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**College of Health Sciences**

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**Department of Pharmaceutics and Social Pharmacy**

**Time-Based Process Mapping and Exploring Factors Affecting the  
Pharmaceutical Supply Chain Process in Saint Peter's Specialized  
Hospital**

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**October 2023**

**Addis Ababa, Ethiopia**

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A Thesis Submitted to the Department of Pharmaceutics and Social  
Pharmacy, School of Pharmacy in Partial Fulfillment of the Requirements  
for the Degree of Master of Science in Health Supply Chain Management

**October 2023**

**Addis Ababa, Ethiopia**

**Addis Ababa University**  
**School of Pharmacy**

This is to certify that the thesis prepared by Abebech Chemedda Oljira entitled Time-Based Process Mapping and Exploring Factors Affecting the Pharmaceutical Supply Chain Process in St Peter Specialized Hospital. Submitted in partial fulfillment of the requirements for the degree of Master of Science in Health Supply Chain Management complies with the regulations of the University and meets the accepted standards concerning originality and quality.

Signed by the Examining Committee

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## **Dedication**

I dedicate this thesis to my husband, Habtamu Amenu, my son Bilisumma Habtamu and my daughter Meti Habtamu for their support and understanding.

## **Acknowledgments**

Above all, I want to thank the All-Powerful God and the Virgin Saint Mary, his mother, for providing me with the motivation, bravery, and strength to pursue and complete this study. I greatly thank my advisors, Professor Teferi Gedif and Mr. Dawit Teshome, for their constant support, scholarly discussions on the subject, and investing the time to offer insightful remarks, and provide feedback for the creation of this final thesis work.

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## **Abstract**

**Introduction:** Time has become the most important factor in this competitive business environment. Time-based competition is a strategy by which a firm makes better use of time as a resource to acquire a competitive advantage. In the pharmaceutical supply chain context, there is a lack of objective evidence regarding how long the entire processes take, which activities are value-adding and which are not, and factors affecting the time are known little.

**Objective:** to perform time-based process map and explore factors affecting the pharmaceutical supply chain process in Saint Peter Specialized Hospital

**Method:** Facility based sequential triangulation quantitative and qualitative study design and observational process mapping and document review used for data collection. Quantitative and qualitative data analyzed using a thematic analysis approach used for qualitative data.

**Result:** Process map of pharmaceutical supply chain at Saint Peter specialized Hospital have mapped by dividing into three such as process map of acquiring pharmaceuticals from EPSS, Acquiring pharmaceutical from private supplier and reporting and resupplying of pharmaceuticals from store. . The Time Based Process Mapping showed that from 7 % to 84.8 % were Non Value Adding. And the factors contributing for these Non Value Adding were unavailability of enough vehicles, not giving priority for pharmaceutical procurement, lack of Standard Operating Procedure, work load & lack of commitment of staff, Shortages of budget to procure pharmaceuticals, an and discrepancy between PO and Invoice of the product during receiving.

**Conclusion:** Process mapping of pharmaceutical supply chain highlight a clear road that pharmaceuticals pass through to reach a customer in Saint peter`s specialized hospital. And it revealed the value adding and non value adding activities of the SPSH pharmaceuticals supply chain from ordering to receiving and reporting and supplied from the store were from 8.1% to 84.3% were non value adding time.

**Key Words:** Pharmaceuticals, Time-Based Process Mapping, Value adding activities

# Table of Contents

<i>Dedication</i> .....	<i>I</i>
<i>Acknowledgments</i> .....	<i>II</i>
<i>Abstract</i> .....	<i>III</i>
<i>Table of Contents</i> .....	<i>IV</i>
<i>List of Table</i> .....	<i>VI</i>
<i>List of figures</i> .....	<i>VII</i>
<i>Acronyms</i> .....	<i>VIII</i>
<b>1. Introduction</b> .....	<b>1</b>
1.1. Background.....	1
1.2. Statement of the Problem .....	2
1.3. Significance of the Study .....	3
1.4. Scope of the Study .....	3
1.5. Research Questions .....	3
<b>2. Related Literature Review</b> .....	<b>4</b>
2.1. Theoretical Review .....	4
2.2. Empirical Review .....	9
<b>3. Objectives of the study</b> .....	<b>11</b>
3.1. General Objective.....	11
3.2. Specific Objectives.....	11
<b>4. Research Methodology</b> .....	<b>12</b>
4.1. Study Setting .....	12
4.2. Study Design and Period .....	12
4.3. Source of population.....	12

4.4. Study Participants and Documents.....	13
4.5. Inclusion and Exclusion Criteria .....	13
4.6. Sample Size Determination.....	14
The target populations of this study were both the employees and pharmaceutical supply chain documents of SPSH.....	14
For Quantitative Data.....	14
Three consecutive pharmaceutical supply chain documents were taken and observed.....	14
For Qualitative Data .....	14
4.7. Sampling Technique.....	14
4.8. Data Collection Instruments and Method.....	15
4.9. Data Quality Assurance Process .....	15
4.9. Data Analysis .....	16
<b>5. Ethical Consideration.....</b>	<b>17</b>
<b>6. Results .....</b>	<b>20</b>
6.1. Demographic Characteristics of FGD Participants.....	20
6.2. Process Mapping and Time Taken for each activity in Pharmaceutical Supply Chain .....	21
6.3. Time-Based Performance Measures .....	25
6.4. Qualitative Findings .....	31
<b>7. Discussion.....</b>	<b>36</b>
<b>8. Limitations of the Study .....</b>	<b>39</b>
<b>9. Conclusion.....</b>	<b>40</b>
<b>10. Recommendations .....</b>	<b>41</b>
<b>References .....</b>	<b>42</b>
<b>Annex I Process map supply chain of pharmaceuticals supply chain at .....</b>	<b>47</b>
<b>SPSH.....</b>	<b>47</b>
<b>1. Process map of acquiring PHARMACEUTICALS FROM EPSS .....</b>	<b>47</b>
<b>Annex II.....</b>	<b>51</b>
1. Focus group discussion Guide Questions .....	51
<b>Annex III.....</b>	<b>53</b>
1. Time Data Collection Format .....	53

## List of Table

<b>Table 2. Time taken for activity at St Peter hospital to receive pharmaceuticals from EPSS .....</b>	<b>26</b>
<b>Table 3. Time taken for main activity at St Peter hospital to receive program pharmaceuticals from EPSS .....</b>	<b>27</b>
<b>Table 4. Time taken to acquire pharmaceuticals from private supplier via RFQ .....</b>	<b>28</b>
<b>Table 5. Time taken to acquire pharmaceuticals from private supplier via open tender .....</b>	<b>30</b>
<b>Table 6. Time taken for reporting and resupplying from store to dispensaries and different service providing unit.....</b>	<b>32</b>

## List of figures

**Figure 1**process mapping to receive Pharmaceuticals from EPSS .....Error! Bookmark not defined.

**Figure 2** Process Mapping ton REceive Pharmaceuticals from Private supplierError! Bookmark not defined.

**Figure 3**process mapping To Distribute Pharmaceuticals to Dispensing and different service providing units from store .....Error! Bookmark not defined.

## Acronyms

DTC	Drug and Therapeutic Committee
DSM	Drug Supply management
EFY	Ethiopian Fiscal Year
FMOH	Federal Ministry of Health
EPSA	Ethiopia Pharmaceutical Supply Agency
FDG	Focus Group Discussion
IFRR	Internal Facility Reporting and Requisition
IPLS	Integrated Pharmaceutical Logistics System
MSH	Management Sciences for Health
NNVA	Non-value-adding activity
PFSA	Pharmaceutical Fund and Supply Agency
RFQ	Request for quotation
RRF	Reporting and Requisition Form
SCM	Supply Chain Management
SM	Store Manager
SMT	Senior Management Team
SPSH	Saint Peter Specialized Hospital
TBPM	Time-Based Process mapping
VAA	Value Adding Activity
WHO	World Health Organization

# 1. Introduction

## 1.1. Background

The majority of organizations have a traditional supply chain strategy. Each department has its workspace in this strategy, and interactions usually occur intradepartmental (Li, 2014). It has found that within a company whose strategy is traditional, much of the work executed is non-value-adding. By this, a significant number of the tasks carried out performed more out of procedure than necessity and, they had removed. On the contrary, the removal of such tasks may be beneficial to the company. Over a decade ago, a few companies had been seen to be aware of this and consequently restructured their supply chain to address this matter (Setijono, 2008).

In setting up effective SCM, the key factors that need to focus on are building relationships and creating value. Companies become more agile, responsive, and competitive when this achieved. Understanding the time dimension is one of the most significant things in Building effective SCM. (Ambe,2010). Time-based competition is a strategy by which a firm makes better use of time as a resource to acquire a competitive advantage. It seeks to compress the time required (Porter, 1985).

When a company attacks time directly, the first benefits to show up are usually shorter cycle times and faster inventory turns. Lower overhead costs usually follow, as the costs of dealing with breakdowns and delays begin to disappear from the system. Therefore, by seeking time reduction, both time reduction and cost reduction are often the rewards. Attacking the sources and causes of delays, helps reduce quality defects in products and services. Thus, by focusing on time, customers' needs met more quickly, and a quality benefit will often accompany the time benefit (Harrison and Hoek, 2011). Time-Based systems with an emphasis on speeding up process times result in a reduction in cumulative lead times. A Time Compression Virtuous Circle is produced (Tiedemann, 2017).

The research for speed has become the latest initiative in the pursuit of competitive advantage. One of the first shortfalls in existing tools generally used by management consultants to analyze logistics and supply chains was the lack of a process-mapping tool that recognized time as an axis. Integration Definitions for process Modeling and other tools are commonly used to link activities and processes but have many shortfalls. Therefore, they do not have a time base and are difficult to audit. This leads to a map that reflects the local procedure manual rather than what people do. They do not discriminate between value-adding Activities and non-value-adding (unnecessary waiting, queuing, rework, etc.). In addition, they spread over many pages, thus making it hard to focus on specific problem areas in a way that grabs management's attention (Schopperle, 2013).

Hospital pharmacies can be more responsive than other industries because they cannot afford to run out of stock during an operation. When patients critically in sick need some medicine, they must always maintain a high amount of buffer stock to avoid zero inventories (FIP, 2020). Therefore, they are more responsive. If medicines are out of stock, it can result in the death of a patient (Atnafu and Balda, 2018). The main goal of a time-based process map is to offer a straightforward method for comprehending present performance. It is useful to distinguish between actions that bring value and those that do not. Even so, there is a knowledge gap in evaluating the time-based process mapping of the pharmaceutical supply chain studied. Since St. Peter Specialized Hospital in Addis Ababa is a specific hospital, this thesis focuses on Time-Based Process Mapping and exploring factors affecting the Pharmaceutical Supply Chain Process in Hospitals. In order to examine time-based process

mapping and explore significant time-delay factors in pharmaceutical supply, this study examines both of these topics.

## **1.2. Statement of the Problem**

Well-organized pharmaceutical service ensures the continuous availability of all pharmaceuticals (Demissie *et al.*, 2022). Conversely, poor pharmaceutical supply management results in unreliable availability, leading to stock out, shortage, and treatment failure. It could also result in significant wastage of resources due to deterioration and expiration, which leads not only to the morbidity or mortality of a patient but also have socioeconomic impacts (Modisakeng *et al.*, 2020).

Supply Chain performance improvement has become a necessary strategy for providing uninterrupted health care service which was improved by identifying the main steps and activities done in each health facility to avail pharmaceuticals (Villarreal, Gonzalez, and Madero, 2004).

Inefficient supply chain practices will affect the overall performance of the health facility. Pharmaceutical Supply Chain is more complex than that of other industries. If vital medicine is out of stock, it can result in the deterioration of patient health and, finally, death. Thus, pharmaceutical supply chains must be more responsive (Nawshad, 2016).

Time-Based Process mapping is a technique for diagnosing supply chain performance. It starts by understanding the symptoms of poor performance. Understanding the current operating system and process is also the first step in gaining widespread recognition of the symptoms and establishing the need to change within an organization (Chapman, 2003). Process mapping and measurement provide the mechanisms to do this. Mapping and measuring a process establishes the performance baseline that enables the effect on the performance of changes to process design to be measured (Salloum, 2013).

Studies showed that as the demand for medicines and health supplies reflects changes in population health and environmental conditions, there is a great need for flexibility and responsiveness in procurement and contracting (Miller and Wilkerson, 2014; WHO, 2016).

In Ethiopia, to ensure communities' access to essential medicines, procuring pharmaceuticals in bulk and decreasing procurement lead time from 240 to 120 days was targeted as strategic objective for pharmaceutical supply and services (MOH, 2019). The study on the procurement practice of program drugs at EPSS shows that the procurement lead time, on average, took 137.3 days from the opening of

the letter of credit to the availing products for use in the EPSS warehouse (Sisay *et al.*, 2021; Boche *et al.*, 2022).

In Saint Peter Specialized Hospital (SPSH), no standard operating manual or other documents show how a pharmaceutical reaches the Hospital. There is also frequent stock out of different pharmaceuticals necessary for the health service. There is no supply chain mapping, but the system takes a long time to avail health commodities from public and private suppliers to patients. However, there is a lack of objective evidence regarding how long the entire processes take and which activities are value adding and which are not. In addition, factors' affecting the time known little.

### **1.3. Significance of the Study**

Time-Based Process Mapping used to generate visibility of the processes within the supply chain, and once this visibility has achieved, it is possible to benchmark similar processes. The study gives the Hospital a clear picture of how the current time-based process map of the pharmaceutical supply chain carried out and which activities are value adding and which are not. The result of this study will provide baseline data used for other who have direct or indirect involvement in the supply chain. Finally, the study may open the eyes of other researchers to conduct other studies in the area, and the evidence from this study will contribute to the scientific community.

### **1.4. Scope of the Study**

The present study attempts to work only on the St. Peter Specialized Hospital pharmaceutical supply chain. It did not focus on an emergency order; instead, for the regular pharmaceuticals supply Chain process.

### **1.5. Research Questions**

- ✓ What are the different processes involved in pharmaceutical supply chain management in Saint Peter Specialized Hospital?
- ✓ What time taken for each process?
- ✓ Which processes are value adding and which are not?
- ✓ What are the factors contributing to the delay of pharmaceutical supply processes?

## **2. Related Literature Review**

### **2.1. Theoretical Review**

#### **2.1.1. Process Mapping**

Process mapping is a method that allows one to identify and expose key elements of a process and to gain insight into actual practice as well as to design new or enhanced processes. Furthermore, to analyze and better understand the systems and processes in which improvement interventions may be introduced (Antonacci, 2008). It is also a simple and valuable tool for improving and streamlining existing business processes or designing and communicating new ones (Bailey, 2011). It uses charts with symbols and arrows to visualize an organization's core processes and their attributes, such as sequence, duration, costs, risks, and responsibilities (Wasson, 2006; OMG, 2011). Process maps can illustrate more clearly than written procedures how a business is conducted, where value is added to a product or service, and where inefficiencies might be occurring. Although the process-mapping technique originated in industrial operations, it has many benefits for streamlining any business (Bertilsson, 2019).

To improve supply chain performance, managers should know exactly what is happening along their supply chain. It is therefore argued that supply chain mapping will deliver insights into the complexity of a supply network and should be the first step in any business if performance or overall sustainability is to be improved (Bertilsson, 2019)

Processes are at the heart of how every business operates, and a greater understanding of what processes are, how they function, and their impact leads to better business management (Maleka, 2015). A map can act as the basis for redesign or modification; it helps to visualize the business and identify areas for further analysis and improvement. In addition, a map can be used as a communication tool across firms and departments and will lead to a common understanding of the process. The map can also be used as an educational tool for new people involved in the process to be oriented to their role in the process (Brumburgh and Raja, 2001; Antonacci *et al.*, 2018).

There are several possible purposes for making a process map. The most common ones are to understand a process, to analyze and improve a process, to train people, and to design new processes.

A flowchart is one of the process mapping tools used to understand a process by using different

symbols to represent activities and decision points within the flow (Malinova and Mendling, 2014).

### **2.1.2. Time-Based Process Mapping**

Time-Based Process Mapping (TBPM) provides an effective lens for supply chain professionals to identify opportunities for improvement in the supply chain. This methodology enables managers to challenge current processes and methods (Sundgren and Lonnbratt, 2019). The key purpose of a TBPM is to provide a simple mechanism for understanding current performance. From this perspective, time is easier to understand and grasp as a performance attribute. Time is an absolute measure compared to cost and quality, which are open to differences in interpretation. Many people may not correctly use cost and quality as a measure due to a poor grasp of how costs happen in reality and misunderstanding the meaning of quality (Sundgren and Lonnbratt, 2019).

Time is a simple measure that everyone understands, even people who have little training, and it allows them to measure the performance of a process or activity. In addition, if the measures are simple to understand, it will be easier for people to figure out the significant issues. Moreover, they can directly measure the process of activities and target a process, which is just adding time (Eswaramurthi and Mohanram, 2013).

TBPM identifies value-adding and non-value-adding activities on a supply chain and guides the user in generating short-term and long-term solutions (Gyllengahm, 2020)

### **2.1.3. Value-added Activity**

Value is defined from the viewpoint of customers, with the capability to deliver exactly the customer-needed product or service with minimal time at a reasonable price (Setijono, 2008). Value-adding activities directly create products or services customers want (Kumar and Rajeev, 2016). Value is added to products or services only when the customer cares about the change improvement and when the health commodities reach customers at the right time (Walker et al., 2021).

The logistics literature often refers to the "seven rights (7Rs)" that must be achieved simultaneously for high customer satisfaction. The 7Rs are the "right product," in the "right quantity," in the "right quality," at the "right place," at the "right time" for the "right customer," and at the "right cost" used to ensure that patients always get pharmaceuticals they need. (Ozalp *et al.*, 2010). To satisfy the customers, there are three competitive dimensions, i.e., price, product differentiation, and delivery time, which depend on the lead-time (Magnusson and Simonsson, 2012).

Lead-time is the time between the initiation of a process and its completion. Lead-time usually refers to the time that elapses between placing and ordering an item and delivering it, but it can also refer to the time it takes to prepare drawings or complete approval processes. Different variables can affect lead-time, such as market conditions, holiday periods, strikes, transportation, inclement weather, etc. Cycle time starts when the work on the job site begins and ends when the work is completed. In other words, cycle or process time measures the execution or productivity rate and adds value to the product. Whereas lead time measures all the time invested in a system, including the time that does not add value to the product, such as waiting or transportation time (Klosova and Kozlovská, 2021).

#### **2.1.4. Non-Value Added Activity**

Non-value-added activities are often called waste, the lean philosophy (Sanahuja, 2020). However, non-value-adding activities are not necessarily wasteful, which contradicts the perception that waste is a synonym for activities that do not add value. Activities referred to as waste add neither value nor move information or material closer to the customer. The products or materials still need to move across the supply chain to the location where the customer wants that product. However, products and materials should not, e.g., be moved or processed unnecessarily since it only leads to additional costs. (Tiedemann,2017).

Over processing and inappropriate use of equipment, techniques, or systems are two waste categories in the pharmaceutical supply chain. Often, a more straightforward strategy would be preferable. Excessive movements of data or materials are waste categories that result in lost time and money.

Long periods of waiting for individuals, information, or items result in poor flow and lengthy lead times. Bad ergonomics and poor workplace management cause unnecessary motion. Poor customer service results when there is excess inventory due to excessive storage and delivery delays of information or goods. Because underutilized employees lack the creativity and abilities to enhance procedures and practices, this results in longer lead times and wastes resources.(Machado *et al.*, 2014)

#### **2.1.5. Pharmaceutical supply chain**

Healthcare organizations worldwide are looking for ways to improve operational efficiencies and reduce costs without affecting patients' care and services. (NHS, 2004).

The pharmaceutical supply chain provides how prescription medicines delivered to patients. Pharmaceuticals produced in manufacturing sites transferred to wholesale distributors, stocked at retail, dispensed by pharmacies, and delivered to and taken by patients (Kaiser, 2005).

An inefficient supply chain is associated with product discontinuity, product shortages, poor performance, lowered patient safety, dispensing errors, and technological errors, causing pharmacy stock shortages (WHO, 2008). Increasing the efficiency of Supply chain processes can contribute to building up a smarter, safer, and lower cost of pharmacy operations in Public Hospitals Medicines Management Units by optimizing the supply processes, reducing errors, and improving patient safety and satisfaction (Squire, 2008).

Workshop by WHO (2006) outlines the difficulties of the medicine supply in African countries. the main challenges being poor information, lack of consumption data, and inadequate storage facilities.

Drug supply management organized around five basic functions of the Medicines Management cycle: selection, quantification, procurement, distribution, and use. At the center of this cycle is a core of management support systems, which include organization, financing and sustainability, information management, human resource, and quality assurance management.

**Pharmaceutical selection** The foundation for real-time accessibility to pharmaceuticals involves the selection of pharmaceuticals based on the evidence or diagnosis, rational utilization, price affordability, optimal resources (monetary and personnel), and a reliable, robust, and self-sustaining supply system (Kolikam, and Kamathi, 2015).

Essential medicines selected depending on public health relevance, evidence on efficacy and safety, and comparative cost-effectiveness. WHO stated that carefully selecting a limited range of essential medicines results in a higher quality of care, better management of medicines, and more cost-effective use of health resources (WHO, 2002).

Non-availability of a committee for selection, STGs, EDL, and Formularies not regularly updated to reflect changes in clinical management and not disseminated are the challenges & bottlenecks of the selection of pharmaceuticals at health facilities in Africa. WHO 2006

**Quantifying pharmaceuticals** is estimating the quantity and cost of the products required for a specific health program (or service) and, to ensure an uninterrupted supply for the program, determining when the products should be procured and distributed (USAID | DELIVER, 2011). Pharmaceuticals quantification refers to calculating the quantities of specific Pharmaceuticals required for a health program for a given amount of resources available, e.g., for a given budget (Emelia al et. 2014).

Moreover, quantification is important for informing supply chain decisions on product selection, financing, procurement, and delivery (EPSA, 2016).

As stated by WHO, challenges & bottlenecks for quantification for pharmaceuticals were Unreliable/inadequate consumption, morbidity, and logistics data, inadequate human resources for quantification, matching needs/quantification with available funds, and fragmentation of quantification.

The quantified pharmaceuticals must be procured by coinciding with the available budgets. Some aspects of procurement performance, such as inefficient processes and delayed delivery or stock out of medical supplies, may affect both efficiency and effectiveness of healthcare systems (Kizito and James, 2013). Many factors contribute to the length of procurement lead-time, categorized into internal and external factors Thai, (2001).

Internal factors include the organizational framework within which the procurement is carried out. According to various writings cited by Kagiri (2005), some of the major contributors to time and cost overruns were poor communication, lack of experience by the procurement manager, procurement delays, lack of planning, poor infrastructure, inadequate resources, lack of motivation, tendering methods, variations, project environment, poor project definition. Other writers have cited inflation, project complexity, inaccurate estimates, change orders, design changes, late submission of drawings, poor specifications, incorrect site information, poor project management. Staff in procurement department often lead to delays by failure to properly plan, failure to submit RFQ's on time, late preparation of tender documents, receiving incomplete documents from bidders, failure to form the evaluation panel in time, delay by the evaluation panel in completing the evaluation process, and protracted contract negotiations. Underestimation preference tendering which may lead to failure to get the right supplier necessitating retender. (Lynch, 2013)

External factors include the market environment, legal environment, political environment, and other environmental factors.

**Inventory Management of Pharmaceuticals** The procured pharmaceuticals must be transported to the service delivery level where the client will receive the products. During this process, the products must be stored until they are sent to the next lower level or until the customer needs them. Almost all businesses store a quantity of stock for future customer needs (USAID | DELIVER, 2011).

A well-organized storeroom will simplify a facility's work; time will not be wasted trying to find needed supplies (PFSA, 2015).

The distribution process begins with the packaging of medicine, a dispatch from the warehouse, and delivery to the health facility of Request. An effective and efficient distribution system depends on the system's design and good management (MSH, 2013).

An ineffective or poorly designed distribution system will likely cause stockouts at health facilities despite stock availability at the central warehouse. On the other hand, an inefficient distribution system can increase its financing requirements, making it unsustainable over time. A balanced approach that acknowledges the current state of technical capacity, administrative structures, and resource availability should guide a distribution system's proper design and operation. (Prashant Yadav, 2011).

A WHO (2006) workshop outlines problems in the distribution of medicines in Africa: poor communication, information, and consumption data. In addition, inadequate storage facilities, temperature control systems, and a lack of quality assurance procedures. The lack of transparent procurement procedures is the main challenge in Africa to distribute of pharmaceuticals in Africa. In addition, lack of appropriate planning, monitoring, and evaluation and inadequate budget allocation.

A report EPSA 2015 pharmaceutical distribution in Ethiopia faces many problems, Such as an uncoordinated drug distribution system, Storage and Processing Problems, and Transportation and Infrastructural Inadequacies (PFSA, 2015).

## **2.2. Empirical Review**

Hospital supply chains have to be more responsive than effective. This observed in the case of Square Hospitals Ltd. The Hospital gives more importance to the quick and accurate delivery of medicine to patients, and they are efficient in this respect. However, there are areas in the supply chain where changes may improve the quality of the service provided by the Hospital (Nawshad P. *et al.*)

Studies undertaken on lead-time management include Tarty (2012), who researched the factors that influence lead-time, and the impact logistics management has on lead-time in public healthcare in Nairobi, Kenya. The findings were that equipment failures influence logistics management; poor warehouse management; poor flow of information; poor order shipping, poor order listing; poor order sorting; ordering costs; bureaucracy in government; order packaging challenges, and poor warehouse planning.

Adzimah's (2014) study, which evaluated the practices used to manage health commodities in a few

Ghanaian hospitals, found that internal bureaucracy, a lack of funding, poor procurement methods, undermined distribution, a lack of storage facilities, a shortage of skilled labor, and logistical issues were the main obstacles to managing inventories in the hospitals.

A study on inventory management practices at public and mission Hospitals in Kenya by Shadrack (2015) explored that the challenges experienced by the inventory management team were; stock outs, inadequate storage space, budget constraints, poor inventory record keeping, lack of teamwork, delayed supplies, delay in getting suppliers and inadequate staffing in the department. Ad-hoc decisions about order frequency and quantity, incomplete stock records, lack of Standardized Operating Procedures (SOPs) to guide staff, and lack of regular performance monitoring were other challenges faced in the studied hospitals.

According to research done on Kenya, the major supply chain management challenges faced in the health sector include poor infrastructure, bulky materials to be transported, and uncertainty in terms of demand. (Samuel, 2008).

In Ethiopia, Supply chain problems like weakness of inventory control, irrational forecasting, weakness of communication between stores and outlets, wastage, stock out, delay in delivery, weak procurement strategy for lab reagents, ineffective communication with facilities, poor quality supplies, inadequate involvement of biomedical unit in supply system negatively influence the health care delivery. (FMOH, 2010, 2016).

### **3. Objectives of the study**

#### **3.1. General Objective**

- To assess the time-based process map and explore factors affecting the pharmaceutical supply chain process in Paint Peter Specialized Hospital

#### **3.2. Specific Objectives**

- To map time-based pharmaceuticals supply chain process
- To identify value-adding and non-value-adding activities within pharmaceutical supply Chain processes in SPSH.
- To explore factors that delay pharmaceutical supply chain processes at SPSH

## **4. Research Methodology**

### **4.1. Study Setting**

The Hospital has formerly known only for TB and HIV/AIDS treatment and has been serving the nation as the only tuberculosis hospital for more than four decades. However, for the past few years, a new reform was launched in 2012 hospital grew from a single-disease hospital into a multi-services health institution. The Hospital has already launched additional new services other than TB, such as internal medicine, pediatrics, dental, gynecology/obstetrics, delivery service, cervical cancer screening, General surgery, dermatology and Venereology, physiotherapy, mother and child health care, neonatal intensive care unit, Anti Retro Viral Therapy and Voluntary and Counseling and Testing, ophthalmology, neurosurgery, intensive care unit, and interventional cardiology services. Concerning the outpatient service, the average monthly outpatient flow is 14,900, and the annual average at the Hospital is 353,712. The Hospital has a capacity of more than 600 beds.

The Hospital has 934 technical and 340 support staff. From health professionals, 74 specialists and subspecialists, 212 GP, 330 nursing professionals, 64 pharmacy professionals, and 254 other health professionals. The total human resources in hospitals were 1274, and the annual pharmaceutical budget was a 64million ETB. (Source St Peter Specialized Hospital, 2022)

### **4.2. Study Design and Period**

A facility-based mixed sequential triangulation study design employing quantitative and qualitative data collection techniques was conduct from September 2021 to June 2022.

### **4.3. Source of population**

The source population of this study was all recorded documents to order Requests and receive pharmaceuticals purchased by hospital budget from the public as well as private suppliers and program pharmaceuticals, and all employees working in SPSH.

#### **4.4. Study Participants and Documents**

Employees who directly involved in the pharmaceuticals supply process starting from lower level to higher level managers who working in the Hospital and documents like RRF, request orders, purchase orders, Newspaper, Bidding documents, letters approved by bid endorsing committees, and chief executive officer (CEO), Award letter, pharmaceutical inventory, IFRR, model 19, model 22, PO, Bin card and DAGU 2

#### **4.5. Inclusion and Exclusion Criteria**

Employees directly involved in pharmaceutical supply chain activities during the data collection were included. These are the DSM case team leader, DSM officers, Hospital purchasers, Pharmacy dispensary unit coordinator, pharmacy director, finance officer, finance director, general service officer, medical and supply store manager, and laboratory department store manager. Employees who did not participate in the supply chain processes excluded.

Furthermore, the supply chain of Pharmaceuticals, i.e., medicine purchased by hospital budget and laboratory reagents and consumable medical supplies and program pharmaceuticals like; antiretroviral drugs, anti-tuberculosis drugs, and family planning drugs, antimalarial were included in the study. Moreover, the supply chain of Medical equipment excluded from this study (since it not regularly procured item)

## **4.6. Sample Size Determination**

The target populations of this study were both the employees and pharmaceutical supply chain documents of SPSH

### **For Quantitative Data**

Three consecutive pharmaceutical supply chain documents were taken and observed.

### **For Qualitative Data**

Purposively 25 individuals who fulfill the inclusion criteria selected from to participate in FDG to address objective two and three and complementing quantitative data

## **4.7. Sampling Technique**

Three consecutive pharmaceutical supply chain documents were taken and observed these were reporting and receiving of pharmaceuticals from EPSS (every month for RDF and every 2 month for program pharmaceuticals), Reporting and receiving of pharmaceuticals from private supplier(as needed) and requesting and receiving of pharmaceuticals from warehouse(every two weeks)

Purposively selected 25 participants were involved in FGD, dividing them into four groups on FGD1 and FGD2; eight participants were involved in FGD 3 five and FGD 4 four participants. FGD one and two participants were mainly involved in availing pharmaceuticals from EPSS and private suppliers, respectively. FGD three participants were mainly involved in pharmaceuticals distribution from stores to different dispensaries and service-providing units (i.e., who fulfill IFRR). The fourth FGD conducted with the management teams in higher positions in the Hospital, who are the final decision makers for all activities.

The contents for the first three FGDs were the same, and the participants were DSM officers, store Managers, Porters, Laboratory store managers, general service officers, drivers, purchasers, and finance officers. The fourth one was with the management team for approval. A purposive sampling method used to select the sample population from pharmaceutical supply chain employees. The respondents for

FGD divided into four groups based on the topic of discussion and their position in the Hospital, and the number of participants in one FGD varied from four to ten.

#### **4.8. Data Collection Instruments and Method**

Data for this study were obtained from primary and secondary data sources. Primary data were obtained by observation and by focus group discussion. The time based process map were sketched (Annex I, Figure 1, 2, 3) and the time table were constructed and (Tables 1, 2,3,4,5)

Secondary sources were document review those which fulfill the inclusion criteria were taken out

Data were collected using the data abstraction format that was developed by investigator, and modified by advisors and the finding of pretest (annex. I).

After the data abstraction, focus group discussion were held using an discussion guiding questions that developed by investigator, and modified by advisors and the finding of pretest (annex. II).

The FGD conducted in a quiet office and lasted from one hour to one hour and twenty minutes. Before the discussion started, the researcher presented her selves, and the participants sat in a circle around the table. The purpose of the discussion explained to the participants, and they informed that the discussion would last for one hour. The participants w invited to describe their opinions in the national, local language (Amharic) to give them freedom, and any ambiguity from the discussion cleared at the time of the discussion. Then the data analyzed thematically.

#### **4.9. Data Quality Assurance Process**

In this study, validity was taken into consideration. Because the questionnaire is constructed by the researcher, it is designed on the basis of the researcher's needs and advisors comment in relation to the study topic and so brings advantages in the sense that it measures exactly what the researcher intends to measure that shows internal validity was checked computing.

A pretest was conducted to test and check the reliability of the items of the questionnaire and once the data collection tools were developed it was pretested in the same hospital. The testing of the tools was conducted to confirm the suitability of the tool for the intended purpose. It also helped in modifying better and estimating the time needed to collect and process the data effectively.

## **4.9. Data Analysis**

### **For Quantitative Data**

People with different roles provide their perspectives and understanding of the process under investigation after the Process map developed by walking the process. The management team examined and verified the final process map's accuracy

### **For Qualitative Data**

On the other hand, themes with direct quotes from the participants used manually assess the qualitative data. The deductive method primarily used in the qualitative topic analysis.

To begin the analysis, the data set's preset codes used. Issues that not covered by the deductive analysis or did not fit the themes employed in the deductive technique coded inductively, where themes created by examining patterns in the data set. Iterative revisions made to the codes, and sets of related codes create themes.

## **5. Ethical Consideration**

Before the study began, the Ethical Review Board of the School of Pharmacy at Addis Abeba University gave it the go light.

The St. Peter specialized hospital management granted the required approval for the study to be conducted. The study's goal, the privacy of the data, and the participants' freedom to opt out or withdraw at any time were all explained to each participant. The participants were informed that taking part in the study would enhance the way the program was implemented and that there would be no negative effects from doing so. They were also informed that their participation would only be utilized for academic purposes.

## **Operational Definition**

The following are the working definitions of the keywords used in this research.

**Pharmaceuticals:** This study indicates any item or product that includes medicines, laboratory reagents, and consumable supplies.

**Supply chain:** In this study includes every step that is involved, from identifying the item for procurement to shipping the pharmaceuticals from the pharmacy store to dispensing or service-giving units

**Value-added activity:** any action taken by supply chain participants that decrease the lead-time for receiving pharmaceuticals that increase the benefit of customers from these pharmaceuticals

**Non-value-adding activities:** activities that increase the lead time to receive pharmaceuticals

## **Researcher's position and reflexivity**

Reflexivity considered an integral aspect of qualitative research, which involves researchers understanding how processes of doing research shape its outcomes. Stating the researcher's position and reflexivity is important in understanding the epistemological and personal conviction of the individual researcher, which pertains to the analytic attention to the researcher's role in the research(Holmes, 2020).

The researcher, a healthcare provider (pharmacist) working in the health facility, has been seen as both an opportunity and a limitation in the research. The researcher is a pharmacist working in a health facility and doing her Master's in Health supply chain management. This may have affected the research as the researcher might unknowingly overlook some health institution factors in the overall research process. The Hospital encounters different supply chain problems in getting pharmaceuticals and avails to patients. However, no insight into the systems that provide for improvement interventions. Knowing that the researcher was a pharmacist (the researcher first approached as a student doing her Master's degree, but some insisted on knowing the profession). Extensively explore and familiarize her with the concept of qualitative research. In addition, the question for FGD revised and modified several times, and development done under the supervision of advisors. In addition, translation, back translation, coding, and theme development done with friends. At the time of the study, the researcher was a novice researcher conducting qualitative research by Focus Group Discussion (FGD) method that required intensive and extensive interaction with participants. FGD allows the researcher to gain a deeper understanding of the participants than other methods by providing an

opportunity for clarification and probing. In designing the research, the researcher's inadequate training in qualitative research methods had been difficult to come around. The researcher only took a course that covered an introduction to qualitative study design and methods as part of fulfilling the Master's program from Addis Ababa University, School of Pharmacy. To minimize its impact on the overall research design, the researcher extensively explored online qualitative study design training, including analysis and presentation, which enabled familiarize her with the concept of qualitative research.

## 6. Results

### 6.1. Demographic Characteristics of FGD Participants

The research was composed of 25 respondents, who came from different disciplines, Namely, Pharmacy (28%), Laboratory (8%), General service (16%), Purchaser (12%) Nurse (12%), Finance (8%), and Management team (16%),

As it can be depicted from table 1, the composition of male and female respondents was 20 (80%) male and 5(20%). Majority of the respondents (72. %) were within age range of 26-35. The service year of respondents was assessed and it was found that 84 % of them had work experience of greater than 6 years, where 12% of them had between 2 and five years of services in the hospital

<b>Socio-demographic variable</b>	<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
Sex	Male	20	80
	Female	5	20
Age	>25	1	4
	26-35	18	72
	36-45	5	25
	46-55	1	4
Service year	>2years	1	4
	2-5years	3	12
	>6 years	21	84
Department	Pharmacy	7	28
	Laboratory	2	8
	General service	4	16
	Purchaser	3	12

	Nurse	3	12
	Finance	2	8
	Management team	4	16

**Table1. Distribution of respondents by their socio demographic characteristics**

## **6.2. Process Mapping and Time Taken for each activity in Pharmaceutical Supply Chain**

This research attempted to map the pharmaceutical supply chain process in the St Peter Specialized Hospital by splitting into three steps. Figure 1, 2 & 3 (Annex I)

The hospital procures pharmaceuticals preferentially from EPSS .Before the procurement process started, a credit contract agreement between the hospital and EPSS have to done for one year. The ideal delivery time is every months and Credit paid within a months of delivery of pharmaceuticals.

The hospital can put emergency order at any time when stock on hand reaches emergency order point

### **6.2.1. Process Mapping of Acquiring Pharmaceuticals from EPSS**

At the beginning of every month, the DSM case team prepares a purchase order for the list of pharmaceuticals purchased by aggregating the demand from the medical store, supply store, and laboratory main store. Based on the purchase order, the Request sent to the EPSS hub online and in hardcopy, and the hub will resupply their pharmaceuticals. DSM officers collect the pharmaceuticals and load them on the SPSH vehicle or contract vehicle based on the volume of pharmaceuticals.

Pharmaceuticals procured on credit bases, and the actual payment effected after receipt within a month. RRF for programs pharmaceuticals like (e.g., ART, Family planning TB, etc.) differs from RDF. These fill every two months until the fifth day of the reporting period and sent to EPSS hub 2. In order to timely deliver and refill the products, electronic and manual reports employed for second-line tuberculosis (SLTB) drugs.

Annex I, Figure 1 :( Process mapping of ordering and receiving of pharmaceuticals from EPSS)

### **6.2.2. Process mapping of purchasing pharmaceuticals from private suppliers**

Although EPSS is the leading supplier of pharmaceuticals, private suppliers supply medicines whenever there is stock out and the medicine is not included in EPSS's pharmaceutical procurement list. Depending on the threshold, open Tender, Request for quotation, and direct procurement are the main procurement methods. Process mapping draws based on the method selected depending on the type of goods procured and the value of the goods procured. (PPM- MOFED, 2011).

According to Ethiopian public procurement proclamation 649-2009 article 39, the hospital purchasing case team adopted the choice of procurement methods. The following methods used to procure pharmaceuticals at the Hospital: Open Bidding, Request for Quotation, and Direct Procurement. The method selected depends on type of goods procured, the value of the goods procured. (PPM –MOFED, 2011) Open tendering is a formal single-stage procurement method in which any interested company, without any pre-selection, may submit a bid; bids usually made against detailed government specifications, and the award usually made to the bidder offering the lowest price.

Request for Quotations Sometimes referred to as shopping, request for quotations method used to buy items of low value. Public body may undertake procurement by means of Request for Quotations (RFQ). In accordance with the requirements set out in Proclamation and Directive for the purchase of readily available standard off the shelf goods or for procurement of works or services for which an established market, so long as the estimated value of such procurement shall not exceed the prescribed amount. The conditions for use of direct procurement may be when small value contract, availability of only one single source, extension of existing contract; for compatibility reasons; and for emergency situations;

According to the circular from the Minister of Finance dated 25/1/2014 E.C regarding threshold, When the cost of procurement of goods does not exceed 200,000,000birr for open tender, 400,000birr for RFQ and for direct procurement of goods does not exceed10, 000 birr. However, the total value of such small procurements within a fiscal year shall not exceed birr 150,000.00

## **The major activities of open tender in hospitals are:**

### **Preparation of bid document**

Bidding document is a legal binding document between the hospital and the bidders that clarifies its requirements, award criteria, terms and conditions to be incorporated in the contract agreement to be signed after the award. The procurement officer populates the standard bid document format with the relevant data based on the endorsed procurement plan and budget proposal documents.

### **Bid advertisement**

Advertisement is used for invitation tender for better communication and transparency of the procurement procedures. It is also used for formal methods of solicitation and limited competition, either the dissemination of upcoming solicitation information through a request for information, a request for expression of interest, or notice of pre-qualification in appropriate media.

### **Bid document issuing/selling**

The national procurement directive requires the bidding document to be available to candidates desiring to participate in the bid on working days during the floating period of the bid in the manner stated in the advertisement. The directive describes the procuring organization to fix the selling price of bidding documents, or may allow candidates to obtain bidding documents free of charge, or at a price, less than the cost incurred in the preparation of such document.

### **Bid clarification**

Suppliers are entitled to request and obtain clarification on floating bids before the bid clarification deadline. The objective of the clarification is to clarify any ambiguity or contradictory anomalies found in the bid document to suppliers.

### **Bid offer receiving**

It is the responsibility of suppliers to ensure that bid offers are submitted to the hospital tender management directorate in accordance with the stipulations in the bid documents.

### **Bid opening**

Bid opening is the process of revealing offers submitted by interested bidders.

- ✓ Procurement coordinator: coordinates bid opening process schedules of bid offer openings

- ✓ The procurement officer in charge: calling bid opening team meeting, taking minutes, handover of bid offer documents and bid bonds, maintain records of the proceedings

### **Bid evaluation**

As per the criteria indicated in the bid document, evaluation will be conducted to confirm compliance/non-compliance of the bid offers against the requirements.

### **Awarding**

Generally, contracts are awarded based on recommendations from a tender endorsing committee. An award may be made subject to the prior fulfillment of conditions.

### **Contract agreement**

A contract is a written, legally binding agreement between the hospital and a supplier, which establishes the terms and conditions, including the rights and obligations of the hospital and the supplier.

Annex I figure 2 shows as Process mapping of ordering and receiving of pharmaceuticals from Private Supplier

### **6.2.3. Process map of requesting and issuing of pharmaceuticals from pharmacy store**

Every two weeks, different pharmacy dispensing outlets and service-giving units fill IFRR and communicate with the dispensing and service-delivering units. The person responsible for dispensing outlets and service units reviews the IFRR and submits it to the store manager. Then, the store manager calculates the consumption and the amount needed to arrive at the maximum for the requisition period and makes it approved by the pharmacy director, and the store manager transcribes the list from the approved IFRR into the issuing voucher Model 22. In case of new programs/ when a new product initiated, the dispenser requests based on the current needs. The store manager enters all the information, including the medicines name, unit, quantity, medicines code, cost, and retail prices. Then, he/she picks the pharmaceuticals from the shelf& arranges them at issuing area.

The store manager signs on the voucher and delivers the requested items to the dispensing outlets and service units the responsible person from the requesting unit reconciles the dispatched items with those listed in the issue voucher and confirms receipt of the product by signing on the issue voucher/model 22. Then the Pharmaceuticals send it to dispensing or service-giving unit, and the bin card updated by store assistance.

Annex I Figure 3: Process mapping of the distribution of pharmaceuticals from pharmacy store to dispensing and service-giving units

### **6.3. Time-Based Performance Measures**

The key purpose of a Time Based Process Map is to provide a simple mechanism for easy understanding of current performance. It achieves this with a graphical representation of the data collected.

The most effective method to collect the data is to track pharmaceutical supply chain process and time spent waiting between them this is actual time taking in days take, compared with FGD Participant recommended time, and does percent of value adding time and non-value adding time determined

To identify value-added activities, the value gaining activities by supply chain participants were considered. Only delayed or waiting were considered as non-value-added activities. Some value-added concurrent activities were also found but for those activities, time was calculated once. Phase wise value-added (VA) and non-value-added (NVA) activity days were calculated from the TBPM of each pharmaceutical supply chain process and tabulated in Table 2-5.

#### **6.3.1 Time Taken to acquire RDF Pharmaceuticals from EPSS**

The time taken for the Activity of RDF Pharmaceuticals requesting to EPSA hub was 22.723 days; 18.521 days (56.9%) VA and 4.206 days (43.1%) NVA. Among all activities getting a vehicle or DSM officer, request a vehicle from general service providers, around 2 hours (75.5%) of the time NVA activity.

SN	Activities	Actual time taking(Days)	FGD Participant Recommended Time	% of value adding time/working hours	wasted time (day)	% of Wasted time
1	DSM case team leader & SM forecast pharmaceutical needs	3	1	33.30%	2	66.70%
2	The DSM case team leader prepare a cover letter to start requesting the process	0.19	0.143	75.30%	0.047	24.70%
3	Approved by the Pharmacy director	0.048	0.024	50.00%	0.024	50.00%
4	Stamped at archive & get reference Number	0.048	0.036	75.00%	0.012	25.00%
5	The DSM officer sends an online request to EPSS & prints out	0.624	0.336	53.80%	0.288	46.20%
6	The pharmacy director approved the Request & stamped it at the archive	0.072	0.0576	80.00%	0.0144	20.00%
8	DSM officer Requested vehicle from General Service providers	0.29	0.071	24.50%	0.219	75.50%
8	DSM officer places PO in person to EPSS	1.452	1.202	82.80%	0.25	17.20%
9	DSM officer collects pharmaceuticals with STV	0.718	0.285	39.70%	0.433	60.30%
10	unload the pharmaceuticals	0.214	0.071	33.20%	0.143	66.80%
11	SM receives, inspects, and registers to model 19	0.857	0.524	61.10%	0.333	38.90%
12	DSM officer collects mode 19 & STV and submits to finance	0.214	0.071	33.20%	0.143	66.80%
13	Make payment	15	17.7	98.00%	0.3	2.00%
	<b>total</b>	<b>22.723</b>	<b>18.521</b>	<b>56.90%</b>	<b>4.206</b>	<b>43.10%</b>

**Table 1. Time taken for activity at St Peter hospital to receive pharmaceuticals from EPSS**

### 6.3.2 Time Taken to Receive program Pharmaceuticals from EPSS.

For program pharmaceuticals, requesting from EPSS hub took on average 12.83 days. Among these days, 11.79(91.9%) VA and 1,034(8.1%) NVA. Requesting vehicles from the general service of the hospital 80.3% of the time spent were NVA time.

<b>Activities</b>		<b>Actual time taking(day)</b>	<b>FGD Participant Recommended Time</b>	<b>% of value adding time/working hours</b>	<b>wasted time (day)</b>	<b>% of Wasted time</b>
1	DSM case team leader & SM forecast pharmaceutical needs	<b>(day)</b>	0.214	49.80%	0.216	50.20%
2	The pharmacy director approve the Request & stamped it at archive	0.1	0.071	71.00%	0.029	29.00%
3	DSM officer Request vehicle from General Service providers	0.36	0.071	19.70%	0.289	80.30%
4	DSM officer Place PO in person to EPSS	0.12	0.108	90.00%	0.012	10.00%
5	Driver delivers pharmaceuticals with STV	11	11	100.00%	0	0.00%
6	unload pharmaceuticals at receiving area	0.14	0.071	50.70%	0.069	49.30%
7	SM receives, inspect and register on model 19	0.39	0.166	42.60%	0.224	57.40%
8	Record keeping (DAGU 2, bin card)	0.29	0.095	32.80%	0.195	67.20%
<b>Total</b>		<b>12.83</b>	<b>11.796</b>	<b>91.90%</b>	<b>1.034</b>	<b>8.10%</b>

**Table 2. Time taken for main activity at St Peter hospital to receive program pharmaceuticals from EPSS**

Remark: 100% were when the activity done within an acceptable time.

### 6.3.3. The Time taken for to Receive Pharmaceuticals from private suppliers via RFQ Techniques

On average, requesting pharmaceuticals from private suppliers via RFQ took 14.3 days. Of which 3.09 days (21.6%) were VA and 11.22 day (78.4%) NVA

SN	Activities	Actual time taking(day)	FGD Participant Recommended Time (day)	%value adding time/working hours	wasted time (day)	% of Wasted time
1	DSM officer bring stock out letter from EPSS	2	1	50%	1	50%
2	DSM officer prepares request order	1.92	0.21	10.90%	1.71	89.10%
3	Finance director approve	0.14	0.07	50.00%	0.07	50.00%
4	DSM officer & purchaser distribute Request Order & Collect	0.86	0.43	50.00%	0.43	50.00%
5	Open the document & check the completeness	0.71	0.21	29.60%	0.5	70.40%
6	Give an award to the winner	1.71	0.14	8.20%	1Q. 57	91.80%
7	Place PO to Supplier	0.29	0.11	37.90%	0.18	62.10%
8	Receive & inspect	6.39	0.78	12.20%	5.61	87.80%
9	Record keeping & Make payment	0.29	0.14	48.30%	0.15	51.70%
	<b>Total</b>	<b>14.3</b>	<b>3.09</b>	<b>21.6%</b>	<b>11.22</b>	<b>78.4%</b>

**Table 3. Time taken to acquire pharmaceuticals from private supplier via RFQ**

### 6.3.4 Time taken for each main activity at St Peter specialized hospital for ordering and receiving pharmaceuticals from private supplier via open tender techniques.

The lead-time for acquiring pharmaceuticals from private suppliers was 161 days among these days 67.75 (42.10%) value adding and 93.25 days (57.9%) non-value adding.

<i>SN</i>	<i>Activities</i>	<i>Actual activity taking(day)</i>	<i>FGD Participant Recommended Time (day)</i>	<i>% of value adding time/ working hours</i>	<i>wasted time (day)</i>	<i>% of Wasted time</i>
1	DSM case team identifies needs and approved by the finance director	4	1	25.00%	3	75.00%
2	Procurement endorsing committee approval	41	4	9.80%	37	90.20%
3	Advertise in News paper	3	3	100.00%	0	0.00%
4	Issuing/selling the doc	10.5	10.5	100.00%	0	0.00%
5	Opening the document	0.5	0.25	50.00%	0.25	50.00%
6	Bid evaluation and selection	2	2	100.00%	0	0.00%
7	Bid endorsing committee approved	48	15	31.30%	33	68.80%
8	Approved by CEO	5	2	40.00%	3	60.00%
9	Awarding the winner	24	7	29.20%	17	70.80%
10	Contract agreement, Receiving pharmaceuticals& Record keeping	23	23	100.00%	0	0.00%
	<b>Total</b>	<b>161</b>	<b>67.75</b>	<b>42.10%</b>	<b>93.25</b>	<b>57.90%</b>

:

**Table 4. Time taken to acquire pharmaceuticals from private supplier via open tender**

**Remark:** 100% is because of acceptable days-

Recommended number of days for the bid to be on flotation is fifteen working days

Recommended number of days for receiving objection from bidders after selection is seven working days.

Recommended number of days Contract agreement, Receiving pharmaceuticals & Record keeping

**6.3 5. The Time taken for distributes pharmaceuticals from pharmacy store to different dispensing and service giving units.**

The time taken to distribute pharmaceuticals from the store to different dispensing and service units was 8.21 days. 1.27days (15.5%)

VA and 6.92(84.3%) NVA.

<b>SN</b>	<b>Activities</b>	<b>Actual time taking(day)</b>	<b>FGD Participant Recommended Time (day)</b>	<b>% of value adding time/ working hours</b>	<b>wasted time (day)</b>	<b>% of Wasted time</b>
<b>1</b>	Dispensary or service-giving outlet conducting an actual physical count of pharmaceuticals	1	0.5	50.00%	0.5	50.00%
<b>2</b>	Unit coordinator completes part IFRR	0.14	0.07	50.00%	0.07	50.00%
<b>3</b>	SMs analyzes completeness	0.14	0.07	50.00%	0.07	50.00%
<b>4</b>	IFRR Signed by the store manager & approved by the pharmacy Director	0.14	0.07	50.00%	0.07	50.00%
<b>5</b>	SM transcribes the list from the approved IFRR into Model 22, &DAGU 2	2.43	0.14	5.80%	2.29	94.20%
<b>6</b>	Pick pharmaceuticals from the shelf & arrange them.	0.29	0.14	48.30%	0.14	48.30%
<b>7</b>	Reconciles the dispatched items with model 22 and confirms receipt signing on the issue voucher	3.57	0.14	3.90%	3.43	96.10%
<b>8</b>	Pharmaceuticals send to the unit Porter	0.29	0.07	24.10%	0.21	72.40%

<b>9</b>	Avail pharmaceuticals at service giving or dispensing unit	0.21	0.07	33.30%	0.14	66.70%
	<b>Total</b>	<b>8.21</b>	<b>1.27</b>	<b>15.50%</b>	<b>6.92</b>	<b>84.30%</b>

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**Table 5. Time taken for reporting and resupplying from store to dispensaries and different service providing unit**

## 6.4. Qualitative Findings

In this study, the main purpose of the focus group discussion was to get staff perceptions, opinions, beliefs, and attitudes toward the supply chain of pharmaceuticals at St Peter Specialized Hospital.

The respondents divided into four groups by their activities. Focus group discussions held with DSM officers, storekeepers, General Service officers, porters, purchasers, and the coordinator of dispensaries, Clinical service directorate, finance director and laboratory Store manager.

### **Perception of participants on process mapping of pharmaceutical supply chain and the amount of time taken**

Participants of the focus group discussions shared their opinions about the overall pharmaceutical supply chain process. They expressed that the process maps help them to communicate with one another and highlight areas for improvement by providing information about the tasks performed in a clear, straightforward manner.

*For me, the process map of pharmaceuticals is essential for us because, during rotation, we do not know the jobs we do unless the former staff tells us, but if we have a process map, consistency does the right things by the right person at the right time. (FDG 1b)*

*“On process map, there are repetitions of tasks like Requesting online and in person and approving by the pharmacy director, and stamping at the archive the letter and the list of pharmaceuticals. If possible, requesting online and delivering pharmaceuticals will decrease the lead time.”FGD1e*

When pharmaceuticals are procured from a private supplier, all the participants agreed that the steps followed, i.e., approving the request letter by the finance director, requesting a vehicle, distributing the letter for private suppliers, and collecting closed envelopes are non-value-added steps, and if the procurement process is automated nationally.

### **Reasons for Taking Time to Receive RDF Pharmaceutical from EPSS**

Participants mentioned reasons that increase the time duration from one-step to the next to get pharmaceuticals from EPSS. Not forecasting on a regular and scheduled basis cited as one of the reasons for taking extended time.

One key informant said, *“Store man and DSM officer take a long time to forecast because there is no fixed schedule for ordering from different service delivery units, and the forecasting activities are done manually. (FDG 1a)*

Securing vehicles to transport pharmaceuticals from EPSS to the Hospital is another time taking task.

*“Although St. Peter Hospital has ten double pick-up cars, it faces vehicle shortages for transporting pharmaceuticals. DSM officer regularly does not get a vehicle on time because of the vehicle's service staff. Because of this, DSM officer, on average, waits for 2- hours to get a van, and the driver returns to the Hospital one hour early without finishing their jobs (i.e., loading/unloading) since the cars provide transportation service to its staff.” (FDG 1h)*

*“Almost all the cars dedicated for medicines transportation are old and stay out of service frequently and do not stay longer.” (FDG 1d)*

*“In my opinion, the problem is not only the inadequacy of vehicles, DSM officer not informing early (timely) to arrange vehicles. If the volume of pharmaceuticals is bulk, they (DSM case team) can inform the Finance department to contract big vehicle” (FDG 1c).*

All Participants agreed that the non-availability of appropriate vehicles for transporting pharmaceuticals, including temperature-controlled ones, is affecting the supply chain of pharmaceuticals.

#### **Reason for Taking Time to Receive Program Pharmaceuticals from EPSS**

Program pharmaceuticals reporting and requisition form (RRF) is sent to EPSS every two months and received, but the quantity received and items are not as reported. Because of this, DSM officers usually go to EPSS to collect the rest pharmaceuticals.

One of the participants said that *most of the time, program pharmaceuticals are not delivered as Requested by quantity and items, so DSM officers go to EPSS up to three times within one report (FGD1h)*

*And because of the near expiration date of the laboratory reagent, the process of reporting and receiving was repeated (FDG 1K)*

#### **Reasons for Taking Time to Purchase Pharmaceuticals from Private Suppliers (by Request Quotation, open Tender, and direct purchasing)**

When pharmaceuticals run out of stock at EPSS, Hospitals first get a stock out letter from EPSS, and SPSH starts purchasing pharmaceuticals from private suppliers with a non-EPSS list using different procurement methods, including Request for quotation (RFQ), open tend, and direct purchasing bases.

Careful selection of pharmaceuticals and methods is necessary because resources for procurement of health products are usually limited hence the need to use them appropriately. However, sometimes identifying the needs, determining the number of pharmaceuticals, and knowing when the pharmaceuticals should delivered is not carefully done. These can affect time and resources.

*Most of the time, pharmacists at the DSM case team do not carefully identify the needs and quantities because of this repeatedly choose to purchase the pharmaceuticals by RFQ. It can consume time and the budget of pharmaceuticals, but if it is carefully identify and quantify, purchasing by open Tender is preferable for purchasing in bulk at an affordable price. (FGD 2d).*

*In addition, DSM case team wait for new arrival and the quantity and items identified for RQF. (FGD 2d)*

*For Request for quotation, private supplier gives the price without having the product. When awarded, they do not deliver the pharmaceuticals timely (FDG 2e).*

*Sometimes purchasing officers do not prioritize pharmaceuticals if they start some activities; we have to wait until they complete the activity they started. (FDG 2b)*

The private supplier also does open tender and direct procurement, and most of the time; open Tender takes much more time than others do.

One participant stated, *"When procurement is done by open tender, the main challenge is that after selection of the supplier, the tender endorsing committee does not convene timely and make the decision because of workload."* (FDG2 a)

Another respondent also said, *"Because of lack of budget, the CEO of the Hospital may not approve the Tender. Therefore, we forced to decrease the quantity by more than 25% until it matched the Hospital's budget. The private supplier may disagree with the adjusted quantity and budget, and the whole process might start again."* (FDG2 g)

Direct procurement is a method St Peter Hospital uses to procure pharmaceuticals. Those with a certificate of sole-supplier can purchase directly from this supplier, but because of a shortage of dollars, they may stock out when they have a stock request disapproved timely.

### **Reason for Taking Time to Unload and Receiving Pharmaceuticals**

Participants listed another challenge: the inadequate number of porters responsible for loading, unloading, delivering, and arranging the pharmaceuticals at hospitals.

One of the participants said, *"Most of the time after, the pharmaceuticals arrived, not unloaded timely even though there are four porters in the Hospital. They are unavailable at the working station when they are called by telephone and working on other hospital activities until they come to take time because the DSM case team should not communicate in advance with the porter."* (FGD1b).

The Hospital has three stores (i.e., medical store, supplies and laboratory store, and medical equipment store) located in a place not convenient for loading and unloading.

*Sometimes EPSS and/or private suppliers deliver pharmaceuticals using delivery notes. So until they issue STV, the pharmaceuticals will not be received on model 19; this may take up to seven days for EPSS and up to a month for private supplier” (FDG1f).* Sometimes the supplier did not deliver in accordance with the purchase order and not complied with delivery contract requirements.

While receiving and issuing pharmaceuticals, all activities were done manually on models 19 and 22 and the computer. *“At St Peter specialized hospital Automated Pharmaceuticals transaction system do not apply yet, and all the transactions are done manually these type of process consume time and energy, and for one transaction done on three places this is over-processing, and it is NVA” (FDG 1c).*

The lack of SOP, which can guide pharmacists in DSM activities, is also challenging. DSM case team and the store man assume responsibility on rotation bases in doing so; if inexperienced or unskilled staff participates, they may cause delays.

One of the participants mentioned that, *“there is a Challenge when DSM case team a rotation is held every year for the DSM case team leader and every six months for store man no any manual and documents that show the activities rather than the former staff tells by mouth all the activities to be done so it takes time .”(FDG3c).*

Another informant added that *there is no orientation on how to perform various activities in-store. Instead, assigned staffs try to work out by trial and error, which is time-consuming. (FDG1G).*

*“Physical counting of items when one assumes SM responsibility on a rotation basis and sorting out discrepancies takes fifteen days.” (FDG1G).*

### **Reason for Delay to Distribute to Different Dispensing or Service-Providing Units**

One factor that increases the time for IFRR is conducting a physical count every two weeks.

One of the informants said, *“Every two weeks, physical inventory is supposed to be conducted to fill the IFRR, but it is not counted correctly and timely. That delay availing pharmaceutical at dispensary” (FDG3A)*

Another informant added that *“most activities are done on paper-based; it takes more time to transcribe it on Model 22.” (FDG3B)*

During rotation, every six months, the reporting and resupplies schedule not followed because handing over the pharmaceuticals takes time.

Another participant also mentioned, *“Ready for shipment pharmaceuticals may delay for two to three days because of the absence of porters who deliver these pharmaceuticals to different dispensing and service delivery units and full numbers of staff (pharmacist) were not available at the workplace, there was a lack of communication between pharmacists and porters.”* (FGD3g).

**Identify VA and NVA activities in SC process.**

All the FGD participants agreed that non-value-adding activities for pharmaceutical supply chains at SPSH. Such as waiting for advertising newspaper for open tender; DSM officer and purchaser physically distributing request orders to the supplier and collecting for RFQ; and dispensary or service-giving outlet conducting an actual physical count of pharmaceuticals every fifteen days are non-value-adding activities and these processes will be eliminated if supply chain system is an electronic system.

## 7. Discussion

The present study maps the pharmaceutical processes and the time taken for each step, identifying value-adding and non-value-adding activities within SC processes. Besides, reasons for taking extended time explored.

Understanding the process of the pharmaceutical supply chain has major implications for the staff's ability to improve the supply Chain. The process maps of the pharmaceuticals supply chain of SPSH sketched by dividing it into three. These are the Process map of acquiring pharmaceuticals from EPSS, the process map of acquiring pharmaceuticals from the private supplier, and the process map of IFRR (Internal Facility requesting and receiving of pharmaceuticals from store) are sketched sequentially. Exercises like process mapping are easy to do. It is one of the most effective methods for multidisciplinary teams to comprehend the true issues and find areas for change. Process mapping has advantages that can be Fadahunsi and Sathiyarayanan (2016) believe that in order to improve processes, it is necessary to comprehend how they are viewed. The goal of all process mapping techniques is to make it easier to comprehend how the processes are currently operating (Hines and Rich, 1997). It has also been demonstrated that process mapping increases process visibility and enables knowledge acquisition and transfer across organizations (White and Cicmil, 2016; Klotz, Horman, Bi and Bechtel, 2008).

Similar to this, studies show where process mapping was use and have reported improvements in team dynamics, communication, and sense of accountability (Klotz et al., 2008; Bowles and Gardiner, 2018). Process mapping, according to Aikenhead, Farahbakhsh, Halbe and Adamowski (2015), helped identify problem areas. Reduced lead times and cost savings may be possible by eliminating issue areas with non-value-adding activities (Klotz et al., 2008). (Van Assen, 2018) goes on to demonstrate in a survey research that businesses using process mapping have improved operational performance and quality.

The purposes for making a process are to understand a process, to analyze and improve a process, to train people, and to design new processes (Steinmann, 2012) This process mapping is used as a standard work tool used to ensure consistency within processes. If used correctly, it provides a way for employees to perform tasks the same way, no matter who performs them.

The average non-value-adding time for ordering and receiving RDF pharmaceuticals from EPSS was around 43.1 % of the total time taken. For program pharmaceuticals from EPSS, 8.1% of the total time

taken and 57%, and 78.4%, of the total time taken were non-value-adding time acquiring RDF pharmaceuticals from EPSS acquiring pharmaceuticals from private suppliers via RFQ and open Tender, respectively. This indicates that procuring pharmaceuticals from EPSS was less time-consuming than from private suppliers. This might be because of many different parties at various stages of the chain involved in the process.

For program pharmaceuticals ordering and receiving From EPSS, only 8.1% were NVA. EPSS directly supplies program items based on a report from the facilities by scheduled deliveries. For program commodities, EPSS expected to resupply facilities with the requested quantities within one month of receiving the Request IPLS so it meets the schedules. (PFSA, 2015)

This study also revealed the time taken from conducting physical inventory for preparing IFFR to receive pharmaceuticals at a dispensary or service-providing unit. It took eight working days; among these days, the non-value adding time was 84.3% because the schedule did not follow correctly. The schedule was that the first day was the day for reporting, and the second day was the day for resupplying. However, during data collection, the schedule did not follow. The delay was because a participant on FGD mentioned a lack of Standardized Operating Procedures (SOPs) to guide staff at the warehouse during rotation, full numbers of staff were not available at the workplace, and there was a lack of communication between pharmacists and porters. These all affected the time of order to delivery of pharmaceuticals at SPSH. These finding is similar to a study conducted in Kenya, lack of teamwork, inadequate staffing, incomplete stock records, lack of SOPs were the main challenge (Shadrack, 2015).

The present study found that the Non-value-adding activities of sub-processes that consume the most time and generate great inefficiency revealed, and the EPSS list supply chain among the non-value-adding activities forecasting for the coming months is 67%. This was because there was waiting time for the store personnel who have experience of the last month's consumptions and, based on past consumption, manually forecast for the next month.

Requiring vehicles also took from 75.5 % to 80.3% NVA time for pharmaceutical SC purposes. This was because no vehicles allocated for the pharmaceutical and used the cars that provide the transportation service for staff; because of this, there was waiting. The finding of this study is similar to the finding of Amanuel mental specialized Hospital unable to schedule transportation timely (Banchirega Mekuria, 2017)

Moreover, the finding of this study revealed that when procurement done via open Tender, it took 161 days to avail pharmaceuticals. This approval by the procurement endorsing committee took time around 48 days, approval by the CEO 5 days, evaluation two days, and awarding 24 days total of 79 days, but the Minister of Finance (MOF) stated that the validity period of the bid should not extend beyond 60 days from the day of bid opening (MOF, 2010).

Giving awards took 24 days this might be not planning the procurement not and adequately prioritized by VEN before the procurement process started. VEN analysis assigns priorities for pharmaceuticals selection, procurement, and use in a supply system; guides inventory management activities; and determines appropriate medicine prices (Deressa *et al.*, 2022). (USAID | DELIVER PROJECT, 2011)

When procurement done by Request for quotation, correcting the discrepancy took time between the purchase order, the product, and the invoices. The stock received but not inspected, recorded, and put on the shelf is not ready to issue and is not available to use. To improve the client's response time, the stock must be available for the customer when they request or need it. (USAID | DELIVER PROJECT, 2011)

When we see the SPSH medical and supply store, picking, loading, and unloading pharmaceutical products is uncomfortable. The supply store not planned and built for warehousing and storage purposes. Therefore, it does not fulfill the warehouse criteria. The warehouse must be accessible to all health facilities or units. Road access must be adequate for the largest vehicle that may need to come into the store; if possible, avoid locating the warehouse on routinely congested roads (USAID | DELIVER, 2019)

Concerning procurement lead-time, on average, it took 13 days to 161 days from identifying the need to avail the products for use in the dispensary or service-giving unit. This was short than the study at North India tertiary care teaching Hospital, which took from 40 days to 400 days from the preparation of demand and issue of the purchase order. (Goyal *et al.*, 2016).

## **8. Limitations of the Study**

As supply chain performance for pharmaceuticals Time-based process mapping overlooked, the findings of this study believed to shed light on existing situations and gaps for improving the supply chain system. Despite these facts, the following limitations should also note. Because of time constraints, the time taken for ordering and receiving pharmaceuticals from private suppliers via open Tender only once taken, not the average time because tendering is done yearly. The study lacks similar studies to compare, contrast, and make comparative conclusions.

## 9. Conclusion

Time-based process map of this study revealed the value adding and non-value adding activities of SPSH pharmaceutical supply chain. From ordering to receiving of product and reporting and supplied from store were from 8.1% to 84.3% of time were non-value-added time.

The study also identified factors contributing for the delay of pharmaceutical supplying processes such as manually preparation of RRF, timely unavailability of vehicle, lack of SOP, poor communication among staff, discrepancy among purchase order, invoice and products.

Thus, it can also concluded that the findings of the study would help the Hospital by illustrating more clearly how pharmaceutical supply chain of SPSH is conducted, where value is added to service, and where inefficiencies are occurred. In addition, by considering all the elements of non-value adding time the Hospital can create an action plan to minimize the non-value adding time of the pharmaceutical supply chain of the Hospital.

## 10. Recommendations

Based on the findings of this study, the following recommendations have made:

- ✓ The pharmacy director and the management team should use the pharmaceutical process map for future improvement
- ✓ The general service Director of SPSH should work on improving the transportation system of the Hospital by allocating vehicles for the pharmaceutical supply chain. In addition, to undergo an even distribution of work within the porter to reduce workload and to improve the time taken for pharmaceutical unloading and distribution to dispensing and service giving unit.
- ✓ The pharmacy department DSM case team should work on preparing SOP for the DSM case team and follow it during rotation
- ✓ The procurement endorsing committee and purchaser of SPSH should work on giving priority to procuring pharmaceuticals.
- ✓ The Minister of Finance (Hospital management) should allocate an appropriate pharmaceutical budget.
- ✓ Workforces who participate on pharmaceutical supply chain management in the hospital should have good communication among staff and should respect the schedule of requesting and receiving of pharmaceuticals.

### Suggestions for Future Research

The researcher recommends a similar Time-Based Process mapping study with a larger sample size, including multi-stakeholder, pharmaceutical Manufacturers, importers, pharmaceutical wholesalers, and distributors. Improving the process and reviewing the change should conduct to understand the overall picture of time-based process mapping.

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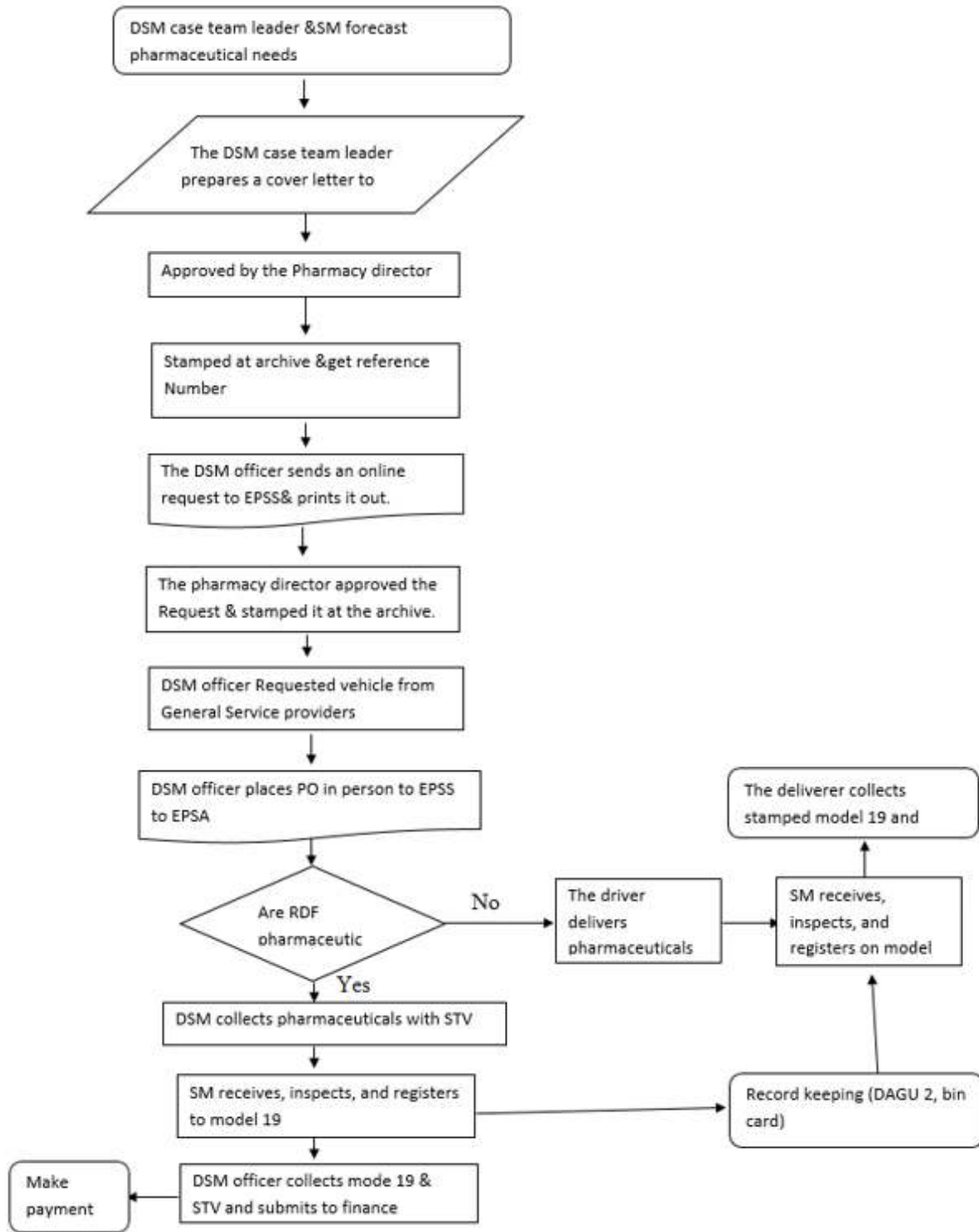
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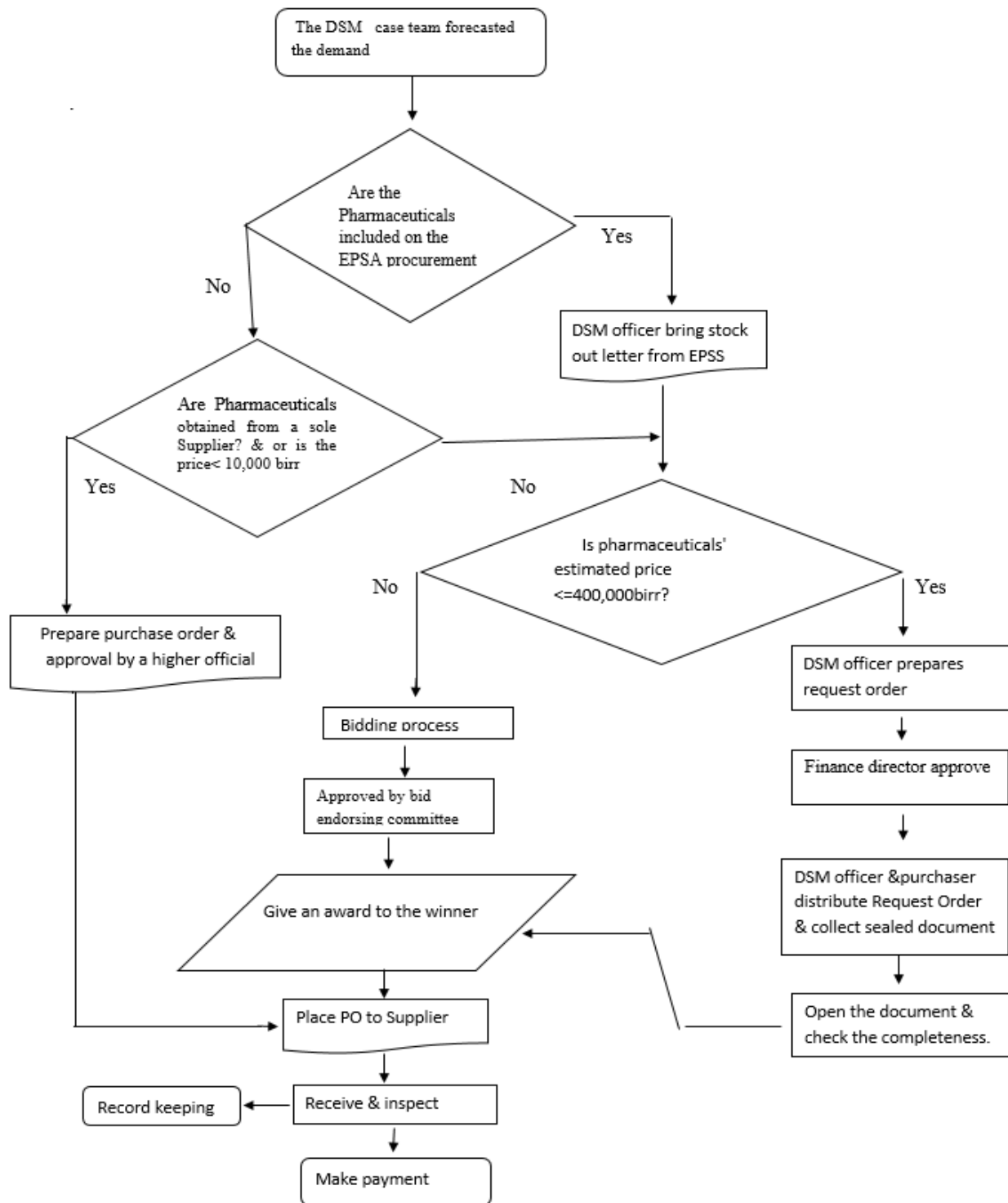
# **Annex I Process map supply chain of pharmaceuticals supply chain at SPSH**

## **1. Process map of acquiring PHARMACEUTICALS FROM EPSS**



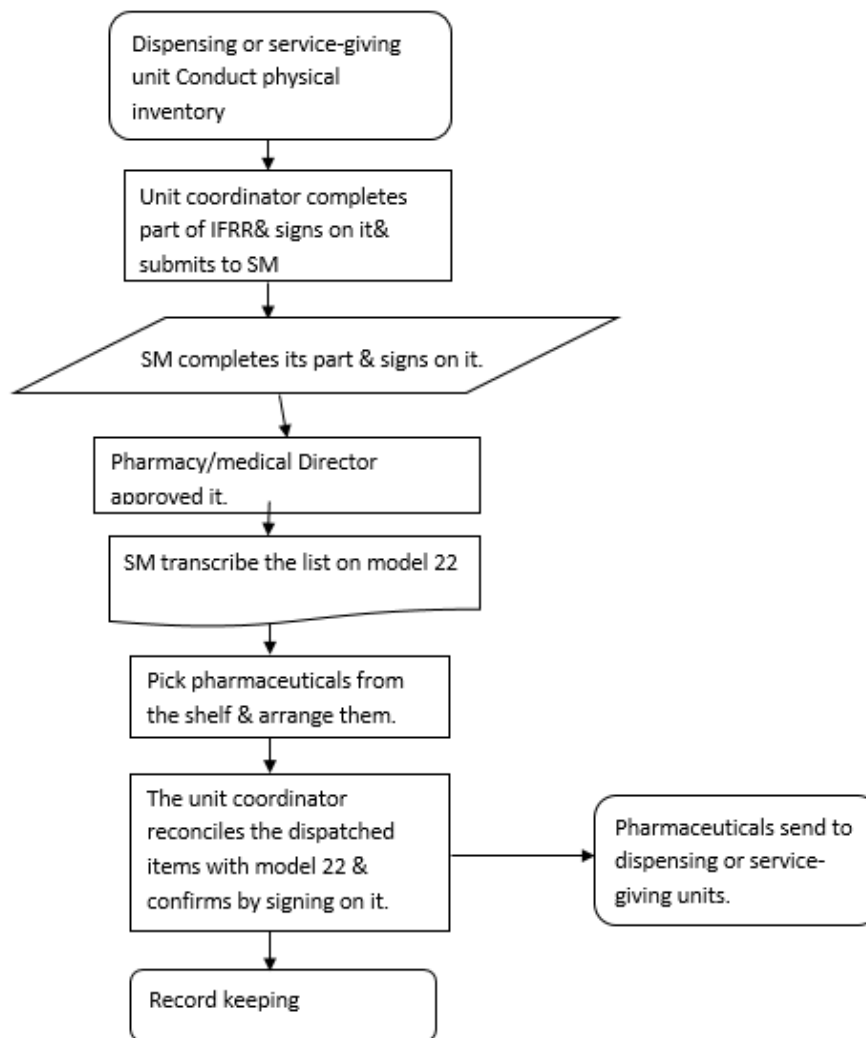
**Figure 1: Process mapping of ordering and receiving of pharmaceuticals from EPSS**

## 2. Process map of acquiring pharmaceuticals from private supplier



**Figure 2: Process mapping of ordering and receiving of pharmaceuticals from Private Supplier**

3. Process map internal facility reporting and resupplying of pharmaceutical at hospital.



**Figure 3: Process mapping of the distribution of pharmaceuticals from pharmacy store to dispensing and service-giving units**

## **Annex II**

### **1. Focus group discussion Guide Questions**

Addis Ababa University

College of Health Sciences

School of Pharmacy

Department of Pharmaceutics and Social Pharmacy

#### **Participants' information sheet and consent form for Focus Group Discussion**

I am **Abebech Chemed**, a Master's Student of Health supply chain management at Addis Ababa University, School of Pharmacy. Currently, I am working on my research entitled "**Time-based process mapping and exploring factors affecting pharmaceutical supply chain at St Peter Specialized Hospital.**" exploratory study" as part of the requirement for my MSc degree. To achieve the study objective, your honest and genuine participation in responding to the question prepared is crucial and highly appreciated. The discussion may take 45-60 minutes and be audio recorded. Your participation is voluntary, and the information you provide will be confidential. Direct quotes might take from your response to use in written and verbal reports of the paper, but your name will never be written, and codes will only identify aggregate responses from different respondents. However, voice recording may use during the interview. Your honest response to the question is paramount for completing the study. There is no right or wrong answer, and you can have clarification for any doubt regarding the questions.

Are you willing to respond to the questions? Yes/No

**Thank you for your time.**

## **Focus group discussion Guide Questions**

**Instruction:** the following general discussion guide questions are intended to collect focus group discussion from participants regarding the current TBPM and factors affecting SC pharmaceuticals at St Peter Hospital.

1. Code no: \_\_\_\_\_
2. Name of the participants: \_\_\_\_\_
3. Date of discussion: \_\_\_\_\_
4. Place of discussion: \_\_\_\_\_

### ***Part 1: Participants Profile***

1. Gender A. Male B. Female
2. Age: \_\_\_\_\_ (in years)
3. Profession: \_\_\_\_\_
4. Academic qualification: \_\_\_\_\_
5. Position: \_\_\_\_\_
6. Work experience: \_\_\_\_\_

### ***Part 2: General Discussion Guide Questions***

1. How do you see the process mapping of the pharmaceutical supply chain of St Peter Hospital?

Probe: clarity/known

Appropriateness

Duration (time taken)

Consistency

2. What are the main factors that increase the time duration from one-step to the next?
3. What should be do to reduce the time from one-step to the next?

**Thank you very much for your cooperation!**

# Annex III

## 1. Time Data Collection Format

SN	Activity	Start date	End date	The actual activity takes time	FGD participant Recommended time	%of value adding time	Wasted time	% of wasted time