ASSESSMENT OF SUPPLY CHAIN PRACTICE AND ASSOCIATED FACTORS FROM HEALTHCARE PROFESSIONALS PERSPECTIVE IN PUBLIC HEALTH FACILITIES, WEST GOJJAM ZONE, ETHIOPIA

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Assessment of Supply Chain Practice and Associated Factors from Healthcare Professionals Perspective in Public Health Facilities, West Gojjam Zone, Ethiopia

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Abstract

Background*:* Supply chain management is the backbone of healthcare system because healthcare service is highly dependent on the availability of drugs and other healthcare supplies at the appropriate time and in the right quantity for treating patients. Effective pharmaceutical supply chain practices helps to minimize stock out, loss due to expiry and pilferage and for ensuring the desired pharmaceutical products are available at all time in adequate amount. In addition, it also has huge role in ensuring the quality of services provided.

Objective: This study intended to assess the status of some of the supply chain practices and associated factors from healthcare professional perspective in public health facilities found in west Gojjam zone.

Method and Materials*:* A descriptive cross-sectional study design was employed for the quantitative part of the study and phenomenology study design was used for qualitative study. Both quantitative and qualitative data regarding to supply chain practice were collected starting from April 28/ 2018 – June 20/2018. Epidata and SPSS version 20 was utilized for data entry and analysis respectively. Simple and multiple linear regressions were done for determining the association and making prediction between dependent and independent variables. A variable with p-value less than 0.05 were considered as significantly associated.

Result: A total of 425 questionnaires were distributed to respondents and413 questionnaires were filled and returned successfully. Supplier relationship management, procurement, information sharing and technology, after-procurement service, and monitoring and evaluation were under-performed supply chain (SC) practice with mean value of 2.64, 2.85, 2.39, 3.34, 2.24, and 1.86 respectively. On the other hand, the storage practice and inventory management was relatively better-performed SC practice with mean value of 3.34 and 3.22 respectively. IPLS skill of the staff and management support were the factors significantly associated with the performance of most of SC practice assessed by this study. This study also reported that shortage of budget allocated, poor management support, and lack of commitment from staff were among the major challenges for most of SC practices in public health facilities found in west Gojjam zone.

Conclusion: Generally, most of the supply chain practices assessed by this study were poorly executed in public health facilities found in west Gojjam zone. The IPLS skill of the staff and management support has been the factors that were significantly associated with most of SC practice. Limited allocated budget, poor management support, and lack of commitment from

staff were among the major challenges for the execution of most of supply chain practices in public health facilities, which were reported by key informants of in-depth face to face interview done by this study.

Recommendation: This study also constructed important recommendations for public health facilities, west Gojjam zonal department, Bahirdar hub Pharmaceutical Fund and Supply agency, and researchers based on its major findings.

Key words: *Supply Chain Practice, Public Health Facilities, Healthcare Professional*

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Acronym/Abbreviation

ADIS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral therapy
CEO	Chief Executive Officer
FMOH	Federal Minister of Health
HCMIS	Health Commodities Management Information System
HIV	Human Immune Deficiency Virus
IFRR	Internal Facility Report and Resupply
IPLS	Integrated Pharmaceutical Logistics System
LIAT	Logistics Indicators Assessment Tool
LMIS	Logistics Management Information System
MIN/MAX	Minimum/Maximum
NGOs	Non-Governmental Organizations
PFSA	Pharmaceutical Fund and Supply Agency
RDF	Revolving Drug Fund
RRF	Report and Requisition Form
SC	Supply Chain
SCM	Supply Chain Management
SRM	Suppliers Relationship Management
TB	Tuberculosis

Chapter One. Introduction

1.1. Background

The Council of Logistics Management (2000) defines Supply Chain Management(SCM) as a systematic, strategic coordination of the traditional business functions within a particular organization and across businesses for the purposes of improving the long-term performance of the individual institute and the supply chain as a whole(1). Supply chain management includes a set of approaches and practices to successfully coordinate suppliers, manufacturers, distributors and customers for improving the long term performance of the individual organizations and the overall supply chain(2). Supply chain management is the backbone of healthcare system because healthcare service is highly dependent on the availability of drugs and other healthcare supplies at the appropriate time and in the right quantity for treating patients(3). Healthcare supply chain management is a set of approaches intended for linking drugs, equipment, food, suppliers, healthcare organizations and transport systems for efficient and effective use of resources to achieve the total quality management in healthcare institutions(4).

Supply chain (SC) practices involve a set of different activities carry out in an organization to support effective management of its supply chain. Supply chain practices are various activities taken by the management of any organization for a better workability of the whole supply chain(5). The SC practices which have potential to affect organizational performance include integration and partnership throughout the supply chain, utilization of information technologies for information sharing, and performance monitoring and evaluation of different SC practice in the organization(6). Efficient procurement and inventory management of health commodities are some of the SC practice in healthcare facilities which have a potential to ensure value for money, which is indispensable to a country encountered lot of developmental challenges(7). Strategic relationship with suppliers, development of specifications and standards, information sharing, and after-procurement service are some of the key SC practice in healthcare facilities which have significant influence on quality of healthcare service(8). Some of the SCM practices that should be executed in public healthcare facilities include information and technology management, demand management, customer relationship management, supplier relationship management, capacity and resource management(3).

The ultimate goal of every supply chain practice in healthcare facilities is to ensure that every customer has commodity security and if healthcare facilities became capable of achieving commodity security, people can feel more confident about the health program and this can motivates them to seek and use basic healthcare services(9). Effectively implemented supply chain practices in healthcare organizations have big role in executing and achieving different cost reduction initiatives; matching the supply and demand of different customer services; and increase responsiveness of service provided by healthcare organizations thereby resulting improved customer satisfaction(10,11). The effective supply chain practices will reduce costs, boost revenues, increase customer satisfaction, and also improve service delivery(12)

Some of the contributing factors to the problems encountered by healthcare institutions during managing their supply chain practices include outdated information systems and infrastructure, week inventory and delivery management, traditional procurement systems, lack of higher level officials involvement, and poor process evaluation and improvement culture(13). The potential challenges of healthcare supply chain system in Ethiopia which are affecting the supply chain practice include frequent stockouts of essential medicines, inability of patient's to afford the cost for quality logistics service, and poor data management at different level of supply chain(14).

Assessment of different parameters of healthcare supply chain practice is important for doing the right thing and making continuous service improvement, satisfying all customers, maintaining sound financial performance, and obtaining the best possible clinical outcome(15). For that reason, this study tried to assess the status of some of the supply chain practices and challenges related to these SC practice in public health facilities found in the west Gojjam zone. This study selected west Gojjam zone as study area because it is one of the most populated zones in Amhara regional state, Ethiopia. This study assessed supply chain practice from the perspective of healthcare professionals because the quality of SC related data documentation in public health facilities found in Ethiopia is poor. Therefore, assessing SC practice from healthcare professional perspective can help the study to capture possible finding that could not be captured through document review and observation. It is expected that this study will offer useful document on the status of SC practice in public health facilities found in west Gojjam zone and facilitate further studies in this area.

1.2. Statement of the Problem

The healthcare supply chain system is extremely complex because it is a business activity which manages diversified locations, changing organizational structures, and multiple information systems across the globe(16). The practice of patient care is holding up with different healthcare supply chain practice, therefore improving the efficiency of those practices can provide opportunities for healthcare institutions to increase the quality of care and reduce costs(17). Most of disease and disability burden in majority of developing countries can be significantly reduced if carefully selected affordable pharmaceuticals are available and properly utilized(16). Managing in-house logistics is becoming extremely complex as healthcare organization advancing into integrated health systems comprising the hospitals, outpatient clinics and surgery centers, nursing homes, and home healthcare services. Therefore, there is an increasing demand for utilizing the technologies in order to optimize the logistical systems, and thereby maintaining the same healthcare service level(18).

A study done in Jordan conclude that the performance of supply chain practices in health facilities has a significant impact on the quality of healthcare services(2). The study done in Ghana reported that poor pharmaceutical inventory management was the major factor affecting the quality of healthcare service in the health facilities. According to this study the availability of drugs and other supplies has been below 60% in studied health facilities over the years and around 15% of reported death was caused by shortage of essential medicines(19). According to a study in South Africa, only 50% of the stock cards assessed had accurate information and the percentage of items for which min-max inventory control system is strictly applied was only 20% across all facilities(20). A study done in Kenya concluded that strategic supplier relationship, information sharing capability, and procurement performance can significant affect the customers satisfaction therefore they should be regularly assessed and improved(21). The finding of a survey done in Ethiopia showed that average percentage of facilities with acceptable storage conditions were 63 % and 43 % for health centers and hospitals stores respectively(22). A study in Addis Ababa reported that there was low level of quality of pharmacy services in the studied hospitals, which resulted from inadequate availability of essential healthcare supplies(23). A study conducted in Addis Ababa reported that utilization of bin cards were found 33.5% in hospital(24). According to the study done in Amhara region, the percentage of health facilities getting the requested quantity of health commodities in full

amount from PFSA was only 47.4%, this resulted frequent stockout pharmaceutical products at health facilities(25).

Ineffective pharmaceutical procurement, quantification, and requisition by the region or healthcare facilities, and lack of transport at any stage of supply chain are the major cause of product stock out at the healthcare providers(26). Due to poor execution of supply chain practice, the quality of healthcare service provided to customers can be significantly decrease and this may results prolonged illness and in some cases death of the innocent patient(27).

Assessment of different parameters of healthcare supply chain practices is important for doing the right thing and making continuous service improvement, maintaining sound financial performance, and satisfying all customers(15). The majority of research done in different countries on SCM practice is from the traditional manufacturing sector aspect, but there have been also various attempts to examine its applicability in the services provider sectors(8). In Ethiopia, there is not enough study done regarding to healthcare supply chain practices, especially in this study area. For that reason, this study tried to assess the status of supply chain practice and associated factors affecting these practices from healthcare professional's perspective. In addition, this study also tried to identify challenges related with supply chain practice in selected public health facilities found in West Gojjam zone. This study tried to answer the following questions:

1. What is the status of supply chain management practices in public health facilities?
2. What are the factors affecting supply chain management practices in public health facilities?
3. What are the major challenges related to supply chain management practice in public health facilities?

1.3. Significant of the Study

This study finding will be useful in providing additional knowledge to existing and future organizations working on healthcare supply chain service. The finding will also offer a useful reference document to public and private health facilities or other stakeholders such Woreda Health Office, Zonal Health Department, Regional Health Bureau, Non-Governmental Organizations (NGOs), and other public health sector subdivisions in their activities to improve the quality of supply chain practice. Regarding to the academia, this study can be used as a

source of reference material for future researches on other related topics. The policy makers within public and private health sectors can also utilize the finding of this study to identify fundamental supply chain areas for further improvement in their organizations. In addition, the research will be helpful in identifying further research areas constructed on its recommendation.

Chapter Two. Literature Review

2.1. Concepts and Definitions

In this section, a critical review of several available literatures related to supply chain practices in healthcare facilities was conducted. Concepts and definitions of supply chain management and different healthcare supply chain practices, and challenges related to healthcare supply chain management practices were among the subjects discussed in this chapter. In addition, principal investigator developed the conceptual framework of this study after reviewing different literatures.

Supply Chain Management

The Global Supply Chain Forum defines SCM as the integration of key business processes from end user through original suppliers that provide products, services, and information which add value for customers and other stakeholders. Supply chain management is about organizing and controlling the information, products, services and money in a way that promotes the quality of organization's business; and it helps to introduce new methods and advancing methods already in use**.** According to Chopra and Meindl, supply chain management is a set of approaches and practices to effectively integrate suppliers, manufacturers, distributors and customers for improving the long term performance of the individual organization and the supply chain as whole(1,2). Supply chain management include planning and controlling of all logistics management activities as well as manufacturing operations and also it comprise coordination and partnership with different external partners, which can be suppliers, intermediaries, and customers(28).

Supply Chain Practices in Healthcare System

Supply chain management practices involve a set of different activities carried out in an organization to support the effective management of its supply chain. The short-term objectives of supply chain practice include increase productivity, minimize inventory, and reduce lead-time whereas the long-term objectives of supply chain practice include increase market coverage and integration of supply chain(6). Healthcare supply chain management had become an important phenomenon for healthcare organizations in order to achieve the goals set by organization

because it has enormous effect on the cost control(2). African Medical Research Foundation(2009) defined healthcare commodity supply chain management as a set of activities and procedures that ensure healthcare commodities are available, accessible and have high quality(17)**.** The healthcare sector in its wider context does not only include clinics, health center and hospitals but also pharmaceuticals manufacturers, pharmaceutical wholesalers, medical supplies retailers, pharmacies, government regulatory agencies, health insurance companies, healthcare technology providers, and information technology sellers(28). A study done in Kenya said that relationship with suppliers, specifications and standards, product delivery, pharmaceutical procurement, information sharing, and after-procurement service are the most important supply chain practices in health facilities which can significant affect quality of healthcare service(8).

A public healthcare supply chain is a network of different interrelated organizations or sectors that ensures the availability of health commodities to the people who need them. There is significant variation exist between the public and private healthcare sectors regarding to implementation of specific supply chain management operation(29). Healthcare supply chain system has a huge role on ensuring every clients or patient are able to obtain quality health commodities, however developing a supply chain system that can administer large number of quality products is very difficult(24). Now a day's , different countries public health sector provide more attention on supply chain management because effective supply chain management practices can helps to minimize costs, enhance income, increase customer satisfaction, and also improve quality of service delivery(8).

Information Sharing and Technology

Information sharing means the exchanging of any information, which is important for decision-making purpose, between two or more parties. When information sharing is good, the forecast at the supplier level can gain significant improvement because under or over estimation of the need can be removed(30). Despite the importance of information flow in supply chain management, it appears that the level of information sharing, information quality and information technology (IT) tools usage still has not reached the ideal state in public health facilities(31). The implementation of information technology in healthcare supply chain system is currently considered as an opportunity to increase not only effectiveness, efficiency, and quality of health services but also the transparency of the economic activities(32). Healthcare facilities integration

with supplier through information technology is important to decrease inventory costs and simultaneously allowing health facilities to be able to meet customers' requirements(28). Logistics Management Information System(LMIS) is a system that support people involved in the management of health commodities for timely documentation, collection and organization of the information necessary for decision making in managing the supply chain of the health commodities(33). Effective and transparent information tracking systems that allow healthcare providers to consistently and accurately record inventory components can helps to reduce adverse patient outcomes(34).

According to a study in Ghana, majority of respondents (97.5%) confirmed that the information they receive from their suppliers influences their purchasing decisions(35). A cross-sectional study in Kenya concluded that information sharing capability of suppliers has a significant effect on customer's satisfaction(21). A cross-sectional study done in Ethiopia conclude that since the vertical national logistics management information system for Human Immunity Virus/Acquire Immune Deficiency Syndrome(HIV/AIDS) laboratory commodities implemented, stock outs for antiretroviral therapy(ART) laboratory monitoring tests, emergency orders, and product wastage appreciably reduced(24).

Medicines Storage Practice and Inventory Management

Appropriate storage environmental controls like suitable temperature, light and humidity, sanitation, ventilation and segregation should be maintained everywhere the healthcare supplies are stored. Medicines Store should be secure and good shelves and equipment to be used for arranging drugs should be available, so that drugs can accessible only to authorized personnel(34).Appropriate inventory management enables the organization to alleviate its inventory costs for example holding costs, stock out costs, and lead time(36). According to the assessment in Namibia, which was done to assess the physical structure and store practices of healthcare supply chain at different level reported that most storage facilities were generally well organized and allied with standard storage conditions (37). A cross-sectional study done in Iran reported that more than 50% of studied hospital pharmacies had well designed and organized pharmaceutical store, which have well maintained condition and sufficient space. And according to this study the majority of pharmacy stores had fire safety equipment and 70% of the pharmacies store were accessible to hospitals dispensary units(38). According to a study in South Africa, only 50% of the stock cards assessed had accurate information and the percentage

of items for which Min-Max inventory control system is strictly used were only 20% across all facilities(20). According to a study In Uganda, record-keeping practices on inventory using bin cards were poorly done and stock balances were frequently not recorded(34). The study done in Tanzania revealed that the overall availability of stock at health facility level at the time of survey was 65% (39). A cross-sectional study done in Ghana concluded that a decline in effectiveness of inventory management practice leads to a decline in patients satisfaction, and prolonged suffer because of disease and even death(20).

The finding of a survey done in Ethiopia showed that average percentage of facilities with acceptable storage conditions were 63 % and 43 % for health centers and hospitals stores respectively(22). A cross-sectional study done in Addis Ababa reported that shortage of space for pharmacy store was the main problem for all pharmacies in all studied hospitals and the main reason for this was insufficient budget allocation for building the store(23). According to the study conducted in Addis Ababa, most of the health facilities(96.2%) reported that the availability and utilization of LMIS tools to manage HIV/AIDS and laboratory commodities was good(41). According to the cross-sectional study conducted in Amhara region, 40.2% of health center investigated was under stocked for at least one of the key items required for tuberculosis related healthcare service and 13.4% of health centers were under stocked for all TB diagnostic reagents. Lack of commitment from health personnel at all levels and product stock out in the Pharmaceutical Fund and Supply Agency (PFSA) branch were reported as the major reasons for frequent stockouts in health facilities(25). A study conducted to assess the SCM performance in health facilities found in Addis Ababa revealed that majority (75%) of the health facilities studied reported stocked out of some non-program drugs at the day of visit, while 37.5% of them were overstocked for some non-program drugs(42).

Medicine Procurement

The major role of procurement is to acquire appropriate quality and quantity of products and services for the business in a timely manner and at the lowest total cost(17). An appropriate healthcare procurement policy should have an integrated approach to development of an essential drugs list; quantification of the need; quality assurance; procurement process; and prompt payment to suppliers(34). An efficient procurement system may possibly ensure value for money, which is indispensable to a country encountered lot of developmental challenges(7). When better procurement practices employed in public health facilities, consequentially it is

capable to improved quality health service provision to the community(43). According to a study in Jordan procurement performance of healthcare facilities significantly affect quality of healthcare service(2). A study in Ghana reported that there was lack of consistent pharmaceutical product selection procedure in most of investigated hospitals(17). According to the assessment done in Tanzania, only 25% of studied health facilities conducted annual quantification exercise and only 22% of the facilities had procurement plans(39). A pilot assessment in Ethiopia done on the status of health facilities supply chain practices revealed that poor availability of essential medicines and insufficiency of on training about SCM practice in the surveyed facilities(44).

Supplier Relationship Management

Supplier relationship management (SRM) is a complicated business process that needs resource allocation by the buyer and supplier to achieve a set of complex outputs and it is highly affected by external conditions(7). The direct objective of SRM is to make effective sourcing processes between healthcare facilities and its suppliers and indirectly it also targeting at quality-related improvements of supply chain operation(32). A study done in Kenya concluded that strategic suppliers relationship has a significant effect on customer satisfaction(21). A cross-sectional study done in Jordan reported that supplier relationship management performance in healthcare facilities can significantly affect quality of healthcare service(2).

The finding from the national survey done in Ethiopia reported that program commodities for majority of surveyed health facilities (78 % of the hospitals and 71 % of health centers) were usually delivered to their stores through delivery from their supplier, in this case it is PFSA. But in the case of Revolving Drug Fund (RDF) commodities, 92 % of hospitals and 75 % of health centers were collecting their product from the suppliers(22). According to the study done in Amhara region, the percentage of health facilities getting the requested quantity of health commodities in full amount from PFSA was only 47.4%(40). According to a study in Addis Ababa, the approximate lead time for majority of the health facilities (41.7%) when product requested from PFSA was 1 to 2 weeks but when it is from private suppliers the lead time for 45.5% of health facilities was between 2 weeks and 1 month(42).

Healthcare Supply Chain Practices Related Challenges

The main challenge in the healthcare supply chain management is the realization of improved performance and service(1). Poor infrastructure, large amount of materials to be transported, poor requisition form filling and late arrival of purchase order to suppliers are some of the challenges associated with healthcare supply chain practice(8). According to a cross-sectional study done in Tanzania, lack of unified system for managing inventory at different level, quantification process and inadequate stock management knowledge have been found as the main challenges in most health facilities(39).

A study conducted on health facilities found in Nigeria identified factors that restrict implementation of LMIS of HIV/AIDS laboratory commodities include lack of training for laboratory professional involved in LMIS, inadequate supply from assigned regular supplier during resupply cycle, delayed delivery from supplier, and inadequate storage space for supplies(33). Some of the challenges for inventory management practice in studied hospitals found in Agroyesum include delays in delivery of medical supplies from suppliers; bureaucratic process in procurement; loss of drugs through theft and damaged; weak administration system; and insufficient funds for procurement(45). Some of the challenges to procurement in healthcare sector include poor estimation of demand, corrupted procurement and tender practices, and inappropriate financial management and payment methods(17). Ethiopia has various health programs, therefore having an effective pharmaceuticals supply chain system for effective and efficient implementation of those health program is a big challenge(41)**.** The topography, its reliance on other countries' seaport, low coverage of road infrastructure network and standards, lack of coordination in transportation of healthcare commodities, lack of well-designed and equipped healthcare commodities stores, and lack of soft and hardware logistics infrastructures are some of the challenges that are making the healthcare SC practice difficult in Ethiopia(14).

2.2. Conceptual Framework

The study framework defines the relationship between dependent and independent variables. Dependent Variable of this study was the supply chain management practices and it was measured from the aspect of its seven dimensions such as suppliers relationship management, procurement, inventory management, information sharing and technology, storage practices, after-procurement service, and monitoring and evaluation. Independent variables of this study

include socio-demographic characteristics, managerial related factors, and health facilities related factors,

The following conceptual framework clearly shows the relationship between dependent and independent variables.

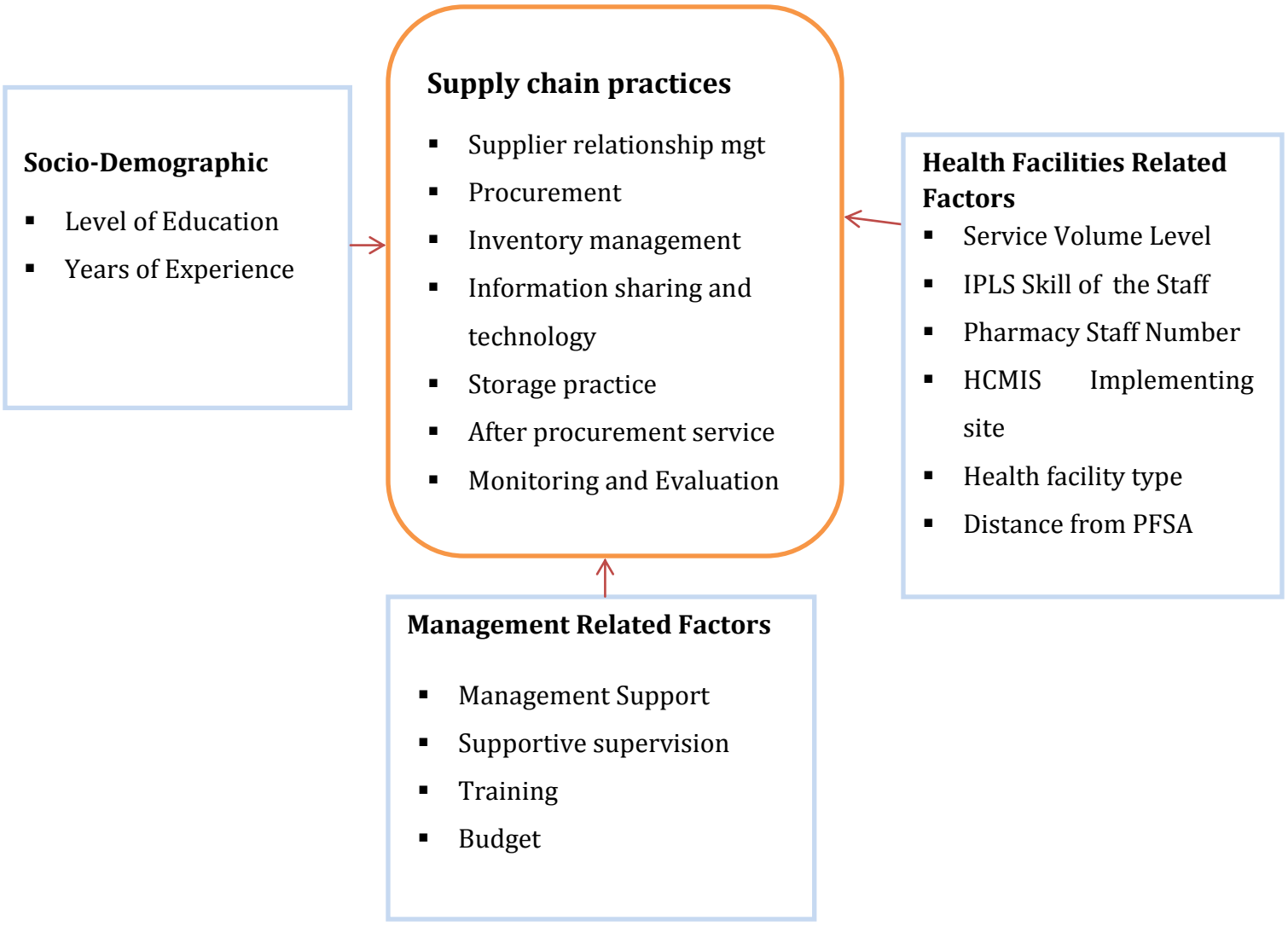

Figure 1: Conceptual Framework developed by principal investigator, 2018

Chapter Three. Objective

3.1. General Objective

This study aims to measure the status of some of supply chain practices and associated factors from the healthcare professional's perspective in selected public health facilities found in West Gojjam Zone.

3.2. Specific Objectives

1. To assess the status of some of the supply chain practices in selected public health facilities found in west Gojjam zone.
2. To determine factors affecting supply chain practices in selected public health facilities found in west Gojjam zone.
3. To explore supply chain practices related challenges in selected public health facilities found in west Gojjam zone.

Chapter Four. Methods and Materials

4.1. Study Area and Period

This study was done in public health facilities found in West Gojjam Zone, which is one of the most populated zones found in Amhara Regional State, Ethiopia. The capital city of this zone is Finoteselam town, which is 174 km away from Bahirdar and 481 km far from Addis Ababa. In this zone an estimated 2.2 million populations are living there and under this Zonal Health Department, there are 94 health centers and 6 primary hospitals. There were a total of 2774 healthcare professional working in all public health facilities found in west Gojjam zone. The data collection was done starting from 28 April/2018 – 20 June/2018 in selected public health facilities found in West Gojjam zone.

4.2. Study Design

This study employed descriptive cross-sectional quantitative study supported by qualitative study to assess the status of supply chain practice and associated factors in selected public health facilities. The qualitative study also employed phenomenology study design.

4.3. Population

4.3.1. Source of Population

The source populations of this study were all public health facilities and healthcare professionals working in those health facilities found in West Gojjam zone. These facilities were all health centers, primary, and general hospitals found in this area.

4.3.2. Study Population

All healthcare facilities and healthcare professionals working in those selected health facilities and who are responsible in different supply chain related tasks were the study populations.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion Criteria

- Public health facilities started service at least six months prior data collection period
- All personnel, who are the member of Drug and Therapeutic Committee(DTC)

- Coordinators of pharmacy, medical laboratory, emergency OPD(outpatient department), Outpatient OPD, Inpatient OPD, Mother and Child Health(MCH), Neonatal Intensive Care Unit, Oral Resuscitation, and Radiology departments.
- Coordinators of each pharmacy dispensing units in public health facilities

4.4.2. Exclusion Criteria

- Military health facilities found in the study area.
- Staffs started working within the last 6 month prior to the data collection period.
- Healthcare professional participated on pre-test

4.5. Sample Size Determination and Sampling Techniques

4.5.1. Sample Size Determination

4.5.1.1. Sample Size Determination for Quantitative Study

According to USAID Delivery Project Logistics Indicators Assessment Tool (LIAT), a minimum of 15 % of health facilities in the study area is recommended for sample size determination(46). However, for this study all hospitals and 50 % of health centers found in West Gojjam zone were selected. In this zone, a total of 94 health centers were found. Therefore, a total of 53 health facilities (i.e. 6 hospitals and 47 health centers) were selected on the first stage of sampling process. On second stage of the sampling process, the number of healthcare professionals included in the sample was calculated by using single population proportion formula by accounting 0.5 p-values and with 95% confidence interval, 5% margin of error, 10% non-response rate, and design effect of 1.2.

$$n = \frac{(Z_{a/2})2p\,(1-p) * g}{d2}$$

Where

- ***n*** **=** *minimum sample size for study*
- $Z_{a/2}$=1.96 with confidence interval of 95% and *a*=0.05
- **P** –value = 50%(0.5)
- **d** = tolerable margin of error; (d) = 5% = 0.05
- **g** = design effect, g= 1.2(47)

$n = \frac{(Z_{a/2})^2\ p\ (1-p)*g}{d^2} \rightarrow n = \frac{(1.96)^2 0.5\ (1-0.5)\ *1.2}{(0.05)^2} \rightarrow$ n= 460 healthcare professionals

By considering 10% non-response, the sample size became 506 healthcare professionals. However, the proportion of the sample size relative to the total population was more than 5%, therefore finite population formula was utilized.

$$nf = \frac{ni}{1 + \frac{ni}{N}}$$

Where;

nf= final sample size

ni= sample size from the formula

N = Size of the study population (47)

$$nf = \frac{ni}{1+\frac{ni}{N}} \rightarrow nf = \frac{506}{1+\frac{506}{2734}} \rightarrow nf = 425\ healthcare\ professionals$$

Therefore, a total of 425 healthcare professionals engaged in different health facility's supply chain practice were included in the final sample to collect data through self-administered questionnaires. The number of professionals selected from each health facility was proportionally allocated based on the total number of staff in each health facilities. In addition, the pharmacy head of each health facility was selected purposively for face-to-face interview to collect quantitative data.

4.5.1.2. Sample Size Determination for Qualitative Study

The qualitative data was collected through in-depth face-to-face interview with 27 key informants (pharmacy head and store managers) until the information collected become saturated.

4.5.2. Sampling Techniques and Procedure

4.5.2.1. Sampling Techniques and Procedure for Quantitative Study

The primary sampling unit of this study was health facility and the secondary sampling unit was individual healthcare professionals who were responsible in different SC practices of selected public health facilities. A two-stage sampling technique was utilized for selecting health facilities and principal respondents, who are healthcare professionals. On the first stage, some health

facilities were selected using lottery method from the sampling frame of health facilities that was included in the frame based on the inclusion and exclusion criteria. On the second stage of sampling process, individual healthcare professional was selected using lottery method from sampling frame of healthcare professional prepared for each selected health facility, which was prepared based on inclusion and exclusion criteria. The number of healthcare professional included in the sample from each selected health facility was allocated proportionally based on the total number of staff in each health facility. In addition, the pharmacy head of each health facility was selected purposively for face-to-face interview to collect quantitative data.

4.5.2.2. Sampling Techniques and Procedure for Qualitative Study

For qualitative study, purposive sampling technique was utilized for selecting the pharmacy head and pharmaceutical store manager of health facilities as key informants for collecting qualitative data through in-depth face-to-face interview.

4.6. Study variables

4.6.1 Dependent Variable

Supply chain practices were the dependent variable of this study and its dimensions include;

- Suppliers relationship management
- Procurement
- Inventory management
- Information sharing and technology
- Storage practice
- After-procurement Service
- Monitoring and Evaluation

4.6.2. Independent Variable

- Socio Demographic
  - ✓ Level of education
  - ✓ Years of experience
- Management Related Factors
  - ✓ Management support
  - ✓ Supportive supervision

- ✓ Training
- ✓ Budget

- Health Facility Related Factors
  - ✓ Service volume level
  - ✓ IPLS skill of the staff
  - ✓ Number of pharmacy Staff
  - ✓ Distance from PFSA
  - ✓ HCMIS implementing site
  - ✓ Health facility type

4.7. Data Collection Instrument and Procedure

4.7.1. Data Collection Instrument

After extensively reviewing several previously done literatures and other materials, checklists and questionnaire with 5-likert-scale were prepared in English. All questions included in the structured questionnaire were grouped and arranged based on the particular issues they were intended to address. Tape recorder and different stationary materials were utilized for collecting data during in-depth face-to-face interview.

4.7.2. Data Collection Procedure

Structured questionnaire was utilized for collecting quantitative data regarding to health facilities' supply chain management practice by administering and collecting the questionnaires under supervision of data collector. Principal investigator collected qualitative data through in-depth face-to-face interview with key informants by using semi-structured questionnaire.

4.8. Data Processing and Analysis

4.8.1. Data Processing

The data was checked for completeness and then entered into Epi-Data software. The principal investigator performed data entry and cleaning process. Once the data cleaning process finished, the data was analyzed with Statistical Package for Social Science (SPSS) programs version 20. The principal investigator manually transcribed digital files and once the files transcribed, it was read twice while listening the record in order to authenticate the accuracy of transcription.

4.8.2. Data Analysis

Frequency distribution, arithmetic mean, and percentages were calculated. Simple and multiple linear regressions between selected variables were done to establish association and make prediction between variables. All variables that were significantly associated with the performance of supply chain practices during simple linear regression were included in multiple linear regressions done for each supply chain practices. A variable with p- value less than 0.05 at corresponding 95 % confidence interval were considered as significantly associated variable and backward stepwise model building technique was utilized for constructing regression model of each supply chain practices. Therefore, only significant variables displayed on multiple linear regression tables constructed for each supply chain practices on the result part of this study. The qualitative data from the digital files was transcribed and thematic content analysis was done.

4.9. Data Quality Assurance

The quality of the data collected was ensured by properly designing and pre-testing of questionnaires. Pre-test was done on 5% of the total sample size (i.e. 22 healthcare professionals) and appropriate modification of the questionnaires was done for improving the reliability and consistency of the data collection tool. In addition, the quality of the data was assured by properly categorizing and coding of questionnaires, providing training for data collectors about the data collection procedures and questionnaires, and evaluating the filled questionnaires for completeness before analysis. Pharmacy professionals who have experience on health commodities' supply chain practices collected the data.

4.10 Ethical Clearance

Permission to carry out the study was granted from Institutional Review Board of Jimma University, Faculty of Health Science. The permission letter from Jimma University was submitted and formal authorization letter was obtained from Amhara Region Public Health Institute. Then the authorization letter was submitted to West Gojjam Zonal Health Department to obtain permission letter. Before starting data collection, the permission letter from ZHD was submitted to each public health facility to get permission for data collection. Verbal consent was obtained from all respondents and confidentiality of the information was assured to them.

4.11. Dissemination Plan

This study finding will be disseminated to all concerned bodies such as Jimma University Faculty of Health Science, School of Pharmacy; Amhara Regional Public Health Institute, all health facilities included in the study; and West Gojjam Zonal Health Department. Finally, the study paper will be submitted to reputable professional journal for publication to be used as reference for further researches.

4.12. Operational Definition and Definitions of Terms

Training: All training related to all health commodities supply chain management practices providing by different stockholders to healthcare professionals working in public health facilities practices and according to this study mean value less than or equal to 2.5 were considered as **Low,** mean value greater than 2.5 and less than 4.5 was considered as **Medium,** *and* mean value greater than 4.5 we considered as **High**.

Supportive supervision: The supportive supervision provided by different organizations to public health facilities related to health commodities supply chain management practices and according to this study mean value less than or equal to 2.5 were considered as **Low,** mean value greater than 2.5 and less than 4.5 was considered as **Medium,** *and* mean value greater than 4.5 we considered as **High**

***Budge*t:** The overall budget allocated by the public health facilities for all health commodities supply chain practice and according to this study mean value less than or equal to 2.5 were considered as **Low,** mean value greater than 2.5 and less than 4.5 was considered as **Medium,** and mean value greater than 4.5 we considered as **High.**

IPLS skill of the staff : according to this study mean value less than or equal to 2.5 were considered as **Poor,** mean value greater than 2.5 and less than 4.5 was considered as ***Good,*** *and* mean value greater than 4.5 we considered as **Very good.**

Management support: The support provided by the management of public health facilities for effective implementation of different health commodities SC practices in their respective health facility practices and according to this study mean value less than or equal to 2.5 were considered as **Low,** mean value greater than 2.5 and less than 4.5 was considered as ***Medium,*** *and* mean value greater than 4.5 we considered as **High**.

Health facility type: It is the type of organizations provides healthcare service to the community and according to this study; it includes health center, primary hospital, general hospital, referral hospital, and specialized hospital.

Better-performed practices: Supply chain practices assessed by this study with mean value greater than the midpoint of 5-likert scale (mean= 3.0)

Under-performed practice: Supply chain practice assessed by this study with mean value lower and equal to the midpoint of 5-likert scale (mean=3.0).

Disagreement: The mean value provided by respondents less than or equal to 3 indicates that they were disagreed for the questions posed to them.

Agreement: The mean value provided by respondents greater than 3 indicates that they were agreed for the questions posed to them.

Health facility's Service volume level: According to the Federal Minster of Ethiopia (FMOH) of Ethiopia, the service volume level of health centers considered as,

- **Low**; if daily patient load is less than or equal to 50 patients,
- **Medium**; if daily patient load is between 50- 80 patients,
- **High**; if daily patient load is greater than or equal to 80 and meet any three criteria from the rest four criteria **OR** serving more than 50 patients and meet all four criteria listed below.
    - ❖ Those criteria are ;
        - ✓ Being ART sites,
        - ✓ Having more than 5 DUs implemented IPLS,
        - ✓ HCMIS implementing sites,
        - ✓ At least 3 years since implementing the HCMIS (48).

Supply chain practices: It is a set of different supply chain activities carried out in public health facilities to support the effective management of its healthcare commodities supply chain and according to this study, supply chain practices include suppliers relationship management, procurement, inventory management, information sharing and technology, storage practices, after-procurement service, monitoring and evaluation.

Suppliers Relationship management: It refers to systematic approach of developing strategic plan for managing all interactions with companies that supply health commodities to the public health facilities.

Inventory Management: Is the process of properly maintaining the health commodities stock at all supply chain levels of the public health facilities and at all times.

Procurement: Is the acquisition of healthcare commodities, works, and services to public health facilities at the best possible total cost, in the right quantity and quality, at the right time and to the right place.

Information Sharing and Technology: It refers to the ability of the public health facilities on sharing any supply chain related information within or outside the facilities in an effective way and the level of technology used for it.

After Procurement Service: It refers the public health facilities' effort to provide maintenance and follow-up service and getting accessories and parts required for maintenance of medical equipment and supplies from suppliers after the sale**.**

Monitoring and Evaluation: Routine and periodic measurement of the performance of the different supply chain practices in public health facilities which helps to demonstrate how well the practices is undertaking and the areas that can be improved.

Chapter Five. Result

5.1 Introduction

This chapter presents the quantitative and qualitative finding of this study done on public health facilities found in West Gojjam zone. It presented the findings from the questionnaires and in-depth face-to-face interview. The results of the study were presented according to the data analysis procedures outlined in the previous chapter. The analysis of collected data was done in line with the study objectives. The data for each SC practice has been analyzed categorically to give clear findings of the study and the finding were presented in charts and tables followed by brief descriptions.

5.2. Response Rate

A total of 425 questionnaires were distributed to respondents and 413 questionnaires were filled and returned successfully. Therefore, the response rate of this study was 97.2%, which was excellent according to the criteria set by Mugenda(36).

5.3. Demographic Characteristics of Respondents

5.3.1. Educational level of Respondents

Majority of the respondents 261(63.2%) were College or University Diploma holders, and 147(35.6%) of them were Bachelor Degree holders.

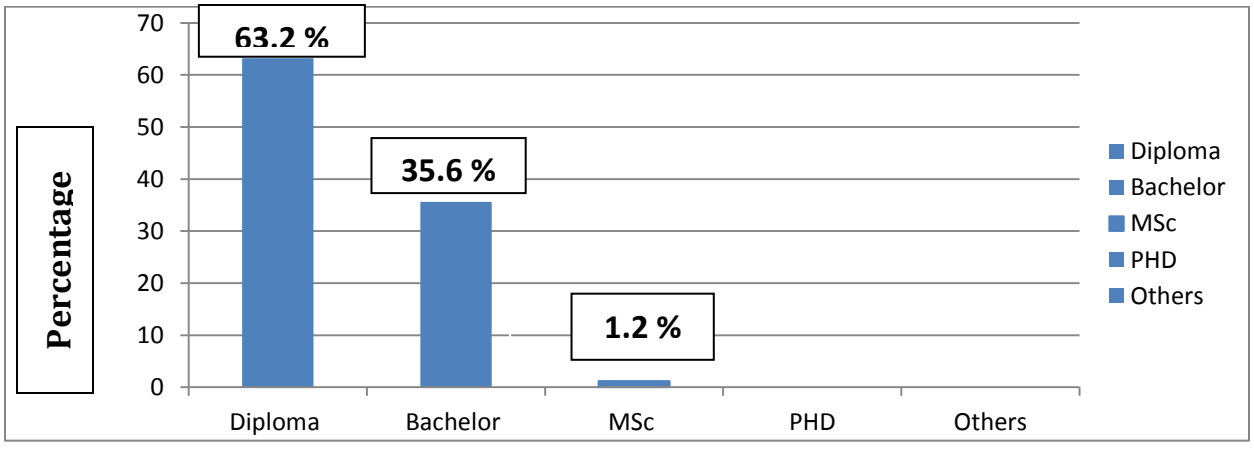

Figure 2: Educational level of respondents participated on the study done in west Gojjam zone, 2018

5.3.2. Work experience of Respondents

Majority of the respondents participated in this study 317 (76.8%) have worked as a healthcare professional in different public health facilities for a period of less than 5 years while 94(22.7%) of the respondents have worked for a period within a range of 5 years up to less than 10 years.

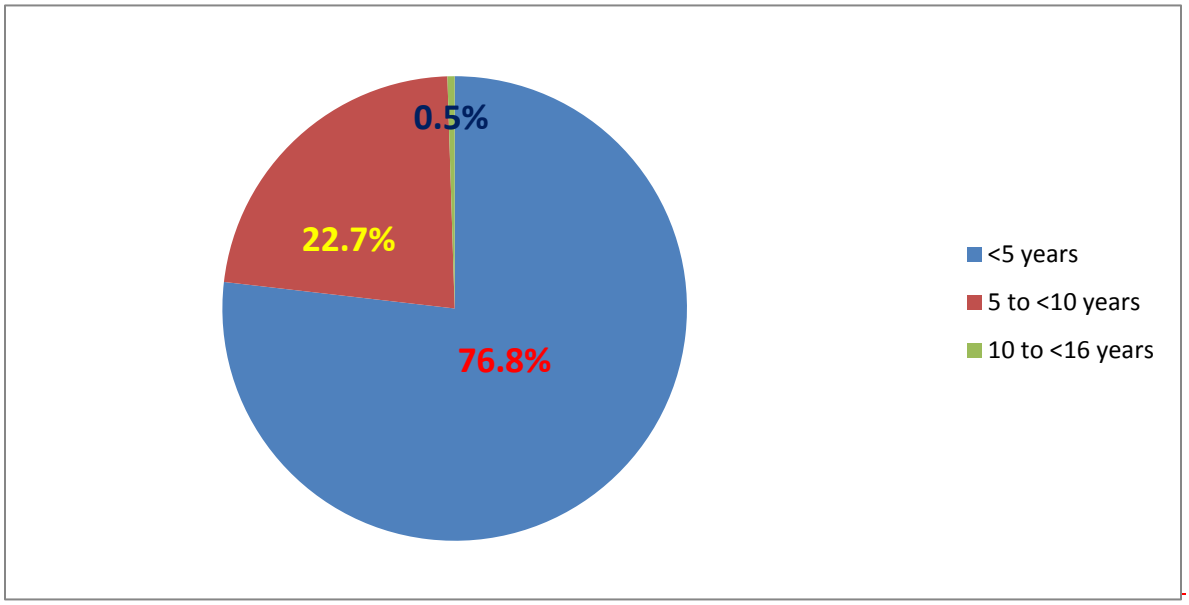

Figure 3: The work experience of respondents participated in the study done in west Gojjam zone, 2018

5.3.3. Health Facility Type

Majority 47(88.5%) of the health facility included in this study was health center and from these health centers most 32(61.5%) of them were not HCIMIS implement site. In this study, 6(11.5%) of health facilities involved in this study were primary hospitals and all of them were HCMIS implementing sites.

Table 1: The percentage of type of health facility included in the study done on public health facilities found in west Gojjam zone, 2018

Type of Health Facility	*HCMIS Implementing Site*		Total
	Yes	**No**	
Health Center	14(26.9%)	32(61.5%)	46(88.4%)
Primary Hospitals	6(11.6%)	0	6(11.6%)
Total	20(38.5%)	32(61.5%)	**52(100%)**

5.3.4. Service Volume Level of Health Facilities

The percentage of health facility included in this study with higher, medium, and lower level of service volume was 20(38.46 %), 17(32.69%), and 15(28.85%) respectively.

Table 2: The frequency of health facility with higher, medium, and lower service volume level included in the study doe on public health facility found in west Gojjam zone, 2018

Service Volume Level	Frequency	Percentage (%)	Cumulative Percentage (%)
High level	20	38.46	38.46
Medium level	17	32.69	71.15
Lower level	15	28.85	100
Total	**52**	**100**	

5.3.5. Other Health Facility and Management Related Factors

The mean value of responses provided by respondents asked about the status of management support to the implementation of supply chain practices in their respective value, IPLS skill of the staff in their respective health facility, training related to supply chain practices, budget allocated for supply chain practices, and the supportive supervision they were getting from other stakeholders was 3.12, 3.31, 3.20, 3.26, and 3.1 respectively. Majority12(23%) of health facilities included in this study were located within the distance range category of 150 up to 200 kilometer far from PFSA. This was followed by health facilities located within the distance range of 50 up to 100 kilometer far from PFSA, which were 11(21.05%). The number of pharmacy staff were 96(53.63%), and 83(46.37%) in health centers and primary hospitals respectively.

Table 3: Other health facility and management related factors in the study done in west Gojjam zone, 2018

Health Facility Related Factors		**Frequency**	**Percentage (%)**
Distance from PFSA	Less than 50 km	7	13.12
	50up to <100 km	11	21.05
	100 up to< 150 km	10	18.03
	150 up to <200	12	23
	200 up to<250	8	15.23
	≥ 250 km	5	9.6
	Total	**52**	**100**
Number of pharmacy staff	Health centers	**96**	**53.63**
	Primary hospitals	**83**	**46.37**
	Total	**179**	**100**

Management Related Factors	**Mean**	**Mode**	**Standard Deviation**	**Maximum**	**Minimum**
Management support	3.12	3	.375	4	2
IPLs skill of the staff	3.31	3	.328	5	2
Training	3.20	3	.546	4	2
Budget	2.86	3	.672	4	2
Supportive Supervision	3.10	3	.689	5	2

5.4. Supply Chain Practice

These supply chain practice assessed by this study include supplier relationship management, procurement practice, inventory management, supply chain related information sharing and technology, storage practices, after-procurement service, and monitoring and evaluation of different SC practice. The respondents were asked to answer multiple questions, designed with likert-scale having five range from *"1- for very disagree'' to "5- for very agree' '*to determine the extent of ''agreement'' and ''disagreement'' regarding to the questions posed to them.

5.4.1. Supplier Relationship Management

5.4.1.1. Descriptive Statistics

The first objective of the study was to examine the status of SC practices in public health facilities found in West Gojjam zone. Therefore, respondents were asked seven questions with 5-likert scale to determine the extent of "*agreement*" and "*disagreemen*t" to the status of implementation of supplier relationship management in their respective health facilities. As we can see on table 4, the mean score of the responses provided by respondents for most of the seven items used to measure suppler relationship management performance were below 3.0.

The responses provided by respondents indicating "agreement" was received from two items namely "*the facility always consider cost, reliability and flexibility during suppliers selection"* and "this *health facility effort to use suppliers warehouse anytime needed is satisfactory*" with mean and standard *deviation* of 3.71(0.663) and 3.05(0.726) respectively. The lowest mean value reported by respondents indicating "disagreement" was received from the first item; namely "*the facility developed and regularly updated SOP related to supplier relationship management*" with mean and standard deviation value of 1.73(0.517). This was followed by the second item which was "*the facilities always try to involve suppliers in the process of overall supply chain related planning and setting goals*" with mean and standard deviation 2.00(0.626).

Table 4: The descriptive statistics of supplier relationship management of the study done on public health facilities found in west Gojjam zone, 2018

Items Used to Measure Supplier Relationship Management	Mean	Mode	S.D	Max	Min
The facility developed and regularly updated SOP related to strategic supplier relationship	1.73	2	.517	3	1
The facilities always try to involve suppliers in the process of overall supply chain related planning and setting goals.	2.00	2	.626	4	1
The facility effort to have frequent meetings between health facility's SCM staff and the suppliers is satisfactory	2.47	2	.576	4	1
Health facility effort to use supplier vehicles anytime needed is always satisfactory	2.99	3	.714	5	1
Health facility effort to use suppliers warehouse anytime needed is satisfactory	3.05	3	.726	5	1
The facility have formal dispute resolution procedure and always resolve disputes with its suppliers based on it	2.52	2	.605	4	1
The facility always consider cost, reliability and flexibility during suppliers selection	3.71	4	.663	5	2

5.4.1.2 Regression between Suppliers Relationship Management and factors

The second objective of this study was to determine factors affecting the supply chain practice in public health facilities found in west Gojjam zone. Therefore, the researcher performed a regression analysis to establish the association and make prediction between the independent variables and the dependent variable. All variables significant at simple linear regression were included for conducting multiple linear regressions. The regression model was developed as follows:

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5$$

Where:

y = Suppliers Relationship Management

β0 = Constant Term

β1= Beta coefficients

X1= number of pharmacy staff

X2= Distance from PFSA

X3=IPLS Skill of staff

X4= Training

X5= Supportive Supervision

Analysis in table 5 shows that the coefficient of determination (the percentage variation in the dependent variable being explained by the changes in the independent variables) R^2 was equals to 0.375.This means number of pharmacy staff, distance from PFSA, IPLS skill of staff, training, and supportive supervision left 62.5 percent of the variation of supplier relationship management unexplained. The P- value of 0.000, which is less than 0.05, implies that the model of ‘‘supplier relationship management’’ performance is significant at the 5 percent level of significance.

Table 5: The model summery of regression analysis of supplier relationship management in the study done on public health facilities found in west Gojjam zone,2018

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.612[a]	.375	.367	.27832	.375	48.796	5	407	.000

a. *Predictors: (Constant),*IPLS Skill of the staff, Distance from PFSA, Training, Number of pharmacy staff, Supportive supervision

The multiple linear regression equation established for this supply chain practice became:

Y = 1.37 + 0.023X1 - 0.011X2 + 0.254X3 + 0.077X4 + 0.064X5

Where:

Constant =1.37, indicates that if number of pharmacy staff, distance from PFSA, IPLS skill of the staff, training, and supportive supervision valued as zero, ‘‘supplier relationship management’’ performance would be 1.37 unit.

B_1= 0.023, indicates that as ‘‘number of pharmacy staff’’ increased by one unit ‘‘supplier relationship management’’ performance increased by0.023 unit.

B_2=-0.011, indicates that as ‘‘distance from PFSA’’ increased by one unit ‘‘supplier relationship management’’ performance decreased by 0.011 unit.

B_3= 0.254, indicates that as ‘‘IPLS skill of the staff’’ increased by one unit ‘‘supplier relationship management’’ performance increased by 0.254 unit.

B_4= 0.077, indicates that as ‘‘training’’ increased by one unit ‘‘supplier relationship management’’ performance increased by 0.077 unit.

B_5= 0.064, indicates that as ‘‘supportive supervision’’ increased by one unit ‘‘supplier relationship management’’ performance increased by 0.064 unit.

Table 6: The multiple regression analysis of suppliers' relationship management in the study done on public health facilities found in west Gojjam zone, 2018

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	1.370	.157		8.731	.000	1.061	1.678		
IPLS Skill of the staff	.254	.052	.239	4.890	.000	.152	.357	.644	1.552
Distance from PFSA	-.011	.000	-.255	-6.371	.000	-.001	-.001	.961	1.041
Training	.077	.027	.120	2.844	.005	.024	.130	.867	1.154
Number of pharmacy staff	.023	.003	.300	6.925	.000	.016	.030	.819	1.221
Supportive supervision	.064	.024	.126	2.662	.008	.017	.112	.682	1.465

a. Dependent Variable: Supplier Relationship Management

5.4.1.3. Challenges Related to Supplier Relationship Management

The third objective of this study was to explore challenges related to SC practice in public health facilities found in west Gojjam zone. Therefore, in-depth face-to-face interviews with key informants were conducted to explore challenges related to supplier relationship management and almost all respondents mentioned absence of clear policy as the major challenge for good supplier relationship management in public health facilities found in west Gojjam zone. As one of the key informant said:

''... actually having close and good relationship with suppliers is very important because when we have good relationship they can be cooperative when you need help ...for example, when you faced unexpected stockout they can understand your situation and help you. However, in our case there is no legal background for developing strategic relationship with private suppliers because we procure medicine through open tender from them...''

The other challenges of suppliers relationship management mentioned by respondents was poor honesty from suppliers' side. As one of the respondent said:

''...most of the suppliers we dealing in our area are liars... they participate with our tender just by promising to fulfill the agreement but after they won most of these suppliers are not liable to the contract they promised during the tender...like delaying the product delivery time, interrupted delivery of product that we agreed to be delivered on single shipment and etc...''

5.4.2. Procurement

5.4.3.1. Descriptive Statistic

The first objective of the study was to examine the status of supply chain practices in public health facilities found in West Gojjam zone. Therefore, the respondents were asked 12 questions to determine the degree of "agreement" and "disagreement" to the status of implementation of procurement practice in their respective public health facilities. As we can see from Annex 2, the mean value of responses provided by respondents for most of the twelve questions used to measure the status of procurement practice in public health facilities were greater than 3.0.

The highest mean value reported by respondents indicating "agreement" was received from the sixth item, namely *"this facility developed and regularly updated its own facility specific medicine list" with* mean and standard deviation of 3.62(0.923). This was followed by first and the last items, namely ''*the facility developed and regularly updated SOP related to*

pharmaceutical procurement'' and ‘‘*Availability of essential medicines in the facility is always satisfactory*’’ with mean and standard deviation of 3.48(.577) and 3.42(.588) respectively.

The lowest mean value of response provided by respondent indicating “disagreement” was received from third item, namely ‘‘*the standards and specifications developed for each item to be procured are comprehensive and appropriate for current clinical setup in the facility*’’ with mean value and standard deviation of 1.72(0.564). This was followed by the second item, namely *‘‘the facility developed and regularly update standards and specifications for each items to be purchase’ ’*with mean and standard deviation of 1.93(0.553).

5.4.3.2 Regression between Procurement Practice and Factors

The second objective of this study was to determine factors affecting the SC practice in public health facilities. Therefore, the researcher performed a regression analysis to establish the association and make prediction between the independent variables with the dependent variable. All variables significant at simple linear regression were included for multiple linear regressions. The regression model was constructed as follows;

$$\mathbf{y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7}$$

Where:

y = Procurement

β0 = Constant Term

β1= Beta coefficients

X1= Management support

X2= Distance from PFSA

X3=IPLS Skill of staff

X4= Training

X5= Service volume level

X6= Budget

X7=Number of pharmacy staff

As we can see on table 7, the coefficient of determination (the percentage variation in the dependent variable being explained by the changes in the independent variables) R^2 was equals to 0.53that means management support, distance from PFSA, IPLS skill of staff, training, service volume level, number of pharmacy staff, and budget left 47 percent unexplained. The P- value of

0.000 (Less than 0.05) implies that the model of ‘‘procurement’’ performance is significant at the 5 percent level of significance.

Table 7: model summery of regression analysis for procurement practice in study done on public health facilities found in west Gojjam zone, 2018

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.728[a]	.530	.522	2.85184	.530	65.222	7	405	.000

*a. Predictors: (Constant),*IPLS skill of the staff, Management support, Service volume level, Distance from PFSA, Budget, Training, Number of pharmacy staff

The multiple linear regression equation was established for procurement practice became;

Y = 8.812 + 2.255X1 - 0.012X2 + 2.479X3 + 1.116X4 + 0.752X5 + 0.8X6 + 0.178X7

Where:

Constant = 8.812, indicates that if ‘‘management support, distance from PFSA, IPLS skill of the staff, training, service volume level, budget, and number of pharmacy staff’’ valued as zero, ‘‘procurement’’ performance would be 8.812 unit.

B_1 = *2.255*, indicates that as ‘‘management support” increased by one unit ‘‘procurement’’ performance increased by 2.255 unit.

β_2 = *-0.012*, indicates that as ‘‘distance from PFSA’’ increased by one unit ‘‘procurement’’ performance decreased by 0.012 unit.

β_3 = 2.479, indicates that as ‘‘IPLS skill of the staff’’ increased by one unit ‘‘procurement’’ performance increased by 2.479 unit.

β4 = 1.116, indicates that as ‘‘training’’ increased by one unit ‘‘procurement’’ performance increased by 1.116 unit.

β5 = 0.752, indicates that as ‘‘service volume level’’ increased by one unit ‘‘procurement’’ performance increased by 0.752 unit.

B6 = 0.8, indicates that as ‘‘budget’’ increased by one unit ‘‘procurement’’ performance increased by 0.8 unit.

B7 = 0.178, indicates that as ‘‘number of pharmacy staff’’ increased by one unit ‘‘Procurement’’ performance increased by 0.178 unit

Table 8: The multiple regression analysis for procurement practice of the study done on public health facilities found in west Gojjam zone, 2018

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	8.812	1.602		5.500	.000	5.662	11.961		
IPLS skill of the staff	2.479	.649	.197	3.822	.000	1.204	3.754	.435	2.297
Management support	2.255	.563	.205	4.008	.000	1.149	3.361	.443	2.259
Service volume level	.752	.209	.146	3.594	.000	.341	1.163	.702	1.425
Distance from PFSA	-.012	.002	-.240	-6.869	.000	-.016	-.009	.954	1.048
Budget	.800	.236	.133	3.387	.001	.336	1.264	.756	1.323
Training	1.116	.274	.148	4.073	.000	.578	1.655	.881	1.135
Number of pharmacy staff	.178	.037	.197	4.758	.000	.104	.252	.679	1.472

A. Dependent Variable: Procurement

5.4.2.3. Challenges Related with Procurement Practice

The third objective of this study was to explore challenges related to SC practice in public health facilities found in west Gojjam zone. Therefore, in-depth face-to-face interviews were done with key informants to identify challenges related to procurement practice in their respective health facilities and most of key informants mentioned limited budget allocated by government as major challenge for procurement in their respective health facilities. As result, the availability of most of vital and essential medicines and supplies in public health facilities become decreased. As one of key informant said:

‘‘*….the budget allocated by the government for pharmaceutical procurement is very limited and it is even almost similar with budget allocated to this health facility for the last two or three years ….But the price of pharmaceutical product dramatically increased, especially at private suppliers….’’*

Almost all respondents mentioned the procurement policy enforced by the government as challenge for pharmaceutical procurement in their health facility. As one of the respondent said:

''... when we get stock-out paper from PFSA, the next option is issuing tender to private wholesalers and the procurement policy enforced by the government requires at least three bidder to participate ....but medicines we just wanted to purchase maybe available only from one wholesaler...which means we are not going to purchase that item even though it is vital.....''

In addition, most of the key informants mentioned the seeping of information about product stock-out from PFSA to private wholesaler as a major challenge, which is resulting unacceptable increment in price by private wholesalers. As one of key informant said;

''.. When products become stock-out at PFSA, private wholesalers will get information about it and immediately they will increase the price of medicines ... even up 2 or 3 times increment per item on the acceptable price because they knew we don't have another option just only them... ''

Another challenge reported by some of respondents as major obstacle for health commodities procurement was delayed reimbursement of budget by health insurance agency. As one of the respondent said;

''....our community is increasingly becoming member of health insurance .... therefore the number of patients that we serving without direct cash payment is dramatically increasing... but Health Insurance Agency is not punctual for reimbursing the payment to us, which is resulting very serious false shortage of budget to be used for pharmaceutical procurement in our health facility.....''

5.4.3. Inventory Management

5.4.4.1. Descriptive Statistic

The first objective of the study was to examine the status of SC practices in public health facilities found in West Gojjam zone. As we can see on Annex 3, the mean value of responses provided by respondents for most of the 21 items used to measure status of inventory management performance in public health facilities were greater than 3.0. The highest mean value reported by the respondents indicating ''agreement'' was received from the first item namely *"the facility developed and regularly updated SOP related to inventory management" with* mean and standard deviation of 3.95(0.399). The second and third higher mean value was received from 7th and 8th items, which were ''*adequate blank inventory recording formats are*

always available'' and ''*the facility regularly prepare and send reports and purchase orders to higher level''* with mean value and standard deviation of 3.83(0.851) and 3.80(0.579) respectively. The lowest mean value of response reported by participants indicating "disagreement" was received from third item, namely *''in this health facility ABC and VEN analysis regularly done*'' with mean and standard deviation of 2.44(0.641). This was followed by 21thitem, namely ''*enough budget always allocated by this facility for printing inventory recording forms and providing training related to inventory management''* with mean value and standard deviation of 2.57(.780).

5.4.4.2. Regression between Inventory Management and Factors

The second objective of this study was to determine factors affecting the SC practice in public health facilities found in west Gojjam zone. Therefore, the researcher performed a regression analysis to establish the association and make prediction between the independent variables and the dependent variable. All variables significant at simple linear regression were included for multiple linear regressions. The regression model of this supply chain practices was constructed as follows;

$$\mathbf{y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5}$$

Where:

y = Inventory Management

β0 = Constant Term

β1= Beta coefficients

X1= Supportive Supervision

X2= Health facility type

X3= IPLS skill of staff

X4= Training

X5= Management Support

As we can see on table 9, the coefficient of determination (R^2), which is the percentage variation in the dependent variable being explained by combined change of the independent variables) was 0.637 that means supportive supervision, health facility type, IPLS skill of staff, training, and management support left 36.3 percent unexplained. The P- value of 0.000 (Less than 0.05)

implies that the model of ‘‘inventory management’’ performance is significant at the 5 percent level of significance.

Table 9: the model summery for regression analysis of inventory management in the study done on public health facilities found in west Gojjam zone, 2018

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.798[a]	.637	.633	.17775	.637	143.110	5	407	.000

a. *Predictors: (Constant*), IPLS skill of the staff, Training, Health facility type, Management support, Supportive supervision

The established multiple linear regressions equation of inventory management becomes;

$$\mathbf{Y = 0.968 + 0.049X1 + 0.147X2 + 0.297X3 + 0.122X4 + 0.18X5}$$

Where:

Constant = 0.968, indicates that if ‘‘supportive supervision, health facility type, IPLS skill of the staff, training, and management support’’ the whole valued as zero, ‘‘inventory management ’’ performance would be 0.968 unit.

B*1* = *0.049*, indicates that as ‘‘supportive supervision” increased by one unit ‘‘inventory management t’’ performance increased by 0.049 unit.

B*2* = *0.147*, indicates that as ‘‘health facility type’’ increased by one unit ‘‘inventory management’’ performance increased by 0.147unit.

β3* = *0.297, indicates that as ‘‘IPLS skill of the staff’’ increased by one unit ‘‘inventory management’’ performance increased by 0.297unit.

β4* = *0.122, indicates that as ‘‘training’’ increased by one unit ‘‘inventory management’’ performance increased by 0.122 unit.

β5* = *0.18, indicates that as ‘‘management support’’ increased by one unit ‘‘inventory management’’ performance increased by 0.18 unit.

Table 10: the multiple regression for inventory management in the study done on public health facilities found in west Gojjam zone, 2018

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	.968	.096		10.079	.000	.779	1.157		
IPLS skill of the staff	.297	.040	.333	7.434	.000	.219	.376	.445	2.247
Training	.122	.017	.228	7.103	.000	.088	.156	.868	1.152
Health facility type	.147	.022	.210	6.577	.000	.103	.191	.874	1.144
Management support	.180	.036	.231	4.981	.000	.109	.251	.416	2.404
Supportive supervision	.049	.016	.114	2.996	.003	.017	.081	.610	1.640

a. Dependent Variable: Inventory management

5.4.3.3. Challenges Related to Inventory Management

The third objective of this study was to explore challenges related to supply chain practice in public health facilities found in west Gojjam zone. Therefore, in-depth face-to-face interviews with selected key informants were done to explore challenges for inventory management in public health facilities found in west Gojjam zone. When key informants were asked about the challenges related to inventory management in their health facility, most of them said that lack of commitment from the staff was the major obstacle for good inventory management in public health facilities. As one of the respondents said;

‘‘…other healthcare professionals…like nurses, medical laboratory technicians and others, handling healthcare commodities in our health facility arereluctant and not committed for this task because they consider updating bin-card as pharmacy professional’s job’’

In addition, most of the key informants also reported that poor health facilities’ management support for the inventory management is the major challenges for good inventory management in public health facilities. As one of the respondents said that:

‘‘…this facility management thinks only pharmaceutical procurement is its duty…even the facility manager never supervised this facility inventory management practices and give feedback to the responsible staff… this is resulting the staff to ignore the responsibility of inventory management.’’

The other challenge of inventory management mentioned by some of the respondents was frequent staff turnover in public health facilities. As one of the key informant said that:

‘‘*…since our facility is found in very remote area, the frequency of staff turnover is very high and most of the staff employ by this facility are inexperienced workers, which is the major cause of interruption of the good inventory management* in our facility.’’

5.4.4. Information Sharing and Technology

5.4.4.1 Descriptive Statistics

The respondents were asked10 questions to determine the degree of “agreement” and “disagreement” to the status of implementation of SC related information sharing and technology in their respective health facilities. As we can see on table 11, the mean value reported by respondents for most of items used to measure status of information sharing and technology performance in public health facilities found were below 3.0.

The highest mean value of responses reported by participants indicating “agreement” was received only from the third item, namely “*the current logistics management information system employed is effective and appropriate”* with mean and standard deviation of 3.40(0.666). The lowest mean value of response indicating ‘‘disagreement’’ was received from the first item namely “*the facility developed and regularly updated SOP related to SC related information sharing and use of the technology employed*” with mean and standard deviation of 1.42(0.521). This activity was followed by the tenth and ninth items, namely “*this health facility always provide adequate training regarding to the information system and technology employed*” and *‘‘this facility always allocate enough budget for information sharing and for employing technology to be used for it’’* with mean and standard deviation of 1.62(0.735) and 2.00(.518) respectively

Table 11: descriptive statistics for information sharing and technology of the study done on public health facilities found in west Gojjam zone, 2018

Items Used to Measure Information Sharing and Technology	Mean	Mode	S.D	Max	Min
This health facility developed and regularly updated SOP related to SC related information sharing and use of the technology employed	1.41	1	.521	4	1
This facility always collected, processed, visualized and presented supply chain related information in a centralized decision point	2.23	2	.512	4	1
The current logistics management information system employed by this health facility is effective and appropriate	3.40	4	.666	5	2
Facility wide visibility of information related to availability and other SCM related issues to concerned body is satisfactory	2.87	3	.716	5	1
This health facility effort to employee information technology is satisfactory	2.04	2	.694	4	1
This health facility effectively used Electronic Data Interchange Technology (EDI) for sharing information	2.72	3	.709	4	1
Information sharing between this health facility and its suppliers is always adequate	2.79	3	.588	4	1
This health facility effort to get information from the supplier related to product availability and other SCM operations is always adequate	2.80	3	.707	4	1
This facility always allocate enough budget for information sharing and for employing technology to be used for it	2.00	2	.518	4	1
This health facility always provide adequate training regarding to the information system and technology employed	1.62	1	.735	4	1

5.4.4.2 Regression between Information Sharing and Technology and factors

The second objective of this study was to determine factors affecting the SC practice in public health facilities. Therefore, the researcher performed a regression analysis to establish the association and make prediction between the independent variables and the dependent variable. All variables significant at simple linear regression were included for multiple linear regressions.

The regression model was constructed as follows:

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3$$

Where:

y= Information Sharing and technology

β0 = Constant Term

βi= Beta coefficients

X1= number of pharmacy staff

X2= Management Support

X3= IPLS Skill of staff

As indicated on table 12, the coefficient of determination (the percentage variation in the dependent variable being explained by the changes in the independent variables) R^2 was 0.508, which means the number of pharmacy staff, management support, and IPLS skill of staff left 49.2 percent of the variation of information sharing unexplained. The P- value of 0.000, which is less than 0.05, implies that the model of ‘‘information sharing and technology’’ is significant at the 5 percent level of significance.

Table 12: The model summary of regression analysis for information sharing and technology in the study done on public health facilities found in west Gojjam zone, 2018

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.713[a]	.508	.504	.20764	.508	140.593	3	409	.000

a. *Predictors: (Constant),*IPLS skill of the staff, number of pharmacy staff, management support

The established multiple linear regression equation of this supply chain practices became;

$$Y = 0.794 + 0.022X1 + 0.222X2 + 0.243X3$$

Where:

Constant =0.794, indicates that if ‘‘number of pharmacy, IPLS skill of the staff, and management support’’ valued as zero, ‘‘information sharing and technology’’ performance would be 0.794 unit.

β1 = 0.022, indicates that as ‘‘number of pharmacy” increased by one unit ‘‘information sharing and technology’’ performance increased by 0.022 unit.

β2 = 0.222, indicates that as ‘‘management support’’ increased by one unit ‘‘information sharing and technology’ performance increased by 0.222 unit.

β3 = 0.243, indicates that as ‘‘IPLS skill of the staff’’ increased by one unit ‘‘information sharing and technology’’ performance increased by 0.243 unit.

Table 13: The multiple regression analysis of information sharing and technology in the study done on public health facilities found in west Gojjam zone, 2018

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	.794	.110		7.198	.000	.577	1.010		
Number of pharmacy staff	.022	.002	.333	8.812	.000	.017	.026	.840	1.190
Management support	.222	.039	.283	5.664	.000	.145	.299	.482	2.073
IPLS skill of the staff	.243	.046	.271	5.276	.000	.152	.334	.458	2.184

A. Dependent Variable: Information Sharing And Technology

5.4.4.3. Challenges Related to Information Sharing and Technology

The third objective of this study was to explore challenges related to SC practice in public health facilities. Therefore, in-depth face-to-face interviews were done to identify the challenges of SC related information sharing and technology in their respective health facility and most of the key

informants mentioned lack of commitment from staff to share information as the major challenge. As one of key informants said that:

''... I think in our facility, staff does not considered this task as responsibility and mostly they provide information when they are asked by others instead of informing in advance. ...for example I remember that an item was procured by the facility and expired in store because the store manager did not informed prescribers about that products...''

In addition, most of the respondent mentioned the absence of information technology in their health facility as challenges for good information sharing between the health facility and suppliers. One of the key informants said that:

''...this facility doesn't have any information technology (like internet, phone, and fax) because it is expensive for us to employ in our health facility. Therefore, when we want to share information and documents with suppliers or other stakeholders either we travel in person or travel to nearby town to find technology''

5.4.5. Storage Practice

5.4.5.1 Descriptive Statistics

The first objective of the study was to examine the status of supply chain practices in public health facilities found in West Gojjam zone. Therefore, the respondents were asked 14 questions to determine the degree of "agreement" and disagreement" to the status of storage practice implementation in their respective health facilities. As we can see on table 14, the mean value of responses provided by respondents for most of questions used to measure the status of storage practice in public health facilities were more than 3.0.

The response from respondents indicating "agreement" was received from the 11 items. The highest mean value of response provided by respondents was received from fourth item, namely "*storeroom always protect from water penetration",* with mean and standard deviation of 4.00(0.749). This was followed by 1st and 9th items, namely *"the facility developed and regularly updated SOP related to storage condition management"* and "*health commodities always stored away from insecticides, chemicals, old files, office supplies and other materials"* with mean and standard deviation of 3.87(0.462)and 3.67(0.692 respectively. The lowest mea value of response provided by respondents indicating "disagreement "was received from the last items, namely *"enough budget always allocated by the facility for renovating or renewing the*

store whenever needed" with mean and standard deviation of 2.40(0.684). This was followed by the 6thitem, which was "*cold storages are always maintained as required"* with mean and standard deviation of 2.95 (0.707.

Table 14: The descriptive statistics of storage practice in study done on public health facilities found in west Gojjam zone, 2018

Items used to Measure Storage Practices	Mean	Mode	S.D	Max	Min
This health facility developed and regularly updated SOP related to storage practices	3.87	4	.462	5	1
In this facility the pharmaceutical storeroom always cleaned regularly	3.49	4	644	5	2
In this facility drugs and other health commodities always stored in a dry, well-lighted, well- ventilated storeroom and out of direct sunlight.	3.59	4	.648	5	2
This facility pharmaceutical storeroom always protected from water penetration	4.00	4	.749	5	2
In this facility latex products always stored away from electric motors and fluorescent lights	3.29	3	.716	5	1
Cold storages are always maintained as required	2.95	3	.707	5	2
Storage areas are accessible only to the authorized personnel and controlled substances are always stored in locked up storage	3.43	4	.807	5	1
Cartons always stack at least 10 cm off the floor, 30 cm away from the wall and other stacks, and no more than 2.5m high	3.01	3	.714	5	2
In this facility pharmaceuticals always stored away from insecticides, chemicals, old files, office supplies and other materials	3.67	4	.692	5	2
In this facility flammable products always stored separately from other products and appropriate safety precautions are always took	3.59	4	.796	5	2
In this facility pharmaceutical always arranged in store in a way that facilitate FEFO procedures and stock management	2.98	3	.657	5	1
In this facility pharmaceutical cartons always arrange in a way that arrows pointing up, and with identification labels, expiry dates, and manufacturing dates clearly visible	3.07	3	.752	5	1
In this facility unusable pharmaceuticals always separated from usable commodities and the inventory records always updated immediately	3.30	4	.793	5	1
Enough budget always allocated by this facility for renovating or renewing the store or for other related storage practices	2.40	2	.684	5	1

5.4.5.2. Regression between Storage Practice and Factors

The second objective of this study was to determine factors affecting the supply chain practice in public health facilities found in west Gojjam zone. Therefore, the researcher performed a regression analysis to establish the association and prediction between the independent variables with the dependent variable. All variables significant at simple linear regression were included for multiple linear regressions. The regression model for storage practice was as follows:

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4$$

Where:

y = Storage Practice

β0 = Constant Term

β1= Beta coefficients

X1= training

X2= management Support

X3=IPLS Skill of staff

X4=budget

Table 15 shows that, the coefficient of determination (R^2), which is the percentage variation of the dependent variable being explained by combined changes in the independent variables, was equal to 0.599. This means training, management support, budget, and IPLS skill of staff left 40.1 percent variation of storage practices unexplained. The P- value of 0.000 (Less than 0.05) implies that the model of ‘‘storage practice’’ is significant at the 5 percent level of significance.

Table 15: The model summary for regression analysis of storage practice in the study done on public health facilities found in west Gojjam zone, 2018

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.774[a]	.599	.595	.19007	.599	152.557	4	408	.000

a. Predictors: (Constant), training, budget, IPLS skill of the staff, management support

The established multiple linear regression equation becomes;

$$\mathbf{Y = 0.96 + 0.05X1 + 0.266X2 + 0.385X3 + 0.035X4}$$

Where:

Constant =0.96, indicates that if ‘‘training, IPLS skill of the staff, budget, and management support’’ valued as zero, ‘‘storage practice’’ performance would be 0.96unit.

β1=0.05, indicates that as ‘‘training’’ increased by one unit ‘‘storage practice’’ performance increased by 0.05unit.

β2=0.266, indicates that as ‘‘management support’’ increased by one unit ‘‘storage practice’’ performance increased by 0.266 unit.

β3=0.385, indicates that as ‘‘IPLS skill of the staff’’ increased by one unit ‘‘storage practice’’ performance increased by 0.385 unit.

B4=0.035, indicates that as ‘‘budget’’ increased by one unit ‘‘storage practice’’ performance increased by 0.385 unit.

Table 16: The multiple regression for storage practice in the study done on public health facilities found in west Gojjam zone, 2018

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	.960	.101		9.532	.000	.762	1.158		
Management support	.266	.037	.334	7.104	.000	.192	.339	.445	2.248
IPLS Skill of the staff	.385	.041	.423	9.285	.000	.303	.466	.474	2.109
Budget	.035	.016	.079	2.220	.027	.004	.065	.769	1.301
Training	.050	.018	.091	2.748	.006	.014	.085	.899	1.113

a. Dependent Variable: Storage practice

5.4.5.3. Challenges Related With Storage Practice

The third objective of this study was to explore challenges related to SC practice in public health facilities found in west Gojjam zone. Therefore, key informants were interviewed to identify

challenges related with storage practices in public health facilities found in west Gojjam zone and most of the respondents said that unstandardized pharmaceutical storage room became the most important obstacle for proper storage practice and maintain good pharmaceutical storage condition. As one of the respondent said;

''... our medicine store was not originally constructed for pharmaceutical storage purpose…it has been antenatal care room before and it has very small space and the roof is much close to the medicine stacks.''

Most of respondents said that shortage of refrigerators became major obstacle for proper storage of products requires cold chain. One of the key informants said that:

''...in our facility, there is only one small refrigerator and it is primarily for vaccines except when there is free space….therefore other products need cold chain are stored outside refrigerator until free we get free space….''

In addition, some of key informants also mentioned poor management support as major challenges for proper storage practice. As one of key informants said:

''….this facility management is not willing to address different pharmaceutical store issues…for example every time supervisors come, they give us the feedback to buy shelves and pallets and we as pharmacy professional always try to convince the facility management….but the management is not considering it as important thing and still we are stacking medicines on the floor….''

5.4.6. After-Procurement Service

5.4.6.1. Descriptive Statistic

The first objective of the study was to examine the status of SC practices in public health facilities found in West Gojjam zone. Therefore, respondents were asked six questions to determine the extent of "agreement" and "disagreement" to the status of implementation of after-procurements service in their respective health facilities. As it can be seen on table 17, the mean responses provided by participants for all items used to measure the status of after-procurement service in public health facilities were found below 3.0.

There was not item with response indicating an "agreement" but the highest response indicating ''disagreement'' was received from sixth item, which was "*in this facility medical equipment and supply never been non-functional due to absence of maintenance and repairing service*"

with mean and standard deviation of 2.72(0.694). The lowest response indicating "disagreement" was received from the first item, namely *"the facility developed and regularly updated SOP related to After Procurement Service*" with mean and standard deviation of 1.65(0.660). The second lowest response indicating "disagreement" was received from the third item which was "*the facility always contract with suppliers to get maintenance and follow up service for medical equipment and supplies after the sale*" with mean and standard deviation of 1.89(0.590).

Table 17: The descriptive statistics of after-procurement service in the study done on public health facilities found in west Gojjam zone, 2018

Items Used to Measure After-Procurement Services	Mean	Mode	S.D	Max	Min
This health facility developed and regularly updated SOP related to After-Procurement Service	1.69	2	.660	4	1
This health facility always contract with suppliers to install medical equipment and supplies after deliver before they leave the facility	2.47	3	.647	4	1
This health facility always contract with suppliers to get maintain and follow up service for medical equipment and supplies after the sale	1.89	2	.590	4	1
The effort that this health facility try to get accessories and parts required for medical equipment and supplies from suppliers is always satisfactory	2.42	2	.627	4	1
This health facility always allocated enough budget for maintenance and follow-up service of medical equipments and supplies	2.27	2	.526	4	1
In this health facility medical equipment and supply never been non-functional due to absence of maintenance and repairing service	2.72	3	.694	4	1

5.3.6.2. Regression between After-Procurement Service and Factors

The second objective of this study was to determine factors affecting the supply chain practice in public health facilities found in west Gojjam zone. Therefore, the researcher performed a regression analysis to establish the association and make prediction between the independent variables with the dependent variable. All variables significant at simple linear regression were included for multiple linear regressions. The regression model of this supply chain practice was constructed as follows:

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3$$

Where;

y=After-procurement service

β0= Constant Term

β1= Beta coefficients

X1= Management Support

X2= Budget

X3=Distance from PFSA

As we can see on 18, the coefficient of determination (R^2), the percentage variation in the dependent variable being explained by the changes in the independent variables, was equal to 0.496. This means management support, budget, and distance from PFSA left 50.4 percent of variation of status of the after-procurement service unexplained. The P- value of 0.000, less than 0.05, suggests that the model of ‘‘after-procurement service’’ is significant at the 5 percent level of significance.

Table 18: The model summary of regression analysis for after-procurement service in the study done on public health facilities found in west Gojjam zone, 2018

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.704[a]	.496	.491	.23791	.496	100.302	4	408	.000

a. *Predictors: (Constant),* Distance from PFSA, budget, management support

The established multiple linear regression equation of after-procurement service became as follows;

$$y = 1.134 + 0.289X1 + 0.05X2 - 0.002X3$$

Where:

Constant=1.134: indicates that, if ‘‘management support, budget, and distance from PFSA’’ valued as zero, ‘‘after-procurement service’’ performance would be 1.134 unit.

β1=0.289: indicates that, as ‘‘management support’’ increased by one unit ‘‘after-procurement service’’ performance increased by 0.289 unit.

β2=0.05: indicates that, as ‘‘budget’’ increased by one unit ‘‘after-procurement service’’ performance increased by 0.05 unit

B3=.-0.002: indicates that, as ‘‘distance from PFSA’’ increased by one unit ‘‘after-procurement service’’ performance decreased by 0.002 unit.

Table 19: The multiply regression analysis of After-procurement service in the study done on public health facilities found in west Gojjam zone, 2018

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	1.134	.101		11.191	.000	.935	1.333		
Management support	.289	.036	.325	7.935	.000	.217	.360	.737	1.357
Budget	.050	.019	.103	2.576	.010	.012	.088	.777	1.287
Distance from PFSA	-.002	.000	-.190	-5.325	.000	-.001	.000	.972	1.029

a. *Dependent Variable*: After-procurement service

5.4.6.3. Challenges Related with After-Procurement Service

The third objective of this study was to explore challenges related to supply chain practice in public health facilities found in west Gojjam zone. Therefore, key informants have been interviewed the about challenges related to after-procurement service in their respective health facilities and almost all respondents mention absence of technicians who are capable of providing maintenance and repairing service as major challenges for maintenance and repairing of medical equipment and supplies. As one of the respondent said:

‘‘…… in this facility there are many un-functional medical equipments … because there is no technician who has skill on maintenance and repairing of medical equipment and supplies……..’’

In addition, most of the key informants mentioned shortage of budget as a major challenge for after-procurement service in their facility. As one of the respondents said:

''...generally, our facility annual budget is limited, from that the budget allocated for maintenance and repairing service is very small. But the cost incur by organizations which can provide maintenance and repairing service is very high....this is resulting the accumulation of un-functional medical equipments in our facility''

5.3.7. Monitoring and Evaluation

5.3.7.1 Descriptive Statistic

The first objective of the study was to examine the status of supply chain practices in public health facilities found in West Gojjam zone. Therefore, respondents were asked four questions to determine the degree of "agreement" and "disagreement" to the extent of implementation of monitoring and evaluation of supply chain practices in their respective health facilities. As we can see on table 20, the mean value of responses provided by participants for all of the items used to measure the status of monitoring and evaluation in were less than 3.0.

There was not response from respondents indicating "agreement" but the highest mean value provided by respondents indicating ''disagreement'' were received from 4th item, namely "*the facility designed and regularly updated SCM related M & E indicators*" with mean and standard deviation of 2.10(0.606). The lowest response indicating "disagreement" was received from the first item, namely *"the facility developed and regularly update SOP related to monitoring and evaluation activities*" with mean and standard deviation of 1.61(0.700).

Table 20: The descriptive statistics of monitoring and evaluation performance in the study done on public health facilities found in west Gojjam zone, 2018

Items used to Measure Monitoring and Evaluation	Mean	Mode	S.D	Max	Min
This health facility developed and regularly update SOP related to M and E activities	1.61	1	.700	3	1
This health facility designed and regularly updated SCM related M & E indicators	2.10	2	.606	4	1
M & E indicators designed by this health facility are appropriate and compressive for its SCM related practice	1.82	2	.583	3	1
This health facility regularly conducts SCM performance appraisal based designed M & E indicators	1.89	2	.579	3	1

5.3.7.2. Regression between Monitoring and Evaluation and Factors

The second objective of this study was to determine factors affecting the supply chain practice in public health facilities found in west Gojjam zone. Therefore, the researcher performed a regression analysis to establish the association and make prediction between the independent variables with the dependent variable. All variables significant at simple linear regression were included for multiple linear regressions. The regression model was developed as follows:

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3$$

Where:

y = Monitoring and Evaluation

β0 = Constant Term

β1= Beta coefficients

X1= Number of pharmacy staff

X2= training

X3= IPLS Skill of staff

As we can see on table 21, the coefficient of determination(the percentage variation in the dependent variable being explained by the changes in the independent variables) R^2 was equal to 0.383, which means number of pharmacy staff, training, and IPLS skill of staff left 61.7 percent of the variation of monitoring and evaluation unexplained. The P- value of 0.000 (less than 0.05) implies that the model of ‘‘monitoring and evaluation’’ is significant at the 5 percent level of significance.

Table 21: The model summary of regression analysis of monitoring and evaluation performance of the study done on public health facility found in west Gojjam zone, 2018

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.619[a]	.383	.377	.39599	.383	63.381	4	408	.000

a. Predictors: (Constant), Skill of staff, training, number of pharmacy staff

The multiple linear regression equation of monitoring and evaluation constructed became as follows;

$$Y = -0.259 + 0.038X1 + 0.081X2 + 0.524X3$$

Where:

Constant = -0.259: indicates that, if the ‘‘number of pharmacy, IPLS skill of the staff, and training’’ the whole valued as zero, ‘‘monitoring and evaluation’’ performance would be -0.259 unit.

β1=0.038: indicates that, as ‘‘number of pharmacy” increased by one unit ‘‘monitoring and evaluation’’ performance increased by 0.038units.

β2=0.081: indicates that, as ‘‘training’’ increased by one unit ‘‘monitoring and evaluation’’ performance increased by 0.081 unit.

β3= 0.524: indicates that, as ‘‘skill of the staff’’ increased by one unit ‘‘monitoring and evaluation’’ performance increased by 0.524 unit.

Table 22: The multiple regression for monitoring and evaluation performance in the study done on public health facilities found in west Gojjam zone, 2018

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficient	T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	-.259	.221		-1.172	.242	-.694	.176		
Number of pharmacy staff	.038	.005	.347	8.091	.000	.029	.048	.820	1.219
Training	.081	.037	.089	2.184	.030	.008	.155	.920	1.087
IPLS Skill of the staff	.524	.067	.343	7.857	.000	.393	.655	.794	1.260

a. Dependent Variable: Monitoring and Evaluation

5.4.7.3. Challenges Related to Monitoring and Evaluation

The third objective of this study was to explore challenges related to supply chain practices in public health facilities found in west Gojjam zone. Therefore, the key informants were asked about challenges related to monitoring and evaluation of supply chain practice carried out by their respective facilities and almost all respondents said that there is lack of training regarding to monitoring and evaluation. As one of the respondent said:

‘‘....this is new concept for me ... and we never do monitoring and evaluation for our works in this facility in more structured way except doing some calculations at the end of the financial year…for example calculating the total money spend annually for pharmaceutical procurement…’’

Some of the respondents also mentioned lack of quality supply chain related data in public health facilities as a major challenge related to monitoring and evaluation practice. As one of the key informants said:

‘‘... actually after a supportive supervision provided by supervisors from higher level health offices, we tried to do monitoring and evaluation for some of the pharmaceutical supply chain activities in our facility…but we could not found appropriate data required for it.

Chapter Six. Discussion

The objectives of this study were to assess the status of some SC practices carried out by public health facilities and identifying factors and challenges affecting performance of these practices. These SC practice assessed by this study were supplier relationship management, procurement, inventory management, information sharing and technology, storage practices, after-procurement service, and monitoring and evaluation of different SC related activities.

The first SC practice assessed by this study was supplier relationship management in public health facilities and this study revealed that it was one of the SC practice that was under-performed (mean=2.64). This indicates that public health facilities were dealing with their suppliers traditionally without clearly stated strategy, which mean they were losing the ultimate advantage of strategic cooperation with suppliers. The underperformed status of this supply chain practice may be attributable to absence of clearly stated policy and standard operating procedure related to supplier relationship management, and dishonest behavior of suppliers that were identified as major challenges for good supplier relationship management in public health facilities through in-depth interview conducted by this study. This study finding was consistent with the finding of a study done in Kenya (mean=2.48) and lower than the finding of another study done in Kenya(mean=4.21)(43)(5). The difference may emanated from the study from Kenya was done on both public and private health facilities but this study included only public health facilities for the assessment. Among different supplier relationship management activity in public health facilities the activity with highest mean score reported by respondents (mean=3.71).was *''considering the cost, flexibility, and reliability of suppliers during supplier selection''.* However, supplier relationship management activities with least mean score reported by respondents (mean=1.73) was ''*development of Standard Operating Procedure (SOP) related to the supplier relationship management''.* The finding of multiple linear regression identified that number of pharmacy staff, length of distance from PFSA (the main supplier of all public health facilities in the region), IPLS skill of staff, provision of training, and supportive supervision were significantly associated with supplier relationship management performance with the regression coefficients of 0.023, 0.011, 0.254, 0.077, and 0.064 respectively. The coefficient of determination (R^2) of the model was 0.375, which means37.5 % of the variation of supplier relationship management performance was explained by combined change of these factors.

The second SC practice assessed by this study was procurement practices of health commodities. According to this study finding, the procurement practice in public health facilities was one of the SC practice in public health facilities that was under-performed (mean=2.85). This finding indicates that public health facilities were not running this important SC practice properly, which has significant impact on product availability and efficient utilization of allocated budget. The under-performed status of this practice possibly resulted from shortage of budget allocated for procurement, stockout information leakage from PFSA to private suppliers, incongruous procurement policy enforced by the government; and delayed reimbursement of payment by health insurance agency that were identified by this study as major challenges for procurement practice through in-depth face-to-face interview. This study finding was consistent with the finding of studies done in Kenya(mean=2.77, 2.22) and lower than the finding of another study done in Kenya(mean=4.01)(49)(43)(50). This difference possibly originated from reality that study from Kenya was done only at hospital but this study was done on both hospitals and health centers. The activity of procurement practice with the highest mean score reported by respondents was *''preparation and updating of facility specific list of medicine to be procured''* (mean=3.62). However, *''development of compressive and appropriate standards and specifications for item to be purchased by public health facilities''* was the activity of procurement practice with the lowest mean score reported by participants (mean=1.72). The finding of multiple linear regressions revealed that the performance of procurement practice was exhibited significant association with management support, length of distance from PFSA,IPLS skill of the staff, training, health facility's service volume level, budget, and number of pharmacy staff with regression coefficient of2.255, -0.012,2.479,1.116, 0.752,0.8, and 0.178 respectively. The coefficient of determination (R^2) was 0.53, which indicates that 53% of the variation of procurement performance was explained by combined change of these factors. Therefore, public health faculties improving the performance of these factors can consequentially result improved procurement practices performance in their health facilities.

The third SC practice assessed by this study was inventory management. According to this study finding, inventory management was one of better-performed SC practice relative to the other assessed SC practice (mean=3.22). This indicated that public health facilities were relatively performing better on reducing unexpected stockout and product wastage than other activities and ultimately this allow public health facilities to provide uninterrupted healthcare service by

reducing frequent stockouts. This study finding was consistent with the finding of a study done in Kenya(mean=3.04)(36). Among different inventory management activities the ‘‘availability *of standard operating procedure (SOP) related to inventory management’’* was the activity of inventory management with highest mean score reported by the participants (mean=3.95). This may be because everybody got IPLS training back with IPLS SOP to his or her health facilities. However, *‘‘conducting regular ABC and VEN analysis’’* was the inventory management activity with the lowest mean score reported by respondents (mean=2.44) and this may be emanated from the poor management support to inventory management, poor staff commitment to inventory management, and high staff turnover that were reported by key informants of this study as major challenges for inventory management in public health facilities through in-depth face to face interview. According to the multiple linear regressions finding, the performance of inventory management in public health facilities was significantly associated with supportive supervision, health facility type, IPLS skill of staff, training, and management support with regression coefficient of 0.049, 0.147, 0.297, 0.122, and 0.18 respectively. The coefficient of determination (R^2) of the multiple linear regressions of this supply chain practices was 0.635, this demonstrates that 63.5% of variation on performance of inventory management in public health facilities was explained by the combined weighted change on these factors. Therefore, public health faculties improving these factors eventually can improve the inventory management performance by some extent in their respective health facilities.

The fourth supply chain practice assessed by this study was supply chain related information sharing and technology in public health facilities. The SC related information sharing and technology was one of the under-performed SC practices in public health facilities (mean=2.39). This indicates that supply chain related information required for decision making were not shared on real time in public health facilities, this has a huge impact on quality of healthcare service provided by public health facilities because without appropriate information the decision to be made cannot be correct. The under-performed status of this practice may be due to poor commitment from staff to share information on real time and absence of information technology to be used for information sharing, which were reported as the major challenges of information sharing by key informants during in-depth face to face interview conducted by this study. This study finding was consistent with the finding of another study done in Uganda(mean=2.65)(31). Among the activities of information sharing, *‘‘the effectiveness of logistic information*

management system currently employed by public health facilities'' was the activity of information sharing with the highest mean score reported by respondents (mean=3.40) whereas *''development of SOP related to information sharing and technology"* was the activity of information sharing with the lowest mean score (mean=1.41). The finding of multiple linear regressions discovered that the performance of SC related information sharing and technology in public health facilities was significantly associated with number of pharmacy staff, management support, and IPLS skill of staff with regression of coefficient of 0.022, 0.222, and 0.243 respectively. The coefficient determination discovered by multiple linear regressions done for this information sharing and technology was 0.508, which indicates that 50.8% of the variation of the performance of information sharing and technology was explained by the change of these factors.

The fifth SC practice assessed by this study was storage practice in public health facilities. As per finding of this study, the pharmaceutical storage practice was the SC practice with highest mean score reported by respondents (mean=3.34) compared to the other practice assessed by this study. This finding shows that public health facilities were better performing on storage of pharmaceutical products to protect these products from damage and loss quality due to inappropriate storage activities. This study finding was lower than the finding of the study done in Ghana(mean=4.48), the difference may be resulted from relatively higher non-response rate happened on the study done in Ghana(17). The activity of storage practice with the highest mean value reported by participants was *''protection of pharmaceutical store from water penetration*'' (mean=4.00) on the contrary *''the allocation of sufficient budget by health facilities for pharmaceutical storage related activities''* was activity of storage practice with the lowest mean value (mean=2.4). The multiple linear regressions done for this supply chain practices revealed that training, management support, IPLS skill of the staff, and budget were factors significantly associated with storage practice performance with regression coefficient of 0.05, 0.266, 0.385, and 0.035 respectively. The coefficient of determination of the multiple linear regressions was 0.599, which means 59.9% of the variation in the performance of storage practice was explained by the combined change in these factors. Therefore, public health faculties improving these factors can ultimately improve the storage practice performance in their respective health facilities. Key informants of in-depth interview conducted by this study also reported poor management support to storage practices, unstandardized pharmaceutical store, and shortage of

refrigerator for cold chain products as major challenge for good storage practice in public health facilities found in west Gojjam zone.

The sixth SC practice assessed by this study was after-procurement service in public health facilities. The finding of this study revealed that after-procurement service was one of under-performed SC practice (mean=2.24). This finding indicates that a lot of medical equipments and supplies were idle in public health facilities because of lack of maintenance and repairing service, this can be ultimately result major healthcare service interruption in public health facilities. The under-performed status of this SC practice possibly resulted from limited budget allocated by public health facilities for after-procurement services, and absence of technicians who have experience on maintenance and repairing of medical equipment and supplies that were identified as major challenges for After-procurement service through in-depth face-to-face interview done by this study. The finding of this study was lower than the finding of the study done in Kenya (mean=4.69), this discrepancy possibly resulted from the fact that study from Kenya was included hospitals but this study included both hospitals and health centers(8). As per the finding of this study, *''development and regularly updating of SOP related to after-procurement service''* was the activity of after-procurement service with lowest mean value reported by participants (mean=1.69) whereas *''the presence of low level of non-functional medical equipment and supplies in public health facilities''* was the activity of after-procurement service with highest mean value reported by respondents (mean=2.72). The finding of multiple linear regression discovered that budget, management support, and distance from PFSA were the factors significantly associated to the performance of after-procurement service in public health facilities with regression coefficient of 0.033, 0.289, 0.05,and –0.002respectively. The coefficient of determination of the multiple linear regressions done for monitoring and evaluation was 0.496, which indicates that 49.6% of the variation of the performance of after-procurement service was explained by the change on these factors.

The seventh SC practice assessed by this study was monitoring and evaluation of different SC practices in public health facilities. Monitoring and evaluation was relatively the least performed supply chain practice compared to the other SC practices in public health facilities assessed by this study (mean=1.86). This indicates that public health facilities were not recognizing the weakness and strength of their SC practice, which means they were unable to take measures and correction accordingly for improving the performance of weakly executed supply chain practice.

The poorly executed status of this practice may emanated from lack of training on monitoring and evaluation of supply chain practices and absence of quality supply chain related data in public health facilities to be used for monitoring and evaluation, which were reported as the major challenge for monitoring and evaluation practice by key informants of in-depth face-to-face interview conducted by this study. The finding of this study was lower than the finding of a study done in Kenya(mean=2.71)(49). According to the response provided by respondents, *''the facility developed and update SOP related to M and E activities''* was the least executed activity of monitoring and evaluation (mean=1.61). On the other hand, ''*designing and regularly updating the SCM related M & E indicators*'' was the better-executed activity of monitoring and evaluation (mean=2.10). The multiple linear regressions identified that the number of pharmacy staff, training, and IPLS skill of staff were the factors significantly associated with the performance of monitoring and evaluation of SC practices in public health facilities with regressions coefficient of 0.038, 0.081, and 0.524 respectively. The coefficient of determination (R^2) computed by multiple linear regression was 0.383, which indicates that 38.3 % of the variation of the performance of monitoring and evaluation was explained by the combined change on these factors.

Chapter Seven. Conclusion and Recommendation

This chapter highlights major findings of this study obtained from the analysis of the collected data on the conclusion part of this chapter. In addition, appropriate recommendation also proposed to public health facilities, Pharmaceutical Fund and Supply Agency, and West Gojjam Zonal Health Department based on the major finding of the study.

7.1. Conclusion

The study discovered that most of supply chain practices assessed by this study such as supplier relationship management, procurement practice, information sharing and technology, after-procurement service, and monitoring and evaluation of different supply chain practice were under-performed in public health facilities found in west Gojjam zone. Storage practice and inventory management of health commodities were relatively better performed supply chain practices compared to other supply chain practices assessed by this study. According to this study finding, the storage practice has been the best executed SC practices relative to other assessed supply chain practice on the contrary monitoring and evaluation has been the least executed supply chain practice relative to the others in public health facilities found in west Gojjam zone.

This study discovered that IPLS skill of the staffs, management support for implementation of SC practices, budget allocated for overall supply chain practices, number of pharmacy professional in public health facilities, SC practices related supportive supervision, health facility type, health facility's service volume level, SC practices related training, and the length of distance from PFSA (the main suppliers of all public health facilities) were among the factors significantly associated with the performance of supply chain practices in public health facilities. Among all mentioned factors, IPLS skills of the staff and management support have been the factors that were significantly associated with the performance of most of supply chain practices assessed by this study. The in-depth interview conducted by this study also discovered that shortage of budget allocated by public health facilities, poor management support, and lack of commitment from staff as major challenges for implementation of most of supply chain practices in public health facilities found in west Gojjam zone. Generally, this study reported that most of supply chain practices assessed by this study in public health facilities found in west Gojjam zone were discovered as poorly implemented.

7.2. Recommendation

7.2.1. Public Health Facilities in West Gojjam Zone

- Public health facilities have to develop and use appropriate policy and standard operating procedure related to supplier relationship management.
- Public health facilities have to involve and consult their suppliers when they perform supply chain related planning.
- Public health facilities have organize and conduct supply chain related review meeting with their suppliers as much as possible, for discussing and resolving issues related to supply chain practices.
- Public health facilities have to develop compressive and appropriate standards and specifications for each item to be procured because it was found as one of poorly executed activities of procurement practice but this is the critical step for procurement to end up with the most appropriate healthcare commodities for its clinical setup.
- Public health facilities should allocate enough budgets for health commodities procurement practice.
- Public health facilities have to enforce health insurance agency to be punctual for reimbursing the payment to them.
- Public health facilities have to allocate sufficient budget for printing different inventory recording and reporting formats and for providing training regarding to inventory management.
- Public health facilities have to conduct ABC and VEN analysis regularly.
- The management of public health facilities has to thoroughly follow the implementation of the inventory management activities and give feedback to the staff responsible for each activity.
- Public health facilities have to develop and use appropriate SOP related to information sharing and technology.
- The management of public health facilities has to vigorously follow the status of supply chain related information sharing in their facility, give feedback, and make the staff responsible for failures he or she committed.

- The staffs working in public health facilities have to be committed for sharing supply chain related information, which required for decision making, to their colleagues on real time.
- Store managers in public health facilities have to arrange pharmaceutical products in a way that support first-expire first-out (FEFO) system.
- Public health facilities should have big enough refrigerator to be used for storage of all pharmaceutical products required cold chain management.
- The management of public health facilities should be committed to follow the status of its health facility storage practices
- Public health facilities have to procure necessary pharmaceutical storage equipment and materials like shelves, pallets, etc.
- Public health facilities have to develop and use appropriate SOP related to their after-procurement service for medical equipments and supplies.
- Public health facilities have to develop and use appropriate SOP related with monitoring and evaluation of SC practice.
- Public health facilities have to develop and use appropriate and compressive supply chain related M and E indicators
- Public health facilities have to regularly measure the performance of the supply chain practices executed by their organization and take correction accordingly on supply chain practices identified as under-performed.
- The management of public health facilities should improve quality of supply chain related data documentation culture in their health facilities.

7.2.2. Recommendation for West Gojjam Zonal Health Department

- West Gojjam zonal health department has to allocate enough budgets, for public health facilities, required for procurement of maintenance and repairing service, and accessories and spare part necessary for medical equipment and supplies in public health facilities.
- West Gojjam zonal health department has to employ technicians, who have experience on maintaining and repairing medical equipments and supplies, for public health facilities found in west Gojjam zone.

- West Gojjam zonal health department has to organize and provide training to the staff working in public health facilities regarding to monitoring and evaluation of supply chain practices because lack of awareness and experience on monitoring and evaluation was identified as a major challenge for monitoring and evaluation.

7.2.3. Recommendation to Bahirdar Hub Pharmaceutical Fund and Supply Agency

- Bahirdar hub PFSA has to control the stockout information leakage to the private wholesalers because health facilities were complaining about it.

7.2.4. Recommendation for Researchers

- This study was done only on public health facilities therefore further studies related to the private health facilities supply chain practices can be done especially comparative studies between public and private healthcare facilities.
- This study assessed the SC practice from healthcare professional perspective and consequentially some important data that can be captured through document review and observation might have been missed, therefore further study incorporated document review and observation can be done.

Limitation of the Study

This study assessed the supply chain practice from healthcare professional's perspective, therefore some data that could be captured through document review, and observation might have been missed. The other limitation of this study was the discussion part of this study lacks extensive comparison of its finding with other similar studies because of lack of literatures done on similar SC practices in public health facilities.

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Annex 1: Questionnaire for Assessing Supply Chain Practice

The following questions are designed to be used for collecting data, regarding to the supply chain practice in public health facilities from the perspective of healthcare professionals working in those public health facilities and have the experience of health commodities supply chain in their respective facilities. The data collected will be treated with a very high degree of confidentiality, and it is only for academic purposes.

Part 1: Demographic characteristics

1. Education level

   College/University Diploma level **.....**1

   Bachelor's Degree **.....**.2

   Master's Degree.**.....**3

   PhD Degree **.....**4

   Others **….....***5*

2. How many years you worked as healthcare professional?**.....**
3. How many years have you worked in this health facility?

   1 – 5 years **.....**1 11 – 15 years **.....**3

   6 – 10 years **.....**2 Over 15 years **.....**4

Part 2: Supply Chain Practice in Public Health Facilities

	1 = Very Disagree, 2=Disagree, 3 = Neither, 4 =Agree. 5 =Very Agree					
	Supplier Relationship Management	**1**	**2**	**3**	**4**	**5**
1	This health facility developed and regularly updated SOP related to strategic supplier relationship					
2	This health facilities always try to involve suppliers in the process of overall supply chain related planning and setting goals.					

3	This health facility effort to have frequent meetings between health facility's SCM staff and the suppliers is satisfactory					
4	This health facility effort to use supplier vehicles anytime needed is always satisfactory					
5	This health facility effort to use suppliers warehouse anytime needed is always satisfactory					
6	This health facility have formal dispute resolution procedure and always resolve disputes with its suppliers based on it					
7	This health facility always consider cost, reliability and flexibility during suppliers selection					
	Procurement					
8	This health facility developed and regularly updated SOP related to pharmaceutical procurement practice					
9	This health facility developed and regularly update standard and specifications for each items to be purchase					
10	In this health facility the standard and specification developed for each item are comprehensive and appropriateness for current clinical setup in the facility.					
11	In this health facility procurement of each item always carried out based on specifications and standards developed					
12	This health facility involve different experts and stockholders including suppliers in developing standard and specification for each items to be procured					
13	This facility developed its own specific essential drug list and update it regularly					
14	All pharmaceutical products procured by this health facility are always included in facility specific essential drug list					
15	This facility effort to exchange procurement related documents and transactions with suppliers through Electronic data interchange(EDI) and the World Wide Web is always satisfactory					
16	This health facility there is always low level of bureaucracy for purchasing health commodities					
17	This facility always allocated sufficiently budget for purchasing pharmaceutical products required to meet the demand					

18	Availability of vital medicine in this facility is always satisfactory					
19	Availability of essential medicines in the facility is always satisfactory					
	Inventory Management					
20	This facility developed and regularly updated SOP related to inventory management					
21	In this facility MIN/Max inventory control systems strictly applied for each items					
22	In this health facility ABC and VEN analysis regularly done					
23	This facility staff engaged ininventory management is always adequate in number					
24	This facility effort to computerized inventory management of pharmaceutical products is satisfactory					
25	In this health facility manual bin cards and stock cards are always up-to-date					
26	In this health facility adequate blank inventory recording formats are always available					
27	This facility regularly prepare and send supply chain related reports and purchase orders to higher level office					
28	In this health facility dispensary units place orders at regular intervals and whenever emergencies occur					
29	Internal reporting procedure and resupply schedule with in this facility is suitable and appropriate					
30	In this facility there is suitable procedures for placing emergency orders by dispensing units					
31	In this health facility pharmaceutical store managers effort to conduct physical inventory count regularly is satisfactory					
32	In this health facility pharmaceutical store balance at books for each items are always equal with physical inventory balance					
33	In this health facility damaged/expired products always physically separated from usable inventory and the books updated immediately					
34	This facility always provide adequate training to the staff regarding to inventory management practice					
35	In this health facility frequency of being over-stocking for items before resupply is very low					
36	this health facility there is always Low level of losses and adjustments for					

	pharmaceutical products in					
37	In this health facility product arrangement of the store always facilitate First Expiry-First Out(FEFO)					
38	Enough budget always allocated by this facility for printing inventory recording forms and providing training related to inventory management					
	Information Sharing and Technology					
39	This health facility developed and regularly updated SOP related to SC related information sharing and use of the technology employed					
40	This facility always collected, processed, visualized and presented Supply chain related information in a centralized decision point, to enable efficient decision making					
41	The current logistics management information system employed by this facility is effective and appropriate					
42	Facility wide visibility of information related to availability and other SCM related issues to concerned body is satisfactory					
43	This health facility effort to employee information technology is satisfactory					
44	This facility effectively used Electronic Data Interchange Technology (EDI) for sharing information					
45	Information sharing between this health facility and its suppliers is always adequate					
46	This health facility effort to get relevant information related with product availability and other SCM operations from the supplier is always adequate					
47	This health facility always allocate enough budget for information sharing and for employing technology for it					
48	This health facility always provide adequate training regarding to the information system and technology employed					
	Storage Practice					
49	This health facility developed and regularly updated SOP related to storage practices					
50	In this facility the pharmaceutical storeroom always cleaned regularly					
51	In this facility drugs and other health commodities always stored in a dry, well-lighted, well- ventilated storeroom and out of direct sunlight.					

52	This facility pharmaceutical storeroom always protected from water penetration					
53	In this facility latex products always stored away from electric motors and fluorescent lights					
54	In this facility cold storages are always maintained as required					
55	Storage areas are accessible only to the authorized personnel and controlled substances are always stored in locked up storage					
56	Cartons always stack at least 10 cm off the floor, 30 cm away from the wall and other stacks, and no more than 2.5m high					
57	In this facility pharmaceuticals always stored away from insecticides, chemicals, old files, office supplies and other materials					
58	In this facility flammable products always stored separately from other products and appropriate safety precautions are always took					
59	In this facility pharmaceutical always arranged in store in a way that facilitate FEFO procedures and stock management					
60	In this facility pharmaceutical cartons always arrange in a way that arrows pointing up, and with identification labels, expiry dates, and manufacturing dates clearly visible					
61	In this facility unusable pharmaceuticals always separated from usable commodities and the inventory records always updated immediately					
62	This facility always allocated enough budget for renovating or renewing the store or for other storage related practices					
	After Procurement Service					
63	This health facility developed and regularly updated SOP related to after- Procurement Service					
64	This health facility always contract with suppliers to install medical equipment and supplies after deliver before they leave the facility					
65	This health facility always contract with suppliers to get maintenance and follow up service for medical equipment and supplies after the sale					
66	The effort that this facility try to get accessories and parts required for medical equipment and supplies from suppliers is satisfactory					

67	This facility always allocated enough budget for maintenance and follow-up service of medical equipments and supplies					
68	In this facility medical equipment and supply never been non-functional due to absence of maintenance and repairing service					
	Monitoring and Evaluation					
69	This health facility developed and update SOP related to M and E activities					
70	This health facility designed and regularly updated SCM related M & E indicators					
71	M & E indicators designed by this health facility are appropriate and compressive for its SCM related practice					
72	This health facility regularly conducts SCM performance appraisal based designed M & E indicators					

	Management Support	1	2	3	4	5
73	This health facility management or DTC meets and discuss on the system implementation at least every other month.					
74	In this health facility logistics system implementations included in BSC and amount of points on measures given					
75	This health facility always conducting logistics review meeting at least once a year per district health office and/or zonal health department					
76	Number of Pharmacy professionals in this health facility are always available as required by the BPR					
77	This health facility always have adequate budget for deployment of pharmacy professionals					
78	This health facility's management regularly receive stock status report from supply officers and give feedback to them					
79	In this health facility skill transfer from trained to untrained profession during release/transfer of trained professionals is always continuous and satisfactory					
80	Higher level officials of this health facility always sign on resupply report and orders and regularly provide of feed backs to the supply officers					
81	Adequate budget always allocated for printing of recording and reporting formats					
	Supportive Supervision					

82	This health facility always get supportive supervision related to supply chain practices from higher level health office or PFSA at least every quarter					
	Training					
	In this facility the overall training provided by different stockholders to the staff regarding to different supply chain practice is always satisfactory					
	Budget					
84	This health facility always allocate sufficient budget for its overall pharmaceutical SCM related activities					
	IPLS skills of the staff					
85	This health facility pharmaceutical store always run by pharmacy professionals					
86	This health facility pharmaceutical store always run by IPLS trained professionals					
87	This health facility staff regularly preparing and sending SCM related report to the concerned body					
88	In this health facility the store managers effort for orienting and establishing Max-Min inventory control system for the DUs is always satisfactory					
89	This health facility staff conduct physical inventory count at least annually					
90	This facility pharmaceutical products always properly stored					
91	This facility staff are capable for updating different inventory record formats					
92	This health facility staff can always properly transposing data from recording formats for preparing supply report					
93	This health facility staff provide regular support to dispensing units on recording, reporting and drugs supply management					
94	All staff of this facility is always capable of generating valid and accurate supply report					

Thank you for your cooperation!!!

Part 3: Questions for Face-to-Face Interview with Pharmacy Heads

The following questions are designed to be used for face-to-face interview with Pharmacy heads in each health facility to collect quantitative data.

	Health Facility Related Factors	
	Service Volume Level	
1	What type of health facility?	Health center…….1 Primary hospital……..2 General hospital……..3 Referral hospital……...4 Specialized hospital.....5 Others……..6 (specify)……
2	The patient load of the health facility per day	1. Less than 50 2. 50-79 3. Greater or equal to 80
3	Do you provide ART service in your facility?	1. Yes 2. No
4	Did you implement IPLS for at least 3 years in your facility?	1. Yes 2. No
5	Do you have at least 3 pharmacy professionals who trained on IPLS?	1. Yes 2. No
6	Does the health facility have more than 5 DU to implement IPLS?	1. Yes 2. No
8	Is it HCMIS implementing facility?	1. Yes 2. No
9	How many years since HCMIS implemented in this facility	1. Less than 1years 2. 1-3 years 3. Greater than 3 years 4. Others

	Staff number	
11	Number of staff with educational qualification of pharmacy	Msc degree…… B.pharm……. Pharmacy technician…… Others……
	Distance	
12	How far is this health facility located from PFSA branch that is serving this health facility? (in Kilometer)	……

Thanks for your Cooperation!!

Part 4: Questions for In-Depth Face-to-Face Interview to Collect Qualitative Data

The following questions are designed to be used for in-depth face-to-face interview with Pharmacy head in each health facility to collect qualitative data.

1. What are the major challenges related to pharmaceutical procurement practices management in your health facility?
    I. Human resource
    II. Capacity building
    III. Management support
    IV. Budget
    V. others
2. What are the major challenges related to inventory management in your health facility?
    I. Human resource
    II. Capacity building
    III. Management support
    IV. Budget
    V. others
3. What are the major challenges related to after-procurement service to medical equipment and supplies in your health facility ?
    I. Human resource
    II. Capacity building
    III. Management support
    IV. Budget
    V. others
4. What are the major challenges related to pharmaceutical storage practice in your health facility s ?
    I. Human resource
    II. Capacity building
    III. Management support
    IV. Budget

V. others

5. What are the major challenges associated with supplier relationship management in your health facility?
    I. Human resource
    II. Capacity building
    III. Management support
    IV. Budget
    V. others
6. What are the major challenges associated to supply chain related information sharing and technology in your health facility?
    i. Human resource
    ii. Capacity building
    iii. Management support
    iv. Budget
    v. others

Thanks for your Cooperation!

Annex 2: Descriptive Statics of Procurement Practice in study done on public health facilities found in west Gojjam zone, 2018

Items Used to Measure Procurement Practice	Mean	Mode	S.D	Max	Min
The facility developed and regularly updated SOP related to pharmaceutical procurement	3.48	4	.577	4	2
The facility developed and regularly update standard and specifications for each items to be purchase	1.93	2	.553	3	1
The standard and specification of each item are comprehensive and appropriateness for current clinical setup in the facility.	1.72	2	.564	3	1
Procurement of each item always carried out based on specifications and standards developed	2.54	3	.571	4	1
The facility involve different experts and stockholders including suppliers in developing standard and specification for each items	2.28	2	.694	4	1
Facility developed its own specific essential drug list and it update regularly	3.62	4	.923	5	1
All pharmaceutical products procured by the facility are always included in facility specific essential drug list	3.22	4	.923	5	1
This facility Effort to exchange procurement related documents and transactions with suppliers through Electronic data interchange(EDI) and the World Wide Web is satisfactory	2.27	2	.873	4	1
There is always low level of bureaucracy at this facility for purchasing health commodities	3.17	3	.811	5	1
This facility always allocated sufficiently budget for purchasing pharmaceutical products required to meet the demand	3.14	3	.783	5	1
Availability of vital medicines in the facility is always satisfactory	3.42	3	.609	5	2
Availability of essential medicines in the facility is always satisfactory	3.46	4	.580	5	2

Annex 3: Descriptive Statistics for Inventory Management of the study done on public health facilities found in west Gojjam zone, 2018

Items Used to Measure Inventor Management	Mean	Mode	S.D	Max	Min
The facility developed and regularly updated SOP related to inventory management	3.95	4	.399	5	1
MIN/Max inventory control systems strictly applied for each items	2.91	3	.718	4	1
ABC and VEN analysis done regularly in this health facility	2.44	2	.641	4	1
Staff engaged in facility's inventory management is always adequate	3.16	3	.793	4	1
The facility effort to computerized inventory management of pharmaceutical products is satisfactory	2.80	2	.942	5	1
Manual bin cards and stock cards are always up-to-date	3.54	4	.643	5	1
Adequate blank inventory recording formats are always available	3.83	4	.851	5	1
The facility regularly prepare and send reports and purchase orders to higher level	3.80	4	.579	5	1
Dispensary units place orders at regular intervals and whenever emergencies occur	3.23	3	.685	5	1
Internal reporting procedure and resupply schedule with in the facility is suitable and appropriate	3.73	4	.571	5	2
There is suitable procedures for placing emergency orders by dispensing units	3.61	4	.590	5	2
Store managers effort to conduct physical inventory count regularly is satisfactory	3.39	3	.664	5	1
balance at books for each items are always equal with physical inventory balance	2.84	3	.649	4	1
Damaged/expired products always physically separated from usable inventory and the books updated immediately	3.10	3	.724	5	1
The facility always provide adequate training to the staff regarding to inventory management practice	3.29	3	.684	5	1
Frequency of being over-stocking for items before resupply is very low	3.24	3	.654	5	2
There is always Low level of losses and adjustments for pharmaceutical products in this health facility	3.19	3	.709	5	2
Product arrangement of the store always facilitate First Expiry-First Out(FEFO)	2.94	3	.677	5	1
Enough budget always allocated by the facility for printing inventory recording forms and providing training related to inventory manage	2.57	2	.780	5	1