensuring the availability of appropriate medicines whenever and wherever they are needed and in the most cost-effective manner. One of its objectives is to achieve access and equity through effective management of the selection, procurement, distribution and use of medicines and medical supplies (National drug policy, 1996).

South Africa's healthcare system is structured like a pyramid, where the bottom represents primary healthcare, which provides the most basic health services, and the top part represents specialised care, which is often concentrated in urban areas, whereas PHCs are often found in rural areas (Neely & Ponshunmugam., 2019).

Primary Health Care is the crucial foundation of a health care system, the key features of primary care as being: the first point entry to a health care system; the provider of person-focused (not disease-oriented) care over time; the deliverer of care for all but the most uncommon conditions (Starfield *et al.*, 2005).

Task shifting is a strategy for addressing staff shortages (Callaghan *et al.*, 2010); it involves the redistribution of healthcare tasks to utilise available healthcare workers to perform duties that would otherwise be performed by another healthcare worker (Iwu & Holzemer.2014). According to a study done by (Tayob.2012), it was highlighted that nursing personnel also perform duties such as managing medicine supplies at PHCs due to a shortage of skilled staff. Task shifting to nursing is the hook to bridge the gap that would otherwise be left by not having pharmacy personnel on-site. Findings of a study conducted by (Edwin *et al.*, 2014) indicated that patients benefit from having a pharmacist on clinic premises. It was further stipulated, pharmacists' intervention is comprised mostly of medication reviews, and that has a positive impact on the quality of life of patients.

The ideal clinic programme was designed to improve the quality of PHC services (Hunter *et al*., 2017). The Ideal clinic is defined as a clinic with good infrastructure, adequate staff, adequate medicines, and excellent administrative processes. In the study, the clinics were evaluated against ideal clinic standards.

The Efficient management of essential medicines supply at the clinic level is vital as stock-outs of the medicines affect morbidity, mortality, and disease epidemiology (Leung *et al*., 2016). According to Tayob (2012), factors that influence the availability of drugs at PHC are:

- The lack of infrastructure for storage and distribution of drugs
- The lack of dedicated transport to ensure constant drug supply
- Losses from expiration, theft, fraud and inappropriate storage

- Availability of human resources
- Inaccurate forecasting of drug requirements

Inventory control involves the protection of stored items from loss, damage, theft, wastage, and to manage the reliable movement of supplies from source to user in the least expensive way (Quick *et al*., 2013). A fully developed system has three key components:

- An inventory management system to obtain the right goods and to monitor their intake and quality
- A stock control system to monitor the flow of goods within the system
- A performance monitoring system to check that the system is operating effectively

Common problems encountered with inventory management were found to be linked to the following; inaccurate stock records, lack of systematic monitoring of the stock, and undefined procedures on ordering frequency and quantity: which are linked to lack of knowledge of the meaning of inventory management, as well as inefficient and ineffective management (Quick *et al*., 2013).

## 1.2 PROBLEM STATEMENT

South Africa is burdened by high rates of chronic non-communicable diseases (Nojilana *et al*., 2016). A regular supply of medicines used in the treatment of non-communicable diseases is essential in achieving desired clinical outcomes. Quick *et al* (2013), has gone to great lengths to explain steps that need to be followed to avoid stock-outs. The key step is to ensure a continuous supply of medicines. It is necessary to know the levels of medicines in the store to maintain a high percentage of stock availability, taking into consideration; over-stocking and expiries. These challenges are mainly attributed to poor inventory control systems, inadequate storage space, as well as the availability of trained staff. Since there is no literature on the inventory management practices used and challenges faced by the primary health clinics of the Dikgale community in the Capricorn municipality of Limpopo province, this study aims to evaluate the current

practices and challenges faced in managing the availability of drugs for chronic non-communicable diseases and provide recommendations.

## 1.3. PURPOSE OF THE STUDY

### 1.3.1 Aim

The study aims to describe the inventory management practices for non-communicable chronic drugs at PHCs in the Dikgale community of Limpopo province and to identify specific challenges related to inventory management.

### 1.3.2 Objectives

- To establish the availability of trained personnel to manage the drug supply at Dikgale Public Health Clinics.
- To evaluate the infrastructure for storage of drugs at Dikgale Public Health Clinics, according to the Good Pharmacy Practice (GPP) requirements.
- To study the distribution process in terms of the availability of medication for the treatment of non-communicable chronic diseases at Dikgale Public Health Clinics.
- To evaluate the stock control systems used in clinics for ordering and record keeping.

### 1.3.3 Research questions

- What are the challenges in the implementation of MSM related to ordering and storage of medicines for chronic non-communicable disease in the primary health care clinics at the Dikgale community?
- Are there stock control systems in place and practised by the clinic personnel for ordering, receiving, and record-keeping of the medicines for chronic non-communicable disease in the primary health care clinics at the Dikgale community?

# CHAPTER 2

# LITERATURE REVIEW

This chapter provides a review of the literature concerning medicine supply management, with a focus on various inventory management models, inventory control systems, and the importance of inventory management in ensuring the availability of non-communicable chronic medicines at Public Health Clinics, associated challenges, and strategies to optimise inventory management.

## 2.1 INTRODUCTION

World Health Organization estimates approximately ten million lives could be saved every year through the improvement in access to essential medicines and vaccines. Several factors contribute to the problem of unequal access to pharmaceutical products: Government inefficiencies, costly drug prices, poverty, poor health infrastructure and corruption (Fidler & Msisha, 2008)

Quality of healthcare can be affected by a multitude of factors such as personal factors of the provider, e.g., short-staffing, budgets and other external factors (Mosadeghrad, 2014). The article also states that quality healthcare can be improved by good leadership, proper planning, education and training, availability of resources, better management of resources (processes and human) as all these things can affect the quality of a health system.

## 2.2 MEDICINE SUPPLY MANAGEMENT

Access to Health services and essential medicines is a recognized constitutional right to the people of South Africa. Standard Treatment Guidelines and essential medicines list was established to fulfil this obligation through the formulation of the National Drug Policy (National drug policy, 1996). It aims to achieve access and equity through effective management of the selection, Procurement, Distribution and Use of medicines and medical supplies (Quick *et al*., 2013). Figure 2.1 below is a diagram of the Medicine Supply Cycle.

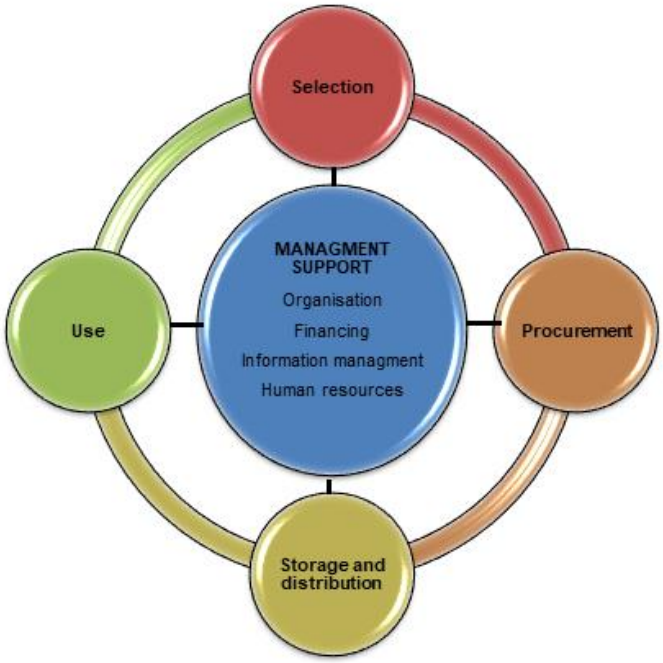



Figure 2.1: Medicine supply cycle (Quick *et al*., 2013).

At the core of the MSM (Figure 2.1) is a core of management support systems, which include organization, financing and sustainability, information management, and human resource management (WHO, 2002). There are vital systems in supporting the management of personnel, the transformation of data into information, and allocation, and monitoring of funds.

Effective pharmaceutical Procurement practices include the determination of order quantities based on reliable needs estimation, the separation of crucial functions, prompt payment, and regular edits (Quick *et al*., 2013). This process also includes advertising tender specifications, awarding contracts for the supply of medicines and medical supplies.

According to SIAPS (2012), the selection of the correct medicines and medical supplies enables effective procurement. Ineffective procurement negatively affects the management of the whole cycle. Selection starts on a national level, taking into account the demographics of the entire country.

Effective distribution management includes ensuring the availability of an efficient network of storage facilities, keeping reliable records of medicine stock balances and consumption, maintaining accountability procedures, ensuring adequate and secured storage conditions, having reliable transport systems and using reinforcing reporting and supervision practices (WHO, 2002)

The final stage completing the cycle of managing pharmaceuticals and related medical items is access to these items by all citizens and the rational, proper use by all commodities (SIAPS, 2012).

## 2.3 GOOD INVENTORY MANAGEMENT PRINCIPLES

Inventory management is a system of tracking inventory levels, orders, sales, and deliveries (Quick *et al*. 2013). Regulation 10 of PFMA (1999) states that the role of Inventory management is to ensure:

- Inventory (stock in this study) does not get stolen, lost, wasted or misused
- Stock levels are at an optimum and economic level
- Procedures are in place for the effective and efficient use of the Institution's assets

### 2.3.1 Inventory Management Models

Inventory management is the core of the drug supply system; it needs to function like a well-oiled machine to be viable (SIAPS, 2012). Two relevant factors are essential in how an inventory management system operates; independent versus dependent demand and "push" versus "pull" logistics.

An Independent demand system applies to the management of procurement and distribution of finished goods. Quantities ordered and ordering intervals are calculated by reviewing trends and past consumption by consumers. The levels are then set to provide service to consumers (Vollmann, 2005).

The Dependent demand system manages inventory requirements for raw materials and supplies based on production needs in a manufacturing or repackaging environment. This system is also known as a materials requirement planning system. Ordering intervals and quantities and inventory levels depend on projected production schedules, for example, the Just-In-Time system (Friedli *et al*., 2010).

In the “pull” system, units orders stock from a warehouse or supplier according to needs. In the “push” system, a central authority (Medical Depot) orders drugs from suppliers, and it determines the quantities to be shipped to the unit, based on contractual obligations between the two parties. A plan is set for distribution to operating units, and procurement is done to carry out that plan (Bruno *et al*., 2015).

### 2.3.2 Inventory Control Models

Items utilised regularly may need to be held in stock for the following reasons; to ensure that it is always available, to reduce ordering and transport costs as well as to avoid shortage costs. The disadvantages of having excess stock include loss due to spoilage and expiry. Systems have been put in place to aid in the selection of stock to be held (Mahoro, 2013).

ABC analysis: items are categorised into three groups, namely A, B, and C. Class A items are 20% of the stock with an expenditure of 80% of the total budget, are usually high-volume and fast-moving drugs. Class B items are 10-20% of the stock with an expenditure of 15-20% of the total budget, whereas Class C items are 60-80% of the items with an expenditure of 5-10% of the total budget; they are usually low volume, slow-moving items (Vila-Parrish & Simmons Ivy, 2013).

VEN analysis: Vital Essential and Non-essential. Vital drugs are usually lifesaving and are crucial to providing basic health services. Essential medicines are effective against

less severe illnesses but are also needed to provide essential health services. Non-essential items are used for minor ailments (Migbaru *et al*., 2016).

After a decision was made about which items to keep routinely; the quantities are established. The level of safety stock required to achieve service levels are determined by average consumption, average lead time, and re-order frequency. Orders can be made annually, perpetually or scheduled (Uthayakumar & Priyan, 2013)

- Annual purchasing: procurement is done once a year for all items; order quantities are done on a large scale. Suppliers may provide spaced deliveries throughout the year according to the contractual agreement
- Scheduled purchasing: in this model, ordering windows are determined, and orders are placed regularly. Ordering frequency is done according to ABC or VEN. For this system to be effective, there should be an inventory information system that can produce reliable information on consumption, stock levels, and outstanding orders (Kritchanchai & Meesamut, 2015).
- Perpetual purchasing: inventory record is maintained for each item. Stock on hand is checked before ordering; whenever stock levels fall below the re-order point, a new order is placed. The advantage of this system is the ability to respond to consumption changes with ease (Holdford & Brown, 2010).

### 2.3.3 Record Keeping Practices

Another critical aspect of a functional inventory management system is the types of records and reports kept. Stock records are a primary source of information used in the re-ordering formulas, and they are also the source of data used to compile the reports discussed later in this section. Stock records can either be manual or computerised (Quick *et al*., 2013).

- Vertical file: cards are stored vertically in alphabetical or numerical order in a card file or drawer.

- Kardex system: file cards are stored in a visible-edge record tray system, names and stock numbers on the lower edge, overlapped to provide an index.
- Bin cards: file cards are physically kept with the stock. It makes it easier to check stock and keep a record.
- Ledger system: records are kept on ledger sheets in a bound or loose-leaf book.

It is necessary to have two stock records for each item; it helps to improve accuracy as well as accountability. Most organisations would have a bin card or vertical file card coupled with a computerised system. The most important aspect of stock records is that it needs to be current and accurate (Mahoro, 2013)

Factors that contribute to inaccurate stock records (Tayob, 2012):

- High-volume, repetitious entries lead to occasional entry errors
- Drug names and descriptions are similar
- Duplicate entries for receipts or issues
- Expired stock not written off stock records
- Theft produces inaccurate records
- Physical stock counts rarely or never taken
- Poorly trained staff
- Minimal supervision of warehouse staff

### 2.3.4 Stock Counting

According to Kefale & Shebo (2019), better training and supervision increases stock accuracy. Physically stock counts need to be done regularly for reordering purposes and for determining the value of the stock. There are two ways to count stock, namely the annual count and cyclic count.

Annual count: it is done once or twice a year; the warehouse is shut-down for a week or a couple of days, then each line of the item is counted, and financials did. Annual count disrupts the supply chain system and causes frustration to consumers as items cannot be taken out during the count. Another disadvantage of counting yearly or twice yearly is when a discrepancy arises, and it becomes difficult to trace back to when and how the problem originated, so the records are corrected to reflect actual stock and losses written off (SIAPS, 2012).

Cyclic count: is also known as continuous counting. Stock is divided into groups, one group may be counted each week or each day, and discrepancies are reconciled. It does not affect the regular day-to-day running of the warehouse. The advantage is that it becomes easier to track down the source of discrepancies. After each count, reports need to be documented (Gurhan & Shang, 2014).

Routine reports on purchasing and inventory management should be produced monthly and annually. In the reports: details such as stock position, beginning and ending inventory value, consumption patterns, expiry status, budget status, purchases, and expenditures should be included and details provided (Mekel *et al*., 2014).

## 2.4 EFFICIENT STORE MANAGEMENT

Medicines and related supplies are expensive commodities and should, therefore, be handled with care to avoid deterioration. These items should be stored in a proper storage space, which is free of humidity and high temperatures and should be equipped with shelves (Quick *et al*., 2013).

### 2.4.1 Security of medicine Storage

The Pharmacy store should be locked at all times, and access should be for authorized personnel only (storekeeper or pharmacist). The number of keys that are made should be limited, and there should be an additional secured area where Narcotics, High

schedule drugs, and expensive items are kept. Locking the store helps to control the movement of stock as well as to avoid theft of supplies, as extrapolated from (GPP, 2017).

### 2.4.2 Storage Environment

According to Good Pharmacy Practice (GPP, 2017), a pharmaceutical store should be located in a dry, weatherproof building, and the temperature should be below 25º Celsius. Temperature and humidity levels should be controlled within appropriate limits. Products sensitive to heat should be refrigerated. The stock should be organised, and put on good quality shelving. Each item should be in a Brazier bin and the bin to be labelled. Drugs and medical supplies should be segregated from linen, food, and other non-medical items. No stock should be put directly on the floor; pallets or wooden frames can be used. The pharmacy store should be a restricted area: only authorized personnel have access.

Refrigerators must be used for storing all heat sensitive pharmaceuticals between 2-8 ºC. These products include Vaccines, Insulin, and Oxytocin, to name a few. No food should be stored in these refrigerators. Temperature charts should be filled daily, twice a day to monitor the trend of the refrigerator temperature over time, and to avoid potential problems. It should be connected to a standby power supply, as with other pharmaceuticals, stock cards should be kept for each item in the refrigerator (GPP, 2017).

## 2.5 INVENTORY CONTROL SYSTEM

The Pharmacy store makes use of records (manual or computerized) for each item in the inventory. Stock cards and physical stock count form part of the most commonly used control systems apart from a mobile-based stock visibility system that was used to check the availability of ARV, TB, and vaccines (Saha & Kumar Ray, 2017).

The stock records document all transactions relating to an item. It may contain information about re-order level, re-order interval, minimum/maximum stock level. Good Pharmacy Practice can be used as a reference for the step by step approach on how to do it (GPP, 2017). The importance of having a stock control system is to avoid the loss of stock due to fraud, theft, or expiry (PFMA, 1999).

### 2.5.1 Physical Count

Physical count refers to the counting of the number of containers of each item regularly. Its purpose is to check that the amount actually in the store equals the BALANCE IN STOCK number on the stock card. It is crucial to verify that each item that is being counted had the same generic name, form, and strength, and unit size (Quick *et al*., 2013).

### 2.5.2 Stock Cards

Literature dictates that each item in the store should have a stock card, even if it is the same product with different pack sizes. A stock card (Bin card) is kept for each item and is fastened to the shelf or Brazier bin. Recording of how and when the item is used should be done. Records on the stock-card include movements, such as receipts (item coming from supplier), issues (moving to the dispensary, or when an item is dispensed directly to a patient (Quick *et al*., 2013). The recording of the movement should be done at the time of movement. For expired, poor quality or over-stocked items, information of removal of such information should also be recorded (Tayob, 2012)

### 2.5.3 Use of FIFO/FEFO

Medicines that expire have cost implications. Every effort should be made to prevent items from reaching expiry date in the facility. Manufacturers print dates on containers to show how long the contents will remain valid. The dates are called expiry dates. Expiry dates should be checked at regular intervals. Items with short expiry dates should be placed in front of those with longer expiry dates. This method is called FEFO,

which is short for First Expiry First Out. The expiry dates of products should always be visible when the product is in storage. Items without expiry dates, e.g.Soaps, and detergents, should be stored in the order they were received. There may be a date of manufacture on the container, indicating the older stock should go first. This method is referred to as FIFO short for First in First Out (Mahoro, 2013)

### 2.5.4 Record-Keeping in Inventory Management

(SIAPS, 2012), details the importance of keeping records of medicines and related supplies. It helps the personnel to know which items are available in stock, how much is available of each item, how much is used regularly, when, and how much of an item should be re-ordered. There are different ways of keeping records; however, in PHC records that are kept are the stock card and order form. Computers can also be used in all aspects of the drug management cycle, from selection to use. There is different software's, e.g. Rx Solution and Pdsx: they are capable of manipulating text and numbers and producing correspondence, reports, graphs and charts (Tayob, 2012)

## 2.6 ORDERING PRACTICE

Supplies are more likely to be available when ordered regularly and in the correct quantities. The number of supplies ordered should be based on the amount that is used or their past consumption. According to Kefale & Shebo (2019), it is essential to know what supplies are needed in your facility to avoid stock-outs (out of stock), avoid having too much stock (over-stocked), avoid wastage and be able to offer health care services, including medicines, to your community.

To determine how much stock to order information regarding the average monthly consumption and lead-time is needed; this information is used to calculate the re-order level (ROL) for each item and decide when and how much to order. The following formula is used to calculate the re-order level (SIAPS, 2012)

$$\text{ROL} = \text{Average monthly consumption} \times \text{Re-order factor}$$

## 2.7 SUPPLIER ORDER FILL RATE

In a supply chain: the order fill rate is the percentage of the stock received in comparison to stock ordered. For example, an order has 100 items on it, and the facility receives 80; therefore, 80/100 X100 = 80% that means the order fill rate would be 80%. However, such information is not yet available for this study as data collection has not begun (Rim *et al*. 2008). In the study, the order fill rate is a relevant element and is also known as Back-order; these items are put on a list and fulfilled when supplies are sufficient.

## 2.8. THE ROLE AND BACKGROUND OF SOP'S

SOP is the shortened form of Standard Operating procedure as listed under abbreviations, and it is defined as detailed instructions needed to ensure uniformity when carrying out instructions (Sajdak., 2013). It is a guideline that details processes to ensure the key elements are included, information such as key components and legal framework are included. All procedures should comply with the scope of practice for personnel expected to perform such a duty (Karim *et al.*, 2018). SOPs need to be specific and tailored for each task, and they serve the purpose of assisting employees in producing the highest quality of work.

All tasks performed in a pharmacy should be detailed in an SOP, from Ordering to receiving and issuing of stock. In this study, SOPs that were looked into was for Cold chain management, storage conditions, medicine management (including expired stock), as well as for receiving. Results were discussed in detail in chapter 4 of the dissertation.

## 2.9 INVENTORY MANAGEMENT: EXPERIENCE IN SOUTH AFRICA

In South Africa, Non-communicable chronic diseases are emerging in both rural and urban areas, and the dominant social group most affected are the low-income people living in urban settings, which causes an increase in pressure on health care services

(Mayosi, 2009). The pressures of the health system affect the economy negatively, thus Addressing the non-communicable disease (NCD) epidemic is critical to improving public health outcomes and better economic growth as well as reduce premature mortality from NCDs (Hofman, 2014).

A study conducted by Ambe & Badenhorst-weiss (2012) outlined SCM challenges experienced by South Africa; inadequate planning and linking demand to the budget, non-compliance to SCM (Supply Chain Management) policy and regulations, lack of proper knowledge, skills, and capabilities.

A review article written by Pharasi & Miot (2013) discussed the objectives of the NDP with regards to Legislation, selection, pricing, procurement and supply, human resources, and traditional medicines co-operation with regional and international organisations. The study detailed the possibility of a ‘’central procurement agency’’ on a national level to curve or to reduce stock-outs, which will, in turn, improve disease prognosis in the long run. Central procurement agency will also reduce the cost of medicines and improve access and availability. State-owned manufacturing of pharmaceuticals was also discussed as a future solution to the stock-out challenge experienced country-wide.

## 2.10 INVENTORY MANAGEMENT: GLOBAL PERSPECTIVE

Globally the burden of non-communicable diseases is falling on developing countries, which has left those countries with under-resourced healthcare systems (Mattke *et al*. 2011). Limited access to safe and effective medication is a contributing factor to increased morbidity and mortality, as effective treatment is hampered by overall limited health system resources and capacity.

A Study conducted by Mattke et al. (2011) showed substantial evidence for a mismatch between supply and demand in many developing countries. The two main reasons for the difficulty of forecasting demand: a lack of accurate data on disease prevalence and medicine needs, and poor coordination and communication between local health

workers and centralised planning bureaucracies, this is more prominent in rural and remote areas.

Another study was conducted in six middle-income countries: China, Ghana, India, Mexico, Russia, and South Africa (Lee & Tayu, 2015). The Impact of NCD multi-morbidity on healthcare was assessed, and the findings were as follows; the prevalence of multi-morbidity in the adult population varied from 3.9% in Ghana to 33.6% in Russia. The number of visits to doctors in primary and secondary care rose substantially for persons with increasing numbers of co-existing NCDs.

Multi-morbidity was associated with more outpatient visits in China and a high chance of hospital admission in India, of which Medicines contributed the most to out of pocket expenditures in persons with multi-morbidity (88.3% for outpatient, 55.9% for inpatient visit in China) in most countries.

The study concluded that Multi-morbidity is associated with higher levels of healthcare utilisation and a more significant financial burden for individuals in middle-income countries. The study made a recommendation that WHO needs to implement universal health insurance and health service coverage, especially for groups such as the elderly and people with multi-morbidity.

### 2.10.1 Inventory management in Developing countries

In Ethiopia, Medicine supply management is divided into four essential functions as it is done globally; selection, procurement, inventory management, and servicing customers or patients (Gebremariam & Unade.,2019). A study was done in ten health centres, and the results are as follows; most of the health centres (8) procured medicines which were not approved by the drug and therapeutic committee with the use of essential medicines list and storage conditions in 50% of the health centres were found to be poor.

In South Africa, several systems are used to address medicine supply issues for patients with NCDs; and several medicines pick up points were established throughout the country; there are ongoing programmes to enhance adherence to medicines as well as adherence to treatment guidelines and EML with their increasing availability. In a hospital setting, initiatives such as stewardship programmes help to curb antimicrobial resistance (Meyer *et al*., 2017). The success of this partnership is due to the availability of external funding.

### 2.10.2 Inventory Management in Developed countries

Industrialised countries are faced with increasing demands for quality health care by ageing populations, and increasing costs of medicines need to have policies on dealing with pharmaceutical issues.

Developing countries started national programmes for essential drugs to promote the availability, accessibility, affordability, quality, and rational use of medicines four decades ago (1970). The foundation of an excellent program is the selection of essential medicines for public supply, based on a systematic review of comparative efficacy, safety, and value for money. Evidence-based national clinical guidelines are essential tools in training health professionals, as well as rational prescribing (Hogerzeil., 2004).

The national drug policy acts as a vehicle to balance conflicting policy objectives and to express government commitment to a common goal. Developed countries would do well to consider and adopt the approaches mentioned above, which have been beneficial in developing countries (National drug policy, 1996). The concept of Essential medicines was launched in 1977 through a publication made by the World Health Organisation (WHO). Essential medicines are then defined as; those that satisfy the priority health care needs of the population. Essential medicines are intended to be available within the context of functioning health systems at all times in adequate

quantities, in the appropriate dosage forms, with assured quality and adequate information, at a price, the individual and the community can afford (DOH, 2018).

The Selection of essential medicines is a two-step process. The regulatory body approves the selected item based on a review of efficacy, safety, and quality without comparison with other medicines. Registered products of the same therapeutic category are then selected based on comparative efficacy, safety, and cost (value for money). The national list of essential medicines is used to guide the procurement and supply of medicines in the public sector (WHO, 2002).

Clinical and essential medicines list improve prescribing quality, lead to better health outcomes; they help with quality control as well as medical audit. Economically they lead to better value for money, simplified systems of procurement, supply, distribution, and reimbursement.

## 2.11 THE NATIONAL HEALTH INSURANCE AND NCD'S

National Health Insurance (NHI) is a health care financing system that is designed to pool funds to buy quality, affordable personal healthcare for everyone irrespective of their financial status so that their healthcare needs can be met (Hunter *et al*., 2012). It was established to achieve Universal Health Coverage for South Africans.

South African health system has been fragmented into two parts for decades, i.e. Private and Public sectors. One of the challenges of the public sector is over-burdened by the population without insurance. The public sector dominates the management of NCDs (Naidoo, 2012).

A study conducted by Hunter et al (2017), detailed, the PHC is at the core of the implementation of NHI; this includes community health centers. According to the study,

a total of 3477 fixed facilities were identified to be in the implementation phase, and this total is for clinics of the whole country (South Africa). Only 322 ideal clinics were accredited in one year. The study further stipulated areas that still need to improve, such as infrastructure, human resources, waiting times, financial management, and supply chain management to improve health service.

The policy for implementation of NHI, which was gazette in the white paper on 29 June 2017, further stipulates; All South Africans will have access to preventive, curative, rehabilitative, and palliative health services that are of sufficient quality and are affordable to every citizen. Quality of healthcare has been associated with dissatisfaction amongst the users of health services in the public sector. The facilities regularly monitor quality problems such as waiting times, staff attitudes, and medicine stock-outs, among other things.

NHI aims to improve service delivery by ensuring that a full range of essential medicines and other medical supplies are available in all public health facilities. Programs such as Direct Delivery Strategy (DDS), Central Chronic Medicine Dispensing, and Distribution Program (CCMD) have already been implemented, as well as a surveillance center that enables the National Department of Health to see which items are not in stock in facilities across the country. These programs help with the ordering and distribution of medicines, thus improving the availability of medicines (Meyer *et al*., 2017).

The successful implementation of NHI depends on the availability of essential medicines in a PHC setting. According to Munedzimwe (2018), the lack of trained human resources who can efficiently manage stock and following the recommended procedures for stock management such as adhering to ordering dates, having minimum/maximum stock levels for all items, would be crucial to achieving the intended therapeutic outcomes.

## 2.12 SUMMARY

This chapter discussed details in the literature about inventory management, NCD's, Medicine supply management, inventory management of medicines globally in both developed and developing world. Challenges in drug supply were explored in great lengths. The drug management cycle was also discussed in detail, from selection, procurement, distribution, and use. Similar studies conducted in both developing and developed countries were also discussed. Importance of having stock available at all times and the importance of adhering to processes and procedures were discussed. Inventory control systems such as Record-keeping, use of FIFO/FEFO, physical count, and stock cards were also highlighted as well as ordering practice.

# CHAPTER 3

# RESEARCH METHODOLOGY

## 3.1 INTRODUCTION

This chapter presents the research methodology which was followed in this study, it includes the process of collecting data from the respondents, as well as methods for analysing the collected data, reliability, and validity of the data collected, and Ethical rules considered.

## 3.2 RESEARCH METHOD

The study followed a Quantitative method to achieve the set objectives. Quantitative research is the numerical representation and manipulation of observations to describe and explain the phenomena that those observations reflect (Brink *et al*., 2016). It aims to focus on objective measurements and statistical, mathematical, or numerical analysis of data collected using polls, questionnaires, and surveys (Babbie., 2010).

The study is quantitative as it complies with the standards of the format for a descriptive quantitative design as stipulated in an article by (Labaree., 2009) which are as follows: subjects are to be measured only once, the association between variables (independent and dependent) is established, and the research focuses on gathering numerical data and generalising it across groups of people.

The study is quantitative since it was concerned with observing the ordering frequency versus the number of times stock was received, whether minimum and maximum stock quantities were established, were records available to prove whether procedures were being adhered to; also different groups of people were interviewed, i.e. Professional Nurses and Pharmacists. It was also retrospective because old records were checked; ordering forms, stock cards, and delivery notes. The respondents were only given the data collection tool once.

## 3.3 RESEARCH DESIGN

The study followed a cross-sectional research design. The cross-sectional research design involves using different groups of people who differ in the variable of interest but share other characteristics such as socioeconomic status, educational background, and ethnicity. In this study, no variables were manipulated by the researcher, i.e. age, gender, education (Brink *et al*., 2016). The study design was chosen to ensure that data acquired for the study could be compared, measured, and evaluated such that it could be analysed systematically with the use of graphs, tables, and figures.

## 3.4 STUDY SITE

Mankweng hospital has 21 Clinics in total. The study was only conducted in Clinics around the Dikgale area, namely Dikgale, Sebayeng, Makotopong, and Seobi-Dikgale, which are situated in Capricorn district, as well as Mankweng Hospital and the Medical depot (LPPD), which are also in Capricorn district.

Mankweng is situated 27km from Polokwane (capital), Dikgale, Sebayeng and Seobi-Dikgale are local to Mankweng hospital at a distance of 32km from Dikgale, 16km from Sebayeng, 27.8km from Makotopong and 18km from Seobi-Dikgale.

## 3.5 STUDY POPULATION

As cited in an article written by Banerjee & Chaudhury(2010), a study population in research refers to a well-defined collection of individuals or objects with similar characteristics for purposes of data collection. In this study, the population comprised of Professional Nurses situated in the Clinics mentioned under the study site, Pharmacists at Mankweng Hospital, as well as Transport officers (Drivers) at the Depot.

In this study, all the Professional Nurses (21) of the Clinics in the Dikgale area were included to participate as the chosen region only had four Clinics. All Pharmacists at Mankweng Hospital (20), as they are responsible for supplying the said Clinics with

Hospital items (not on Clinic formulary). The drivers (10) who deliver the boxes (of medicines) dispatched from the medical depot to Clinics, and they make use of a delivery note, which ensures there are no discrepancies in terms of the boxes received at the Clinic versus the number that was dispatched from the warehouse (medical depot).

### 3.5.1 Inclusion criteria

Inclusion criteria refer to the eligibility or characteristics of the respondents to take part in the study (Salkind., 2010). It is used to rule in the target population for a research study. Proper selection of inclusion criteria minimises the external and internal validity of the study, improves feasibility, and minimises ethical concerns.

In this study, the inclusion criteria comprise of the following people:

- All the professional nurses as they are involved in the ordering and management of medicines used in chronic non-communicable diseases at the particular clinics.
- All Pharmacists working at Mankweng Hospital are involved in Clinic support visits at primary health care clinics attached to Mankweng Hospital as part of the Chronic Care Model.
- Transport officers that are involved in transporting medical supplies to Clinics.

### 3.5.2 Exclusion Criteria

Exclusion criteria are described as the characteristics that disqualify prospective subjects from inclusion in the study (Salkind, 2010)

In this study, the exclusion criteria comprise of the following;

- Other pharmacy personnel, such as pharmacist interns, learner-basic pharmacist assistants and learner post-basic pharmacist assistants will be excluded from the study because they work under the supervision of a Pharmacist

- Security personnel, cleaners, and general assistants will also be excluded as they are not involved in stock related issues, and they are professional support staff.
- Enrolled nurses and enrolled nursing assistants located at the clinics will also be excluded from the study. Their primary role is to assist the Professional Nurse with taking vitals (Temperature, Blood pressure, weight) for patients.

### 3.6 SAMPLING

A sample is a smaller representative collection of units from a population used to determine truths about that population (Bala & Etikan, 2017). Thus sampling is the process of selecting a portion of the population to represent the entire population (Kotur & Anbazhagan, 2014). In this study, the sample size consisted of all the professional nurses in the four clinics at the Dikgale area, all pharmacists at Mankweng hospital, and ten drivers at the medical depot. No sampling review was performed due to a small number of clinics and only one Hospital in the area.

The sample size is illustrated below;

- 21 professional nurses N1=21
- 20 Pharmacists at the Hospital N2=20
- Ten drivers at the depot N4= 10

### 3.7 DATA COLLECTION

Data collection commenced after approval from the Turfloop Research Ethics Committee as well as the Department of Health, was received. Data was collected from previous records from September 2017 to March 2018. The step was crucial as it determines the success of a study.

### 3.7.1 Data Collection Procedure

Data from personnel were collected over three weeks, whereby one facility was visited at a time. Professional nurses of each clinic were briefed at the same time about the project, and then each was given a consent form; people who agreed to participate in the study were given questionnaires to fill in individually and given a time frame (20 minutes) to complete them.

Similarly, data from pharmacists were collected after informed consent has been sort from individuals; Pharmacists were given the questionnaire to administer after a brief discussion of the topic as a group. The pharmacists get rotated regularly to clinics.

Transport personnel at LPPD was briefed about the study and given consent forms to fill in; individuals who agreed to participate in the study were given questionnaires to fill in over 20 minutes.

### 3.7.2 Data Collection Instruments

To address the objectives of this study; data were collected through the following means:

*Questionnaire store manager/nursing personnel (Appendix 2)*

- This tool helped in assessing the practices followed by nursing personnel for ordering, receiving, storing and record-keeping of the medicines
- The questionnaire consisted of six sections: the first section requires demographic information, the other sections comprised of questions about Drug supply management, ordering practices, receiving of stock, storage area (whether medicines are stored in a secure medicine room) as well as cold chain maintenance.

Questions were extracted from the key elements for PHC facility requirements, as stipulated in GPP (2017).

*Questionnaire pharmacist at feeder hospital (Appendix 3)*

- The Pharmacists at Mankweng Hospital administered the tool, which was used to obtain information regarding the practices followed by clinic staff in the ordering, storage, record keeping, and compliance with legislation as observed by the pharmacists during their visit to the clinics.
- This tool comprised of five sections: the first section required demographic data, the second set of questions were about who orders stock for clinics, the next section explored the pharmacists view about the storage area of medicines at the clinics, to how cold-chain is maintained as well as whether clinic personnel complies with written procedures and legislation.
- The questions asked were adopted from a tool used by Tayob (2012) for a similar study done in the Sedibeng district of Gauteng province.

*Transport personnel questionnaire (Appendix 4)*

- This tool was given to the transport personnel, responsible for the delivery of medicines to the clinics. This tool helped the researcher to determine what could be some of the challenges experienced by transport personnel. This questionnaire was adapted from a study conducted by Mahoro (2013).

*Researcher checklist (Appendix 5)*

- This tool was utilised by the researcher to validate/confirm the responses by the Pharmacy and Nursing staff, in terms of practices followed in the ordering, receiving, storing, and record-keeping of medicines.
- The tool had six sets of questions, from checking for cracks on the walls and pest infestation to whether the stock is packed on shelves as it should, to availability of stock cards, copies of ordering forms, and invoices of receipt stock as well as the availability of reference materials.
- Researcher checklist was adapted from key elements in Good Pharmacy Practice GPP (2017).

*Checklist for stock card utilisation and stock availability review (Appendix 6)*

- This checklist aided the researcher to observe the utilisation of stock card, in terms of updating the stock levels frequently, correlation of physical stock with the figures on the stock card, and compare trends for medicines used to manage chronic non-communicable diseases. Minimum and maximum stock, as well as consumption over a six-month, were checked.
- The stock card format that was used in clinics is adapted from Quick *et al*. (2013)

## 3.8 VALIDITY

Validity refers to whether or not a study is well designed and provides results that are appropriate to generalize to the population of interest (Golafshani, 2003). In this study, a pilot study will be run to check if the questionnaire is comprehensive to achieve the research objectives, and to ensure construct validity.

### 3.7.1 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. In this study, the researcher used a simple random sampling technique, which is an effective way of controlling extraneous variables, therefore achieving validity.

### 3.8.2 External Validity

External validity is defined as the degree to which the results can be generalised to other subjects, settings, and times (Schimdt & Brown, 2012). In this study, results could be generalised to other clinics around the Mankweng area because simple random sampling was used, a reliable technique that allows generalizability.

### 3.8.3 Construct Validity

Construct validity is concerned with this question: “What construct is the instrument measuring?” it is used to explore the relationship of the instrument’s results to measures of the underlying theoretical concepts of the instrument (Brink *et al*., 2016). A pilot study was conducted two months before the formal data collection, and construct validity was ensured by the stability and quality of the data collection tool.

## 3.9 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 (Golafshani, 2003). Clearly defined measurements and a well-detailed questionnaire were used to ensure the reliability or generalizability of the study. Reliability was further ensured by avoiding participant error by collecting the data at the same time, preferably in the morning; further, only one researcher will be used for data entry to improve reproducibility.

## 3.10 DATA ANALYSIS

Data analysis has to do with what happens to the data after it has been collected. Brink et al. (2016) explain the various techniques that can be used to display data and aim to answer the set research objectives. Smith & Firth (2011) further explains that the purpose of data analysis is to describe and summarise the data, identify relationships between variables, as well as forecast outcomes, among other things.

Data collected was then captured into a computerised data analysis software (IBM SPSS Version 25). The researcher first captured data collected at the Clinic used for the Pilot study, three sets of sheets were captured, i.e., Questionnaire administered by Professional Nurses, Researcher checklist as well as stock card utilisation tool. Data captured was then sent to a statistician to aid with analysis and plotting of graphs and figures. Statistical tests were also run on the software to obtain p-values.

## 3.11 ETHICAL CONSIDERATIONS

Ethical standards adhered to during conduction of the study are listed below

### 3.11.1 Permission to Collect Data

Ethical clearance was obtained from the University of Limpopo since the study involves human subjects. The research proposal was submitted to the School of Healthcare Sciences Senior Degrees' committee (SDC) for approval. After approval by the SDC, 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 (Appendix 7). The ethical clearance certificate, together with the research proposal, was used to seek research authorisation to from the Department of Health Provincial Research Committee (Appendix 9), as well as Capricorn district Manager for Primary Health Care (Appendix 8).

### 3.11.2 Informed Consent and Voluntary Participation

Participation was voluntary, and participants had the right to withdraw at any time without any penalty. The study was conducted on principles of anonymity, confidentiality, and informed consent. Therefore, no subjects participated in the study without fairly consenting (Appendix 1), and no coercive measure to take part in the study was exercised on them.

### 3.11.3 Anonymity and Confidentiality

Participants were assured of the confidentiality of the study, to maintain the principles of anonymity, no human subject taking part in the study would be allowed to furnish their names or identity, unless such identity points out to basic demographics such as age, gender, and others. The consent form was not labelled in any way relating to the questionnaire To attain anonymity and confidentiality. Lastly, the information given during the study will be kept prudently confidential. The data collected is not going to be used for any other purpose other than for research purposes and will be stored in the University of Limpopo pharmacy department for not less than five years.

## 3.12 BIAS

All the questionnaires (4) used, are written in English, a language understood by all the participants of the population group. Time was taken into consideration to avoid participants talking to each other about the questions included in the questionnaire. Individuals were each given a consent form and questionnaire to complete for all groups.

### 3.12.1 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 statistical analysis, resulting from the method of collecting samples (Brink *et al*. 2016). Selection bias was minimised by including all clinic personnel who meet the inclusion criteria and who consent to participate in the study.

### 3.12.2 Respondent Bias

Some respondents could answer favourably to please the researcher or to hide any lack of knowledge. The questionnaires were completed anonymously to minimize this bias. The researcher checklist was used to avoid respondent bias and as a means of verification.

## 3.13 CONCLUSION

In this chapter, the study setting, population, reliability, validity was discussed in detail, furthermore; data collection technique was discussed as well as data capturing and analysis. It was a retrospective quantitative, cross-sectional study that involved a review of past orders, invoices, and stock cards in Dikgale clinics attached to Mankweng hospital as well as the depot, which supplies the said clinics with stock. Data was captured on SPSS software according to the different sampling populations.

# CHAPTER 4

# RESULTS AND DISCUSSION

In this chapter; the findings of the study, based on questionnaires administered, are discussed in detail to address the objectives. The findings were interpreted following the data analysis software used, as described in Chapter 3. The data interpretation is divided into four sections, namely clinic, depot pharmacist, hospital pharmacist, and drivers. The descriptive summary on stock management practices at the four clinics, as well as the challenges experienced by pharmacists who visit the clinics weekly, the pharmacists who supply the clinics with stock, and the drivers who are responsible for ensuring the stock, reaches the clinics were discussed.

## 4.1 DEMOGRAPHICS

The following sub-sections discuss the demographics of both pharmacists at the feeder hospital and the nursing personnel at clinics.

### 4.1.1 Demographics of Pharmacists

A total number of 20 pharmacists agreed to participate in the study. The questionnaire was based on the observations of the clinic setting from the pharmacist's point of view as they are the ones who visit the clinics weekly on a rotational basis.

Seventy percent of pharmacists were female (n =14) and 30% were male (n=6).The age groups were 10% for 18-25, 75% for 26-35, 10% for 36-45 and 5% for 46+ as depicted in the below graph (Figure 4.1). Sixty percent (60%) of the pharmacist population had been working for 1-5 years, 20% had been working for 6-10 years, and the last batch of 20% had been in service for 10+ years.

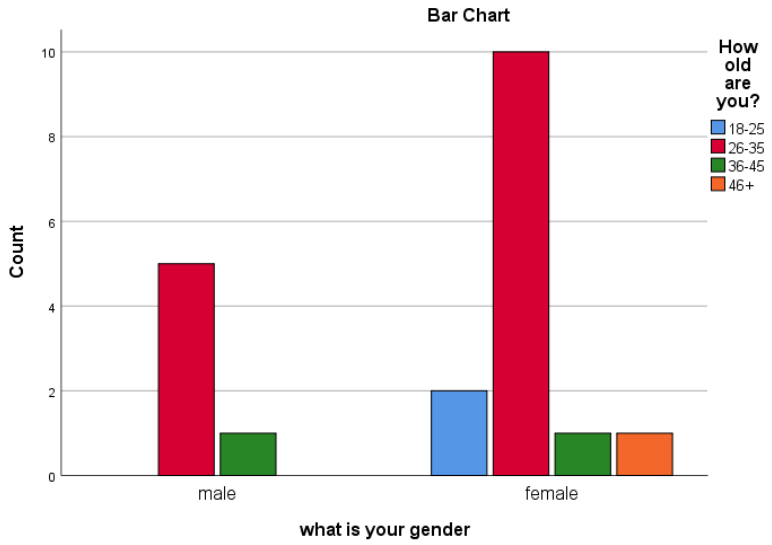



Figure 4.1: Gender and age-distribution pharmacist feeder hospital

### 4.1.2 Demographics of Professional Nurses

A questionnaire (Appendix 2) was distributed among all the professional nurses across four clinics. However, not everyone consented to participate in the study, resulting in a 69% response rate, with a sample size of n=18.

**Table 4.1: Demographics for nursing personnel in all clinics**

| Features of sample | Number and percentage n (%) |
|---|---|
| ***Gender*** | |
| Female | n=18 (100%) |
| ***Age*** | |
| 18-25 | n= 2 (11.1%) |
| 26-35 | n=5 (27.8%) |
| 36-45 | n=5 (27.8%) |
| 45+ | n=6 (33.3%) |
| **Number of years' *experience*** | |
| 1-5 | n=4 (22.2%) |
| 3-5 | n=4 (22.2%) |
| 10+ | n=10 (55.6%) |

All of the respondents (n=18) were black females: therefore, gender as a variable was not checked as it is constant. 33,3% were within the age group of 45+, 26-35, and 36-45 were equally on 27,8%, whereas 18-25 was the minority age group at 11,1%, as shown in Table 4.1 above.

The third variable on the demographics information was the number of years of experience. Results show that majority of the nursing population had 5+ years of experience at 55,6% (n=10), followed by 5-10 and 1-5, which were found to be equally at 22,2%, as depicted in the table above. The experience is significant in that; the more experienced staff is, the abler they are to navigate through most daily duties with ease as they have been practising for more years.

### 4.2 TRAINING OF NURSING PERSONNEL

Staff training is very crucial in any establishment as it helps familiarize personnel with policies and documentation as well as rules for the establishment.

Only 33.3% of the nursing personnel indicated that they were trained compared to the 66.7% that were not trained on the medicine supply management (MSM). On the questionnaire administered to pharmacists at the feeder hospital, 30% indicated that they provide training once a year, 30% do it twice a year, and 40% have never provided training on MSM to nursing personnel at the clinics.

As shown in Table 4.2 below, in both populations, the majority were neither given nor received training on drug supply management.

**Table 4.2: Nursing Personnel training**

| Features of sample | Number and percentage n (%) |
|---|---|
| ***Received Training(Nurses)*** | |
| Yes | n=6 (33.3%) |
| No | n=12 (66.7%) |
| ***Given training (Pharmacists)*** | |
| Once a year | n=6 (30%) |
| Twice a year | n=6 (30%) |
| Never | n=8 (40%) |
| ***Calculation of Average Monthly consumption (Nurses)*** | |
| Yes | n=7 (38.9%) |
| No | n=11 (61.1%) |

The majority of the nursing population 61.1%, Table 4.2 did not know how to calculate the average monthly consumption since they did not receive any training, which means they were also unable to calculate the minimum and maximum stock levels and re-order fill rate as all of these concepts are interlinked. This was proven by the stock cards and ordering books utilised by clinics on a weekly or day to day basis, as reported on the information documented by the researcher on the data collection checklist. However, the majority of the nursing population agreed on the importance of calculating average monthly consumption levels.

As shown in Table 4.3, the chi-square value is 0.002 which indicates the significance of calculating average monthly consumption, which will aid with calculating the minimum and maximum stock levels, which were not being done in all clinics.

**Table 4.3: Chi-square test for calculation of monthly consumption**

| | Value | Df | Asymptotic Significance (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| **Pearson Chi-Square** | 9.164[a] | 1 | **.002** | | |
| **Continuity Correction[b]** | 6.455 | 1 | .011 | | |
| **Likelihood Ratio** | 11.840 | 1 | .001 | | |
| **Fisher's Exact Test** | | | | .004 | .004 |
| **Linear-by-Linear Association** | 8.655 | 1 | .003 | | |
| **N of Valid Cases** | 18 | | | | |

Training on SOP for managing medicines was evaluated, and p values were found to be 0.034 and 0.013 for age and number of years' experience, respectively, in Table 4.3. Which shows that age and experience are significant variables; it may also be indicative of professional nurses have started working at a young age and did not join the profession late and would, therefore, have accumulated the number of years of experience. The results show that the younger population has mostly not been trained, whereas the older population has been.

**Table 4.4: Chi-square tests for SOP training versus the number of years' experience**

| Chi-Square Tests | | | |
|---|---|---|---|
| | Value | df | Asymptotic Significance (2-sided) |
| **Pearson Chi-Square** | 16.200[a] | 6 | **.013** |
| **Likelihood Ratio** | 18.542 | 6 | .005 |
| **Linear-by-Linear Association** | 11.027 | 1 | .001 |
| **N of Valid Cases** | 18 | | |

a. 12 cells (100.0%) have expected count less than 5. The minimum expected count is .44.

Based on the results obtained on Table 4.4, it appears that training is lacking and a much-needed requirement to curb stock-outs, avoid over-stocking certain items as well as avoid stock-expiry.

## 4.3 INFRASTRUCTURE AND STORAGE CONDITIONS

According to GPP(2017), a pharmaceutical store should be located in a dry, weatherproof building, and the temperature should be below 25 ºC. All medicines should be stored in a well-secured area with temperature and humidity controlled within appropriate limits. Products sensitive to heat should be refrigerated. The stock should be organised and put on good quality shelving. Each item should be in a Brazier bin and the bin to be labelled.

This section describes the storage conditions of medicines at clinics, storage of thermo-labile medicines, and the security of the medicines stored.

### 4.3.1 Storage conditions

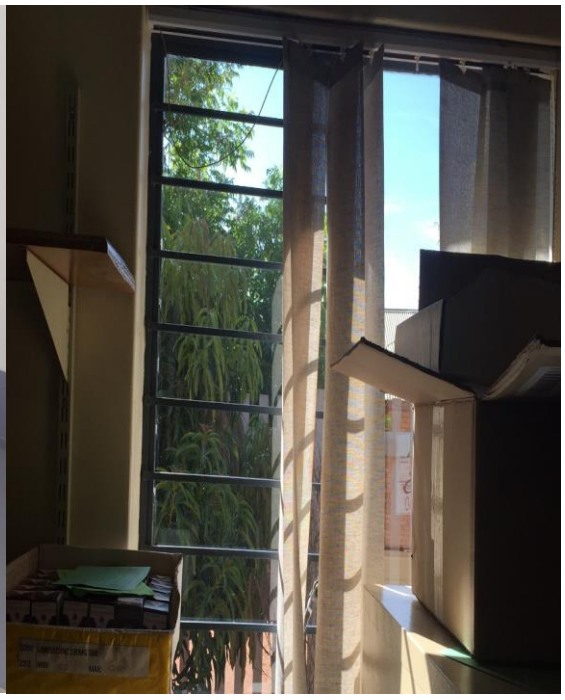
The following results were obtained in terms of the condition of the store areas from three different sources, i.e. the Nursing personnel, Pharmacist at Feeder hospital, and the Researcher checklist.

- The storage areas of all clinics were fitted with shelving. However, space is not sufficient for all brazier bins for stock that is meant to be kept at clinics (Figure 4.2a). Only one in four Clinic complies with excess stock being placed on shelves: the other clinics' boxes were either found on the floor or in the surgical store where the temperature is not monitored.
- As indicated in Table 4.5, 60% of respondents agree that the storage space is sufficient for orderly arrangement, and the 40% disagrees. As per the researcher observation, in all clinics, medicines were stored neatly on shelves according to dosage forms, and no medicines were stored directly on the floor, improvising

was done as depicted in Figure 4.2b, where cupboards were placed underneath medicine boxes.

- The Majority of the respondents (90%) said the storage area was clean and tidy and shelves dusted, and 10% said it was not (Table 4.4). At the time of the researcher, visit clinics were found to be clean.
- All clinics had a functioning air-conditioner, but only two of the four clinics had available temperature records, and up to date; the other two had temperature records but were not up to date.
- Almost all of the respondents, 94.4%, indicated they record temperature twice a day for both room and fridge, whereas 5.6% indicated it is done once a day. However, the results obtained from pharmacists at the feeder hospital and the researcher checklist are as follow; Ninety-five percent of pharmacists said the temperature is measured twice daily in both the storeroom and consulting room, and 5% said it is not measured.
- The researcher checklist shows that not all clinics comply with measuring the temperature twice a day; on average, it is done once a day across all the clinics from which data was collected from, and some clinics were a week behind.
- Only one of the four clinics had a storage area that was in good condition; the other three either had cracks or holes as well as signs of water damage on walls (Figure 4.2c) and signs of pest infestation.
- One out of four clinics met the standard of having high rise windows or burglar-proof; the other three are domestic windows with no burglar proof and dysfunctional blinds (Figure 4.2d).


(a) (b)



(c) (d)

**Figure 4.2 Medicine storage at clinics**

**Table 4.5: Shelving and storage area in Clinics**

| Storage feature | Nursing personnel | Pharmacy personnel | Researcher Checklist |
|---|---|---|---|
| **Adequate space and shelving** | Yes 77.8% (n= 14)<br>No 22.2% (n=4) | Yes 60% (n=12)<br>No 40% (n=8) | 50% of clinics n=2 |
| **Cleanliness** | Yes 83.33% (n=15)<br>No 16.7% (n=3) | Yes 90% (n=18)<br>No 10% (n=2) | 25% of clinics n=1 |
| **Cracks and water damage** | Not an indicator | Yes 75% (n=15)<br>No 25% (n=3) | 25% of Clinics n=1 |

According to the researcher checklist, only 50% of the clinics had adequate space for shelving, whereas 77.8% of professional nurses said the space was adequate, and only 60% of the pharmacist population indicated the space is sufficient. On cleanliness, 83.33% of nursing personnel indicated their premises were clean, 90% of the pharmacist indicated the premises were clean, and according to the researcher checklist, only one clinic out of 4 (25%) was found to be clean. Cracks and water damage were not an indicator on the questionnaire for nursing personnel. 75% of pharmacists found the buildings to be having cracks and signs of water damage, and the researcher only found them in 25% of the clinics.

### 4.3.2 Storage of thermo-labile medicines

The following are minimum requirements for cold storage of pharmaceuticals, i.e. Vaccines and other biologicals (Insulin as it falls under medication for NCDs)

- The Refrigerator must be used for only vaccines, insulins, oxytocin, and anti-venoms.
- The Temperature should always be between 2 to 8 °C.
- The Temperature must be recorded twice a day on a temperature chart.

- The Stock-card must be available for all products in the fridge.
- Temperature charts should be filed daily so that monthly trends can be observed.
- The refrigerator needs to be connected to a generator for back up should there be a power outage.

The following results were obtained in terms of the storage of thermos-labile medicines from three different sources, that is; the Nursing personnel, Pharmacist at Feeder hospital, and the Researcher checklist.

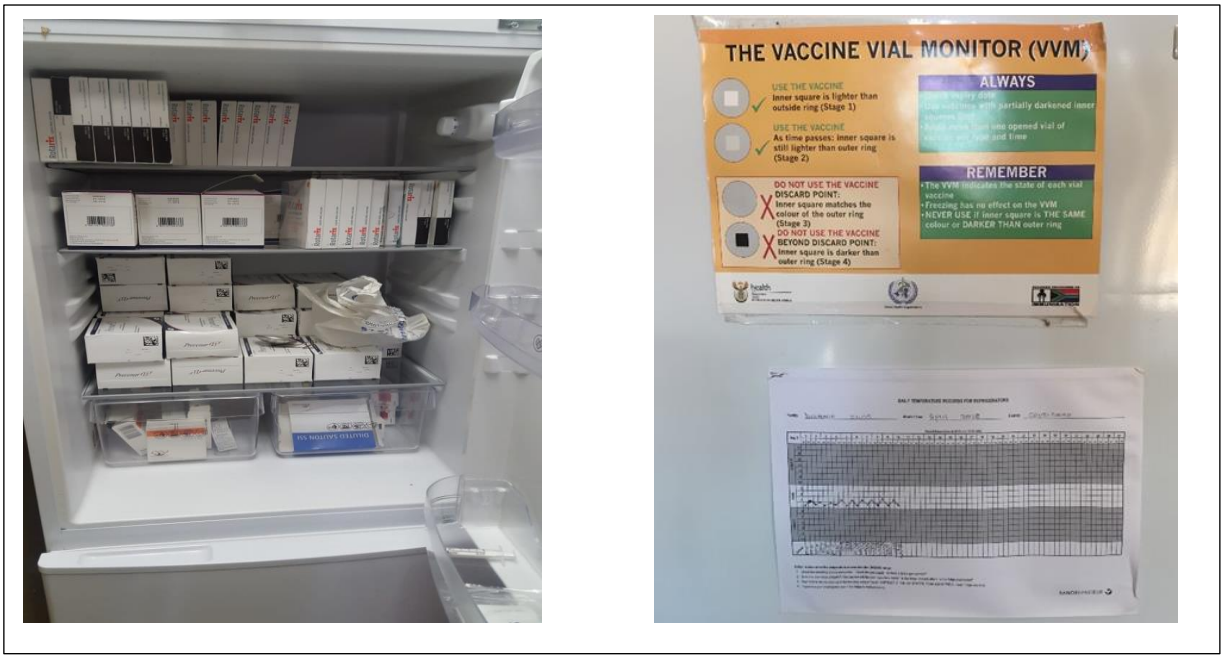



**Figure 4.3. A Fridge used for thermo-labile medicines (pictured on both inside and outside)**

- All vaccines and thermo-labile (100%) are stored in a refrigerator (Figure 4.3). Almost all of the respondents, 94.4%, indicated they record temperature twice a day for the fridge, whereas 5.6% indicated it is done once a day.
- 94.44% said they had a dedicated EPI fridge, which is specially manufactured for storing thermo-labile medication, and 5.56% had they had no such a fridge, they used a domestic fridge instead and only kept thermo-labile in it.

- Two of the four clinics had available temperature charts, and up to date; the other two had temperature records but were not up to date. Some were a week behind, and some of the temperatures were only recorded once a day.
- Food was found in the same refrigerator as medicines in two of the clinics, and this contravenes with GPP standards.
- 77.78% of respondents indicated there is an SOP available for cold chain management, and 22.22% indicated they have never seen the said SOP. Pharmacists indicated all clinics have a copy of the SOP booklet. However, a copy was not physically seen by the researcher during data collection.

All respondents N=18 Indicated there is no back-up generator in all clinics from which data was collected from; this also reflected in the researcher checklist as well as responses from the pharmacist at feeder hospital. However, all clinics indicated that the feeder hospital collects stock from the clinic if the power goes out for more than 12 hours to avoid loss of stock and spoilage.

### 4.3.3 Security of storage area

The Pharmacy store should be locked at all times, and access should be for authorized personnel only (GPP., 2017). Locking of the storeroom is essential as medicines are expensive commodities, and they are scheduled in such a manner that they need strict control; therefore, it is crucial to control the key. Locking helps personnel to be in control of the items and encourages accountability (SIAPS., 2012).

All pharmacists (n=20) indicated that medicines are stored in a secure storeroom. Based on the results obtained, 83.3% (n=15) of the nursing personnel said the storeroom is lockable, and the key is always held by a responsible person, whereas 16.7% (n=3) said the storeroom was not lockable.

Schedule 5 medicines are placed in a lockable cupboard since they are mind-altering items, and regulations stipulate that is should be controlled and locked as well. All Clinics are compliant in this regard. Figure 4.4 shows a schedule medicine cupboard in one of the clinics.


**Figure 4.4: Schedule 5 cupboard in clinic C**

A total of 25 quality indicators were evaluated by the researcher using the research checklist (Appendix 4) to assess the infrastructure and storage conditions at the clinics. Scoring is done either by giving 100 for compliance and 0 for non-compliance. The total score is for 2500 to achieve a100% compliance. Table 4.6 illustrates the results obtained for all the clinics.

**Table 4.6: Quality indicators for storage and security of medicines at all clinics**

| Indicator | % Compliance (Average) | Clinic A | Clinic B | Clinic C | Clinic D |
|---|---|---|---|---|---|
| **Infrastructure conditions** | | | | | |
| Is the storage area separate from the dispensing area? | 75% | 100 | 0 | 100 | 100 |
| Is the storage area large enough to keep all supplies? | 0% | 0 | 0 | 0 | 0 |
| The storage area is kept locked all the time when not in use | 50% | 100 | 0 | 100 | 0 |
| Authorised personnel keeps the | 75% | 100 | 0 | 100 | 100 |
| There are no cracks, holes or sign of water damage on walls | 50% | 0 | 100 | 0 | 100 |
| Is the ceiling in good condition? | 50% | 100 | 100 | 0 | 0 |
| Air-conditioner is installed and is in good working condition | 100% | 100 | 100 | 100 | 100 |
| The windows are painted white or have curtains/blinds | 100% | 100 | 100 | 100 | 100 |
| The windows are high rise or have burglar-proof bars | 75% | 100 | 100 | 100 | 0 |
| The storage area is pest free | 50% | 100 | 0 | 100 | 0 |
| The refrigerator is in good condition | 100% | 100 | 100 | 100 | 100 |
| Temperature records are available and up to date | 50% | 100 | 0 | 100 | 0 |
| There is no food in medicine fridge | 100% | 100 | 100 | 100 | 100 |
| **Storage procedures** | | | | | |
| Stock is placed on shelves | 100% | 100 | 100 | 100 | 100 |
| Excess stock placed on pallets | 50% | 100 | 0 | 100 | 0 |
| Medicines are classified on shelves by dosage form or pharmacological class | 100% | 100 | 100 | 100 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Items grouped into quantities that are easy to count | 75% | 100 | 100 | 100 | 0 |
| No expired medicines on shelves | 100% | 100 | 100 | 100 | 100 |
| Medicines with shorter expiry dates are placed first in brazier bins | 100% | 100 | 100 | 100 | 100 |
| Expired medicines are separated from other medicines | 100% | 100 | 100 | 100 | 100 |
| Thermo-labile medicines are stored in a fridge | 100% | 100 | 100 | 100 | 100 |
| No damaged containers or packs found on shelves | 100% | 100 | 100 | 100 | 100 |
| There is a record of destroyed/expired medicines | 0% | 0 | 0 | 0 | 0 |
| Schedule 5 is stored in a locked cupboard | 100% | 100 | 100 | 100 | 100 |
| SOP for storage procedure is available | 100% | 100 | 100 | 100 | 100 |
| Total | 2000 | 2200 | 1700 | 2100 | 1600 |

*100 = Complies 0= non-compliant

The total score for all indicators is 2500 however, the total average compliance for all clinics is 2000 (80%), which means clinic A (88%) and C (845) were above average whereas clinic B (68%) and D (645) were below average with Clinic D being the least compliant at a score of 1600.

For a PHC to function optimally, the Department of Health set the ideal clinic requirements. “An Ideal Clinic is a clinic with good infrastructure, adequate staff, adequate medicine and supplies, good administrative processes and sufficient bulk supplies that use applicable clinical policies, protocols, guidelines to ensure the provision of quality health services to the community” (Hunter *et al*., 2017). As per this, the clinics need to get a minimum of 90% compliance under the infrastructure aspect.

In the current study, none of the clinics achieved this with only clinic A having achieved 88%.

The overall score was low due to the following aspects; Storage area was not large enough to keep all supplies, there were cracks on walls as well as signs of water damage, there was no record of expired medicines, the excess stock was not placed on pallets and temperature records were not up to date.

### 4.4 MEDICINE SUPPLY MANAGEMENT

The primary goals of national drug policies and public-sector medicine supply systems are to provide access to needed medicines, promote the rational use of medicines and ensure quality, safety, and efficacy of those medicines (Quick *et al*., 2013). Successful supply requires that items are always available at all times for patients who need them. Such requires that items should be ordered often and in the correct quantities. Management sciences for health have specific reasons which are necessary to know what supplies are needed at a health facility and are as follows:

- Avoid not having enough stock (out of stock items)
- Avoid having too much stock (over-stocked items)
- Avoid waste (loss or mismanagement of supply)
- Be able to offer reliable health care services, including medicines

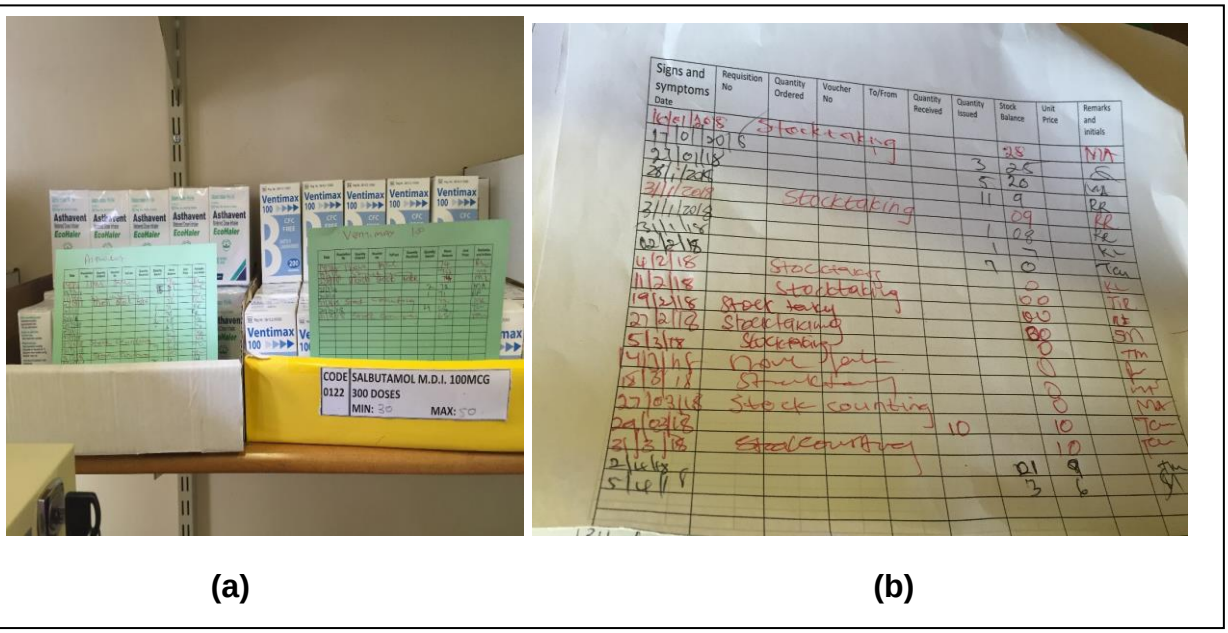
In this section, variables such as inventory systems used to order, how often the stock is counted, determination of order quantities, delivery, and receiving of medicines, as well as record keeping are discussed.

### 4.4.1 Inventory Systems

Literature states that information on the stock cards can be divided into two categories, i.e. fixed information such as the name of the medicine, strength, dosage form, and pack size, and variable information, which consists of information from transactions such as quantity received or issued over time, which will then determine the minimum and maximum stock levels (Quick *et al*., 2013).

All clinics use manual/paper-based inventory management and stock control system (Figure 4.5 a). Stock cards are also used to place an order as details such as quantity received from previous orders aids personnel to make future orders. Stock cards were available in all clinics; only 26.67% of the medicines used for NCDs did not have stock cards at all, compared to 73.33% of items that did. As shown in the table below (Table 4.7), blank space is for no stock card in the brazier bin at various clinics.

The completeness of basic information on the stock cards (name of medicine, dosage form, and strength) was 100%. All clinics did not have minimum and maximum stock levels on both the stock card and the brazier bin besides. It is interesting to note that it is consistently the same two clinics that do not have stock cards for the same items. The only transactions done according to the stock-card are issuing and stock-counting, which is referred to as stock-taking. Orders and receipts were not recorded consistently (Figure 4.5 b).




**(a)** **(b)**

**Figure 4.5: Stock card system at clinics**

### 4.4.2 Stock Counting

Stock counts help personnel to clearly see usage patterns and thus make the process of ordering easier. Stock counting also helps personnel to determine the minimum and maximum stock levels as well as re-order levels (Mekel *et al*., 2014)

All respondents n=18 indicated that stock balance on a stock card as it is the only method of the stock management system used. 44.4% of respondents indicated only count the stock once a week, whereas 55.6% indicated they only count the stock once a month, which is inconsistent as clinic orders on a bi-weekly basis.

Table 4.7 is the stock-card utilization tool observed by the researcher from all the clinics from which data was collected. It shows variations of stock card not being used every time a transaction was made, and; this is shown by stock physically counted, not tallying with the stock recorded on the stock card. A total of 15 items were identified to be clinic stock for NCDs

**Table 4.7: Stock levels for NCD's at all clinics**

| PRODUCT | LAST RECORDED | | | | PHYSICAL QUANTITY | | | | DIFFERENCE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metformin 500mg | - | 15 | - | 1 | - | 15 | - | 1 | - | 0 | - | 0 |
| Aspirin 300mg | 238 | 350 | 29 | 350 | 150 | 350 | 6 | 100 | -88 | 0 | -23 | -250 |
| Methyldopa 250mg | 5 | 1 | 0 | 10 | 5 | 2 | 0 | 10 | 0 | 1 | 0 | 0 |
| Lansoprazole 30mg | - | 4 | - | 0 | - | 1 | - | 0 | - | 3 | - | 0 |
| Atenolol 50mg | 250 | 25 | 49 | 1 | 225 | 25 | 59 | 1 | -25 | 0 | 10 | 0 |
| Amlodipine 5mg | 328 | 0 | - | 420 | 158 | 0 | - | 480 | -170 | 0 | - | 60 |
| Simvastatin 10mg | 00 | 7 | 26 | 10 | 00 | 7 | 8 | 12 | 00 | 0 | -18 | 2 |
| Enalapril 10mg | 1295 | 270 | 33 | 30 | 1102 | 260 | 0 | 26 | -193 | -10 | -33 | -4 |
| Glibenclamide 5mg | 200 | 5 | 14 | 48 | 150 | 25 | 15 | 59 | -50 | 20 | 1 | 11 |
| Metformin 850mg | 205 | 390 | 15 | 50 | 145 | 320 | 0 | 0 | -60 | -50 | -15 | -50 |
| Orphenadrine 50mg | 123 | 65 | 8 | 8 | 130 | 65 | 8 | 8 | -7 | 0 | 0 | 0 |
| Salbutamol 100ug | 58 | 20 | 23 | 20 | 115 | 20 | 19 | 20 | -57 | 0 | -4 | 0 |
| Beclomethasone 200ug | - | 20 | 30 | 20 | - | 20 | 20 | 20 | - | 0 | -10 | 0 |
| Hydrochlorothiazide 12.5mg | 40 | 60 | 33 | - | 40 | 0 | 4 | 170 | 0 | -60 | -29 | 170 |
| Folic acid 5mg | - | 0 | 44 | 65 | - | 0 | 39 | 56 | - | 0 | -5 | -9 |

*Clinic A Clinic B Clinic C Clinic D

Appendix 6 (Stock-card utilization review) was used to obtain results tabulated above, and the focus was on the discrepancies found between stock physically counted by the researcher versus stock recorded on the stock-card. Based on results tabulated above, overall discrepancies are less for clinic D at a difference of -70 compared to other clinics, followed by clinic B with a discrepancy of -99, Clinic C at a discrepancy of -126, and clinic A with a discrepancy of -650, which was the most significant variance.

This is an indicator of stock-card utilisation, and it shows the efficiency in which the clinics use the stock cards, it also shows that inventory for medicines for NCDs is not being managed as they should. The paper trail is not clear as only “stock counting” is indicated on the stock card, and it is not consistent. The other factor is; information such as minimum/maximum stock levels are not indicated, “Orders” and “receipts” are also not indicated on the stock card.

Positive variances will result in a positive financial discrepancy, whereas the negative variance will result in a negative financial discrepancy. All these are in contravention of the Public Finance Management Act (1999) Like in accounting, the stock must always balance, and i.e. the number of items recorded on the stock card or an electronic system must always match the quantity counted physically. In all clinics, the discrepancies are on the negative, which reflects bad financial management because the stock has prices, which means that there is a financial responsibility that comes with managing stock, and the mismanagement will have an adverse financial implication.

**Table 4.8: Stock-card discrepancy check**

| Features of sample | Number percentage as an average n (%) |
|---|---|
| Positive discrepancies | n=3 (20%) |
| Negative discrepancies | n=6 (40%) |
| No stock cards (Blank) | n=4 (26.67%) |

The above table (4.8) indicates the percentage of discrepancies found in table 4.7. Negative discrepancies were found to be highest at 40% as an average between the four clinics. The negative discrepancy simply means that stock is being physically taken from the storeroom without being subtracted from the stock card. A Positive discrepancy, which was found to be 20%, is an indicator that stock is being added to brazier bins without being put on the stock card, which results in more items found during stock count than items recorded. The blank or no stock card indicates that 26.67% of the items are not being accounted for as there is no evidence of when stock is received, issued, or counted. Overall the discrepancies are an indicator that stock is poorly managed, across all clinics.

### 4.4.3 Ordering practices

Respondents indicated that 77.78% of the time, professional nurses are responsible for ordering the stock, and pharmacist assistant orders the stock 22.22% of the time. This variation differs in that no pharmacist assistant is appointed in all the clinics. It could also mean that some nurses give external people (Pharmacist assistants from feeder hospital) permission to place orders for them.

45% of the respondents (majority) indicated that Community Service Pharmacist (CSP) is responsible for clinic orders. They audit the items before sending orders to the medical depot. They are also responsible for stock movements, i.e. when an item is fast-moving in one facility but slow-moving in another, they move it to a fast-moving facility (65% of Nurses indicated they practice stock rotation).

The Majority of the respondents, 72.22%, indicated stock is ordered on a bi-weekly basis, whereas 16.67% is convinced it is done monthly, and 11.11% indicated they do it weekly. The weekly one is done from the hospital as the pharmacists indicated in their questionnaire, which will be later discussed in the section for feeder hospital.

The frequency is important as stock levels go down with time, ideally before safety stock is reached. When the order arrives, the stock level is brought back to maximum.

Record keeping of order forms was not readily available in all clinics from which data was collected from, as personnel do not have a copy machine and rely on the feeder hospital to provide copies; however, some copies were observed in 2 of the clinics as documented in the researcher checklist. The practice was not consistent as some weeks did not have copies at all despite ordering, and some of the orders from feeder hospital were made via telephone as supported by data collected from the pharmacists.

### 4.4.4 Re-order levels

All four clinics had re-order levels for tracer medicines only and none for all the other medicines. The lack of re-order levels by the clinics is a significant factor that contributed to a shortage of medicines, and it can also lead to over-stocking, which will result in expired stock or under-stocking items, which results in stock-outs.

### 4.4.5 Calculation of re-order levels

The minimum and maximum stock levels, if calculated correctly, help personnel to not exceed the required levels and also helps reduce stock expiry. The opposite is true for minimum/maximum stock levels being too low; this results in stock-shortages (WHO, 2006)

44.44% of the respondents said they use a formula to determine quantities needed to order each time an order is placed, 38.89% said they do not know how the quantities are determined, orders are done haphazardly, the remaining 16.67% said they use “other” methods like ordering based on the invoice of the previous quantity received.

The other reason for the lack of ROL for all items is no maximum and minimum stock is documented on the stock card; reasons could vary from staff not knowing how to calculate or the lack of time to calculate them even though they had indicated they know how to do it and it was also indicated that a formula is used to order; it was still not being implemented across all the clinics. Results backed this theory up as only 38.9% of staff did know how to calculate maximum stock, which is the minority, compared to the 61.1% who knew how to calculate it but was not practising hence the discrepancy.

The p-value was found to be significant (p=0.016) for the determination of quantities to order using a formula, where 87.5% of the respondents indicated they used a formula when ordering would be ideal. The chi-square value for knowledge of calculation of average monthly consumption was found to be 0.02, which is significant. 72.7% (majority) of the respondents do not know how to calculate it compared to 27.3% (minority) who do know.

The relationship between how often stock is counted and knowledge of calculation of maximum stock was found to be significant at a P-value of 0.01, whereby 83.3% of the respondents do know how to calculate maximum stock according to answers obtained from the questionnaire.

### 4.4.6 Standard Operating Procedure

The Standard operating procedure is a step-wise approach compiled by an organisation; it aids employees with day to day tasks such that it does not differ from person to person. It aims to achieve efficiency, quality output, uniformity of performance and helps with compliance of industry regulations (Schellack & Meyer, 2010).

SOP for medicine supply was looked into for all necessary functions of a pharmacy storage area for medicines, starting from Ordering, Receiving, Cold chain management, storage, and management of expired stock, among other things.

44.4% (n=8) of respondents were aware of the existence of SOP for medicine supply management, whereas 38.9% (n=7) were not aware of it, 16.7% (n=3) left a blank space on the questionnaire. It could mean the question was not well understood, or they were not sure whether the SOP was available or not.

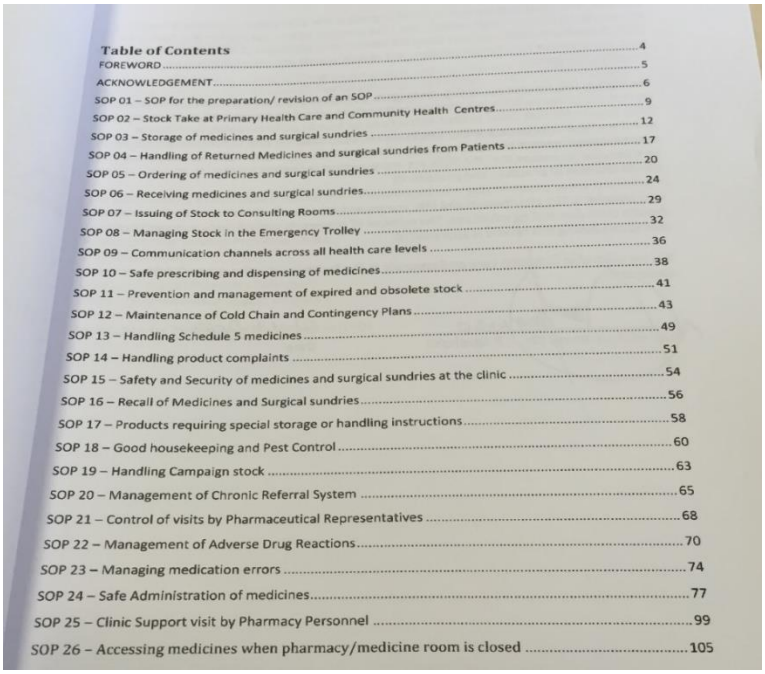


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**Figure 4.6: SOP Booklet for PHC's**

Researcher findings were that each Clinic has a booklet consisting of 26 SOP's (Figure 4.6) for all Clinics; the booklet covers SOPs from stock-take, ordering, receiving, managing cold chain products, and accessing of medicines when the pharmacy/medicine room is closed to the handling of returned medicines among other things.

### 4.4.7 Short-dated list

The purpose of a short-dated list is to ensure that no stock expires on shelves and also aids employees in applying the principles of FEFO as they become aware of which items expire first and ensure the expiry of such items does not happen (Higgins, 2010).

61.11% of respondents indicated they compile a short-dated list weekly, 33.33% quarterly, and a small number of 5.56% monthly. This exercise is of crucial importance as it helps personnel to utilize stock which expires first and rotate to other facilities to avoid expiration.

The study found discrepancies between the questionnaire filled by professional nurses and the researcher checklist, such as availability of an expired medicine register and excess stock being placed on pallets. No expired medication was found on the premises of all four clinics, and the medication is taken back to the hospital by the pharmacists and documented and priced per clinic, then put in buckets for disposal.

All pharmacists at the feeder hospital (n=20) said there is a system for checking expiry dates on medicines in the storeroom as well as the consulting rooms.

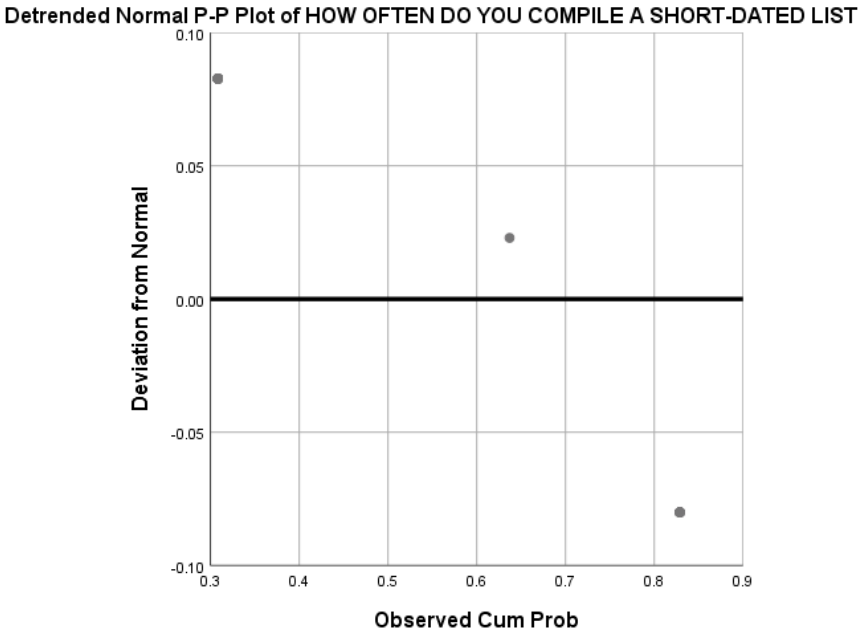


**Figure 4.7: Short-dated list compilation plot**

Figure 4.7 shows a deviation plot of a compilation of the short-dated list; it validates the significance of compiling a short-dated list for all items in the storeroom. The P-value is 0.02, which is significant. Compiling a short-dated list assists personnel to practice stock rotation among themselves as clinics or with the feeder hospital so that slow-moving items could be shared and curb their expiry.

### 4.4.8 Handling of expired medicines

Expiry dates should be checked at regular intervals. Items with short expiry dates should be placed in front of those with longer expiry dates. This method is called FEFO, which is short for First Expiry First Out. Items without expiry dates should be stored in the order they were received. There may be a date of manufacture on the container, indicating the older stock should go first. This method is referred to as FIFO, short for First in First Out (Higgins, 2010).

90% of the respondents acknowledge Clinics do have an SOP for dealing with expired and obsolete stock, whereas 10% do not know about such an SOP. 100% of respondents said there is a system for checking expiry dates on medicines in the storeroom as well as the consulting rooms.

Based on the information gathered from all parties, nurses and pharmacists work together to ensure no stock expires, and nurses work with each other across facilities for stock rotation of short-dated stock as no expired medicines were observed in all clinics.

### 4.4.9 Distribution

The distribution cycle begins when the supplier dispatches the medicines. Distribution management includes ensuring the availability of an efficient network of storage facilities, keeping reliable records of medicine stock balances and consumption,

maintaining accountability procedures, ensuring adequate and secured storage conditions, having reliable transport systems, and using reinforcing reporting and supervision practices (Quick *et al*., 2013).

Data were collected from two groups of the population, namely drivers (n=10) from the depot and nursing personal (n=18) at clinics. The results were further validated using the researcher checklist employed.

#### 4.4.9.1 Delivery of medicines

Results obtained in terms of the delivery of medicines to clinics from the drivers at the medical depot;

- Stock is always delivered in a closed van, all respondents answered positively, 60% (n=6) of respondents indicated that orders always fit into a vehicle at one time and the other 40% (n=4) does not fit. This was further observed on results obtained from nursing personnel; sometimes deliveries are done on two different days for the same order. Figure 4.8 indicates that it is a partial delivery and not the full delivery, which means the remaining stock was delivered on a different day.
- 90% (n=9) of the respondents answered yes to a dedicated vehicle to deliver medication, whereas 10% (n=1) indicated there is no dedicated vehicle, whichever one is available gets utilized.
- Thirty percent (n=3) of the drivers reported there is always a discrepancy in terms of medicine delivery, 60% (n=6) reported there is sometimes a discrepancy, and 10% (n=1) reported to have never experienced a discrepancy**.**
- 90% (n=9) of the drivers work on a pre-determined delivery schedule and are always almost able to deliver on the said dates, whereas only 10% indicated they do not work on a schedule (n=1). The10% is a contradiction because the researcher observed a schedule during data collection.

- Ninety percent (n=9) of the drivers reported maintaining a cold chain during transportation, and the ten percent (n=1) reported never to pay attention. It could be that he was an assistant driver or was new, as, in all clinics, the cold chain was always maintained in terms of storage.
- If the cold chain is not maintained or it is broken, 20% (n=2) of the drivers indicated they report to the clinic, and 80% (n=8) indicated they report to the medical depot. The stock is then taken back to the medical depot, as clinics do not accept obsolete stock. Receiving such stock could result in negative financial implications as cold products are very expensive.
- The drivers confirmed that stock is received by nursing personnel all the time (100%). Boxes are counted and checked against the delivery note before signing it and putting a stamp.

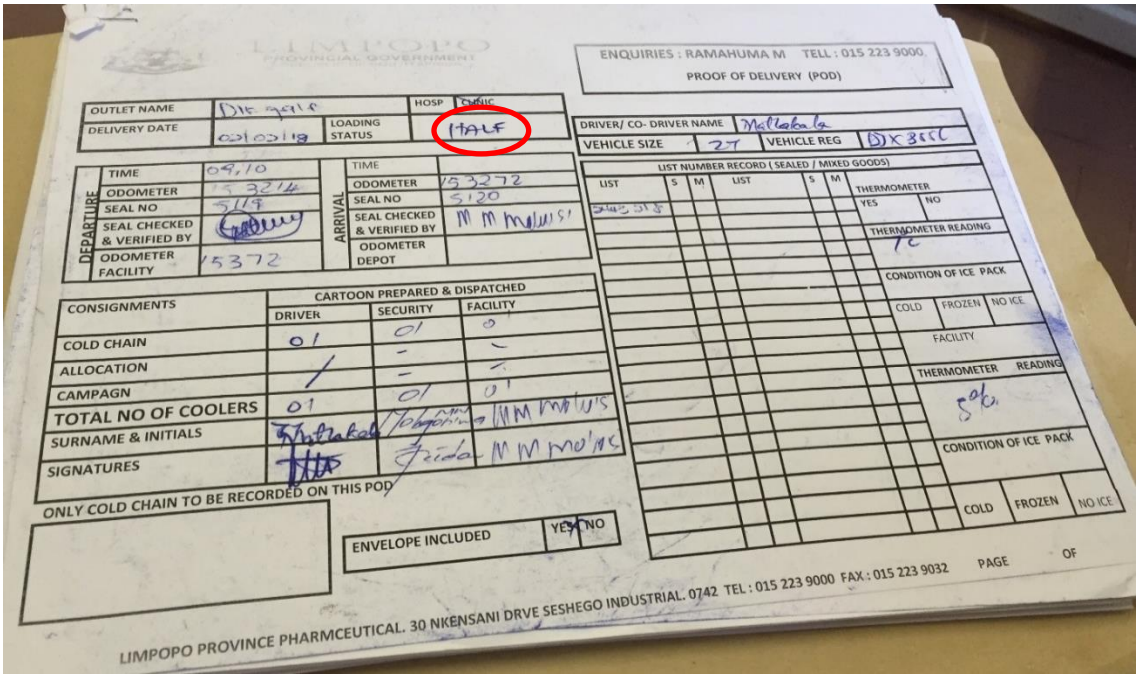


**Figure 4.8: A Delivery note from the medical depot**

### 4.4.9.2 Receiving

Literature states that; upon delivery of medicines, the responsible person must carry out a full inspection starting from seal number of the vehicle, counting the number of

boxes, and checking the temperature of the cooler box for thermos-labile medicines. Schedule 5 and cold items should be received first, as they are considered high-value items (GPP, 2017).

Upon the arrival of a shipment, the responsible personnel for receiving should check the items delivered stock from the supplier. The delivery should contain what was ordered. Supplies should be checked for the following; Quality (damaged goods or poor packaging), expiry date (whether it is not expired or near expiry date), as well as checking for fewer items than ordered and items received without being ordered (SIAPS, 2012).

The following results were obtained in terms of the receiving of medicines at clinics from nursing personnel;

- All respondents N=18 indicated a file is kept for invoices of all items received, either from the medical depot or the hospital. Stock acquired from other clinics were documented in a manual book. The researcher checklist proved this to be true for all clinics.
- The stock is always received by nursing personnel 100% of the time, and this was also observed in the questionnaire by drivers from the medical depot.
- 77.78% of respondents indicated an SOP for receiving is available, and 22.22% indicated that it is not available. The difference between the responses indicated that information might not be well disseminated among all staff members as a copy of all SOPs was found in all the clinics, as discussed in the previous sub-topic.
- 70% (n=7) of the drivers reported there is always personnel to count the number of boxes, and 30% (n=3) reported there is sometimes a person to check the boxes upon delivery. The response on the nursing personnel questionnaire was, they are sometimes short-staffed and are not always able to receive the stock as they should due to patient overload.

- As per the researcher checklist, deliveries are not always acknowledged, signed, and dated on the prescribed forms in 50% of the clinics, and the other 50% always do it as documented. This was also reflected by the response obtained from the driver questionnaire; 70% of the drivers reported there is always personnel to count the number of boxes, and 30% reported there is sometimes a person to check the boxes upon delivery.

The picture below (Figure 4.9), is an example of an invoice for stock received from the medical depot (a) and feeder hospital (b). As shown by the picture below, most of the invoices filed are not signed in 3 of the 4 clinics.

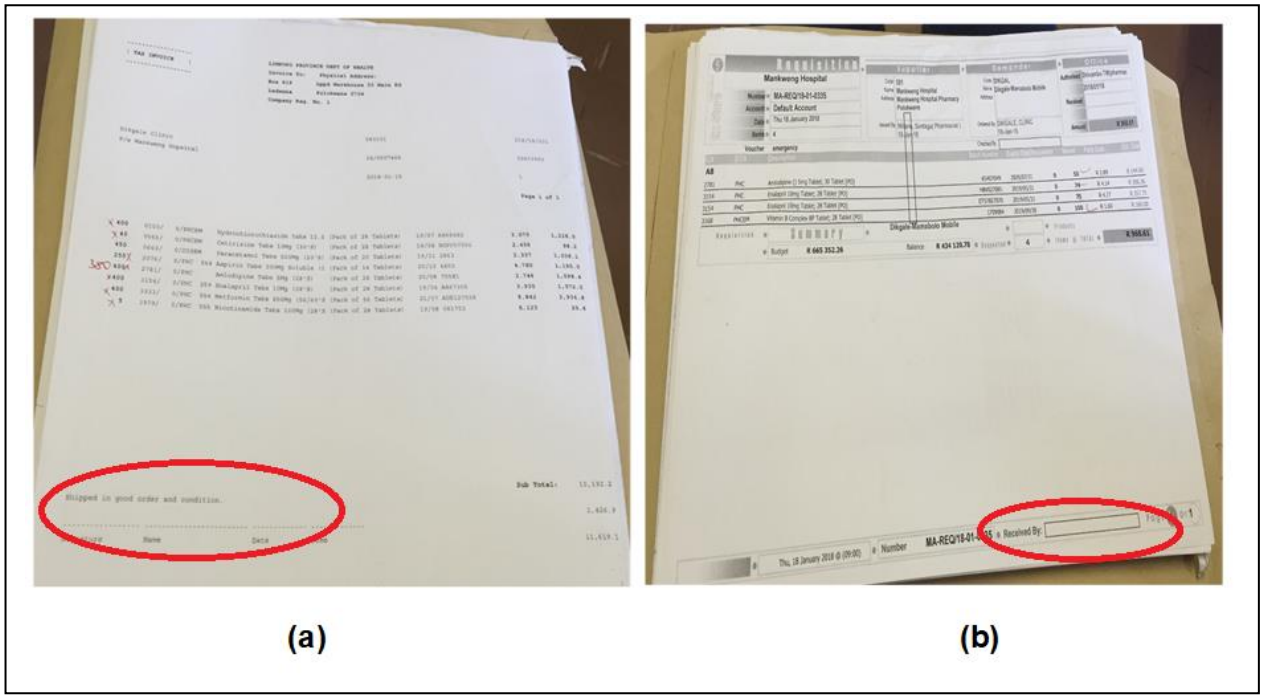


**Figure 4.9: Invoice from medical depot and feeder hospital**

The scale of assessment was either on compliant or non- compliant, and there was no partial compliance, and the tool used to collect this data was the researcher checklist.

A total of 17 quality indicators were evaluated by the researcher using the research checklist (Appendix 4) to assess the medicine supply management at the clinics. Scoring is done either by giving 100 for compliance and 0 for non-compliance. The total

score is for 1700 to achieve a100% compliance. The following table (Table 4.9), illustrates the results obtained for all the clinics.

**Table 4.9: Quality indicators for medicine supply management at clinics**

| Indicator | % Compliance (Average) | Clinic A | Clinic B | Clinic C | Clinic D |
|---|---|---|---|---|---|
| An authorised person receives stock physically | 100% | 100 | 100 | 100 | 100 |
| Boxes are counted and verified, condition checked for quality | 100% | 100 | 100 | 100 | 100 |
| Deliveries are acknowledged and dated, signed and stamped on the prescribed forms | 100% | 100 | 100 | 100 | 100 |
| Discrepancies and damages are noted on the delivery note | 100% | 100 | 100 | 100 | 100 |
| Delivery person signs and dates delivery before leaving the facility | 100% | 100 | 100 | 100 | 100 |
| Fridge items are delivered in a cooler box, and cold chain maintained | 100% | 100 | 100 | 100 | 100 |
| All discrepancies are recorded and reported to suppliers and copies filed | 0% | 0 | 0 | 0 | 0 |
| Are all receipts recorded on stock cards? | 25% | 100 | 0 | 0 | 0 |
| SOP for receiving is available | 100% | 100 | 100 | 100 | 100 |
| **Stock card** | | | | | |
| Is there an SOP for handling a stock card? | 100% | 100 | 100 | 100 | 100 |
| There is a stock card for each item in the storage area | 75% | 100 | 100 | 100 | 0 |
| All information on the stock card is recorded and up to date | 25% | 0 | 0 | 100 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| The stock card is kept in the same bin as the item | 100% | 100 | 100 | 100 | 100 |
| Information is recorded on the stock card at the time of movement | 0% | 0 | 0 | 0 | 0 |
| The amount on balance tallies with physical count | 0% | 0 | 0 | 0 | 0 |
| A physical count is made regularly | 100% | 100 | 100 | 100 | 100 |
| Minimum/maximum stock levels indicated in pencil | 0% | 0 | 0 | 0 | 0 |
| **Total** | **1125 (66%)** | **1200** | **1100** | **1200** | **1000** |

*100 = Complies, 0= non-compliant

None of the clinics complied with the standard of recording receiving discrepancies and reporting them to the supplier as there was no evidence of such records found in all clinics. Only 25% of the clinics (clinic A) complied with the standard of recording receipts on stock-cards regularly/frequently, and the other three were not recording at all.

Almost all the clinics except one had a stock card for each item in the storeroom, and the other one did not have a stock-card for all items. None of the clinics recorded the information at the time of movement, this is noted by the frequency of “stock count” on the stock card and no issues being documented on them, and none of the clinics had a stock balance which tallied with the stock card. All the clinics did not have a minimum and maximum stock levels documented on stock cards despite indicating they do know how to calculate them in the questionnaire administered.

The total score for all indicators is 1700; however, the total average compliance for all clinics is 1125 (66%), which means clinic A and C at 71% were above average whereas clinic B and D at 65%.

## 4.5 CHALLENGES EXPERIENCED

Table 4.10 shows challenges experienced at clinics by two population groups, i.e. the nursing personnel and the pharmacists. Parts of the challenges contradict results obtained by the researcher, as no expired medicines were found in all clinics.

**Table 4.10: Comparing challenges faced by nurses and pharmacists**

| Nursing personnel | Pharmacists |
|---|---|
| Stock-outs | Stock expiration |
| Not enough storage | Storage problems (not enough) |
| Over-stocking | Frequent orders by clinics |

Twenty-five (25%) percent of pharmacists who consented to participate in the study had a challenge of expiration of stock from the clinics. However, when the researcher did a checklist, no information about stock expiry was documented, and there is no record of expired medicine that was destroyed or sent to the feeder hospital.

Ten percent (10%) of the pharmacists indicated storage problems as the main challenge with clinics, and this information was validated by the researcher checklist wherein all clinics were found to be having little storage space to keep enough pharmaceuticals that are needed for a month's supply. Pharmacists further indicated duplicate orders by nursing personnel, and they are supposed to order bi-weekly; however, the nursing personnel still request for the stock from the hospital weekly.

The issue of over-stocking indicated by nursing personnel reflects on storage when sufficient stock is ordered; storage is not enough, and staff might get an impression that stocking was over-done. This information is validated by the lack of minimum and maximum stock levels on stock cards, and order quantities are not documented on

stock-cards; right quantities frequently needed are not rightfully documented, which might be a cause of some of the challenges experienced.

Sixty-five (65%) percent of the pharmacists indicated that both expiries of medicines and storage space were a challenge they often encountered with clinics, and this information contradicts the one obtained from nursing personnel as they indicated their challenge is stock-outs. The Nursing personnel also indicated they have an issue with over-stocking. However, their ordering practices do not reflect this problem well; it only shows that not enough stock is kept hence the double ordering, as discussed earlier in chapter 4.

83.3% of respondents ticked late orders on a question of challenges experienced in terms of clinics. Causes of stock-outs experienced; 66.7% said supplier-related, 16.7% said quantification related where more product than estimated is required, and the remaining 16.7% indicated it is both supplier-related and quantification related.

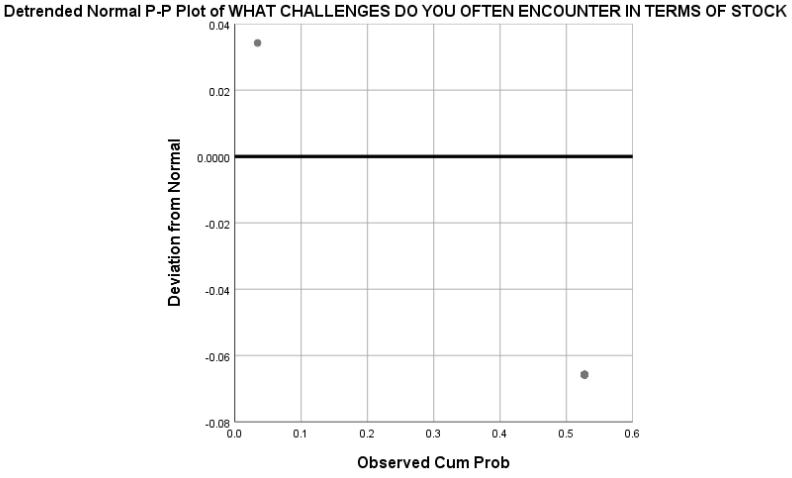


**Figure 4.10: P plot of challenges experienced**

Figure 4.10 shows a p-value of 0.03., which means that challenges experienced in terms of inventory management are significant.

## 4.6. COMPARISON OF RESULTS WITH IDEAL CLINIC STANDARDS

The Ideal clinic project was designed to mitigate the current deficiencies of PHC, as already discussed in detail in chapter 2.

### 4.6.1 Infrastructure

According to a study that was done by Hunter *et al*. (2017), overall compliance for clinics was 28%. This study was done across the country, and a total of facilities visited was 3477. In this study, the percentage compliance was 66%, which is above average when compared to the mentioned study above. This is due to clinic non-compliance to vital elements such as adequate storage space, no signs of pest control, among others.

### 4.6.2 Supply chain management

Results obtained from Hunter *et al.* (2017) showed that clinics could reach average scores; however, 80% of the clinics did not achieve ideal status. Similarly to this study, an average percentage of 66% was achieved for compliance to supply chain management practices due to lack of staffing and time-management for duties performed outside of attending to patients.

### 4.6.3 Cold chain management

The NHI feasibility study done showed 87% on average, for compliance with the monitoring of temperature for a thermo-labile fridge. In this study, the average percentage for compliance for maintenance of cold chain was found to be 94.4%, which is well above ideal clinic standard findings.

### 4.6.4 Human resource

According to findings by Hunter et al. (2017), only 75% of staff are available on PHC premises, and they are expected to perform all duties. In this study, nursing personnel is the only health professional.

## 4.7 SUMMARY

This chapter discussed the main findings of the study regarding the staff training on MSM, availability of suitable infrastructure, practices, and challenges associated with the inventory management at the Dikgale Primary Health Care clinics. Data collected from various sources (pharmacists, professional nurses, drivers from the medical depot) were analysed quantitatively, findings were cross-referred with researcher findings using the check-list. The following chapter contains a summary of conclusions based on the results of this chapter and recommendations.

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# CHAPTER 5

# CONCLUSION AND RECOMMENDATIONS

This chapter summarises the findings and concludes the study. It is divided into three main parts which are Infrastructure, human resource, and inventory management.

## 5.1 INFRASTRUCTURE

Adherence to minimum standards of good pharmacy practice is a legal requirement that all facilities which offer pharmaceutical services must do, as stipulated in GPP (SAPC, 2014). The facility should be such that access of the public to medicines and scheduled substances is controlled, the pharmacy is clean and tidy, and the appearance is of professional standards.

One of the objectives was to evaluate the infrastructure for the storage of medicines at Dikgale PHCs. The objective was met by the results obtained below.

### 5.1.1 Locking of the Pharmacy Storeroom

The study found that the medicine store is locked at all times when not in use across all clinics. This conclusion is based on the results obtained as some of the nursing personnel were not aware that the storeroom needed to be locked. Schedule 5 medicines were locked in a cupboard together with a schedule 5 register across all clinics. The physical quantity of the locked items was tallying with the register across all four clinics.

### 5.1.2 Storage Area

The infrastructure of three out of four clinics was the new model type with a dispensary, whereas one clinic was the old model with medicine being stored in a small room. Air-conditioner was functional in all four clinics; the temperature was monitored in all clinics,

although some (two) were not always consistent with monitoring it twice a day as stipulated in GPP.

All four clinics did not have adequate storage space to store enough stock to last for a month. This factor contributed to some items not being available as nursing personnel orders based on the available storage space. This was further observed during the collection of data from the pharmacists at the feeder hospital, and nurses sometimes order from the hospital the same items ordered from the medical depot and receive a double supply. Other items like bandages and Large Volume Parenteral (Intravenous solutions) were stored in a different storeroom with toilet paper and stationery in four of the clinics. The temperature of the room was not monitored in all clinics from which data was collected.

### 5.1.3 Conditions of the Storage Area

Only one out of four clinics had no cracks on the wall and no sign of water damage. Two of the clinics had a ceiling that was in good condition. Three of the clinics had no sign of pest infestation. The clinics do not fully comply with the GPP requirements as some items are stored where they are not supposed to be stored, and conditions of storage are not fully complied with by the personnel.

## 5.2 HUMAN RESOURCES

The GPP standards for training personnel aim to ensure that staff can provide a comprehensive and useful pharmaceutical service; all staff should continuously review their level of professional knowledge and expertise. One of the objectives of the study was; to establish the availability of trained personnel to manage the medicines supply at Dikgale PHCs. The objective is met through the results obtained below.

The study found in all clinics concerned, stock control and stock management are done by professional nurses (Enrolled Nurses) only as they are appropriately qualified, competent, and fit to work in a pharmacy. Pharmacy act 53 of 1974 allows nursing personnel to handle and dispense medicines to patients provided they have a dispensing license. The district issues the license to all clinics as a measure to meet such a requirement.

The study found that not all nursing personnel received training (33.3% of respondents) on managing pharmaceuticals, especially the newly appointed as discussed in chapter 4. Pharmacists are responsible for training nursing personnel, based on the results obtained; they seemed not to be doing well in this aspect as the majority of them had not trained anyone (40% of the respondents); however, training could either be formal or informal, the latter being on the job learning and seeking clarity for procedures not well understood.

In all clinics, no pharmacist assistant is appointed to assist on-site, which means an already over-burdened nurse does all duties because patients still need to be attended. All programs which are implemented are done without increasing the number of employees at clinics; one such a program is the CCMD, which is a service for the collection of chronic medicine by patients, among other programmes.

The training gap needs to be closed in order to meet the minimum requirements as per GPP guidelines and also help to reduce medicine stock-outs as personnel will be well equipped to handle stock. Training needs to be done regularly, and every time a new person gets appointed.

### 5.3 INVENTORY MANAGEMENT

The burden of chronic disease for both communicable and non-communicable has been on the rise for some time, and it requires a health system that will provide a

comprehensive and proper service for NCDs and communicable diseases alike (Mahomed & Asmall, 2015). Medicines are especially essential in such patients, and the management should be comprehensive in order to meet the needs of the patients.

### 5.3.1 Ordering and receiving

In all clinics, a Professional nurse is responsible for ordering and receiving supplies; however, no signature specimen was available on site, and there is no rooster on who should do it when. Thirty-nine (39%) percent of the respondents did not know how to quantify order quantities; this factor contributes to stock-outs experienced at clinics. Orders are almost always made in writing, especially orders made to the medical depot. However, orders made from the feeder hospital are sometimes made telephonically. Stock is not always received on bin cards, as observed and discussed in chapter 4.

### 5.3.2 Usage of bin cards

The study found that stock card was not used every time a transaction was made. This was verified by counting the actual stock and comparing it to the stock written on the card. Both negative and positive variations were found and discussed in chapter 4.

### 5.3.3 Stock-take

According to GPP (2017), professional standards for a PHC; stock take is to be done twice a year, i.e. at the beginning and the end of a financial year. Pharmacists at feeder hospital (Community service pharmacists) are the ones tasked to do it since clinics do not have enough human resources to carry out the task. A report of variations and discrepancies is then sent to the District pharmacist.

An objective of the study was to evaluate the stock control systems used in clinics, ordering, and record-keeping methods. The objective was met from the findings of the results obtained. Stock control systems are in place but are not always utilised, and

processes are not consistent among staff members across clinics. In closing, stock control systems are inadequate and could be another factor that contributes to out-of-stock.

## 5.4 DISTRIBUTION OF MEDICINES TO CLINICS

The distribution of medicines begins after dispatch from the supplier. Delivery of medicines is done by the same ten drivers across Capricorn district clinics. Deliveries are scheduled, and almost always, the schedule is adhered to; however, sometimes deliveries get split if the load is too much and the remainder of the stock is delivered the next day, the loading status is noted to be incomplete (half). The Cold chain is always maintained during transportation of thermo-labile medicines as indicated by the temperature recorded, as depicted in chapter 4. Storage during the transportation is also essential; hence deliveries are done in a closed van as discussed in detail in chapter 4.

All clinics did not have a secure dedicated area for deliveries to come through, and the stock is usually offloaded outside of the medicine room upon receipt. All clinics do not have a dedicated person to receive stock and to receive stock immediately upon offloading as this may lead to theft of delivered items before consolidation and documenting on bin cards. This bothers transport officers as they always have to ask nursing personnel to receive the stock. Sometimes there is no one to check and count all boxes, resulting in stock being unattended for some time.

## 5.5 RECOMMENDATIONS

- Pharmacy personnel should be placed in all clinics to deal with stock related issues and maintenance of the pharmacy.
- All Nursing personnel should be trained on medicine supply management, and the importance of it should be emphasised upon appointment

- Pharmacists should do more to support clinics by providing training at each visit and look out for areas that lack. Infrastructure conditions need to be improved, and the current model does not address all the needs for adequate storage of pharmaceuticals
- Clinics could do well with an electronic stock control system linked to the feeder hospital, which will also make a determination of minimum and maximum stock levels easier.

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## APPENDIX 1: CONSENT FORM

**PROJECT TITLE:** Inventory management of non-communicable chronic diseases medicines in public health clinics at Dikgale community, Limpopo province

**SUPERVISOR:** Mr Poka M.S.

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 inventory management of medicines used to manage non-communicable chronic diseases
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 2: QUESTIONNAIRE STORE MANAGER/NURSING PERSONNEL**

Clinic ID: _____

Date of visit: _____

*mark with an (X) in the appropriate answer

| No | Question | Possible answer |
|---|---|---|
| | **Demographic questions** | |
| 1 | Age | 18-25 ( )<br>26- 35 ( )<br>36 – 45 ( )<br>45+ ( ) |
| 2 | Gender | Male ( )<br>Female ( ) |
| 3 | Number of years of experience | 1- 5 ( )<br>6 – 10 ( )<br>10+ ( ) |
| | **General questions** | |
| 1 | What is your category of registration with Nursing council? | Prof Nurse ( )<br>Enrolled Nurse ( )<br>Enrolled Nurs Ass ( ) |
| 2 | How many years have you been practising? | 1-3yrs ( )<br>3-5 yrs ( )<br>5+ yrs ( ) |
| | **Medicine supply questions** | |
| 1 | Who is responsible for inventory management of medicines for non-communicable chronic disease? | Nurse( )<br>Pharma assistant ( )<br>Pharmacist ( )<br>Medical officer ( )<br>Other ( ) |
| 2 | How often do you count the stock (balance the stock) | Once a week ( )<br>Once a month ( )<br>Other ( ) |

| | | |
|---|---|---|
| 3 | Where do you write the stock balance? | Stock card ( )<br>Tick register ( )<br>Other ( ) |
| 4 | How do you determine the quantities you need to order? | Formula ( ) specify<br>Don't know ( )<br>Other ( ) specify |
| 5 | What is your lead time? | …….. (days)<br>…….(weeks) |
| 6 | What challenges do you often encounter in terms of stock? | Over-stocking ( )<br>Stock-outs ( ) |
| 7 | Have you been trained on medicinessupply management? | Yes ( )<br>No ( ) |
| 8 | How many patients do you see per month? | |
| 9 | How many use medicines for management of non-communicable chronic disease? | |
| 10 | Do you have SOPs on medicine management? | ……. If yes provide proof |
| 10 | Do you know how to calculate Average Monthly Consumption (Ave) | Yes ( )<br>No ( )<br>Formula: |
| 11 | Do you know how to calculate the maximum stock? | Yes ( )<br>No ( ) |
| 12 | What do you use to write Minimum/Maximum stock levels on the stock card? | Pen ( )<br>Pencil ( )<br>Marker ( ) |
| | **Ordering practice** | |
| 1 | Are All orders are placed in writing and copies filed accordingly? | Yes ( )<br>No ( ) |

| | | |
|---|---|---|
| 2 | Do you have a file for keeping all the orders made? | Yes ( )<br>No ( ) |
| 3 | Is there a dedicated person for ordering stock? | Yes ( )<br>No ( ) |
| 4 | How often do you place orders? | Once a week ( )<br>Bi-weekly ( )<br>Monthly ( ) |
| | **Cold Chain Maintenance** | |
| 1 | Are all Vaccines stored in a refrigerator? | Yes ( )<br>No ( ) |
| 2 | Is there a back-up generator or other emergency power system for use in case of a power failure? | Yes ( )<br>No ( ) |
| 3 | Is there a dedicated EPI (vaccine)fridge? | Yes ( )<br>No ( ) |
| 4 | Is there an SOP for Cold chain management? | Yes ( )<br>No ( ) |
| | **Storage facilities** | |
| 1 | How often do you record the temperature of the room and fridge used to store medicines? | Twice a day ( )<br>Once a day ( ) |
| 2 | Is all stock stored on shelves? | Yes ( )<br>No ( ) |
| 3 | No stock is placed directly on the floor? Yes for stored on floor and No for Not stored on floor | Yes ( )<br>No ( ) |
| 4 | The storeroom is lockable and dedicated person holds the key? | Yes ( )<br>No ( ) |
| 5 | The storeroom has curtains or blinds? | Yes ( )<br>No ( ) |
| 6 | An SOP for storage conditions is available? | Yes ( )<br>No ( ) |
| | **Receiving supplies** | |
| 1 | Do you have a file for discrepancy records? | Yes ( ) |

| | | |
|---|---|---|
| | | No ( ) |
| 2 | Do you keep a file for invoices of stock received? | Yes ( )<br>No ( ) |
| 3 | How often do you compile a short-dated list? | Weekly ( )<br>Monthly ( )<br>Quarterly ( ) |
| 4 | Is there an SOP for receiving supplies? | Yes ( )<br>No ( ) |
| | Total | |

## APPENDIX 3: QUESTIONNAIRE PHARMACIST AT FEEDER HOSPITAL

Person ID: _____

Date of visit: _____

| No | Question | Possible answer |
|---|---|---|
| | **Demographic profile** | |
| 1 | Age | 18 – 25 ( )<br>26 – 35 ( )<br>36 – 45 ( )<br>45 + ( ) |
| 2 | Gender | Male ( )<br>Female ( ) |
| 3 | Number of years of experience | 1 – 5 ( )<br>6 – 10 ( )<br>10+ ( ) |
| | **General questions** | |
| 1 | Who is responsible for Clinic orders? | Pharma Ass ( )<br>Nurse ( )<br>CSP ( )<br>Other ( ) |
| 2 | How often do you assist Clinics with stock? | ……. Week<br>……Month<br>……Year |
| 3 | How often do you train Clinic staff on how to handle stock? | Once a year ( )<br>Twice a year ( )<br>Never ( ) |
| 4 | Do they practice stock rotation? | ……. If yes provide evidence |
| 5 | How often do you do Clinic visits? | Once a week ( )<br>Once a month ( ) |

| | | |
|---|---|---|
| | | Never ( ) |
| 6 | What challenges do you experience in terms of Clinics? | Emergency orders ( )<br>Expiration of stock ( )<br>Storage problems ( ) |
| | **Storage management** | |
| 1 | Medicines are stored in a secure pharmacy store or medicine room | Yes ( )<br>No ( ) |
| 2 | The pharmacy, pharmacy store or medicine room is fitted with burglar bars | Yes ( )<br>No ( ) |
| 3 | There is sufficient space in the pharmacy for orderly arrangement of stock and proper stock rotation | Yes ( )<br>No ( ) |
| 4 | There are no cracks, holes, or signs of water damage in the pharmacy. Yes if there are no cracks and no if there are | Yes ( )<br>No ( ) |
| 5 | The storage area is clean and tidy (shelves dusted, floor swept clean and walls clean) | Yes ( )<br>No ( ) |
| 6 | Medicines are stored neatly on shelves according to a classification system | Yes ( )<br>No ( ) |
| 7 | There are no medicines stored directly to the floor ( yes if not stored and No if there is ) | Yes ( )<br>No ( ) |
| 8 | Only authorised personnel have access to the pharmacy store | Yes ( )<br>No ( ) |
| 9 | A working air-conditioner is present in the storage area | Yes ( )<br>No ( ) |
| 10 | Temperature is measured twice daily (morning and afternoon) in both the store room and consulting room | Yes ( )<br>No ( ) |
| 11 | Is there an SOP for storage facility layout? | Yes ( )<br>No ( ) |

| | | |
|---|---|---|
| | **Cold chain maintenance** | |
| 1 | Each refrigerator has a working dial thermometer | Yes ( )<br>No ( ) |
| 2 | The temperature in the refrigerator is betwwen 2 – 8 degrees | Yes ( )<br>No ( ) |
| 3 | No medicines or vaccines are stored in the refrigerator door | Yes ( )<br>No ( ) |
| 4 | No food is stored in the refrigerator. (yes if no food is stored and no if food is stored) | Yes ( )<br>No ( ) |
| 5 | A backup system is available for use in case of power failure | Yes ( )<br>No ( ) |
| 6 | Is there an SOP for Cold Chain Management? | Yes ( )<br>No ( ) |
| | **Legislation/practice** | |
| 1 | Standard operating procedures (SOP) are available for dealing with Expired/ obsolete stock as well as stock rotation? | Yes ( )<br>No() |
| 2 | Documentation showing proof of ordering and receipt of stock is available | Yes ( )<br>No ( ) |
| 3 | FIFO and FEFO principles are practiced | Yes ( )<br>No ( ) |
| 4 | A system is in place to check expiry dates on medicines in the medicine room and consulting rooms | Yes ( )<br>No ( ) |
| 5 | No expired medicine are observed in store room or consulting room. (yes if not observed and no if observed0 | Yes ( )<br>No ( ) |
| 6 | A system is in place to write off any expired medicine | Yes ( )<br>No ( ) |
| | Total (Sum of positive responses) | |

## APPENDIX 4: RESEARCHER CHECKLIST

Clinic ID: _____ 1= Complies 0= not compliant

Date of visit: _____

| No | Aspect | Score |
|---|---|---|
| | **Storage procedures** | |
| 1 | Stock is placed on shelves | |
| 2 | Excess stock placed on pallets | |
| 3 | Medicines are classified on shelves by dosage form or pharmacological class | |
| 4 | Items grouped in quantities that are easy to count | |
| 5 | No expired medicines on shelves | |
| 6 | Medicines with shorter expiry dates are placed first in Brazier bins | |
| 7 | Expired medicines are separated in a marked container and away from other medicines in the storage area | |
| 8 | Thermo-labile medicines are stored in the refrigerator | |
| 9 | Items without expiry dates are stored in order in which they were received | |
| 10 | No damaged containers or packs were found on shelves | |
| 11 | There is a record of destroyed/ expired medicines | |
| 12 | Schedule 5 is stored in a locked cupboard | |
| 13 | SOP for storage procedures is available | |
| | **Infrastructure conditions** | |
| 1 | Is the storage area separate to Dispensing area? | |
| 2 | Is the storage area large enough to keep all supplies? | |
| 3 | The storage area is kept locked all the time when not in use | |
| 4 | The key is kept by an authorized person | |
| 5 | There are no cracks, holes, or sign of water damage on walls | |
| 6 | Is the ceiling in good condition? | |

| | | |
|---|---|---|
| 7 | Air-conditioner is installed and is in good working condition | |
| 8 | The windows are painted white or have curtains | |
| 9 | The windows are high rise or have burglar proof bars | |
| 10 | The storage area is pest free | |
| 11 | The refrigerator is in good condition | |
| 12 | Temperature records (room and fridge) are available and up to date | |
| 13 | No stock is placed directly on the floor | |
| 14 | There is no food in medicine fridge | |
| | **Ordering** | |
| 1 | The SOP for ordering is available | |
| 2 | Copies of orders are duplicated and filed accordingly | |
| 3 | Signature specimen for person authorised to place orders is available | |
| | **Receiving supplies** | |
| 1 | Deliveries are received by an authorized person physically | |
| 2 | Number of boxes are counted and verified, the condition of the boxes is also checked for quality | |
| 3 | Deliveries are acknowledged and dated, signed and stamped on the prescribed forms | |
| 4 | Discrepancies and damages are noted on the delivery note | |
| 5 | Delivery person signs and dates delivery before leaving facility | |

| | | |
|---|---|---|
| 6 | Fridge items are delivered in a cooler box and thermometer is in place to record the temperature of the delivery container | |
| 7 | Supplies received match items on invoice | |
| 8 | Are there Broken, leaking or damaged containers? | |
| 9 | Are items unsealed or unlabeled? | |
| 10 | All discrepancies are recorded and reported to suppliers and copies filed | |
| 11 | Are all receipts recorded on stock cards? | |
| 12 | SOP for receiving stock is available | |
| | **Stock card** | |
| 1 | There is an SOP for handling a stock card | |
| 2 | There is a stock card for each item in the storage area | |
| 3 | All information on the stock card is recorded and up-to date | |
| 4 | The stock card is kept on the same shelve as the item | |
| 5 | Information is recorded on the stock card at the time of movement | |
| 6 | The amount on the Balance column of the stock card tallies with the stock in the brazier bin | |
| 7 | A physical count is made regularly | |
| 8 | Minimum/Maximum stock levels are indicated in pencil | |

| | Reference material | |
|---|---|---|
| 1 | Latest copy of STG/EDL PHC is available on site | Yes ( )<br>No ( ) |
| 2 | Latest copy of STG/EDL Paediatric is available on site | Yes ( )<br>No ( ) |
| | Total (sum of positive responses) | |

## APPENDIX 5: TRANSPORT OFFICER'S QUESTIONNAIRE

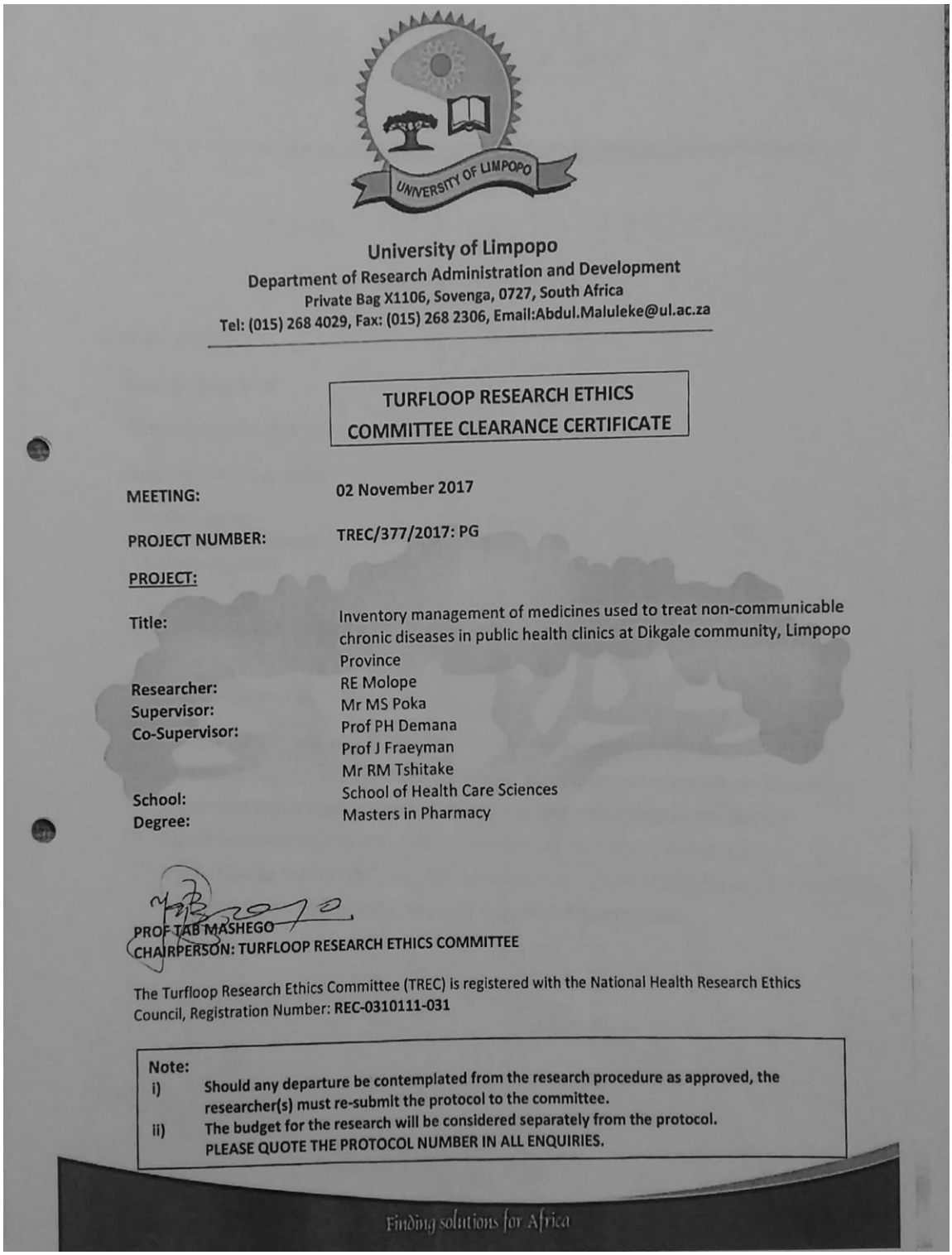
| No | Aspect | Answer |
|---|---|---|
| 1 | Is there a dedicated transport for pharmaceuticals? | yes ( )<br>No ( ) |
| 2 | Is there a dedicated vehicle to deliver medication? | yes ( )<br>No ( ) |
| 3 | What type of vehicle do you use to transport medication? | Closed van ( )<br>Open van ( )<br>Other ( ) |
| 4 | Does the order fit into a vehicle at one time? | Always ( )<br>Sometimes ( )<br>Orders have to be split ( ) |
| 6 | If the order is split, do you deliver the balance same day? | Yes ( )<br>No ( ) |
| 7 | Do you have a delivery schedule that you follow? | Yes ( )<br>No ( ) |
| 8 | Are you able to deliver on the drafted schedule? | Always ( )<br>Never ( )<br>Sometimes ( ) |
| 9 | Are security personnel always available to check the number of boxes? | Always ( )<br>Never ( )<br>Sometimes ( ) |
| 10 | Is there a dedicated personnel to receive the order at the Clinic? | Yes ( )<br>No ( ) |
| 11 | Who is the person receiving the order at the Clinic? | Nursing personnel ( )<br>Security ( )<br>Other ( ) |
| 12 | Are the number of boxes checked immediately when the stock is received? | Always ( )<br>Sometimes ( )<br>Never ( ) |

| | | |
|---|---|---|
| 13 | Please explain what happens when boxes are not checked immediately | |
| 14 | Is there an accompanying delivery note with each order? | Always ( )<br>Some times ( )<br>Never ( ) |
| 15 | Is the order checked against delivery note in your presence? | Always ( )<br>Some times ( )<br>Never ( ) |
| 16 | Is the delivery note signed by a person who received the order? | Always ( )<br>Some times ( )<br>Never ( ) |
| 17 | Do you return the delivery note back to the Pharmacy? | Always ( )<br>Some times ( )<br>Never ( ) |
| 18 | Has there been discrepancies in terms of delivery of medication? | Always ( )<br>Some times ( )<br>Never ( ) |
| 19 | Is the cold chain maintained when delivering medication? (Cooler box with ice packs) | Always ( )<br>Sometimes ( )<br>Never ( ) |
| 20 | If cold chain is not maintained, who do you report to? | Do not report ( )<br>PHC ( )<br>Pharmacy ( ) |

## APPENDIX 6: STOCK CARD UTILISATION AND STOCK AVAILABILITY REVIEW

| Product | Last stock balance recorded | Physical qty based on actual count | Diff betwn recorded &physical count | No of days stock-out Jan '18 | No of days stock-out Feb '18 | No of days stock-out Mar '18 | No of days stock-out Apr '18 | No of days stock-out May '18 | No of days stock-out Jun '18 |
|---|---|---|---|---|---|---|---|---|---|
| Digoxin 0.25mg tablet | | | | | | | | | |
| Isosorbide mononitrate 20mg tablet | | | | | | | | | |
| Glyceryl trinitrate 0.5mg tablet | | | | | | | | | |
| Methyldopa 250mg tablet | | | | | | | | | |
| Atenolol 50mg tablet | | | | | | | | | |
| Amlodipine 10mg tablet | | | | | | | | | |
| Enalapril 10mg tablet | | | | | | | | | |
| Carvedilol 6.25mg tablet | | | | | | | | | |
| Simvastartin 10mg tablet | | | | | | | | | |
| Metformin 500mg tablet | | | | | | | | | |
| Gliblenclamide 5mg tablet | | | | | | | | | |
| Saccharine | | | | | | | | | |
| Phenobarbital 30mg tablet | | | | | | | | | |
| Haloperidol 1.5mg tablet | | | | | | | | | |
| Orphenadrine 50mg tablet | | | | | | | | | |
| Salbutamol inhaler 100mcg | | | | | | | | | |
| B eclomethasone inhaler 200mcg | | | | | | | | | |
| Beclomethasone inhaler 100mcg | | | | | | | | | |

## APPENDIX 7: TREC APPROVAL



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 4029, Fax: (015) 268 2306, Email:Abdul.Maluleke@ul.ac.za

**TURFLOOP RESEARCH ETHICS COMMITTEE CLEARANCE CERTIFICATE**

**MEETING:** 02 November 2017

**PROJECT NUMBER:** TREC/377/2017: PG

**PROJECT:**

**Title:** Inventory management of medicines used to treat non-communicable chronic diseases in public health clinics at Dikgale community, Limpopo Province

**Researcher:** RE Molope
**Supervisor:** Mr MS Poka
**Co-Supervisor:** Prof PH Demana
Prof J Fraeyman
Mr RM Tshitake
**School:** School of Health Care Sciences
**Degree:** Masters in Pharmacy

**PROF TAB MASHEGO**
**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) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.**
ii) **The budget for the research will be considered separately from the protocol.**
**PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

## APPENDIX 8: DISTRICT APPROVAL

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH: CAPRICORN DISTRICT

REF : S.5/3/1/2

ENQ : Hlatshwayo MM

TEL : 015 290 9154/9096

FROM : DISTRICT EXECUTIVE MANAGER

TO : Molope RE
Department of Pharmacy
University of Limpopo
Private Bag x1106
Sovenga
0727

**SUBJECT : PERMISSION TO CONDUCT STUDY ON THE INVENTORY MANAGEMENT OF MEDICINES IN PUBLIC HEALTH CLINICS, GA-DIKGALE.**

The above matter refers:-

1. Permission to conduct the above study is hereby granted.
2. Kindly be informed that :
   - In the course of your consultation there should be no action that disrupts the services.
   - After completion of the research, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   - Kindly note that the Department can withdraw the approval at any time.
3. Your cooperation will be highly appreciated.

DISTRICT EXECUTIVE MANAGER

23.03.2018
DATE

1

## APPENDIX 9: PROVINCIAL APPROVAL

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Ref:4/2/2

Enquiries: Stols M.L (015 293 6169)

Molope RE (LP_2017 11 019)
Department of Pharmacy
University of Limpopo
Private Bag X1106
Sovenga
0727

Greetings,

**RE: Inventory Management of Medicines used to treat Non-Communicable Chronic Diseases in Public Health Clinics at Ga-Dikgale Community , Limpopo Province**

The above matter refers.

1. Permission to conduct the above mentioned study is hereby granted.
2. Kindly be informed that:-
   - Research must be loaded on the NHRD site (http://nhrd.hst.org.za) by the researcher.
   - Further arrangement should be made with the targeted institutions, after consultation with the District Executive Manager.
   - In the course of your study there should be no action that disrupts the services.
   - After completion of the study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   - The above approval is valid for a 3 year period.
   - If the proposal has been amended, a new approval should be sought from the Department of Health.
   - Kindly note, that the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated.

Head of Department

24/01/2018.
Date

18 College Street, Polokwane, 0700, Private Bag x9302, POLOKWANE, 0700
Tel: (015) 293 6000, Fax: (015) 293 6211/20 Website: http/www.limpopo.gov.za