AN ASSESSMENT OF COVID-19-RELATED PERSONAL PROTECTIVE EQUIPMENT'S (PPES) INVENTORY MANAGEMENT AND STORAGE PRACTICES IN SELECTED COVID-19 TREATMENT CENTERS IN ADDIS ABABA, ETHIOPIA

BY

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BY

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Advisor: Zelalem Bayisa (PhD)

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Declaration

This research paper, titled "An assessment of COVID-19 related Personal Protective Equipment's (PPEs) Inventory Management and Storage Practices in Selected COVID-19 Treatment Centers in Addis Ababa, Ethiopia " represents my work, which I completed after registering for a Master's degree at Addis Ababa University, and which has not previously been included in a thesis or dissertation submitted to this or any other institution.

The research was carried out at Addis Ababa University, Ethiopia, under the guidance of Zelalem Bayisa (Ph.D.).

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Statement of Certification

This is to certify that Helen Fikru has carried out this thesis on the topic entitled “An assessment of COVID-19 related Personal Protective Equipment's (PPEs) Inventory Management and Storage Practices in Selected COVID-19 Treatment Centers in Addis Ababa, Ethiopia” under my supervision. As a result, I certify that her work is appropriate and of sufficient quality to be presented in partial fulfillment of the requirements for the Master of Arts in Logistics and Supply Chain Management degree.

Zelalem Bayisa (PhD).

Signature: _____

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By

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List of Abbreviations/Acronyms

ARV	Antiretroviral
AA	Addis Ababa
AIDS	Acquired Immune Deficiency Syndrome
AMC	Average Monthly Consumption
COVID-19	Coronavrus Disease 2019
CSA	Central Statistical Agency
EOP	Emergency order point
EPSA	Ethiopian Pharmaceuticals Supply Agency
FEFO	First expired/First out
FMHACA	Food, Medicine and Health Care Administration
FMOH	Federal Ministry of Health
FMOH	Federal Ministry of Health
GSC	Global Supply Chain
HC	Health Center
HCWs	Health care workers
HIV	Human Immune Virus
Hsp	Hospital
IBM	International Business Machines
IFRR	Internal Facility Request and Resupply Form
IPLS	Integrated Pharmaceutical Logistics System
LIAT	Logistics Indicator Assessment Tool
LMIS	Logistics Management Information Systems
LSAT	Logistics System Assessment Tool
MOS	Months of Stock
MSH	Management Science for Health
PMED	Pharmaceuticals and Medical Equipment Directorate
PPE	Personal protective equipment
RAND	Random
RHB	Regional health Bureaus
RRF	Report and Requisition Form
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
SNNP	Southern Nations, Nationalities, and Peoples
SOPs	Standard operating procedures
STV	Stock transfer voucher number
USAID	United States Agency for International Development
WHO	World Health Organization

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Abstract

There is a global shortage of PPE, and one way to increase use is to improve the supply chain management systems. Health facilities in Ethiopia are managing COVID-19-related commodities using existing warehousing, inventory management, and distribution infrastructure, despite a lack of sufficient planning due to the pandemic. Maintaining proper inventory levels at many levels of the pharmaceutical supply chain is critical to ensuring continuous supply. Therefore, the purpose of this study was to assess the covid-19 related personal protective equipment's (PPEs) inventory management and storage practices in selected covid-19 treatment centers in Addis Ababa, Ethiopia. Using a checklist and semi-structured questionnaire, as well as an interview guide, a descriptive cross-sectional and exploratory study design with a mixed approach including quantitative and qualitative research methodologies carried out and SPSS and Microsoft Excel sheets were used to analyze quantitative data. Thematic analysis techniques were also used to manually analyze qualitative data. The assessment findings showed that 90.5 percent of PPEs were available, with 9.5 percent out of stock ranging from 137 to 180 days, with the average stock out frequency 1 lasting the full six months. To ensure that all PPEs were accurately inventoried, logistics tools were used. The findings of the assessment also showed that only three of the seven PPEs, however, had updated bin cards, therefore, with bin card stock exceeding physical count in two of the centers for 43 percent of the PPEs. The assessment indicated that the COVID-19 treatment centers failed to meet the majority of the storage practice standards, with adherence to each center's falling below 50 percent. Limited storage space, poor inventory infrastructure, insufficient staff, and timely inventory management training are all major challenges identified. Therefore, the inventory management and storage practices for PPEs were inadequate.

Key words: *Inventory Management, storage, PPEs, challenges, COVID-19*

CHAPTER ONE
INTRODUCTION

1.1 Background of the study

A novel Coronavirus disease (COVID-19) outbreak caused by 2019-nCoV started in China according to Zhu et.al (2019) and the World Health Organization (WHO) on March 11, 2020, has declared (COVID-19) outbreak a global pandemic (WHO, 2020).

Ethiopia confirmed its first case of COVID-19 on 13 March 2020; two days later the WHO declared a pandemic, and as of 17 Dec 2021, the country tested 3,963,291 suspects, of whom 375,019 (9.5%) cases had been confirmed positive and of these, 6,859 (1.8%) died and 350,777 (93.9%) recovered (Worldometer, 2021). Out of the total cases, 65 percent of the cases were found in Addis Ababa, which was the highest when compared with the other regions (COVID-19 et, 2021).

After WHO proclaimed the coronavirus disease pandemic a global health emergency, global supply chain (GSC) disruptions began. End-to-end supply chain activities, particularly medical and food supplies have been adversely impacted by the COVID19 pandemic.

The pharmaceutical sector is critical to the delivery of high-quality healthcare, especially during pandemics, when the supply chain for medicines can be overburdened or stopped for a variety of causes. Lockdowns also restricted in-country and cross-border movements, as it did during the early days of the COVID-19 pandemic; this had a significant impact on how pharmaceutical supplies were transported and supplied during that time.

Public and private health facilities in Ethiopia are currently managing the isolation, diagnosis, and treatment service of COVID-19 infection suspects and patients. For these services, proper management of health commodities is vital to have a smooth operation and quality service. Inventory management is one of the most crucial components of the pharmaceutical supply chain (Prasath, 2017). It all about ordering, receiving, storing, issuing, and maintaining proper records (USAID deliver project, 2011).

The backbone of health commodities supply management is inventory management, without it, the entire supply chain structure would fail. Failure to have efficient inventory management can result in resource wastage, irrational drug use, shortage, or overstock of essential medicines resulting in a poor quality of healthcare service.

1.2. Statement of the problem

In most circumstances, the Ethiopian government is responsible for delivering basic health services in the country. This depends, among other things, on the availability of the most cost-effective medicines that address the population's primary healthcare needs in sufficient quantities; appropriate dose forms, and of consistent quality at all times (FMHACA, 2010). When providing direct care to COVID-19 patients, WHO guidelines on preventing SARSCoV-2 infection in healthcare settings advocate using personal protective equipment (PPE) to increase the safety of HCWs and improve the safety of patients (WHO, 2020). Face masks, face shields, goggles, gowns, head covers, and boot covers are examples of personal protective equipment (PPE) that provide critical protection from hazardous or infectious particles in the environment (Livingston, 2020).

Health care workers (HCWs) who work with patients collect samples, and conduct tests are regularly exposed to symptomatic cases, increasing their risk of contracting the virus. According to the UN, over 1.4 million COVID-19 infections were reported in HCWs worldwide in July 2020, accounting for 10 percent of all cases (DW.COM, 2020). However, with adequate PPE use, the risk of transmission can be decreased (WHO, 2020). In addition, the proper use of PPE is enough to keep HCWs from being infected by SARSCoV-2 (Suzuki, 2021).

The COVID-19 response is expected to require 89 million medical masks, 76 million examination gloves, and 1.6 million medical goggles per month, according to WHO and distributed only nearly half a million units of PPE to 47 countries, but supplies are rapidly running out. PPE for health care workers and caregivers must be prioritized at the regional, national, and global level where shortages risk healthcare worker protection in the delivery of critical health services. In light of ongoing global PPE shortages, approaches that can help health care facilities maximize PPE use include improving PPE supply chain management systems.

The health facilities in Ethiopia were using the existed warehousing, inventory management, and distribution infrastructure to manage COVID-19 related commodities without having sufficient preparation due to the pandemic. Maintaining the right levels of inventory at multiple levels of the pharmaceutical supply chain is crucial to ensuring uninterrupted supply. Despite the fact that in Ethiopia there were several studies done in the area of different pharmaceutical categories , information on the magnitude of PPE availability, the actual inventory management and challenges particularly in the research field identified as a gap.

Hence, this study assessed the inventory management and storage practices COVID-19 related PPE in COVID treatment centers in Addis Ababa, Ethiopia.

1.3 Research Questions

The following research question is meant to address the objectives and the statement of the problem of this research.

- How is the availability of Personal Protective Equipment (PPE)?
- What is the inventory management practice of PPE?
- How PPE are stored at the Pharmaceutical store?
- What are the challenges of inventory management and storage of COVID-19 PPE?

1.4 Objectives of the Study

1.4.1 General Objectives

This study will be conducted to assess inventory management and storage practices of COVID-19 Personal Protective Equipment's (PPE) in selected public COVID-19 treatment centers in Addis Ababa, Ethiopia.

1.4.2 Specific Objectives

1. To assess the availability of Personal Protective Equipment (PPEs)
2. To evaluate the inventory management practice of PPEs in selected facilities
3. To assess how PPE are stored in the health facilities
4. To determine the challenges of inventory management and storage of COVID-19 PPEs.

1.5 Significance of the Study

Because the COVID-19 pandemic is, a recent occurrence and health facilities lack experience managing commodities related to pandemics, information on inventory management practices for COVID-19 products at public health management is limited. As a result, this research will provide insight into current inventory management and storage practices as well as the challenges that the public health sector is currently dealing with.

To maintain effective health service delivery, commodity management in the health sector should adhere to well-established principles while remaining flexible and adaptable to a variety of situations, including pandemics. Federal Ministry of Health (FMOH), Ethiopian Pharmaceuticals Supply Agency (EPSA), Regional health Bureaus (RHBs) and health facility management can use the research findings to improve the infrastructure of health facilities and the capacity of store managers. It could also be helpful to modify the existing inventory management standard operating procedures (SOPs) by accommodating best practices and challenges in handling COVID-19 PPEs.

In addition to the above, researchers will be able to use the findings to do additional research in the area of public sector inventory management and storage of COVID-19 related health commodities which are used for prevention, diagnosis and treatment.

1.6 Scope of the Study

The study aimed to determine the availability of Personal Protective Equipment (PPEs) for COVID-19, the stock out period, duration of stock out for the past six months, the discrepancy between the physical count on the day of the visit with the bin card or with the electronic inventory system. Furthermore, the practice of using electronic or hard copy bin cards to record transactions, the practice of ordering and receiving at the health facility whether appropriate documents as per SOPs are used, the storage conditions of PPEs, and the challenges of inventory management and storage.

The study area was selected public COVID-19 treatment centers found in the Addis Ketema , Yeka and Nifas Silk Lafto sub cities in Addis Ababa. Addis Ketema Subcity is located in the city's northwestern area of the city, not far from the center, and comprises 13 sub administrative areas with a total size of 7.41 km square and a population of 271,664. Yeka Sub city located in northeastern suburb of the city. It

borders with the districts of Gullele, Arada, Kirkos and Bole, and comprises 10 sub administrative areas with a total size of 85.46 km square and a population of 337,575. Nifas Silk Lafto Sub city located southwestern suburb of the city and It borders with the districts of Kolfe Keranio, Lideta, Kirkos and Bole and Akaky Kaliti.There are 10 sub administrative areas with a total size of 68.30 km square and a population of 335,740 (Addis Ababa city Mayor Office, 2011).

Seven PPEs was the focus of the study i.e. Medical facemask, N95 mask, Examination Gloves, Face shield, eye goggles, boots and Cover all-suite.

1.7 Definition of Terms

The following are definitions of terms and concepts that will be used in the study from a conceptual and operational standpoint.

1.7.1 Conceptual Definition of Terms

Availability of Products: Available in the health facility during the time of visit (Ghei 1995).

Bin card (Manual inventory Management): A bin card is an individual stock record that contains information on a single product (USAID deliver project, 2014). The stock is physically kept with the bin cards. This system simplifies visual checks, serves as a reminder to retain records, and backs up previously described records (MSH, 2012).

Electronic Inventory Management: Computerized inventory management systems to keep track of all transaction in the store (USAID deliver project, 2014).

Inventory Management: Inventory management system that involves ordering, receiving, storing, issuing and recording limited items based on the policy listed by the responsible body/ ministry of health (Chuchu, 2002).

Personal Protective Equipment (PPEs): Items are the protective barriers and respirators used alone or in combination by a health care worker to protect mucous membranes, airways, skin, and clothing from contact with harmful or infectious agents (WHO, 2020).

Stock out: unavailability of usable stocks at the health facility (Odinga, 2007)

1.7.2 Operational Definition of Terms

COVID-19 treatment Centers: Are Public Health facilities (hospitals and health centers) used to treat COVID-19 cases and, administered by government.

1.8 Limitation of the study

This study was no exception, and it had some limitations. Due to the originality of the study, there are very few published studies that are connected to the inventory management practice of COVID-19 related PPEs, particularly in Ethiopia, establishing comparisons was challenging. However, comparable studies in Ethiopia and other countries were employed in other health commodity groups.

Due to time and budget constraints, only selected public COVID-19 treatment centers in Addis Ababa was included, limiting the findings' applicability to the private sector. It also disregards the likelihood of regional variations in inventory and storage practice and PPEs availability. As a result, the researchers recommend assessing an increased number of health facilities and a wider range of outcomes.

1.9 Organization of the Study

This research consists of five chapters, which are listed below.

Chapter 1. Describes the study's general background, problem statement, study objectives, significance, and limitations.
Chapter 2. Deals with a review of the relevant literature that comprises a description, summary, and critical evaluation of works that are appropriate for the research issue under discussion.
Chapter 3. Provides the research Methodology adopted for the study to be carried out.
Chapter 4. Discuss the description of the main findings of the research and the interpretation of the result.
Chapter 5. This chapter entails an overview of the study as well as the findings produced from the data analysis. Recommendations are provided at the end of the chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The inventory management practices and challenges theoretical literature review relevant to the thesis work and an empirical literature review that includes various authors' ideas to assist and provide a strong foundation, particularly for the analysis and interpretation of data and making recommendations based on the findings are the topics covered in this chapter.

2.2 Theoretical Literature Review

2.2.1 Healthcare Supply Chain Management

The supply chain for pharmaceutical products is crucial in the healthcare sector for guaranteeing a high standard of care for patients and appropriate products supplied to pharmacies. In terms of cost, it is estimated that supply contributes for 25-30 percent of hospital operating expenses (Roark, 2005). Because resources are limited, it is necessary to make the best use of what is available and to arrange and administer the pharmacy store in such a way that it provides effective health care services (Vishavdeep et al., 2015).

The primary goals of healthcare supply chain are to lower healthcare costs while maintaining patient service quality by increasing the efficiency and productivity of the healthcare system (Rachmania and Basri, 2013). The approach efforts to cut procurement and carrying expenses while keeping a sufficient stock of products on hand to meet client and prescriber expectations.

As a result, it is critical that this be well managed to guarantee that both service and cost objectives are maintained.

2.2.2 Introduction to Inventory Management

Inventory management is a critical component of supply chain management that prevents healthcare against service disruptions (Chopra, 2013). Inventory is described by Stock and Lambert (2001) as the stock of any item, product, or resource used in an organization or institution. Inventory is defined as the stock of pharmaceutical items

retained by an organization or institution to fulfill future demand in pharmaceutical supply chain operations. It is a complete inventory of medicines possessed by an organization or institution, and it is the pharmacy's most valuable asset (Ali, 2011).

Inventory management, according to Desselle and Zgarrick (2009), is a continuing process of planning, managing, and regulating inventory with the goal of minimizing total inventory investment while harmonizing supply and demand.

To ensure uninterrupted delivery, the healthcare supply system should assure adequate stock of all essential commodities. This needs the health facility store's effective and efficient inventory management by keeping a close track on products. Inventory management is critical in the health commodity supply chain, as it involves the implementation of the routine pharmaceutical ordering procedure. It assists in maintaining a consistent supply to patients, hence preventing product stock outs and decreasing inventory-holding expenses (Clark, 2012).

Inventory management and control's main goal is to inform managers how much of a product to reorder, when to reorder it, how frequently orders should be placed, and what the required safety stock is in order to avoid stock outs. Inventory management can result in major improvements in patient care as well as the most efficient use of resources. Patients can benefit from value-added services provided via continuous management (Mahatme, 2012).

2.2.3 Why to hold inventories?

Inventory management's main goal is to advise managers about the quantity of commodities to order, when to place orders, and how much safety stock to have on hand in order to avoid frequent stock outs. The most significant roles of inventories are to: i) satisfy expected client need for medical supplies; ii) protect against stock outs; iii) take full benefit of ordering cycles; and iv) allow a health care institutions to maintain operating (Ozcan, 2005).

Companies keep inventories for a variety of reasons, one of which is that they cannot order and have products delivered at the same time. As a result, stocks act as a buffer between the rate at which a supplier can deliver products and the rate at which the company uses the product. A second important reason to keep inventory is to manage the above-mentioned cycles' variability and unpredictability. Customer

demand, or the needs of patients, will fluctuate depending on a variety of factors and is particularly hard to forecast. Furthermore, suppliers may be unable to meet delivery deadlines due to issues with machines, employees, quality, and so on.

According to Rossetti (2008), inventory management plays a significant role in pharmaceuticals management by reducing total healthcare costs while maintaining quality of treatment by enhancing and boosting the efficiency of the healthcare supply chain system. Even better, a well-managed inventory management system can improve healthcare product inventory control, resulting in a 30 percent reduction in overall inventory (Kim, 2015).

To deal with ordering, receiving, and storing of products, all facilities need an inventory management system and established protocol to document and accounting of stocks (MSH, 2012). When properly established and followed in day-to-day operations, these control system can provide a foundation for consistent quality, improved financial performance, and increased regulatory compliance (Woo-Miles, 2015).

2.2.4 Benefits of inventory Management

Inventory management's main purpose is to find the right balance between the competing economics of not keeping too much product on hand. Inventory management can result in major improvements in patient care as well as the most efficient use of resources.

Some of the benefits are as follows:

1. Ensures that you do not run out of stock by determining how much inventory you should keep on hand at all times.
2. It will assist in reducing unnecessary storage space costs, as having too much inventory can lead to an inappropriate fund spent on storage space.
3. Inventory tracking throughout time and having provisions in place for any inventory problems will prepare the organization for scenarios that would otherwise have a large negative impact.
4. Inventory forecasting, which can help to foresee and plan for demand, is aided by good inventory management.

In addition, inventory management is critical for the pharmaceutical supply chain, as it entails the implementation of the routine pharmaceutical ordering procedure. It assists in maintaining a consistent supply to patients, hence eliminating product stock outs and lowering inventory-holding expenses. Pharmaceutical inventory controls ensure that effective inventory records and processes are maintained and established, which serve as the foundation for preventing theft and corruption. The inventory control system is also utilized for requisitioning, issuing medications, preparing consumption statistics for forecasting, and preparing consumption and stock balance reports required for procurement. Pharmaceutical stock records should be detailed enough to create an audit trail that accurately tracks the flow of medications and budgets across the supply chain (MSH, 2012).

2.2.5 Inventory Management Techniques

The visual technique, the perpetual method, and the periodic approach are the three ways used in pharmacy store to manage inventory (West , 2009).The visual technique requires the store manager to physically check the stock on hand to a list of the items that should be kept on hand at the store. When the stock number goes below the desired specified amount, the pharmacist initiates a purchase order. The perpetual inventory management approach is the most popular and efficient method for managing pharmaceutical inventory in developed countries. It entails a computerized system which it continuously and methodically monitors inventories at all times. When a pharmaceutical order is filled, the stock on hand is recorded into the computer software, and the right amount of products is automatically deducted from the inventory.

Health facilities in Ethiopia are following a periodic review inventory policy. According to Chopra and Meindl (2013), inventory is reviewed at constant periodic intervals and an order is placed to boost the inventory level in the periodic review policy. Due to demand unpredictability, the quantity of an order does not remain constant in this situation, but the duration between orders remains constant. The use of a periodic review policy can have a favorable impact on the company, such as saving time while monitoring inventory levels (Ma & Lei, 2013). However, if a business has a high sales volume, the drawback of the use periodic review policy-causing errors in deciding the quantity of inventory (Ma and Lei , 2013).

2.2.6 The consequence of poor inventory management

The availability of high-quality products at the appropriate time is critical to providing high-quality health care. Even without availability of inventory, it is impossible to provide any significant health service to patients and clients. Effective and efficient commodity stock control will assure comprehensive care to clients, which can only be achieved when adequate structures and procedures are in place in any business or industry. Stock out of any item on a regular basis shows ineffective stock control, which could be caused by inadequate planning, forecasting, coordination, procurement procedures, inventory pilferage, inventory obsolescence, or a lack of funds (Edward et al., 2017).

Poor inventory management in the public pharmaceutical supply chain leads to a waste of financial resources, shortages of some essential medicines or overages of others that expire, and a decline in the quality of patient treatment in many countries (MSH, 2012).

Inadequate inventory controls can result in both under and overstocking of products, resulting in waste or higher holding costs and stock outs.

- Overstocking of certain items might take up a substantial proportion of the pharmaceutical budget, leaving money for other, potentially life-saving products short.
- Medicines that are overstocked are more likely to expire, especially those with a limited shelf life.
- Under stocking may cause a patient's treatment to be delayed, resulting in more suffering and death.

2.2.7 Factors which contributed to poor inventory management

The logistic process, including inventory control, is driven by information; making inventory decisions without complete and timely data is irrational (USAID, 2011). Furthermore, the hiring of qualified human resources, regular supporting supervision, ongoing reporting, and periodic evaluation of inventory control operations all contribute to the efficient use of resources and improved service levels (Tiye, 2018).

Most hospitals and health centers in Ethiopia are using a bin card coupled with a computerized system. The most crucial feature of stock records is that they must be up to date and accurate (Mahoro, 2013).

The following are some of the contributing factors to inaccurate stock records (Tayob, 2012):

- High workload result in common entry mistakes.
- The names and descriptions of products are similar and sometimes ambiguous
- Duplicate entries of transactions
- Expired stock is not removed from stock records.
- Physical stock counts are rarely performed.
- Staff who aren't well-trained and store staff who aren't well-supervised.

2.2.8 Challenges of Inventory Management

Medicines management, according to Ali (2011), is a highly professional and technical activity that can only be accomplished by adequately skilled, trained, and sufficiently skilled work force at both the managerial and operational levels.

Health facilities fail to invest in technology and infrastructure, which creates a challenge when it comes to implementing inventory management practices. The company should put in place the necessary infrastructure to ensure maximum and minimum inventory levels. This allows the company to reduce costs on storage, stockouts, and lead times (Njoroge, 2015).

In their study on medicine stock out and inventory management challenges, Kagashe and Massawe (2012) indicate that there was a shortage of logistic competence and understanding among workers involved in medicine supply. Inventory management inefficiencies, according to Waako et al. (2009), are caused by human resource challenges on the one hand, as well as imprecise procedures and a lack of standardized stock monitoring on the other.

According to Amato (2014), the following are four of the most common inventory management issues in health care facilities.

i. Complicated Customer Requirements: The needs of patients are complex and unique. That means health-care facilities should manage a vast inventory and keep everything organized so that each patient can receive the best possible care.

ii. Unpredictable demand: Inventory fluctuations are unavoidable. They are even more noticeable in a health sector atmosphere. Contagious infections come and go, and an emergency intervention may be required on any given day. As a result, health facilities frequently face unanticipated supply shortages, or a chaotic scenario may prohibit them from accessing limited resources in a timely manner.

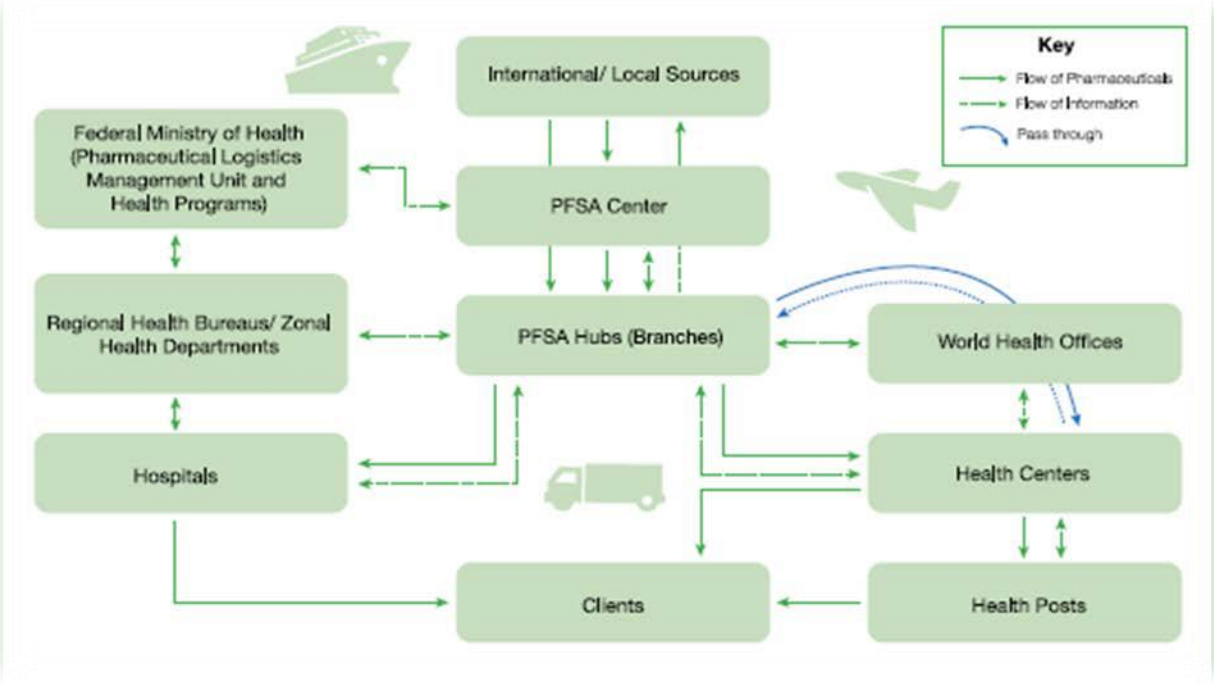
iii. Temperature and short shelf-life products: The shelf life of several pharmaceuticals and materials is limited. Others are vulnerable to damage because of temperature fluctuations. As a result, healthcare facilities must secure sensitive inventory while also ensuring that things are used in the proper order to avoid expiration. If inventory is not adequately tracked, disorderly facilities potentially waste a huge amount of resources.

iv. Security: Health care inventory have always been a security concern. It is possible to steal pharmaceuticals, or to tamper with sensitive items. Both of these vulnerabilities can expose a health facility to severe safety and legal risks.

2.2.9 Pharmaceutical stock and information flow in public health care in Ethiopia

The Ethiopian-integrated pharmaceutical logistics system is a single reporting and distribution system for medicines based on the EPSA's entire mandate and scope and was developed with the intent of integrating all vertical programs into one supply chain and delivering pharmaceuticals directly to health facilities every other month from EPSA.

Ethiopia's pharmaceutical supply chain management collects and reports logistics data on a bi-monthly basis. RRF sends information from the health facilities to EPSA while IFRR from dispensing units to the health facility store (EPSA, 2015).



Source: Standard Operating Procedures (SOP) Manual for the Integrated Pharmaceuticals Logistics System in Health Facilities of Ethiopia (2017).

Figure 2.1 Flows of Pharmaceuticals and Information in the Integrated Pharmaceutical Logistics System (IPLS)

In Ethiopia, public health facilities use both hard copy and electronic inventory management methods; however, employing technology to manage inventory is one strategy to improve poor commodities management (Verdian, 2020).

Ethiopia's Ministry of Health with EPSA established standardized inventory management systems that would be used by public health facilities across the country, whether they are manually run or computerized. The logistics forms include the bin card, the Internal Facility Request and Resupply Form (IFRR), and the Report and Requisition Form (RRF). The bin card is stored in the store with the product managed and updated with each transaction. Internal transfers of products with in the

facility's store and dispensing units are reported using the IFRR voucher. The RRF is used to place orders for medical supplies from EPSA hubs (IPLS SOP, 2015).

As per Ethiopia Pharmaceutical Supply Agency – EPSA (2017), the Business Processes in IPLS are:

i. Requesting: The Report and Requisition Form (RRF) is used by hospitals and health centers to report on the quantities of pharmaceuticals used, lost, or transferred, as well as stock available and quantities to order pharmaceuticals. Facilities have until the 10th day of the month after the end of the reporting period to submit their completed and approved RRF to EPSA hubs.
ii. Receiving: EPSA hubs supply pharmaceuticals to hospitals and health centers that have timely received and authorized RRFs. Every other month, medications are delivered to hospitals and health centers. EPSA vehicles will wait for the pharmaceuticals shipment while the items are counted and verified, taking note of any discrepancies and obtaining proof of delivery (Model 19). Before being sent to dispensing units, all medications should be received by a store manager.
iii. Issuing: Most pharmaceuticals should be stored in the pharmacy store of a Health Centre or Hospital in order to maintain pharmaceutical quality and effectively manage pharmaceuticals. Pharmaceuticals should be issued in small quantities twice a month to service providers (nurses, clinicians, out-patient pharmacies, etc.) at their work area.

2.2.10 Record Keeping

In inventory management, it is crucial to keep track of all transactions. The risk of discrepancies in various activities that take place in the storage room is reduced when reliable records are kept. The Store staff and administration will have access to the information they need to make logistics decisions. The primary source of data in inventory management is stock keeping records, which can be either manual or electronic. Stock records that are accurate and up to date are essential for good inventory management since they are used to calculate future needs. Stock holding is necessary to ensure that vital commodities are available practically all of the time (MSH, 1997).

The most important thing to remember regarding stock records, whether manual or computerized is that they must be up to date and correct. It is impossible to effectively manage the reordering process if stock movement cannot be tracked (MSH, 2012).

2.2.11 Physical Stock Counting

Stock accuracy improves with increased training and supervision, according to Kefale and Shebo (2019). Physical stock counts are required on a regular basis for reordering and assessing the stock's value. The term "physical count" refers to the process of counting the number of units of each item on a regular basis. Its aim is to ensure that the amount in the store reconcile with the bin card balance.

Inventory management requires physically counting the quantity and type of goods in the store during any one time to match the products in stock with stock-keeping records. Quick et al. (2013) emphasize the need of verifying that each item being counted has the same product name, and unit of measure.

The annual count and the cyclic count are the two methods for counting stock.

i. Annual count is performed once or twice a year, the warehouse is close down for a week or two, and each item of inventory is counted. The annual count interrupts the supply chain and generates consumer dissatisfaction because products cannot be issued during the count. Another drawback of counting once or twice a year is that if there is a discrepancy, it is difficult to identify when and how the problem occurred, so the records are adjusted to show the actual stock and losses taken off (SIAPS, 2012).

ii. In cyclic counting, stock is split into groups, with one group being counted every week or day and discrepancies rectified. It has no impact on the warehouse's day-to-day operations. The benefit is that it would be easier to identify the cause of discrepancies. Reports must be written after each count (Kok and Shang, 2014).

2.2.12 Store Management

Controlling the movement of goods, storage areas, material handling practices, and monitoring quality and availability are some of the inventory management responsibilities (Ofori-Ayeh, 2016). Medicines and essential products are high-value items that should be handled with caution to avoid damage. These products should be

stored in a climate-controlled environment free of humidity and extreme temperatures and should be kept on racks (Quick et al., 2013). Throughout the multiple warehouses, proper storage preserves the physical integrity and reliability of items and their packaging until they are distributed to clients (USAID| DELIVER PROJECT, 2011).

The manufacturing and storage environment of pharmaceutical items can have a significant adverse effect on the quality. The most critical elements in product degradation are extreme heat and relative humidity (Kommanaboyina and Rhodes, 1999). Hence, light, humidity, ventilation, temperature, and security should all be in good condition and it's critical to have warehouses store with sufficient storage capacity. All pharmaceutical products must be kept according to the manufacturer's instructions. Pharmaceutical stock should be stored in settings that are appropriate for the product's nature and stability (Bajaj et al., 2012).

Pharmaceutical products must be kept under conditions that minimize deterioration, contamination, or damage, according to the Ethiopian Food, Medicine, and Healthcare Administration and Control Authority guideline for good storage practice to facilities that store pharmaceutical products and materials in order to avoid efficacy and quality problems caused by improper storage practice. They must be stored in temperatures and/or humidity levels that are suitable with their advised storage requirements. Storage rooms should be large enough to accommodate the various types of pharmaceutical items and supplies in an orderly manner. Pharmaceutical items should be kept in premises that ensure their quality, and stock should be maintained according to the "first expired/first out" (FEFO) policy (FMHACA, 2015).

2.3 Empirical Literature Review

Many developing countries' health commodity supply systems have serious inventory management issues, which have been documented in various research reports (Battersby, 1984). In under developed countries, poor availability and access to basic health commodities are major roadblocks to providing essential health care.

2.3.1 Brief Insight into the results of inventory management Practice and Challenges Globally

Various countries assessed the public health sector inventory management system in depth in order to assess its strengths and weaknesses.

The case study of Hani et.al (2013) in one public hospital in Indonesia concluded problems that often hindered the efficient inventory management at the hospitals were lack of human resources, insufficient information, and technology system, and a limited warehouse area are all problems that frequently occur in hospitals.

Based on the web-based survey done by Nemat et al. (2021), the majority of participants (91%) said they had access to medical face masks, while just 26 percent said they had access to facial protective shields, indicating that PPEs were readily available during the COVID-19 pandemic, which may have resulted in low infection rates among health care workers in Jordan.

According to the findings of a study conducted at community health centers in the Western Cape, Antiretroviral (ARV) medicine inventory management was poor in terms of overall quality of record keeping and store upkeep. Poor stock management was discovered to be a serious concern particularly updating and maintaining accuracy in record-keeping (Mahoro, 2007).

Manyuat et al. conducted research in Jubek State, South Sudan. (2021) showed that in the storeroom assessment, the majority of measuring standards received a score of 37 percent, while the inventory management received a score of less than 75 percent. Johnson et al. (2021) found that 92.31 percent of hospitals in Nyamira County, Kenya kept precise and up-to-date stock records, 100 percent of them provided important logistics data and 75 percent maintained separate ARV storage space.

Inventory management in Namibia was characterized by a lack of record keeping; most facilities had inadequate computer access and understanding of how to utilize them. Stock cards were utilized, although they were not well maintained. The staff lacked the necessary training and expertise to perform correct recording processes. Pharmacist monitoring and assessment procedures were lacking, particularly in areas without a regional pharmacist. There were also poor storage conditions, including an absence of

store access security and air conditioning. In the facilities studied, there were no uniform techniques for quantifying drug demands (Aboagye et al., 2003).

According to studies conducted in South Africa and Kenya, ineffective inventory management systems and a lack of management ownership resulted in difficulties in obtaining accurate records of information and product flow, low availability of essential drugs, and challenges implementing first expired, first-out (FEFO) with the expiration of large stocks. Poor inventory management is strongly linked to low professional skill levels, a lack of management follow-up, and the assignment of the wrong type of experts (MSH, 2012). Inadequate staff and training, a lack of proper storage, and an unpredictable supply of pharmaceuticals were among the issues identified by Johnson et al. (2021) in hospitals in Nyamira County, Kenya.

The study of Kagashe and Massawe (2012) in regional hospitals in Tanzania determined that personnel involved in medicine supply in the hospitals analyzed lacked logistical competence and the majority of the personnel lacked knowledge of inventory control and medical quantification techniques. One of the key issues contributing to stock-outs was a lack of funding to purchase the medicines.

2.3.2 Inventory Management Practice and Challenges: Experience in Ethiopia

According to an Integrated Quantitative and Qualitative Study conducted showed that bin cards, reporting and refilling forms, and model 19 (receiving models) and model 22 (issuing models) were all available at public hospitals in Southwest Ethiopia. However, the majority of these forms were not being used for personal protective equipment's (PPE) logistics management. Except for surgical and disposable gloves, no hospitals used logistical record-keeping tools for PPEs. Only seven (16%) of the predicted 44 bin cards were present, and only six (13.75%) of the bin cards were updated. None of them had given the provider a report or placed an order for personal protective equipment. As a result, the study found that all of the institutions evaluated lacked appropriate personal protective equipment and mismanaged their inventory of accessible equipment. (Ejeta et al., 2021)

Fentie et al. (2015) assessed the availability of essential medicines and inventory management practices in Gondar town's public primary health care facilities. The finding of this research indicated that essential drugs were generally available in 91

percent of cases, during the six months, the average stock out of tracer drugs in health facilities was 30.5 days and the discrepancy between physical count and a stock record count of essential medicines among the surveyed health facilities ranged from 0 percent to about 60 percent.

A cross-sectional study done in the Public health institution of Dessie city Administration concluded that the maximum, minimum, reorder, and buffer stock levels were not properly maintained and the practice of good storage management was not satisfactory (Bayked, et.al., 2021). A recent study by Mitiku et al. (2020) at Public Health Centers in Bahirdar Town also highlights that the average time of stock out of essential medicines was 26.2 percent; 56.7 percent of the stock keeping records were accurate and 22.7 percent records were greater than physical counts.

According to the findings of the study conducted at Woreda health offices in the west Harerge Zones, pharmaceutical storage, arrangement, and in Habro, Darolebu, Gemechis, and Chiro stores, issuing practices were found to be good, but in Odabultum stores, they were found to be poor. There were insufficient storage and reception areas in Habro, Darolebu, and Odabultum stores, as well as racks in Habro, Odabultum, and Chiro stores, and pallet in Gemechis, Odabultum, and Chiro stores.Only Habro and Chiro stores used bin cards. In all of the research stores, there have been no ways of maintaining and measuring the drug store's room temperature (Kassie and Mammo, 2014).

According to a comparable study conducted by Kefale and Shebo (2019) at Adama town health centers, the total average availability of essential medicines was 76.3 percent on the day of the study. During the 12 months, the average length of stock out days was 40.6 days. The physical inventory is lower than the balance on the bin card, ranging from 0 percent to 33.3 percent.

Only 28.5 percent of bin-cards were correctly completed, the average stock out rate of key essential medicines was around 27 percent, with an average stock-out duration of 35 days, and only 25 percent of health facilities meet the standards of good storage condition criteria, according to Gurumu and Ibrahim (2016) study of inventory management performance of key essential medicines in health facilities in East Shewa Zone, Oromia Regional State, Ethiopia.

At Addis Ababa, Ethiopia, a study was conducted on Integrated Pharmaceuticals Logistics System (IPLS) Management HIV/AIDS and Tuberculosis Laboratory Diagnostic Commodities in Public Health Facilities. In 92.6 percent of facilities, IPLS recording and reporting formats such as bin cards, internal facility reports and requests (IFRR), and report and request forms (RRF) were available. 61.5 percent of facilities reported regular bin card updates, while 84.6 percent and 92.6 percent of facilities completed the IFRR and RRF, respectively. When compared to hospitals, health centers (76.5 percent) used bin cards more frequently (33.3 percent). Furthermore, during the previous six months, 92.6 percent of facilities reported stock out for one or more commodities (Tilahun, et al. 2016). Deressa et al. (2021) reported that there was a significant shortage of suitable PPE and 72 percent of the hospital staff were dissatisfied with the availability and use of PPE in selected Addis Ababa hospitals; however, this study did not look at how stocks managed at the store and the challenges of the inventory management system.

According to Ejeta et al., a shortage of these PPEs was caused by a shortage at the provider source, a budget constraint, the procurement process' complexity, overconsumption, and transportation restrictions (2021), who studied the inventory management challenges of PPEs at Public Hospitals in Southwest Ethiopia. Gurumu and Ibrahim (2016) study of inventory management performance of key essential medicines in health facilities in East Shewa Zone, Oromia Regional State, Ethiopia also showed that budget constraints, human resource inadequacies, and an oversupply of near-expiry pharmaceuticals were also recognized as important inventory management difficulties in this study.

As a result, maintaining efficient inventory management practices and analyzing the challenges of PPEs are two of the most critical components of assuring the ongoing availability of PPEs for healthcare personnel to protect themselves and minimize transmission in healthcare settings.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Description of the Study Area

Addis Ababa is the capital city of Ethiopia and holds 527 m2 of area. The population of Addis Ababa is estimated to be 3,774,000 in 2021(CSA, 2013).

In total, the city administration has 13 hospitals and 102 health centers that provide different types of health services (FMOH, 2020/2021). As per the Dec 2021, FMOH report, there are 17 COVID-19 Public treatment centers, and 6 of them are administered by the Federal Ministry of health and the 11 by Addis Ababa Regional Health Bureau. The COVID-19 treatment centers are found in all the 10 sub-cities and some of the sub-cities have more than one center based on their caseload.

3.2 Research Approach

The study employed a mixed method combining quantitative and qualitative research methods, to assess existing PPEs inventory management practice and challenges of the COVID-19 treatment centers.

3.3 Research Design

This study used a descriptive and exploratory research design, which is a facility-based cross-sectional descriptive study. Descriptive studies are performed to collect data without altering the environment as well as provide a description of the present situation. The researcher has no control over the factors; only can do is report on what has occurred or is currently occurring.

Hence, the quantitative technique allowing the researcher to examine inventory management and storage practices by using Semi-administered questionaries' and observational checklists. Again, qualitative methodologies were also employed through in-depth interviews to know the store managers' perspectives being interviewed about the challenges of inventory management of PPEs.

3.4 Population and Sample

The main inclusion criteria of this study was a health facility should be COVID -19 treatment centers found in Addis Ababa and there are 17 treatment centers (FMOH

2021). However, due to the limited resource, visiting all was not feasible. As a result, the Logistics Indicator Assessment Tool (LIAT) suggests that in the event of a resource shortage, 15 percent of facilities can be used (USAID/DELIVER PROJECT, 2008). Therefore, three (18 %) COVID-19 treatment centers were selected based on LIAT suggestion. Addis Ketema Sub city Woreda 10, Dagmawi Minilik Hospital and Nifas Silk Lafto Sub city Woreda 4 COVID-19 treatment centers (15 percent) selected randomly using excel function (=RAND) by assigning a random number to each row, sort those numbers, and select the required number of rows from the study population.

The list of PPE selected based on the FMOH guidance provided for the rational use of PPEs for COVID-19 includes Facemask, N95 mask, Gloves, Face shield, goggles, boots and Cover all suite (WHO, 2020).

In addition, the relevant store managers who are managing the stores where PPEs are kept were the target to provide the information.

3.5 Data Sources and Types

Primary data was obtained from store managers using semi-structured questionnaires, face-to-face interviews by using recording devices, and an observation checklist, while secondary data was collected via documents such as bin cards, Report & Request Form (RRF), Internal Facility Report, and Resupply Form (IFRR), model 19 (receiving voucher), and model 22 (Issuing voucher).

3.6 Data Collection Procedures

Questionaries' were structured based on thematic areas of the study, developed, and designed using information obtained from published journal publications about this research, and some were also adopted from Logistics System Assessment Tool (LSAT) and LIAT, all of which were based on the study's objectives.

3.7 Ethical Consideration

The researcher requested for an official letter of cooperation of support from Addis Ababa University School of Commerce to the three COVID-19 treatment centers selected in the study area.

The researcher sought permission from the COVID-19 treatment facility management and described the study's purpose before giving the questionnaires. The store managers

were given a similar explanation, and the respondents' verbal consent was obtained. To ensure anonymity, anonymous questioners were used after it was explained to the respondents that their names would be unnecessary.

3.8 Data Analysis

To ensure completeness, consistency, and correctness, the data collected using questionnaires and observation was analyzed, summarized, edited, and tabulated. To evaluate the acquired data, a descriptive analytical technique was utilized with the help of the Statistical Package for Social Sciences (SPSS version 20) and Excel. Frequency counts, percentages, and averages were used to analyze and present descriptive data. Quantitative explanations were used to provide meanings to quantitative data and to explain its effects. The data from the qualitative method was rigorously evaluated in order to identify the primary difficulties. The research findings were used to draw appropriate conclusions and provide recommendations.

3.9 Validity and Reliability

The study's validity was assessed in three ways. To begin, the researcher's classmates peer-evaluated the data collection tools to ensure that the instructions were clear, the language was understandable, and the tools were user-friendly. Second, the researcher's adviser evaluated the contents of the data collection instruments to ensure that they had enough information to meet the study's objectives and were unbiased. Finally, based on the literature review, the instruments used in prior studies were compared to the ones used in this study, and any necessary revisions and improvements were made.

To ensure the study's reliability and generalizability, clear measurements and a comprehensive observation checklist were used. Furthermore, using the right data collection tool improves reliability. To avoid inter-researcher variability, just one data collector was used for data collection and entry to improve repeatability.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this research was to analyze the inventory management and storage practice of COVID-19 Personal Protective Equipment (PPE) in selected public COVID-19 treatment centers in Addis Ababa, Ethiopia. This chapter contains the analysis, presentation, and interpretation of the data. The data analysis and interpretation process consists of two sections. The first section, which is based on the questionnaire's responses, is a quantitative data analysis. The second is a qualitative interpretation, which is based on the interview results.

Table 4.1 Profile information of respondents

Variable		Frequency
Profession	Pharmacy Degree	3
Position of the interviewee	Store Manager	3
Total Professional Service Months/Years	3 Years	1
	7 Years	1
	8 Years	1
Number of years working as a store manager at the health facility	11 months	1
	12 months	1
	9 months	1

All of the store managers interviewed have a pharmacy degree and have worked in the field for between three and seven years. For 9 to 12 months, they also worked as a store manager at the COVID-19 treatment center.

4.2 Results

4.2.1 Availability of Personal Protective Equipment (PPEs)

Table 4. 2 Stock out of the PPEs on the day of the visit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	19	90.5	90.5	90.5
	Yes	2	9.5	9.5	100.0
	Total	21	100.0	100.0	

The tracer PPEs were available in 90.5 percent (19) in the sampled COVID-19 treatment centers however 9.5 percent (2) of the PPEs were stocked out.

Table 4. 3 Stock out within the Last 6 months

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	N/A	1	4.8	4.8	4.8
	No	18	85.7	85.7	90.5
	Yes	2	9.5	9.5	100.0
	Total	21	100.0	100.0	

Two of the PPEs (9.5 percent) were stocked out in the past six months.

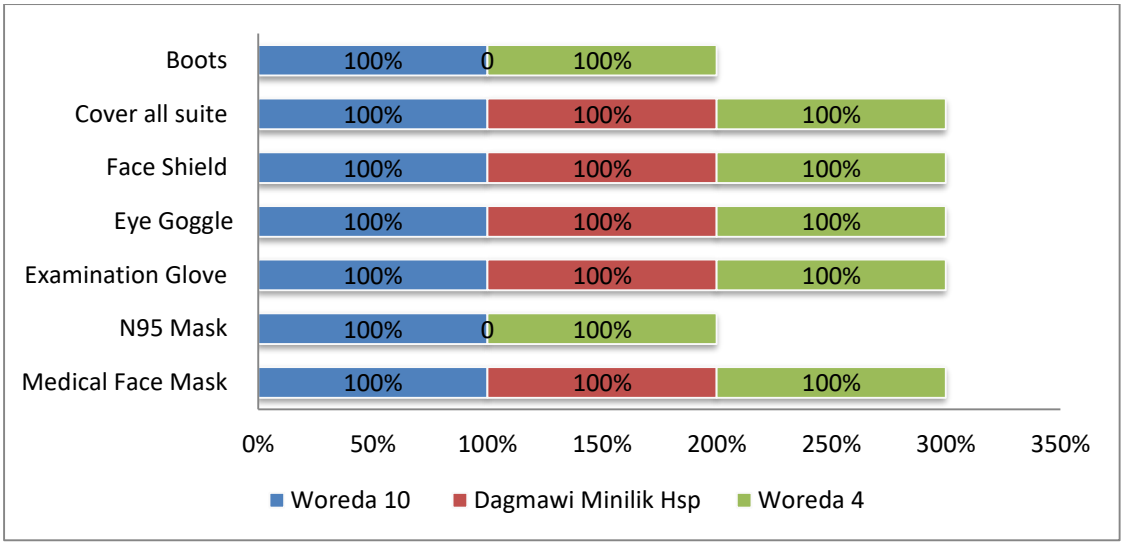


Figure 4. 1 Availability of PPEs on the day of the visit

Boots and N95 masks were not available on the day of the visit at Dagmawi Minilik Hospital.

Table 4. 4 Below /above EOP (O.5 months is the cut off)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Above	18	85.7	85.7	85.7
	Below	2	9.5	9.5	95.2
	N/A	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

Because there was no bin card to determine the AMC based on previous issue data, it was not possible to determine the stock level available in one COVID -19 treatment center for one product. Hence 85.7 percent of the PPEs were above the emergency order point (0.5 MOS) and 9.5 percent of the PPEs were below the emergency point.

Table 4. 5 Total number of days the product was stocked out in the past six months

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	137	1	4.8	4.8	4.8
	180	1	4.8	4.8	9.5
	N/A	19	90.5	90.5	100.0
	Total	21	100.0	100.0	

Using bin cards as a source of data, the frequency of stock outs was analyzed in facilities that had at least one stock out in the six months prior to the assessment. The information was acquired solely from health-care facility stores; it did not consider whether products were available at different service areas at the time.

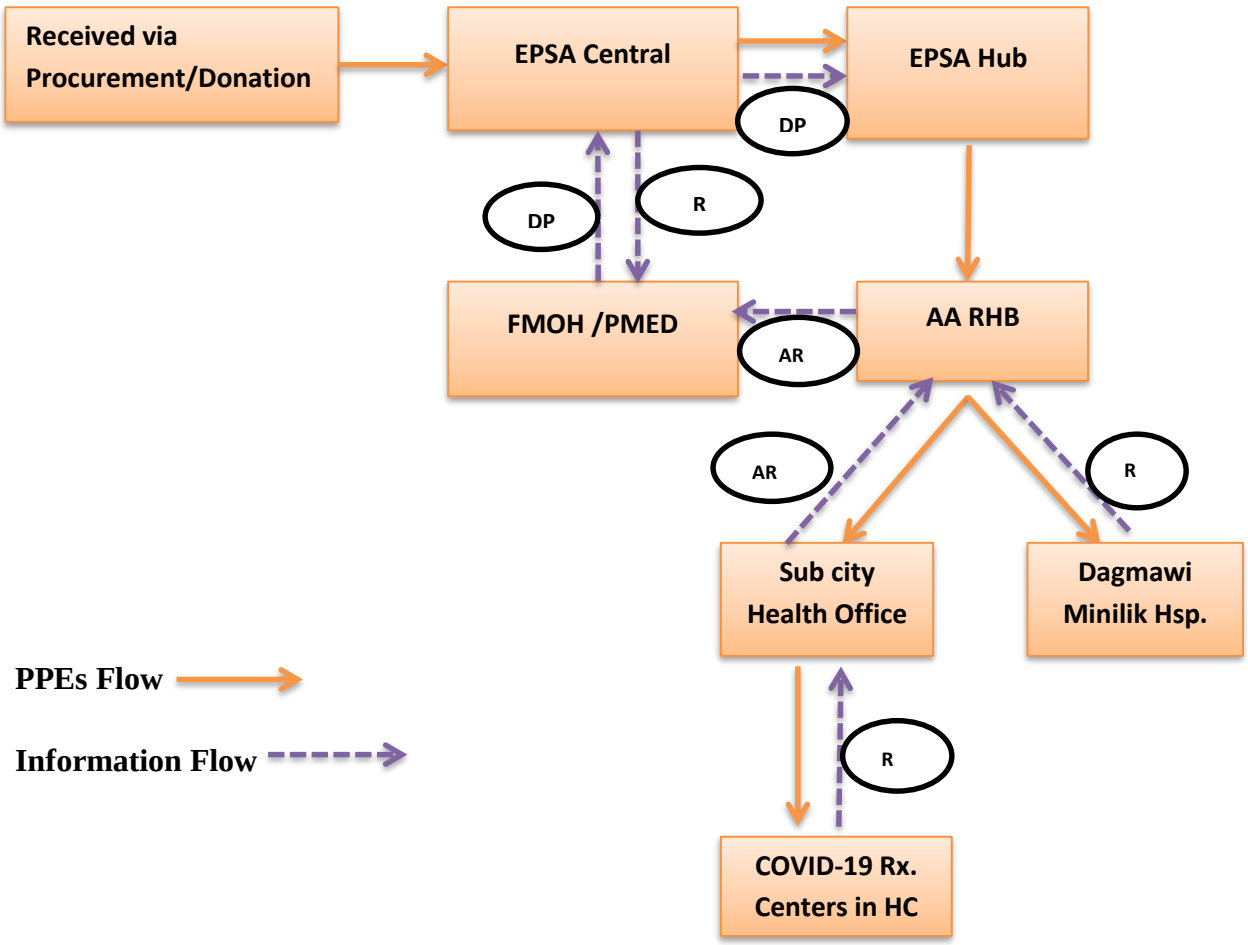
Two (9.5 percent) of the PPEs were stocked out from expected (21) once in the previous six months, for varying periods of time, with stock outs lasting 137 and 180 days.

4.2.2 Inventory management practice of PPEs in selected facilities

4.2.2.1 Reporting, Ordering and Receiving of PPEs

The COVID-19 treatment facilities used a specifically made reporting form for PPEs. The reporting template was comparable to the RRF (report and requisition form) that was used to report on other product categories at the health facilities, but it did not include a part to establish the ordered quantities. The COVID-19 treatment facilities using this template to report their beginning balance, quantity received, consumption, and ending balance, as well as any challenges they faced during the reporting period.

The two COVID-19 Treatment centers located at health centers send monthly reports and requisition forms to the sub city health office, whereas Dagmawi Minilik Hospital sends quarterly reports to the Addis Ababa regional health bureau. The RHB aggregates and sends this report to the FMOH, whereas the sub city health offices send it to the Addis Ababa regional health bureau.



DP- Distribution Plan **AR**- Aggregated Report **R**- Report

Figure 4.2 Information and Product flow

FMOH prepares a distribution plan for each region based on the aggregated report and sends it to EPSA central, which then sends the products to EPSA hubs, who then deliver them to the regional health bureau. The regional health bureau will once again use the information provided to create a distribution plan for each COVID-19 treatment center they manage.

The PPEs for COVID-19 treatment centers received from the respective sub city, while Dagmawi Minilik hospital gets them from the Addis Ababa Regional Health Bureau. The COVID -19 treatment centers issued Model 19 (receiving voucher) after receiving, and the different departments at the health facility used the internal form for reporting and requisition (IFRR) to request PPEs on a bi-monthly basis, which is similar to the IPLS, and the store manager issued Model 22 (issuing voucher).

All three COVID-19 treatment centers assessed had their store managers self-learn how to fill out the reporting template, and they rarely received guidance from their respective higher levels when it comes to COVID-19 product management.

4.2.2.2 Availability and Utilization of logistics tools

Table 4. 6 Availability of bin cards (Manual and/or Electronic)

			Bin card available (Manual/Electronic)		Total
			No	Yes	
Name of COVID Center	Woreda 10	Count	0	7	7
		Percent	0.00%	100.00%	100.00%
	Dagmawi Minilik Hsp	Count	0	7	7
		Percent	0.00%	100.00%	100.00%
	Woreda 4	Count	1	6	7
		Percent	14.30%	85.70%	100.00%
Total		Count	1	20	21
		Percent	4.80%	95.20%	100.00%

Source: Assessment data, May 2022

Although manual bin cards were accessible for 95.2 percent (20) of the PPEs, the Woreda 4 COVID center did not have bin cards for 4.8 percent (1) of the PPE.

Table 4.7 Availability logistic tools for PPEs

S.No	Tools	Availability	
		Yes	No
1	Bin card Manual	20 (95.2 %)	1 (4.80%)
2	IFRR	21 (100%)	0 (0.00%)
3	RRF	21 (100%)	0 (0.00%)
4	SOP Manual	21 (100%)	0 (0.00%)
5	Automated record	0(0.00%)	21(100%)

Source: Assessment data, May 2022

For all of the selected PPEs, IFRR, RRF, and SOP manuals were available in all of the COVID-19 treatment centers. However, 4.8 percent of the PPEs did not have a bin card. In certain COVID-19 treatment centers, automated records were not employed to document PPE transactions.

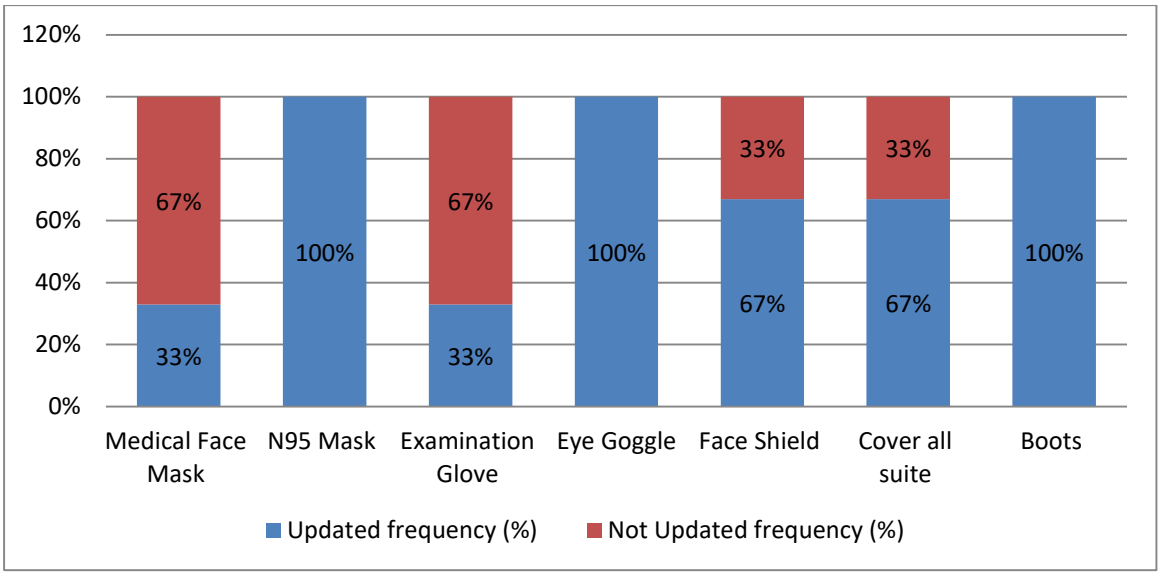


Figure 4.3 COVID -19 centers stock record updating practices

For N95 mask, eye goggle and boots all bin cards were updated; however, 67 percent of bin cards for Medical Face Mask and Examination Gloves were not updated, and 33 percent of bin cards for Face shield and Cover all suites were not updated.

4.2.2.3 Comparison of physical count with the bin cards Stock

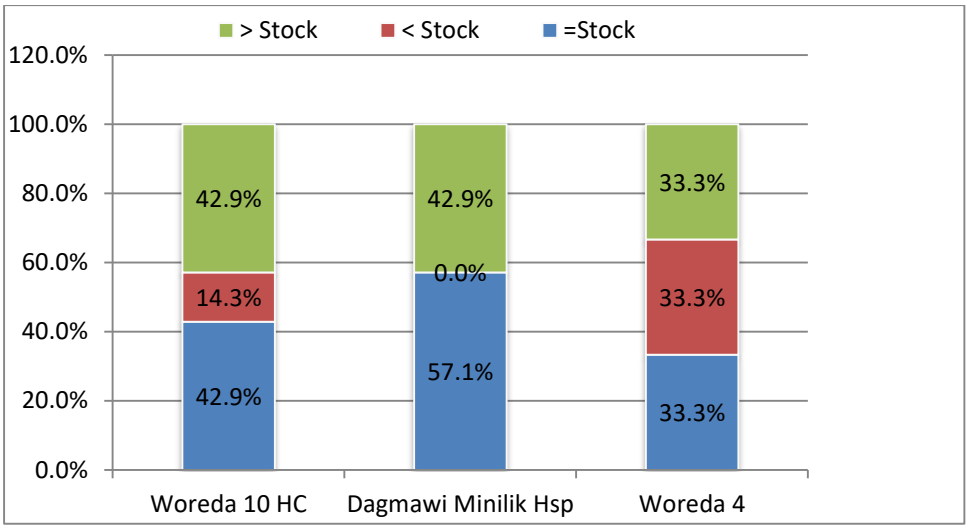


Figure 4. 4 Percentage discrepancies between physical count and balance on bin card at three COVID-19 treatment centers

One of the indications of poor record keeping is a physical count that is less than the balance on the bin card. The proportion of disparity varied throughout all COVID-19 treatment centers in this study, with the highest percentage in Woreda 10 and Dagmawi Minilik, where the stock on bin cards was higher than the physical count on 43 percent of the bin cards where as it was 33 percent in Woreda 4. According to the store managers, this is due to not updating the bin cards immediately after physically issuing the PPEs owing to workload. In Woreda 10 and Woreda 4, respectively, 14 percent and 33 percent of the recorded balances were less than physical counts.

Table 4. 8 Bin Card discrepancy checks of PPEs

Features of bin cards	Frequency of discrepancies
Positive discrepancies	n=3(15%)
Negative discrepancies	n=8(40%)
No Discrepancies	n=9(45%)

Source: Assessment data, May 2022

This assessment showed a positive discrepancy of 15 percent, the negative discrepancies were found to be 40 percent and there is no mismatch between the physical count and the bin cards in 45 percent of the instances. To undertake the

comparison, a bin card for one PPE was not found, and there is no evidence of previous transactions.

4.2.2.4 Paired sample T test

The Paired Samples T Test compares two variables' means. It calculates the difference between the two variables in each case and determines whether the average difference is significantly different from zero (Kim, T.K., 2015).

The test's goal is to see if statistical evidence exists that the mean difference between paired observations is significantly different from zero.

The assumption

Ho : There is no significant difference in mean

H 1: There is significant difference in mean

Decision rule: if p value is less than alpha values (0.05) reject Ho.

Table 4. 9 Paired sample test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Balance from the bin card - Physical count on the day of the visit	128.75	395.559	88.45	-56.377	313.877	1.456	19	0.162

Source: Assessment data, May 2022

The p value is greater than the alpha value in this case, indicating that there is no significant difference between the bin card balance and the physical count on the day of the visit.

4.3 Storage Practice of PPEs

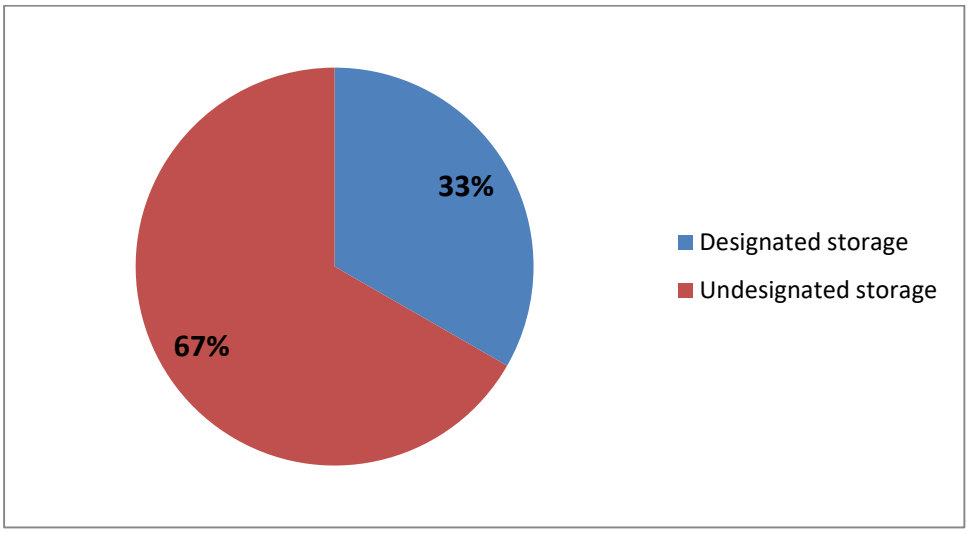


Figure 4.5 Storage space for PPEs

Although 67 percent of COVID-19 treatment centers do not have designated storage space, 33 percent do.

Table 4. 10 Adherence to Good Pharmaceuticals storage Practice Standards for the storage of PPEs

#	Descriptions	Response in number		Percent Adherence
		No	Yes	
1	Does the facility has dedicated storage for PPE and other COVID-19 related products?	2	1	33%
2	Does the facility has dedicated staff to manage PPE and other COVID-19 related products?	3	0	0%
3	Products are arranged and organized according to a logical categorization	3	0	0%
4	Products are protected from direct sunlight.	0	3	100%
5	Are unwanted items in the store room separated from the usable stock?	0	3	100%
6	Products are arranged so that identification labels, expiry dates, and/or manufacturing dates are visible.	3	0	0%
7	Products are stored and organized in a manner which facilitates use of First to-Expire, First-out.	3	0	0%
8	Cartons and products are protected from water during all seasons	3	0	0%
9	The storeroom is maintained in good condition	1	2	67%
10	The current space and organization is sufficient for existing products and reasonable expansion	3	0	0%
11	Storage area is secured with a lock and key, but is accessible during normal working hours by authorized personnel.	0	3	100%
12	Storage area is visually free from harmful insects, rodents, or other animals	0	3	100%
13	Cartons and products are in good condition, not crushed due to mishandling.	1	2	67%

14	Products are stored at the appropriate temperature during all seasons according to product temperature specifications.	0	3	100%
15	Products are stacked at least 10 cm off the floor.	3	0	0%
16	Products are stacked at least 30 cm away from the walls and other stacks.	3	0	0%
17	Products are stacked no more than 2.5 meters high.	3	0	0%

Source: Assessment data, May 2022

According to this assessment, 52.9 percent (9) of the good storage practice standards are not fulfilled at all when PPEs are stored in the selected COVID-19 treatment centers, whereas 29 percent (5) of the standards are met and 17.6 percent (3) of standards are partially met.

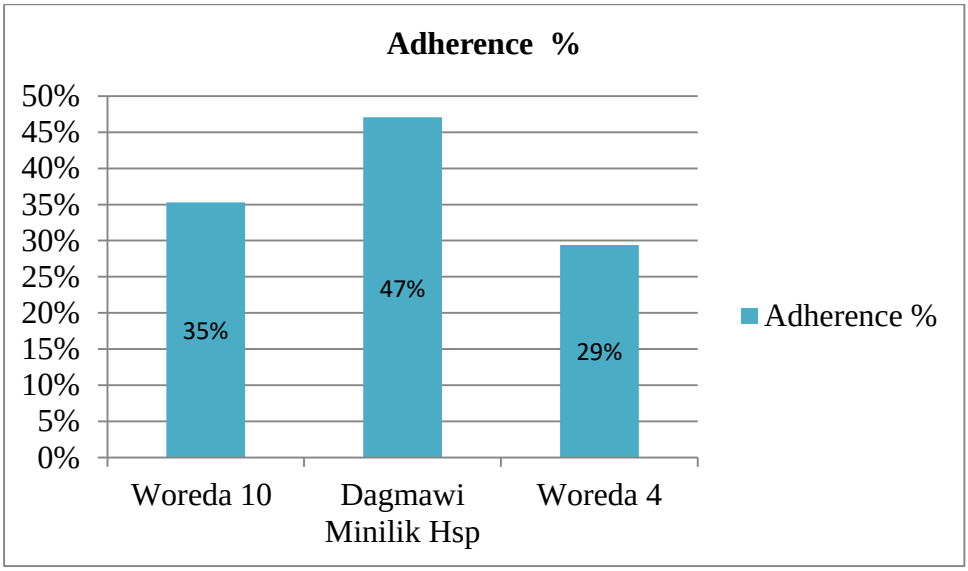


Figure 4.6 Adherence to Storage Practice in selected COVID-19 Rx. Center, In Addis Ababa, May, 2022

Dagmawi Minilik Hospital follows 47 percent of the storage standards, whereas Woreda 10 and Woreda 4 follow 35 percent and 29 percent of the storage standards, respectively.

4.3.1 Inventory management and storage challenges

4.3.1.1 Quantitative Result

The challenges faced by the COVID-19 treatment centers in this study were compared to a list of inventory management issues reported in prior researches. For the polar points, a three-point Likert scale was used to provide agree, disagree, and neutral options.

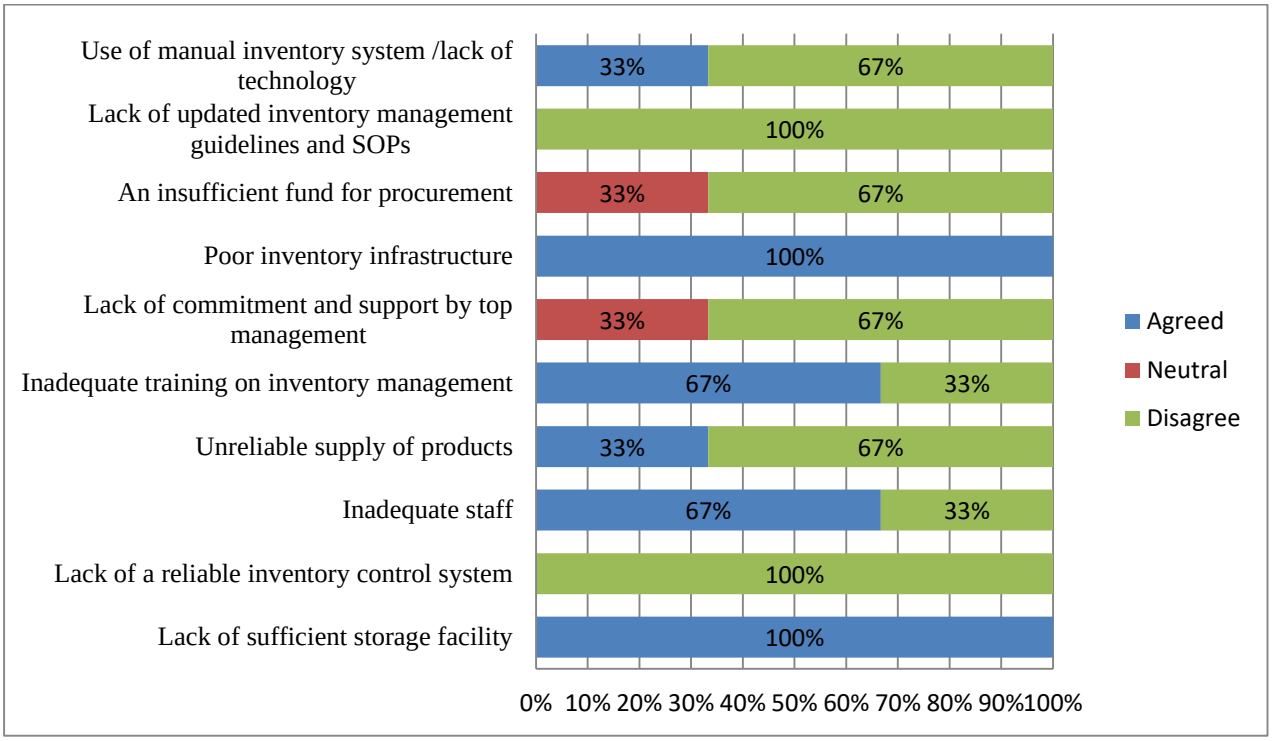


Figure 4.7 Challenges affecting Inventory management and storage

All of the selected COVID-19 treatment centers agreed that insufficient storage space and poor inventory infrastructure are the challenges however was disagreed that lack of updated inventory management guidelines and SOPs and a reliable inventory control system are their challenges.

Inadequate staff and inventory management training were identified as some of the challenges by 67 percent of the centers. Again, 67 percent of the centers disagreed that unreliable product supply, a lack of commitment and support from top management and insufficient procurement funds are their challenges. Lack of commitment and support from top management, as well as insufficient funds for procurement difficulties, elicited neutral responses from 33 percent of the centers.

4.3.1.2 Qualitative Result

In-depth face-to-face interviews with key informants were used to obtain qualitative data (i.e. store managers). Depending on the attributes of the results, the data was categorized into two thematic areas. The issues include storage room issues as well as human resource and capacity building challenges.

i. Storage room capacity and infrastructure suitability

Because COVID-19 came as a pandemic, health facilities were unprepared, and they were forced to rely on existing infrastructure to deliver care and treatment. According to one of the interviewees,

"*Other general service products (i.e. blankets, bed sheets, soaps, stationaries, etc.) were also included in the pharmaceutical store I was managing because the general service store room was converted into a duty room for the duty staffs that were caring for the COVID-19 patients. This added a workload, and the storage space was inconvenient for proper storage practice*".

Another respondent also responded that,

"*The store room we use is on the third floor of the building, and because PPEs are bulky, lifting the cartons once they were offloaded from the trucks proved tough*".

ii. The human resource and capacity building related challenges

Almost every COVID-19 treatment center assessed had a shortage of human resources in the pharmay department. There was no dedicated store manager appointed to manage COVID-19 related products or the supply store. Due to a lack of human resources, one individual may be responsible for multiple tasks in some facilities. For example, one person stated that,

" I am managing three stores found at different locations within the health facility at the same time, due to this I did not get enough time to update bin cards and monitor the stocks ".

Another store manager also indicated that

"In addition to the store room, I sometimes cover the medicine dispensary unit when the pharmacist is not around hence I was unable to find the time to properly manage the store room".

In addition to shortage of human resources, there were few incentives for employees, and available employees had very limited opportunities to upgrade themselves through further education and training due to the pandemic. One store managers said that

"There were logistics trainings available, but due to the workload caused by the COVID-19 pandemic, we were not allowed to attend ".

Another store manager responded that

"*Working as a store manager at COVID-19 treatment centers in health center was an underrated activity since they were not treated just as those who worked at COVID-19 treatment centers in hospitals. Because they did not receive risk allowance, whereas others who worked in hospitals did".*

4.4 Discussion

4.4.1 Availability of PPEs

During pandemics, health supply systems should be able to quickly and reliably acquire and deliver key health commodities, such as personal protective equipment (PPE) for health care personnel(WHO , 2020). Inventory management's main purpose is to avoid stock outs and overstocks of critical supplies, which can result in poor medical care, expiry, and economic loss (WHO, 2004). As a result, effective inventory management of products is critical.

The findings of this study focused on inventory management performance at COVID-19 treatment centers, with indicators such as PPE availability, bin card accuracy, ordering and receiving practices, PPE storage condition, and inventory management and storage challenges.

The availability of PPEs in the assessed COVID-19 treatment centers was 90.5 percent, with 9.5 percent of PPEs was stocked out, which is higher than the study conducted by Deressa et al. (2021) on the availability and use of PPEs in Addis Ababa, which showed that during the COVID-19 pandemic, the frequently available PPE as reported by study

participants has improved. Surgical facemask and N95 respirator availability, for example, has grown from 59.3 percent and 12.6 percent before the pandemic to 82.6 percent and 24.2 percent during the pandemic, respectively. Another study by Ejeta et al. (2021) found that COVID-19 PPEs were available in 75 percent of public hospitals in Southwest Ethiopia.

Madziatera, D., (2020) did an observational study on the availability of PPEs in wards at Queen Elizabeth Central Hospital, Blantyre, Malawi, and found that PPE was available in 75.8 percent of the wards.

The average number of days the PPEs were out of stock at COVID-19 treatment centers in the six months prior to data collection was 159 days, with the average stock out frequency of one lasting the entire six months in one of the COVID-19 treatment centers, which was higher than the study done by Fentie et al. (2015) in Primary Public Health Facilities of Gondar Town, where the average number of days the tracer medicines were out of stock over the six months was 59 days.

4.4.2 Ordering and Receiving practice of PPEs

The ordering and receiving practice of PPEs was observed in this study to be not integrated with the existing system, resulting in COVID-19 treatment centers not determining their demand and being supplied directly by EPSS hubs. This is primarily due to the fact that PPEs and other COVID-19 products are not fully supplied, and a pull system is not used for the centers to request quantities and refill accordingly.

According to Ejeta et al. (2021)'s study on the Logistics Management of COVID-19 Personal Protective Equipment in Public Hospitals in Southwest Ethiopia, there was an irregular supply schedule from SNNP RHB, and COVID-19 supplies and equipment were pushed regardless of the quantity of needed. SNNP RHB, for example, has only supplied once in the last three months. One of the key informat revealed in the same study was that their hospital acquired COVID-19 supplies and PPEs from EPSA, RHB, and the zonal health department. As a result, managing COVID-19 supply and protective equipment is a new challenge.

4.4.3 Availability and Utilization of inventory management tools

Information is at the core of the logistics system. The logistics system will not function properly without complete, timely, and precise data (Kumurya, 2015). LMIS forms (manual or electronic) are essential for keeping this information current, as an absence of LMIS tools can lead to poor logistics data quality (Kolapo et al., 2009) .

LMIS forms (i.e Bin cards, IFRRs, adopted reporting form, receiving and issuing vouchers) were available and used in all COVID-19 treatment sites in this study which was in line with the study conducted in Southwest Ethiopia (Ejeta et al. 2021) and Another study done in Addis Ababa found that 96.2 percent of the facilities assessed had LMIS forms (Tilahun et al., 2016).

Maintaining accurate stock records informs the logisticians about the facility's stock status and allows them to take timely corrective actions. This study revealed that 95.2 percent (20) of the required bin cards were available for PPEs, out of a total of 21. All bin cards for N95 masks, eye goggles, and boots were updated; however, 67 percent of Medical Face Mask and Examination Gloves bin cards were not updated, and 33 percent of bin cards for Face shield and Cover all suites were not updated . This was significantly higher when compared to a study conducted in Southwest Ethiopia (Ejeta et al. 2021), just 7 (16 percent) of the expected 44 bin cards were used, and only 6 (13.75 percent) of the bin cards were updated. This considerable variance could be attributed to the research's timeframe, as there were more cases of COVID-19 in 2021, and the treatment facilities' logistical management preparations were insufficient compared to the study done in 2022. The task of using and updating bin cards was compounded by, the lack of sufficient training about COVID-19 PPEs and their logistics management,

4.4.4 Comparison of Physical count with the Bin cards stock

A mismatch between bin card record balance and physical count of products is one of the indicators of inventory management indicators in health facilities.

Figure 4 shows the rate of discrepancy among the assessed COVID-19 treatment centers. The results demonstrate that the rate of difference among COVID-19 treatment centers was not uniform. The COVID-19 treatment centers have a discrepancy rate that

ranges from 0 percent to 43 percent. Physical count was less than bin card record balance for over 43 percent of the PPEs assessed in two of the centers. This could mean that for 43 percent of the PPEs available in those COVID-19 treatment centers, bin cards were not updated when they were issued. It's a significant situation, because incorrect data impedes the treatment center's capacity to effectively manage their supply chain, resulting in erroneous actions. There should be no discrepancies between physical inventory and bin card balances for each item in an ideal scenario, but there is an acceptable level of error in practice. Deviations of more than 10 percent may require data quality improvement efforts (LIAT, 2008).

The study result done by Fentie et al. (2015) in Primary Public Health Facilities of Gondar Town showed that the discrepancy percentage was ranging from 0% to around 60 percent and physical count was less than bin card record balance for nearly half of the tracer medicines surveyed in one of the health centers. According to another study by Kefale and Shebo (2019), the percentage of tracer medications whose physical inventory is lower than the balance on the bincard ranges between 0 and 33.3 percent, which is lower than the result of this assessment.

There was a positive discrepancy of 15 percent indicates that product is being introduced to the store without being registered on the bin card, resulting in the physical count discovering more PPEs than were recorded. In the above table, the negative discrepancies were found to be 40 percent, implying that stock is physically removed from the storage without being deducted from the bin card. There is no mismatch between the physical count and the bin cards in 45 percent of the instances. The discrepancies across all COVID-19 treatment sites imply that stock is being improperly managed. When compared to a study by Mahoro, A. (2013), at community health facilities in the cape metropole, Western Cape, the prevalence of negative differences was 25.2 percent, whereas the frequency of positive discrepancies was 36.6 percent.

For monitoring current inventory and forecasting future demands, inaccuracy in record-keeping systems limited the benefit. The received quantities, the stock transfer voucher number (STV), the batch, expiry date, and the date of receipt should all be put on the bin card to update the stock on hand when PPEs arrives at a COVID-19 treatment center. When PPEs are issued from the storeroom to the dispensary units, the same

protocol should be followed, with the date of issue and quantity issued being documented on bin cards (Lufesi et al., 2007).

Timely data entry on the bin cards is critical for the availability of accurate and up-to-date records, which will improve inventory control efficiency and make data reporting and monitoring easier.

4.4.5 Storage Practice of PPEs

The store's management should facilitate the flow of products from the provider to the customer in the most efficient and cost-effective manner possible, without significant quality loss, wastage, or theft. The primary goal of store management is to meet the requirements of receiving, storing, and issuing of products.

The storage condition of the COVID-19 treatment centers was assessed using indicators from the LIAT and other literatures, which were based on visual observation and good pharmacy practice requirements for storage condition. When PPEs are stored at the selected COVID-19 treatment centers, 52.9 percent (9) of the good storage practice standards are not met at all, whereas 29 percent (5) of the standards are met and 17.6 percent (3) of the standards are partially met. The result of this assessment, which is significantly lower than a study conducted by Iqbal, M.J. et al. (2015) in District Sirinagar, India, which reported the maximum percentage adherence of 80 percent in managing drug expiry and the lowest percentage adherence of 22.9 percent.

The most fulfilled conditions among the COVID-19 treatment centers was ‘Products are protected from direct sunlight’ (100 percent), ‘damaged or expired products separated from the usable stock’ (100 percent), ‘Storage area is secured with a lock and key’ (100 percent), ‘Storage area is visually free from harmful insects, rodents, or other animals’ (100 percent) and ‘products are stored at the appropriate temperature’ (100 percent).

The least fulfilled condition across the selected was the COVID-19 treatment centers was ‘Dedicated staff to manage PPE and other COVID-19 related products (0 percent), ‘Products are arranged and organized according to a logical categorization ’ (0 percent), ‘ Products are arranged so that identification labels, expiry dates, and/or manufacturing dates are visible ’ (0 percent), ‘ Products are stored and organized in a manner which facilitates use of First to-Expire First-out ’ (0 percent), ‘Cartons and products are

protected from water during all seasons ’ (0 percent), ‘the current space and organization is sufficient for existing products and reasonable expansion ’ (0 percent), ‘Products are stacked at least 10 cm off the floor ’ (0 percent), ‘ Products are stacked at least 30 cm away from the walls and other stacks ’ (0 percent), and ‘ Products are stacked no more than 2.5 meters high ’ (0 percent).

The facility based adherence assessment showed that the highest overall percentage adherence was found at Dagmawi Minilik hospital, with 47 percent, followed by 35 percent at Woreda 10 and 29 percent at Woreda 4 which is comparable to a study conducted by Iqbal, M.J. et al. (2015) in District Sirinagar, India, which found 64.1 percent adherence at the Children's Hospital, 54.3 percent at the District Hospital, 49.3 percent at the Medical College (MC), 29.6 percent at the Sub-District Hospital , and 24.4 percent at the Primary Health Centre (PHC).

The Dagmawi Minilik hospital maintains higher storage standards than the other two COVID-19 treatment centers. This may be due to the fact that the Dagmawi Minilik hospital has a separate storage area for COVID-19 PPEs, whilst the other two only have one store room to manage all types of products. In comparison to health centers, hospitals demonstrated better fulfillment of storage conditions, only 18.9 percent of health centers met more than 80 percent of storage conditions, compared to 61.1 percent of tertiary hospitals, 50.0 percent of general hospitals, and 59.1 percent of primary hospitals according to the IPLS 2019 survey report. Damaged and expired products are segregated from the main stock and held in a separate storage until they are disposed of by the disposal authority.

4.4.6 Inventory management and storage challenges

Insufficient storage space and poor inventory infrastructure were identified as the main challenge by all of the COVID-19 treatment centers; however they disagreed to identify the need for updated inventory management guidelines and SOPs, as well as a reliable inventory control system as their challenges. 67 percent of the facilities reported insufficient staff and inventory management training as some of the challenges. Unreliable product supply, a lack of commitment and assistance from top management, and insufficient procurement budgets were all identified by 67 percent of the centers. Insufficient money for procurement challenges, as well as a lack of

commitment and support from top management, received neutral responses from 33 percent of the centers.

The challenges reported in this assessment were similar to those noted in previous research. For instance, in a study conducted by Johnson et al. (2021) in public hospitals in Nyamira County, Kenya, inadequate staff (72.2 percent), inadequate training (44.5 percent), and unreliable supply of medicines were found to be the most common issues (44.4 percent), and lack of proper storage (44.4 percent), incompetent staff (80.6 percent), poor record keeping (72.2 percent), and poor reporting (69.4 percent) were identified as common inventory and storage management challenges.

CHAPTER FIVE

SUMMARY OF KEY FINDINGS, CONCLUSION AND RECOMMENDATION

5.1. Introduction

The purpose of this chapter is to provide the conclusions reached as a result of the questionnaire and interview analysis, as well as to make recommendations for future research.

5.2. Summary of Key Findings

This research was conducted towards an attempt to assess the inventory management and storage practice of PPEs in selected COVID-19 treatment centers of Addis Ababa. Three COVID-19 treatment centers were selected and data collected. A descriptive cross-sectional and exploratory study design with a mixed approach including quantitative and qualitative research methodologies was carried out using a checklist and semi-structured questionnaire, as well as an interview guide, and quantitative data was analyzed using SPSS and Microsoft Excel sheets. Manual qualitative data analysis was also done using thematic analysis methodologies.

The following Summary has been drawn on the bases of the findings of the data analysis effort.

Availability of PPEs

The results of the assessment revealed that 90.5 percent of PPEs were available, with 9.5 percent out of stock for 137 to 180 days on average, with the average stock out frequency 1 lasting the entire six months. The average number of days the PPEs were out of stock at COVID-19 treatment centers in the six months prior to data collection was 159 days.

Inventory Management Practice

In this assessment, it was found that PPE ordering and receiving practices were not connected with the existing system, resulting in COVID-19 treatment facilities not being able to determine their demand and being supplied directly by EPSS hubs. This is primarily owing to the fact that PPEs and other COVID-19 products are undersupplied, and the centers do not have access to a pull system that allows them to request quantities and have them filled as needed. Logistics tools were used to ensure

that all PPEs were appropriately inventoried. Only three of the seven PPEs had updated bin cards, according to the findings of the assessment, with bin card stock exceeding physical count in two of the centers for 43 percent of the PPEs.

Storage Practices of PPEs

The fundamental purpose of store management is to meet product receipt, storage, and distribution needs. The assessment indicated that the COVID-19 treatment centers failed to meet the majority of the storage practice standards, with adherence to each center's falling below 50 percent. Limited storage space, poor inventory infrastructure, insufficient staff, and timely inventory management training are all major challenges identified.

Inventory Management and Storage Challenges

All of the COVID-19 treatment centers recognized insufficient storage space and poor inventory infrastructure as their key concerns; however, they disagreed on the need for updated inventory management guidelines and SOPs, as well as a reliable inventory control system.

5.3. Conclusions based on the findings

The research objectives can be stated as follows:

- To assess the availability of Personal Protective Equipment (PPEs)
- To evaluate the inventory management practice of PPEs in selected facilities
- To assess how PPE are stored in the health facilities
- To determine the challenges of inventory management of COVID-19 PPEs.

The study used an observational checklist, semi-administered questionnaires, and interviews to accomplish the above objectives. To offer a background of the practice of inventory management and storage of health commodities, a vast number of literatures were read.

As per study's first objective, the availability of PPEs for patient care and diagnosis was not a concern in this assessment as 90.5 percent (19) PPEs were available at the COVID-19 treatment centers from the expected, with 9.5 percent (2) of PPEs being out of stock for varied amounts of time, with stock outs ranging between 137 and 180 days, with the average stock out with frequency one lasting the entire six months

However, the facilities expressed concern that as the number of COVID-19 cases decreasing, so did the usage of PPEs, resulting in an overstock of PPEs.

In regarding the second objective, when it comes to inventory management practices for PPEs, the ordering and receiving practices were not the same as the other program health commodity groups through IPLS because PPEs were not fully supplied and the push system supply strategy was used. However, the SOH and consumption data were available for the FMOH and regional health bureaus to determine the needed quantity for the COVID-19 treatment centers based on the information they received and also the available stock.

Almost all of the COVID-19 treatment centers used logistics tools to ensure that all PPEs were properly inventoried. However, only three of the seven PPEs had up-to-date bin cards, therefore the proportion of physical count vs. bin cards difference differed among all COVID-19 treatment facilities, with bin card stock exceeding physical count in two of the centers in 43 percent of the PPEs. Other reasons of inaccurate data have been identified in the literature, including manual data entry, and the rate for which data becomes updated. According to a study conducted, inaccuracy at one point of the supply chain does have a negative impact on inventory performance at other levels (LIAT, 2008).

Overall, inventory management of PPEs at the assessed treatment centers was unsatisfactory, and we can conclude that this was due to a lack of storage room infrastructure and sufficient human resources.

In terms of the third objective, the assessment revealed that the majority of the storage practice standards were not met by the COVID-19 treatment centers, and that adherence to the standards of each centers was below 50 percent, which is most likely due to the fact that the majority of them lacked designated storage space for PPEs and the required storage infrastructure.

Finally, the findings show that, based on quantitative and qualitative assessments of the challenges of inventory management and storage of PPEs, all of the COVID-19 treatment centers agreed that the main challenges are insufficient storage space, poor inventory infrastructure, insufficient staff, and timely inventory management training.

5.4 Recommendations

In view of the aforementioned conclusions, the researcher wishes to offer some recommendations that, if implemented, could result in some positive improvements to the current approach of managing PPEs. Various considerations must be taken based on the recent experiences to improve the management of PPE during pandemic to support supply chain institutions in making an informed decision during constrained high demand situations to support the pandemic response. The researcher made the following recommendations based on the study's findings and the study's main emerging challenges.

- Because most health facility pharmacy stores are not designed specifically for the storage of pharmaceuticals, special attention should be paid to the store's physical setup or remodelling to allow for the implementation of optimal and good pharmaceutical storage practices.
- Improving inventory management procedures necessitates a high level of coordination and visibility among all parties, as well as the use of logistics management technology. For PPEs, the use of existed web-based inventory management technology in stores should be considered.
- The researcher suggests that management expose its employees to training on a periodic basis to ensure their inventory management skills for new and existing employees are improved.
- By monitoring the physical count on a frequent basis, inaccuracies can be minimized in the recording process.

- The Addis Ababa RHB, as well as the sub-city health office, should also encourage personnel to accurately document COVID-19 PPEs through continuous mentorship and supervision

It is therefore recommended that the study be performed with a considerably larger sample drawn from both public and private COVID-19 treatment centers in order to investigate the availability, inventory management, and storage methods of PPEs in greater depth. This will allow for the leverage and adoption of methods that will enable long-term improvements in both the private and public sectors.

A comparable study should also be conducted in other regions to identify the level of inventory management practices and their impact on COVID-19 treatment center performance. This will allow for stronger comparisons, which will lead to the development of solid conclusions based on statistical evidence.

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Annex

I . Data Collection Instrument
Introduction

This questionnaire was developed for the primary goal of gathering information on the inventory management techniques and challenges of COVID-19-related PPE in Addis Ababa's public COVID-19 treatment centers. The information gathered would only be used for academic purposes.

Consent Form

Participant's statement

I have read this consent form or had the information read to me. I have had the chance to discuss this research study with a study counselor. I have had my questions answered in a language that I understand. I freely agree to participate in this research study. I understand that all efforts will be made to keep information regarding my personal identity confidential.

By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study. I agree to participate in this research study: [ ]Yes [ ]No

Participant printed name: _____

Section A. General Information

Name of Health Facility:

Region :

Sub City :

Position of the interviewee:

Profession :

Total Professional Service Months/Years :

Number of years working as a store manager at the health facility:

Data collection date:

Section B.

1. Availability of PPE

#	Product	UOM	Is the product managed at this facility? Yes/No	Bin card available (Manual/Electronic)	Is there Stock out of the product on the day of the visit (Yes/No)	Below /above EOP (O.5 months is the cut off)	stock out within the Last 6 months? (Yes/No)	Frequency of stock out in the past 6 months	Total number of days the product was stocked out
1	Medical Face Mask								
2	N95 Mask								
3	Examination Glove								
4	Eye Goggle								
5	Face Shield								
6	Cover all suite								
7	Boots								

2. Comparison of physical count with the balance on bin card and the practice of using manual or electronic bin cards to record transaction.

2.1 Has bin card been updated in the recent 30 days? (Consider the bin card up-to-date if it was last updated with a balance and the facility has not had any transactions.)

	Product	UOM	Bin card updated (Yes/No)	Balance from the bin card	Physical count on the day of the visit	Difference	Reason for the difference if it is known
1	Medical Face Mask						
2	N95 Mask						
3	Examination Glove						
4	Eye Goggle						
5	Face Shield						
6	Cover all suite						
7	Boots						

3. The practice and usage of appropriate documents for ordering and receiving PPEs at health facilities

3.1 Check if the Model 19, Model 22, IFRR and RRF were in use at the store and dispensary units (for the past three review/reporting periods).

3.1.1 Check model 19 were issued when products were received from EPSA hubs or RHBs

3.1.2 Check if Model 22 were issued when products issued to dispensary units

3.1.3 Check if dispensaries requesting the store by using IFFR

3.1.4 Check if the store sent RRF to EPSA hubs

3.1.5 Check which government entity is supplying PPEs to the health facilities

3.2 Are there written procedures and guidelines (e.g., manuals, job aids, SOPs) to help staff carry out their logistics responsibilities?

	Questions	**Answer**
3.3	Are there any LMIS forms send to the higher level?	Yes No
3.4	How often are these LMIS reports sent to the higher level?	Monthly, Bi-monthly Quarterly Any other
3.5	When was the last time you sent an order/report for products at this facility?	Within the last month, 2 months ago 3 months ago More than 3 months ago
3.6	How did you learn to complete the forms/records used at this facility?	Never learned, During a logistics workshop On-the-job training On-the-job training (self-learning) Other Specify
3.7	Who determines this facility's resupply quantities?	The facility itself higher level Other specify
3.8	When did you receive your most recent supervision visit?	Never received Within the last month Within the last 3 months Within the last 6 months More than 6 months ag Other (specify)

4. Storage Condition assessment

Note : Assess the storage area where PPEs are stored at the health facility

4.1 Does the facility has dedicated storage for PPE and other COVID-19 related products?

4.2 Does the facility has dedicated staff to manage PPE and other COVID-19 related products?

4.3 How does the program cope with inadequate storage space?

#	**Description**	**Yes**	**No**	**Comment**
4.4	Products are arranged and organized according to a logical categorization: e.g. by program, alphabetically, pharmacological, etc			
4.5	Products are protected from direct sunlight.			
4.6	Are unwanted items (damaged or expired drugs, non-pharmaceutical items, etc.) in the store room separated from the usable stock?			
4.7	Products are arranged so that identification labels, expiry dates, and/or manufacturing dates are visible. (If more than 75 percent of the shelf area is organized(of the tracer products managed), code Yes)			
4.8	Products are stored and organized in a manner which facilitates use of First to-Expire, First-out.(If more than 75 percent of the shelf area is organized (of the tracer products managed)			
4.9	Cartons and products are protected from water during all seasons (e.g. No leaking roof and wall, shelf-having clearance from the floor, etc.).			
4.10	The storeroom is maintained in good condition (clean, no trash, sturdy shelves, and boxes well organized).			
4.11	The current space and organization is sufficient for existing products and reasonable expansion (i.e., receipt of expected product deliveries to meet the existing demand.			

4.12	Storage area is secured with a lock and key, but is accessible during normal working hours by authorized personnel.			
4.13	Storage area is visually free from harmful insects, rodents, or other animals (excluding cats). (Check the storage area for traces of bats and/or rodents [droppings or insects])			
4.14	Cartons and products are in good condition, not crushed due to mishandling. If cartons are open, check if products are wet or cracked due to heat/radiation.			
4.15	Products are stored at the appropriate temperature during all seasons according to product temperature specifications.			
4.16	Products are stacked at least 10 cm off the floor.			
	Products are stacked at least 30 cm away from the walls and other stacks.			
	Products are stacked no more than 2.5 meters high.			

5. The challenges of inventory management of COVID-19 PPEs.

Please indicate or rate the challenges that your health facility faces in Inventory management of PPEs using the likert scale given (disagree, neutral, agree).

Challenges affecting Inventory Management	**Disagree**	**Neutral**	**Agree**
Lack of sufficient storage facility			
Lack of a reliable inventory control system			
Inadequate staff			
Unreliable supply of products			
Inadequate training on inventory management			
Lack of commitment and support by top management			
Poor inventory infrastructure			
An insufficient fund for procurement			
Lack of updated inventory management guidelines and SOPs			
Use of manual inventory system /lack of technology			