SCHOOL OF GRADUATE STUDIES

COLLEGE OF COMMERCE

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

OUTBOUND LOGISTICS OF MEDICINES IN PRIVATE PHARMACIES IN ADDIS ABABA

BY

SEID ALI SANI

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A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS (MA) IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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ADDIS ABABA

LOGISTICS AND SUPPLY CHIAN MANAGEMENT

OUTBOUND LOGISTICS OF MEDICINES IN PRIVATE PHARMACIES IN ADDIS ABABA

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Declaration

I, the undersigned, declare that this thesis entitled "Outbound logistics of medicines in private pharmacies in Addis Ababa" is my original work and has not been presented for a degree in any other university and all the references used for the thesis has been duly acknowledged.

Name: Seid Ali Sani

Signature: _____

August 2017

This thesis entitled "Outbound Logistics of medicines in private pharmacies in Addis Ababa" has been submitted for examination with my approval as a university advisor. I certify that, the study is his own original work, conducted under my guidance and supervision; and suitable for the award of MA in Logistics and Supply Chain Management.

Name: Matiwos Ensermu (PhD)

Signature: _____

August 2017

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The Researcher

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List of Abbreviations

ANOVA	Analysis of Variance
DT	Dispersible Tablet
EFY	Ethiopian Fiscal Year
ETB	Ethiopian Birr
FEFO	First Expire First out
FMHACA	Food, Medicine and Health care Administration and Control Authority
FMOH	Federal Ministry of Health
HFs	Health Facilities
IPLS	Integrated Pharmaceutical Logistic System
NGOs	Non-Governmental Organizations
PFSA	Pharmaceutical Fund and Supply Agency
ORS	Oral Rehydration Salt
RHB	Regional Health Bureau
SCM	Supply chain management
SD	Standard Deviation
WHO	World Health Organization

Abstract

Across low- and lower-middle income countries, the average availability of selected essential medicines has been reported to be low, 57% in public sector facilities and 65.1% in private facilities. Many studies have investigated public drug-supply systems, but only a few have looked into the private pharmaceutical sector in low-income countries. The aim of the study was to assess the outbound logistics of private pharmacies. A cross sectional study involving prospective data collection was conducted in selected private pharmacies in Addis Ababa, focusing on availability of essential medicines, inventory and store management and disposal practices. Face to face interview and observation was made to gather pertinent data using a modified version of the LIAT and WHO/HAI methodology. A total of 67 private pharmacies from Independent, Chain, Kenema and Hospital pharmacies were assessed. Results of the study revealed that the overall availability of selected essential medicines at private pharmacies during visit was 83.18%. Hospital pharmacies had higher availability of medicines compared to other private pharmacy groups in this study ($p < 0.05$). The major reason for stock out of essential medicines in studied private pharmacies was non-availability in the market while prescription pattern was the most important factor that determines level of inventory. When observing storage conditions of private pharmacies, this study found out that, for larger proportion (77.61%) of the private pharmacies, the storage conditions were at acceptable level (score ≥ 80). However, it was observed that majority of the pharmacies, 58 (86.6%), accumulated medicine wastes. The respondents were complaining that there are no 'disposal firms' for private pharmacies to dispose their accumulated medicine. In general, Private pharmacies in this study were neither engaged in reverse logistics of expired medicines nor willing to collect expired medicines from their patients which may lead to accumulation of medicine wastes or inappropriate disposal at households. Similarly, the study identified that the three most important challenges affecting SCM of private pharmacies were difficulty of obtaining continuous supply, disposal challenge and unethical business practice. It is recommended that the government should support drug-take-back program and establishment of environment friendly medicine disposal firms in Ethiopia.

Key words: Essential, Medicine, Availability, Inventory, Storage, Disposal, Private Pharmacies, Addis Ababa.

Chapter 1: Introduction

1.1. Study Background

Modern health care is unthinkable without the availability of necessary medicines. Medicines not only save lives and promote health, but also prevent epidemics and diseases too. Accessibility to medicines is too the fundamental right of every person, and its effectiveness is substantially affected by the functioning of logistics system (Kar *et al*., 2010). Health sector supply management play pivotal role to ensure accessibility of health care for all segments of the population. In Ethiopia, the government is the primary health care provider and supplier of pharmaceuticals for the public sector through Pharmaceutical Fund and Supply Agency (PFSA). In the public sector of many countries funding for health care is insufficient and the available resources may not be well managed; drug stock outs are common, drug deliveries often late and inadequate (Bennett *et al*., 1997). The inadequacies in the public sector compel patients to revert to the private sector, which may be responsive to overcome government inefficiency in drug supply (Basu *et al.*, 2012).

The annual pharmaceutical market in Ethiopia is estimated to be worth US$ 400 to US$ 500 million and growing at an impressive rate of 25% per annum. A 2012 estimate by Frost & Sullivan suggests the Ethiopian pharmaceutical market could witness growth rates of "slightly over 14%" to reach an approximate value of just under US$ 1 billion by 2018. The local industry comprises 22 pharmaceutical and medical suppliers and manufacturers, with 9 involved directly in the manufacture of pharmaceutical products. Around 35–40% of their total output is supplied to the private sector at a price premium of 10%. The annual private pharmaceutical market in Ethiopia is estimated to be worth US$ 100 million. The public sector, through the PFSA, procures almost 70% of all the medicines consumed in Ethiopia, but there is still significant out-of-pocket expenditure on health, estimated at 46% by the Ethiopian Food, Medicines, Healthcare Administration and Control Authority (FMHACA) (FMOH & MOI, 2015).

There are still gaps to make the availability of vital and essential medicines 100% in public health facilities. In achieving this, the role of the private sector is paramount though availability related findings are focused on public facilities. Private pharmacies are also playing a growing role in helping to fill some of the gaps in the capacity of public health institutions to meet demands for essential medicines. Studies indicate that private pharmacies tend to have more reliable supplies of

essential medicines (Wales *et al.,* 2014) and the private sector to be a popular source of treatment in sub-Saharan Africa for various reasons that include reliability in stocks (PSP4H, 2014). However, a research in Tanzania indicated that retail pharmacies do not always stock "essential medicines" but often only stock fast moving medicines since slow moving medicines incur greater working capital costs than fast moving medicines (Yadav, 2009).

The logistics information is the motor that drives the pharmaceutical logistics. A pharmaceutical logistics system should include standard inventory management that provides pharmaceuticals to be stored and distributed in the right conditions. The goals of inventory management are to protect stored items from loss, damage, theft, or wastage, and to manage the reliable movement of supplies from source to user in the least expensive way. The quality of pharmaceuticals is very dependable on the storage conditions (MSH, 2012). Pharmaceuticals designed for humans often become unfit to use for a variety of reasons, ranging from a physical damage of packaging to expiration. These unfit to use accumulated pharmaceuticals represent sub-optimal delivery of health care and the potential for environmentally unsound disposal, which can pose exposure risks for humans and animals (Ruhoy & Dauhgton, 2007). Pharmacy logistics processes are related to several issues that impact negatively the cost and quality of the medication services. Studies show different inefficiencies including out-of-stock (unavailability), high costs, medicine shrinkage, high frequency of reorders, counterfeit products, time-consuming product recalls, incorrect inventory management and improper use of technology. These inefficiencies affect severely the sustainability of healthcare system in general and the patient security in particular (Romero, 2013).

Many studies have investigated public drug-supply systems, but only a few have looked into the private pharmaceutical sector in low-income countries (McCabe *et al*., 2011). Though there is an attempt to study some of the challenges in private pharmacy activities (Sulzbach *et al.,* 2009), there are little studies if not none so far to describe the supply chain management (SCM) practices and performance of private pharmacies in Ethiopia. The general objective of this study was to describe the outbound logistic management practice of private pharmacies in Addis Ababa focusing on availability of essential medicines, inventory and store management and disposal practice. The findings from this study will provide inputs to the existing national efforts to improve supply management of pharmaceuticals in Ethiopia.

1.2. Problem Statement

Although World Health Organization (WHO) outlines that access to medicines is the fundamental right of every person (Kar *et al*., 2010), it is estimated that two billion people do not have access to medicines and four million lives could be saved every year in Africa and Southeast Asia with the appropriate treatment and medicine (Schöpperle, 2013). Across low- and lower-middle income countries from 2007-2012, the average availability of selected essential medicines was 57% in public sector facilities and 65.1% in private facilities; these statistics highlight the extent to which this is a problem in many developing countries (Wales et al., 2014). In recent years, even in a market known to be one of the most efficient in Europe, reports from the Netherlands indicate that 3-5% of drugs are un-available at the time they are ordered (Aitken *et al.,* 2014). In Ethiopia, most of the health challenges which lead to morbidity and mortality could have easily been prevented or treated by ensuring the continuous availability and proper use of few essential medicines. However, these essential medicines are not adequately available at all public health facilities on continuous basis due to multiple reasons (Gedif *et al*., 2016).

Federal Ministry of Health (FMOH) identified supply chain gaps as a threat for the Health Sector Transformation Plan in addition to suboptimal public-private partnership. The national survey conducted in January 2014 on IPLS to measure system performance at 270 public health facilities (hospitals, health centers and health posts) indicated that the average availability of essential tracer medicines at public health facilities on the day of visit was 89% though the target was to increase the availability of essential pharmaceuticals from 65% to 100%. On the other hand, assessment made in 17 Federal and Addis Ababa City Government hospitals, revealed that the availability of key medicines varies significantly among hospitals. The availability of key medicines at the dispensaries of these hospitals at the time of visit ranged from 33.3% to 100% (FMOH, 2015). Gedif *et al* (2016) also reported that availability of key tracer medicines at public health facilities varies from 70%-90% and stock out duration of 43.3 to 61.1 days.

The performance of both public and private importers in supplying medicines in response to hospital requests was reported to be poor (44.7%) (FMOH, 2015). FMOH has planned to increase availability of essential medicines at all level of the healthcare to 100% and reduce wastage rate from current 8% to less than 2% by 2019/20 and to reduce procurement lead-time from 240 days to

120 days by 2019/20 (FMOH, 2016[a]). Despite these efforts, there is still a long way to go to continuously avail products across the supply chain. Steady economic growth, improvements in the delivery of health care and introduction of social health insurance coverage across the country in July 2015 could lead to growing demand (FMOH & MOI, 2015). In 2008 Ethiopian Fiscal year (EFY), PFSA has planned to procure Ethiopian Birr (ETB) 8.87 billion worth of pharmaceuticals and medical supplies. However, it has procured a total amount of ETB 6.4 billion, 72% of the planned procurement in the year (FMOH, 2015). In this regard, the role of the private sector is of paramount importance to fill the gap in 2.4 billion worth of pharmaceuticals.

When patients are unable to get their prescribed medicine at public health facilities, they will try to get at private pharmacies. Moreover, patients from private hospitals expected to utilize the private pharmacies. However, a research in Tanzania indicated that retail pharmacies do not always stock "essential medicines" but often only stock fast moving medicines since slow moving medicines incur greater working capital costs than fast moving medicines (Yadav, 2009). In a study conducted in Amhara, Oromia and Addis Ababa, the administrative challenges that private pharmacy owners/administrators most commonly reported was difficulty in obtaining continuous supplies, client inability to pay, competition from both public and private pharmacies, and excessive government regulations (Sulzbach *et al.,* 2009). These challenges could affect availability of essential medicines in private pharmacies. Most supply chain research works/reports in Ethiopia has been undertaken for the public sector and not on private pharmaceutical supply chains which was the focus of this study.

In addition, country wide assessment in 2007, revealed major problems in the entire supply chain management including disorganized and uncoordinated forecasting, shortage/stock-out of essential pharmaceuticals, high wastage rate (> 8%), poor storage and distribution and irrational use of medicines (Yiegezu, 2014). In effect, there is high dissatisfaction of stakeholders, health care providers, patients and the community at large (PFSA, 2016). In addition to the negative impacts on financial outcomes from the pharmacy's business perspective, inventory mismanagement could have deleterious corollaries on patient safety. Such outcomes could be attributed to the availability of expired, counterfeit, substandard, or spoiled pharmaceutical product (JPP, 2011). The storage condition for pharmaceutical products should also comply with the recommended Good Storage

Practices so as to preserve the integrity of the products stored. A report in Ghana and Mali revealed that the pharmacy owner's office may have air conditioning, but not the storage areas, potentially degrading products (McCabe *et al*., 2011). One of the objectives of this study was to assess storage conditions of medicines store on private pharmacies.

Moreover, due to their potential hazards to health and environment, collection and treatment of medical wastes have always been an important issue and a risky business. As soon as any object is considered as a medical waste, it must be promptly processed through strict procedures and closely monitored all the way from its inception through its disposal (Sasan, 2013). Medicines which are unfit for use shall not be stored for more than six months (FMHACA, 2011). Reports indicated absence of regular tracking and reporting of waste products and delayed disposal of waste products at PFSA, leading to accumulation in store and space occupation. The disposal sites shall be environment and society friendly and shall be approved by appropriate organ in accordance with Environment Impact Assessment. PFSA does not have the mechanism, infrastructure, and system to handle pharmaceutical waste disposal on time in addition to the shortage of resources for waste disposal (PFSA, 2016). If this is a challenge for the government supplying agency, private pharmacies may also face such challenges. Any health institution which does not have an approved disposal facility shall use disposal referral system of licensed disposal firms, respective medicines suppliers or central disposal sites for disposal of unfit for use (FMHACA, 2011). However, there are no such firms in Ethiopia currently. Hence, it is important to assess how retail pharmacies are disposing their medicine waste. This paper attempted to gain a better understanding of how private pharmacies dispose expired medicines or involve in reverse logistics of medicines.

Many studies have investigated public drug-supply systems, but only a few have looked into the private pharmaceutical sector in low-income countries (McCabe *et al*., 2011). Though there is an attempt to study some of the challenges in private pharmacy activities (Sulzbach *et al.,* 2009), there are little studies if not none so far to describe the SCM practices and performance of private pharmacies in Ethiopia. This study was conducted to assess the availability of essential medicines and describe the SCM practices of private pharmacies in relation to their inventory control system, storage and disposal.

1.3. Research Questions

The intention of this study was to answer for the following research questions; what are the outbound SCM practices of private pharmacies in Addis Ababa. In order to achieve this, the following specific research questions were formulated.

1. How much is availability of essential medicines in private pharmacies?
2. How is the private pharmacies inventory control?
3. How is the private pharmacies store management?
4. How private pharmacies practice reverse logistics and dispose expired medicines?
5. What are the challenges of private pharmacies in medicine logistic system?

1.4. Research Objective

1.4.1. General Objective

The general objective of this study is to assess and describe the outbound logistics of private pharmacies in Addis Ababa.

1.4.2. Specific Objectives

- To assess availability of essential medicines in Addis Ababa based private pharmacies
- To assess the inventory management practices of Addis Ababa based private pharmacies
- To assess the storage conditions of the Addis Ababa based private pharmacies
- To describe the practice of reverse logistics and disposal of medicines in private pharmacies
- To identify challenges affecting the SCM of medicines in private pharmacies

1.5. Significance of the Study

There is limited attempt to study the outbound logistics of medicines in private pharmacies in Ethiopia. The findings from this study will be an interest for private pharmacies, FMOH, FMHACA, PFSA, Regional Health Bureaus (RHBs), private and public health facilities, Non-governmental organizations (NGOs), universities and other parties working to improve pharmaceutical SCM in Ethiopia. The significances of this study also include the following:

1. The study will provide baseline information on the disposal practice and current trends of revers logistics of medicine in private pharmacies
2. The study will contribute to improve inventory and storage management of private pharmacies
3. The study will help in identifying challenges of private pharmacies in the outbound logistics of medicines
4. The study will be used as an input in understanding, designing and implementing effective and efficient supply chain strategy in private pharmacies
5. The study will contribute on the limited knowledge in the area of SCM of pharmaceutical commodity in Ethiopia in general and private pharmacies in particular
6. The study will provide inputs to the existing national efforts to improve the SCM of pharmaceuticals

1.6. Scope of the Study

The scope of this study was description and evaluation of the outbound logistics of medicines in private pharmacies of Addis Ababa. It was limited to private pharmacies point of reference towards availability, inventory management, storage management, reverse logistics and disposal practice. The study was limited to private retail pharmacies and their suppliers; hence, Ethiopian Red Cross Society pharmacies, NGO pharmacies and public health facility pharmacies were not included. In this study the suppliers and the end users (patients or clients) were not included. Information regarding suppliers and end users was obtained from the private pharmacies.

1.7. Operational Definitions

Private Pharmacy: Private Pharmacies shall mean an independent pharmacy, a chain pharmacy, a Kenema pharmacy or private hospital pharmacy that is licensed as a pharmacy by the government and that dispenses medications to the patient and general public at retail prices. It does not include a pharmacy that dispenses prescription medications to patients primarily through the mail, nursing home pharmacies, long-term care facility pharmacies, government hospital pharmacies, clinics, charitable or not-for-profit pharmacies or government health center pharmacies.

Independent pharmacy: An independent pharmacy shall mean a retail pharmacy independently owned privately by one person or a small group of people or individual businesses and which is not directly affiliated with any chain of pharmacies. Independent pharmacy also purchases and prices by its own and not dictated by corporate policies. It usually only has 1 to 3 pharmacies.

Chain Pharmacy: The chain pharmacy shall mean private pharmacy which has numerous locations consisting of four or more dependent pharmacies owned by the same individual or business organization.

Private hospital pharmacy: Private hospital pharmacy shall mean a pharmacy found within the premises of a private hospital or as part of a private hospital which usually provide medications for the hospital customers or the public. It may sell over-the-counter as well as prescription medications.

Kenema Pharmacy: Kenema pharmacy shall mean a community pharmacy owned by the Addis Ababa city council which is independently owned and operated from government hospitals and health centers.

Essential medicines: "those medicines that satisfy the priority health care needs of the population and are intended to be available within the context of functioning health systems at all times in adequate amounts, in the appropriate dosage forms, with assured quality, and at a price the individual and community can afford" (World Health Organization).

1.8. Organization of the Thesis

This thesis has the following organization:

The introductory Chapter 1 dealt with the background, statement of the problem, research questions, and objectives of the study, operational definition, significance, scope and limitations of the study. Chapter two discussed the review of related literatures on health care supply chain in Ethiopia, availability, inventory management, store management, health care SCM in Ethiopia and essential medicine SCM. Chapter three described the study design and methodology, sample and sampling methods; tools, procedures and sources of data collection; and data analysis. Chapter four covered the findings of the study, the analysis, interpretation and discussion of the results by comparing with the existing literature and best practices. Chapter five summarized the major findings and conclusion. It also presented the recommendations from the study, its limitations and area of future research.

Chapter 2: Related Literature Review

2.1. Health care Supply Chain in Ethiopia

A public health supply chain is a network of interconnected organizations or actors that ensures the availability of health commodities to the people who need them. A well designed health system cannot function without a well-designed, well-coordinated and well-maintained SCM-one that can ensure an adequate supply of essential health commodities to the clients who need them. Public health supply chain is under rising pressure to operate efficiently. With large scale investment in health programs, a widening portfolio and volume of products and expansion of services to new populations, supply chain must be flexible and responsive in this changing environment (JSI, 2012). In Ethiopia, the three major groups that comprise the health care supply chain are producers & importers (companies that make and import pharmaceuticals, medical devices and healthcare supplies), intermediaries (wholesale distributors) and providers (hospitals, health centers and private health care facilities including private pharmacies).

The Government of Ethiopia has expressed its commitment to meet the country's demand for essential medicines and to systematize its supply, distribution and use as stated on the National Drug Policy of Ethiopia which was issued in 1993. The policy addresses all aspects of medicines supply management including; selection, procurement, stock management and distribution, and medicines regulation and use. The pharmaceutical sector is regulated by FMHACA and regional regulatory bodies. Health service is provided mainly by public institutions supported by private ones under the leadership of FMOH and RHBs. Import and wholesale of pharmaceuticals are done by the public & private sectors, NGOs and international organizations (PFSA, 2014). Despite major strides to improve the health of the population, Ethiopia's population still face a high rate of morbidity and mortality and the health status remains relatively poor (FMOH, 2010). A major challenge is reaching a population whose majority lives in rural areas. Achieving this aim is a complex undertaking, which is becoming increasingly more so as the diversity and volume of medicines regularly expands (PFSA, 2014).

The logistic system in Ethiopia has long had a reputation for being cumbersome and unreliable. The five year Growth and Transformation Plan (2010/11-2014/15) has clearly indicated that maternal and new born care, child health and halting and reversing the spread of major communicable

disease such as HIV/AIDS, TB and malaria as the highest priorities of the health care sector which are also emphasized by internationally agreed upon initiatives, especially the Millennium Development Goals (MDGs). In order to create the necessary conditions for achieving these targets, the timely and coordinated efforts that make pharmaceuticals available to those who need them are fundamental. In this respect, the Health Sector Development Program (HSDP IV) which is designed to support the policies, strategies and targets of the government for the Growth and Transformation Plan, has considered pharmaceuticals supply and service as one of the eight core processes. Consequently PFSA is established with the mission to avail need based; quality assured pharmaceuticals at an affordable price in a sustainable manner with a mandate to be sole provider of forecasting, procurement, storage, inventory management and distribution of pharmaceuticals to the public health sector in Ethiopia (FMOH, 2010; 2015; PFSA, 2015).

2.2. Integrated Pharmaceutical Logistic System (IPLS)

In Ethiopia, all public Health facilities (HFs) obtain essential and vital pharmaceuticals primarily through IPLS, a single reporting and distribution system. To be successful in ensuring that patients always receive pharmaceuticals, IPLS must fulfill the Six Rights (the right products, in the right quality, of the right quantity, at the right place, at the right time, and for the right cost. IPLS has improved inventory management / record keeping of HFs, centralized and integrated forecasting of pharmaceuticals, direct delivery of pharmaceuticals from PFSA- minimizing the lead time and hence the stock-out rate at HFs and also improved communication between PFSA and HFs, leading to more effective management of emergency orders. Although there are improvements, there are still inventory management challenges at HFs. IPLS is the primary mechanism through which all public health facilities obtain essential and vital pharmaceuticals (PFSA, 2015; 2016).

2.3. Essential Medicines Availability

Pharmaceuticals are crucial high value input for the health care systems that often make a difference in the health outcomes for the individual and the population. Access to essential medicines was outlined by WHO as one of the eight essential components of primary health care. Hence, access to medicines is the fundamental right of every person. However, WHO pointed out that approximately 67% of the population lack access to essential medicines. Approximately one-third of the developing world's population does not have regular access to essential medicines. WHO defines essential medicines as "those that satisfy the priority health care needs of the population and are intended to be available within the context of functioning health systems at all times in adequate

amounts, in the appropriate dosage forms, with assured quality, and at a price the individual and community can afford. Essential medicines are selected with due regard to disease prevalence, evidence on efficacy and safety, and comparative cost-effectiveness" (FMHACA, 2015[b]; Gedif *et al*., 2016).

The National Medicine Policy was established in 1993 with the aim to provide universal access to good quality essential medicines. FMHACA was established in 2009 with the mandate to regulate food, medicines and health care services, and with PFSA to reform and restructure the pharmaceutical supply and regulatory functions. The public sector, through PFSA, procures almost 70% of all the medicines consumed in Ethiopia, but there is still significant out-of-pocket expenditure on health, estimated at 46% by FMHACA. The annual pharmaceutical market in Ethiopia is estimated to be worth US$ 400 to US$ 500 million and growing at an impressive rate of 25% per annum. A 2012 estimate by Frost & Sullivan suggests the Ethiopian pharmaceutical market could witness growth rates of "slightly over 14%" to reach an approximate value of just under US$ 1 billion by 2018**.** There are approximately 200 importers of pharmaceutical products and medical consumables in Ethiopia. The local industry comprises 22 pharmaceutical and medical suppliers and manufacturers, with 9 involved directly in the manufacture of pharmaceutical products. Most of the manufacturers operate below their capacities and supply only about 20% of the local market. In 2014, local pharmaceutical companies supplied products to the value of US$ 44.2 million. Local manufacturers have limited product portfolios and are thought to be able to supply only 90 of the more than 380 products on the national essential medicines list. Around 35–40% of their total output is supplied to the private sector at a price premium of 10%. The annual private pharmaceutical market in Ethiopia is estimated to be worth US$ 100 million (FMOH & MOI, 2015).

The provision of complete health care necessitates the availability of safe, effective and affordable medicines and related supplies of the required quality, in adequate quantity at all times. Despite this fact, in the past, the pharmaceutical SCM system of the country had several problems including non-availability, unaffordability, poor storage and stock management and irrational use. IPLS is the term applied to the single pharmaceuticals reporting and distribution system based on the overall mandate and scope of the PFSA. It aims to ensure that patients always get pharmaceuticals they need (PFSA, 2015).

The value of imported medicine to Ethiopia in 2008 EC was 8.78 billion Birr. FMHACA has issued licenses for 7864 retail establishments, 568 new licenses were issued for manufacturers, exporters, importers and distributors and 575 new licenses for medicine retail outlets. Moreover, inspection was carried out in 282 import and distributors and 7089 retail outlets. Concerning narcotic drugs, psychotropic substances, and precursor chemicals, performance on import permit was 73.3% and the value of imported products was 2.5 billion Birr, while proper use control was 62% (FMOH, 2016[a]).

PFSA has followed stock status of identified vital and essential pharmaceuticals closely, and in EFY 2008, the national vital and essential pharmaceuticals/medicines stock status on average reached 86%. The national vital and essential drug list is increased to 713 from 350 to accommodate an additional list of drugs included in the national Community Based health Insurance scheme. In EFY 2008, it was planned to procure ETB 8.87 billion worth of pharmaceuticals and medical supplies. Out of the planned target, PFSA procured a total amount of ETB 6.4 billion worth of pharmaceuticals and medical supplies (ETB 2.4 billion revolving drug fund and ETB 4.0 billion health program), 72% of the planned procurement in the year. In addition, the agency has received pharmaceuticals and medical supplies worth ETB 7.6 billion procured by development partners. Overall, the agency has availed pharmaceuticals and medical supplies worth a total amount of ETB 14.04 billion (FMOH, 2016a). However, there are still gaps to make the availability of vital and essential medicines 100% in public health facilities. In achieving this, the role of the private sector is paramount though availability related findings are focused on public facilities.

The national survey conducted in January 2014 on IPLS to measure system performance at public health facilities (hospitals, health centers and health posts) indicated that the system significantly improved the availability of essential pharmaceuticals at health facilities. The average availability of essential tracer medicines at health facilities on the day of visit was 89% though the target was to increase the availability of essential pharmaceuticals from 65% to 100%. Average availability of the tracer pharmaceuticals during six months prior to the study was 78.1%. (Abiy *et al.,* 2015; FMOH, 2015). On the other hand, assessment made in 17 Federal and Addis Ababa City Government hospitals, which are supposed to give tertiary level of care, revealed that the availability of key medicines varies significantly among hospitals. The performance of both public and private importers in supplying medicines in response to hospital requests was poor (44.7%). The

availability of key medicines at the dispensaries of these hospitals at the time of visit ranged from 33.3% to 100%. This shows the need to work hard to ensure the continuous availability of needed pharmaceuticals at these referral hospitals, including pharmaceuticals used for the management of non-communicable diseases (FMOH, 2015).When patients are unable to get their prescribed medicine at public health facilities, they will try to get at private pharmacies since healthcare is typically one of the last areas where consumers cut spending.

FMOH identified supply chain gaps mainly on forecasting and distribution as a threat for the health sector transformation plan in addition to suboptimal public-private partnership (coordination, mistrust and reporting) and inadequate counterfeit control (sub-standard imports). FMHACA has planned to achieve 100% inspection of manufacturers, importers/wholesalers, retailers and health facilities as per the standard and to decrease the percentage of substandard medicines circulating in the market from 8% to 1% (FMOH, 2015).

PFSA has made remarkable achievements over the five years in terms of procurement, distribution, and warehousing and inventory management. The value of pharmaceuticals procured in 2008 budget year was more than ETB 6.5 billion. This indicates that the procurement of pharmaceuticals has increased by more than 80% from 2003 to 2008 EFY. Regarding distribution of pharmaceuticals, that worth more than ETB 12.6 billion, were distributed in 2008 budget year which shows an increase of 147% from 2003 EFY. With respect to infrastructure, a total of 17 modern warehouses were constructed at the center and branches of the Agency during the last five years. This has increased the warehouse capacity of the Agency by 289,150 m^3 and the total Agency-owned warehouses capacity to 305,910 m^3. The inventory management across the supply chain has showed significant improvement. Despite the aforementioned achievements, there is still a long way to go to continuously avail products across the supply chain. In connection with this, PFSA identified interrupted supply, wastage and inefficiencies as major problems across the entire supply chain. In effect, there is high dissatisfaction of stakeholders, health providers, patients and the community at large (PFSA, 2016).

2.4. Inventory Management

Inventory management is defined as the continuing "process of planning, organizing and controlling inventory" that aims at "minimizing the investment in inventory while balancing supply and demand". Specifically, the process aims at reducing procurement and carrying costs, while maintaining an effective stock of products to satisfy customer and prescriber demands. Managing materials (pharmaceutical products) in that process is an integral part of the business model for all pharmacy settings, especially community and hospital practices. On the other hand, inventory mismanagement causes unnecessary rise in procurement and carrying costs and an imbalance in the supply and demand equation (JPP, 2011). The purpose of an inventory control system is to inform personnel when and how much of a pharmaceuticals to order and to maintain an appropriate stock level to meet the needs of patients. A well designed and well operated inventory control system helps to prevent shortages, oversupply, and expiry of pharmaceuticals (PFSA, 2015).

In pharmacy operations, inventory is referred to as the stock of pharmaceutical products retained to meet future demand. Inventory represents the largest asset in pharmacy practice, and its value continues to rise because of the growth in variety and cost of pharmaceutical products. From both financial and operational perspectives, efficient inventory management plays a great role in pharmacy practice. From financial viewpoint, efficient inventory management enhances gross profits and net profits by reducing the cost of procured pharmaceutical products and associated operational expenses. In addition, cash flow will improve upon saving on purchasing and storing less costly products. Such cash flow can be used to pay operational expenses and invest in other services. From operational viewpoint, effective inventory management ensures meeting customer and patient demands. Unavailability of a product when needed may cause the community pharmacy to lose a customer and predisposes inconvenience to the prescribing physician; and may adversely affect patient's wellbeing in hospital pharmacy settings, especially when the product is an essential lifesaving one. In addition to the negative impacts on financial outcomes from the pharmacy's business perspective, inventory mismanagement could have deleterious corollaries on patient safety. Such outcomes can be attributed by the availability of expired, counterfeit, substandard, or spoiled products and unavailability of essential products (JPP, 2011).

Every distribution network shall be subject to strict drug inventory control, supervision and data exchange in order to forecast drug demands, to prevent wastage and avoid shortage of drugs.

Periodic stock reconciliation should be performed by comparing the actual and recorded stocks. This should be done at defined intervals. Stock discrepancies should be investigated in accordance with a specified procedure to check that there have been no inadvertent mix-ups, incorrect issues and receipts, thefts and/or misappropriations of pharmaceutical products. Documentation relating to the investigation should be kept for a predetermined period. All product-specific monitoring records should be kept for at least the shelf-life of the stored pharmaceutical product plus one year (FMHACA, 2015[a]).

Pharmacists cannot take the impacts of inventory mismanagement lightly. Improper management of pharmacy inventory has deleterious impacts on patient safety. Pharmacists should consider details pertaining to pharmacy inventory management when assessing a potential medication error or other drug therapy problems, e.g. patient needs a medication but not receives it due to product unavailability; and loss of efficacy due to incorrect storage conditions (JPP, 2011).

2.5. Storage of Medicines

Warehousing plays a vital role in providing a desired level of customer service at the lowest possible total cost. Warehousing activities are an important link between the producer and the customer (Owusu *et al.* 2014). Storing is the safe keeping of pharmaceuticals to avoid damage, expiry, and theft. Proper storage procedures help to ensure that storage facilities protect the shelf life of products, that only high-quality products are issued, and that there is little or no waste due to damaged or expired products. If proper storage procedures are followed, customers can be assured that they have received a high quality product. Storage conditions will affect the quality of the pharmaceuticals being stored. Rooms that are too hot, stacks of cartons that are too high, and other poor storage conditions can cause damage or cause a reduction in shelf life. A well-organized storeroom will simplify a facility's work and time will not be wasted trying to find needed supplies (PFSA, 2015; FMHACA, 2015[a]).

The storing of medicines up to their point of use required documentation which documents all activities in the storage areas, including the handling of expired stock. These should adequately describe the storage procedures and define the route of materials and pharmaceutical products and information through the organization in the event a product recall is required. Records should be kept for each delivery that include the description of the goods, quality, quantity, supplier, supplier's batch number, date of receipt, assigned batch number and expiry date. Such records

should be retained for a period equal to the shelf life of the incoming materials and products, and plus one year. All stocks should be checked regularly for obsolete and outdated pharmaceutical products and due precautions should be observed to prevent their issuance. Any stock re-issued should be so identified and recorded in stock records and medicines returned from patients to the pharmacy should not be taken back as stock, but should be destroyed. Storage areas should be of sufficient capacity to allow the orderly storage of the various categories of pharmaceutical products (FMHACA, 2015[a]).

Storage areas should be designed or adapted to ensure appropriate and good storage conditions. In particular, they should be clean and dry and maintained within acceptable temperature limits. Pharmaceutical products should be stored off the floor, walls and ceiling as well as suitably spaced to permit cleaning and inspection. Pallets and shelves should be kept in a good state of cleanliness and repair. Moreover, storage areas should be ventilated and free from accumulated waste and vermin. There should also be a written program for pest control. The pest control agents used should be safe and there should be no risk of contamination of pharmaceutical products. There should also be a fire extinguisher in the store (FMHACA, 2015[a]). However, as indicated by McCabe *et al* (2011) good storage and distribution practices have not been prioritized by supply chain actors in the three countries they studied in Africa. Alongside the poor last-mile distribution in Ghana and Malawi and weak batch tracking in all countries, for example, retailers often store products in poor conditions. In Ghana and Mali the pharmacy owner's office may have air conditioning, but not the storage areas, potentially degrading products (McCabe *et al.*, 2011).

Pharmaceutical products should be handled and stored in such a manner as to prevent contamination, mix-ups and cross-contamination. A system should be in place to ensure that the pharmaceutical products due to expire first are sold and/or distributed first. Broken or damaged items should be withdrawn from usable stock and stored separately. Storage areas should be provided with adequate lighting to enable all operations to be carried out accurately and safely (FMHACA, 2015[a]). Narcotics and other hazardous, sensitive and/or dangerous pharmaceutical products, as well as products presenting special risks of abuse, fire or explosion should be managed properly. Narcotic and Psychotropic medicines and their prescriptions should be locked in a cabinet (FMHACA, 2002).

2.6. Disposal and Reverse Logistics of Medicines

As the production and consumption of medicines is increasing worldwide, so do the pharmaceutical residues and their metabolites in the environment. Along with environmental pollution through metabolite excretion of treated humans and animals, improper disposal of unused medicines adds to the polluting waters and soil-harming aquatic organisms. Additionally, pharmaceutical residues in the environment may have harmful effects on human health, primarily contributing to the increase in antibiotic resistance and interfering with the human hormonal system (Jonjić & Vitale, 2014).

Ensuring safe management and disposal practice is required to protect the public and the environment from health risks and hazards of medicines waste. The safe and compliant disposal of pharmaceuticals should be environmentally friendly and reinforce the commitment to green, sustainable logistics practices. Medicines which are unfit for use shall not be stored for more than six months. Approval and authorizing of disposal of medicines shall be sought from the appropriate organ. Moreover, disposal certificates shall be issued by the appropriate organ after disposal of medicines waste have been carried out. The disposal sites shall be environment and society friendly and shall be approved by appropriate organ in accordance with Environment Impact Assessment. Any health institution which does not have a disposal facility approved by the appropriate organ shall not carry out medicines waste disposal and shall use disposal referral system of licensed disposal firms, respective medicines suppliers or central disposal sites. Health care facilities & retail medicine outlets shall submit applications for disposal of unfit for use medicines to central disposal sites, respective suppliers, or licensed disposal firms and shall report/copy to the appropriate organ (FMHACA, 2011).

Reports indicated that, absence of regular tracking and reporting of wasted products at PFSA and delayed disposal of waste products leading to accumulation in store and space occupation. PFSA does not have the mechanism, infrastructure, and system to handle pharmaceutical waste disposal on time in addition to the shortage of resources for waste disposal (PFSA, 2016). If this is a challenge for the government supplying agency, private pharmacies may also face such challenges.

Due to their potential hazards to health and environment, collection and treatment of medical wastes have always been an important issue and a risky business. As soon as any object is considered as a medical waste, it must be promptly processed through strict procedures and closely monitored all the way from its inception through its disposal (Sasan, 2013). Reverse logistics is the management

of products after they have been sold or delivered to a customer and then must be returned to the point of origin. Put another way, it is the movement of items from their typical final destination for the purpose of capturing some value, reintroduction into the supply chain, or proper disposal. Sometimes it can even involve excess inventory and recalls (Gibson, 2008). Pharmaceutical returns require regulatory compliance; secure handling for controlled drugs, airtight security, risk assessment and innovation. Supply chain visibility is also essential for any pharmaceutical supply chain including reverse logistics, as counterfeiting and lost or stolen products continue to be a major concern for this industry. The best practices and benchmarks of medical reverse logistics will continue to develop, especially as community-based programs are created to address the environmental issues and concerns of medication disposal (Tompkins, 2010).

2.7. Challenges of Private Pharmacies

Literatures identified the difficulties of the medicine supply chains of African countries; whereas the main challenges are poor information, communication and consumption data, inadequate storage facilities and a lack of management procedures. The challenges also include selection and quantification of demand, a lack of transparent procurement procedures, inadequate storage facilities and capacity, lack of guidelines for good storage procedures, a lack of appropriate planning, monitoring and evaluation and inadequate budget allocation (Schöpperle, 2013). Private pharmacies may face challenges related to the cost and availability of working capital or credit, and high price. At private retail pharmacies and drug shops in Tanzania, retail prices for most medicines were found to be many times higher than the international reference price and made essential medicines unaffordable to large segments of the Tanzanian population. High price of medicines in the private sector greatly limited the use of appropriate medicines and lead to increased use of substandard and ineffective medicines. A research in Tanzania indicated that retail pharmacies, drug shops and wholesalers do not always stock “essential medicines” but often only stock fast moving medicines. Slow moving medicines incur greater working capital costs than fast moving medicines (Yadav, 2009).

In Mali, Pharmacists claim that the business environment hinders their business. They report that the cost of their business is too high due to high taxes and the annual pharmacy license fees. Pharmacists have problems accessing credit because they claim that the banking system does not understand the pharmaceutical sector. They claim that interest rates are too high (12–15 percent a

year) and banks require substantial guaranties for loans or lines of credit, which are difficult to provide. This is particularly a problem for pharmacists entering the profession (McCabe *et al.*, 2011). In a study conducted in Amhara, Oromia and Addis Ababa, the administrative challenge that pharmacy owners/administrators most commonly reported was difficulty in obtaining continuous supplies, client inability to pay, competition from both public and private pharmacies, and excessive government regulations (Sulzbach *et al.*, 2009). Moreover, Schöpperle (2013) identified main challenges of medical supply chain in sub Saharan Africa as human resource capacity and skills, general management and management of processes, transparency and communication between levels, budget planning, physical capabilities and resources, use of data for management decisions, commitments, motivation and accountability.

Common problems associated with the supply and distribution of pharmaceuticals often include poor supply chain management, stock pilfering, insufficient human resources, and limited financing resulting in chronic stock outs. In resource-poor settings where public services fail to meet demand, the private and voluntary sectors are increasingly being called on, prompting some policy makers to consider private mechanisms as alternatives to state-run drug procurement and distribution systems. It is often assumed that the private sector targets wealthy clients and therefore has higher prices. Evidence however shows that the poor are often the largest consumers of private health services. National household surveys suggest that the poor, for a variety of reasons other than price, (such as perceived quality of care, availability of medicines and health care workers, discrimination, and additional payments) resort to buying medicines for cash from private and informal drug sellers (McCabe *et al.*, 2011).

Chapter 3: Methodology of the study

3.1. Description of the Study area

Addis Ababa is the capital city of Ethiopia and diplomatic capital of African Union. Administratively the city is divided into ten sub-cities and 116 woredas. It has an area of 540 km^2 of which 18.2 km^2 are the rural side of the city (Addis Ababa City Council, 2015). According to Central Statistical Agency's population projection, the population of Addis Ababa is 3.352 million of which 52.6% are females (FMOH, 2016[b]). The urban population is 100% with 2.4% annual growth rate. Administratively, the city is divided into 10 sub cities (Addis Ketema, Akaki, Arada, Bole, Gulele, Lideta, Kirkos, Kolfekaranyo, Nefas Silk/ Laphto and Yeka). As a capital city of Ethiopia, Addis Ababa houses many organizations that have stake with the pharmaceutical logistics including, the Central PFSA (FMHACA, 2013). Most of the importers, wholesalers, and pharmaceutical industries in the country are also found in Addis Ababa. Addis Ababa has a total of 56 hospitals (government and private), more than 825 private health facilities, 98 health centers and more than 720 pharmacy outlets and 17 Kenema pharmacies (AACAHB, 2016).

3.2. Study Design

A comparative cross sectional study involving prospective data collection in selected private pharmacies in Addis Ababa was conducted to describe the outbound logistics of medicines in private pharmacies by answering research questions, i.e. how is availability of essential medicines, inventory and storage management practice? It also intended to evaluate how private pharmacies practice reverse logistics and dispose expired and/or unfit for use medicines. This study was expected to provide a picture of the existing situation by describing the facts and actual circumstances. Descriptive cross-sectional study design was used to describe private pharmacies outbound logistics of medicines. The study area was Addis Ababa City Administration. Quantitative approach was used to answer the research questions. The study participants were from selected independent, chain, hospital and kenema pharmacies. The methods used to collect data were interview and observation using questionnaires and checklists. The variables used to describe the outbound logistics of medicines in private pharmacies are pharmacy category, availability, stockout, inventory management, storage management, reverse logistics and disposal practices. The variable used to evaluate availability is stock available in the pharmacy during visit and in the past three months.

Study Population

The source population for the study was all private pharmacies and Kenema pharmacies having similar structure and was available in the 2006 E.C list of FMHACA. The study population consisted of pharmacies from Independent, Chain, private Hospital and Kenema pharmacies.

Inclusion and Exclusion Criteria

Pharmacy personnel at independent pharmacies, Chain pharmacies, private Hospital pharmacies and Kenema pharmacies across Addis Ababa were enrolled in the study after they consented to participate. Pharmacies in government hospitals, NGO hospitals, Pharmacies under specialized hospitals (MCH, Caridiac,etc) and Red Cross as well as drug stores were excluded from the study. Moreover, these eligible pharmacies that refused for interview and observations or closed for some reason were also excluded.

3.3. Sampling

Sampling Frame: The sampling frame for selecting private pharmacies was the list of private pharmacies in Addis Ababa who renew their licenses in 2006 E.C. obtained from FMHACA which served as a sampling frame for the selection of the private pharmacies.

Sample Size: Probability sampling techniques was used to determine the sample size to maximize validity of the results of the study. The sample size required for the study was determined using OpenEpi software version 3.01 (Dean *et al.,* 2013), the estimation formula for the sample size was as indicated below.

$$\text{Sample size } n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$$

Where,

- *DEFF* = Design effect=2
- *N* = Population size(for finite population correction factor = 270
- *d* = Confidence limits (margin of error) = 10%
- *p* = % frequency of outcome factor in the population (average availability of selected essential medicines) =89%

Considering the total population size (for finite population correction factor) of private pharmacies to be 270, the confidence level will be set to 95%, with margin of error 10% and, assuming that the average availability of selected essential tracer medicines in public health facilities to be 89% (Abiy *et al.*; FMOH, 2015), with the design effect of 2, the sample size required for this assessment was 67. Hence, the calculated sample size of the study with 95% confidence level and 10% variability was 67 private pharmacies which were distributed among the four strata according to their share of private pharmacies proportionally.

Sampling Steps: The total number of private pharmacies was stratified in to four strata; private independent pharmacies, private chain pharmacies, private hospital pharmacies and Kenema pharmacies. A proportionate sampling technique was used to determine the number of private pharmacies from the four strata for the study. The private pharmacies of each group (in each stratum) were listed and their share is determined proportionally and the specific pharmacies from each stratum were selected by lottery method as shown in the sample allocation below (Table 1).

Table 1: Proportionate sample allocation

Stratum	Total size of the stratum	Sample size from the stratum
Independent private pharmacies	221	55
Private Chain Pharmacies	17	4
Private hospital pharmacies	19	5
Kenema pharmacies	13	3
Total private pharmacies	270	67

(Source: Own Survey, 2017)

3.4. Data Collection and Management

Data Collection

Quantitative data was collected using face to face interview and observation from April 17 to April 30/2017. Most questions were reviewed from the DELIVER Logistics Indicators Assessment Tool (LIAT) tool (JSI, 2005) and WHO/HAI methodology (WHO/HAI, 2008; WHO, 2010) tailored specifically to address the private pharmacies in Addis Ababa to assess availability of selected essential medicines, storage condition and inventory management. The data collection instrument was a modified version of the LIAT and WHO/HAI methodology.

Interview: Questionnaire (Appendices 2, 4, 6, 7) with tailored questions was used to interview pharmacy personnel at private pharmacies to describe the inventory management practice, disposal, reverse logistics, and challenges of private pharmacies.

Observation: Customized essential medicine list checklist (Appendix 3) was used to assess availability of essential medicines in private pharmacies. Observation was also conducted to assess the storage conditions of private pharmacies according to the pre-prepared observation checklist (Appendix 5).

Data Collectors

The data was collected by the principal investigator and two pharmacists after they were oriented on the data collection tools and the process of data collection, on how to fill questionnaire and extract the necessary information from private pharmacies after getting consent. Data collectors visited the private pharmacies and record medicine availability and storage condition using observation checklist. Moreover, they also interviewed the pharmacy personnel regarding inventory management, disposal, reverse logistics and the challenges they faced during their day to day pharmacy business.

3.5. Data Quality Assurance

To assure the collection of appropriate data and to maximize quality of collected data, pre-test was conducted in four private pharmacies from each category which were not in the sampling frame and did not form part of the survey sample. This enhances validity and the restructuring of questionnaire to ensure that the required information can be obtained without any ambiguity. Pre-test was also used to revise data collection instrument so they become clearer to respondents. To ensure the efficiency and capability of data collectors to carry out data collection, orientation was given about the purpose of the study and how to administer questionnaire or collect appropriate data. Collected data was also checked for completeness before and during data processing.

3.6. Data Entry and Analysis

Collected data was checked in detail for consistency and completeness, cleaned and coded prior to data entry process. Statistical package for social sciences (SPSS) version 20.0 for windows programs was used for quantitative data entry and analysis. All the data collected were checked for accuracy and completeness prior to entry in to the data base. After the data entry, the data base information was cross-checked with the data collection forms before commencement of analysis. The data was presented in the form of description, tables and graphs. Descriptive statistics including percentage, mean and standard deviation were used to summarize study variables. Analysis Of Variance (ANOVA) test was used to detect statistically significant differences between the four pharmacy categories. ANOVA test was used with a determined level of significance as $P < 0.05$ and 95% confidence interval. Tukey test was also used to identify the actual difference among the pharmacy groups in the study when ANOVA indicated significant differences in the study groups.

3.7. Disseminating Study Findings

The report of this study will be used for partial fulfillment to the degree of masters of Logistics and Supply Management in the Department of Management, School of Commerce, Addis Ababa University. The result of the study will be presented at School of Commerce and shared to FMOH, FMHACA, PFSA, Addis Ababa City Health Bureau, study private pharmacies and their respective Zonal and Sub-City offices. The findings will also be published in different local and international Journals.

3.8. Ethical Considerations

Approval to conduct this study was obtained from Addis Ababa University, School of Commerce after defending the proposal. Discussion was held about the purpose of the study to secure permission from each pharmacy and verbal consent (Appendix 1) was obtained from all the respondents. Before study participants were requested for consent they were informed in detail about the purpose and procedures of the study; the content of the questioner; its benefit; confidentiality of the information collected from them; the voluntary nature of participation and their right not to respond to questions if they do not want to answer as well as to stop answering and withdraw from the interview and observation process at any time. Support letter was also secured from Ethiopian Pharmaceutical Association (EPA) and School of Commerce. Moreover, soft copy of important materials like FMHACA waste disposal guideline, storage guideline and other materials that will help them in their duties were also shared.

Chapter 4: Results and Discussion

4.1. Characteristics of Pharmacies

A total of 67 private pharmacies involving independent (55), chain (4), kenema (3) and hospital (5) pharmacies were included. As indicated in Table 2, most of the pharmacies involved in this study was established after 1987 though the earliest being in 1949. It was also seen that 41.79% of the pharmacies provide compounding service while larger proportion (59.7%) of the pharmacies involved in weight measurement. In addition to dispensing and compounding, most of the pharmacies engaged in cosmetics and nutrition supply (Table 2).

Table 2: Characteristics of Pharmacies

		Independent Pharmacy	Chain Pharmacy	Hospital Pharmacy	Kenema Pharmacy
Establishment year		N=53	N=4	N=4	N=3
	1949-1966	2 (3.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	1967-1986	5 (9.4%)	0 (0.0%)	0 (0.0%)	3 (100%)
	1987-2006	46 (86.8)	4 (100%)	4 (100%)	0 (0.0%)
	Earliest	1949	1989	1992	1972
	Latest	2006	2005	2002	1989
Pharmacy professionals in the pharmacy		N=55	N=4	N=5	N=3
	Mean	4	6	5	11
	Maximum	6	7	10	12
	Minimum	2	5	3	9
Pharmacy Services		N=55	N=4	N=5	N=3
	Compounding	25 (45.5%)	1 (25%)	0 (0.0%)	2 (66.7%)
	Weight measurement	37 (67.3%)	3 (75%)	0 (0.0%)	0 (0.0%)
	BP measurement	25 (45.5%)	4 (100%)	0 (0.0%)	1 (33.3%)
	Cosmetics	54 (98.2%)	4 (100%)	4 (80%)	3 (100%)
	Nutrition	53 (96.4%)	4 (100%)	4 (80%)	3 (100%)

(Source: Own Survey, 2017)

4.2. Characteristics of Respondents

Sixty seven pharmacy personnel from the four groups of pharmacies were included in the interview. The socio-demographic profile of the respondents is displayed in table 3 below. Larger proportions of the respondents were males (70%) with overall mean age of 41.76 (SD± 10.26). Most of them had Bachelor's degree. Their mean year of experience in the pharmacy profession was 16.56 years (SD± 9.87) (Table 3).

Table 3: Characteristics of respondents

		Independent Pharmacy N=55	Chain Pharmacy N=4	Hospital Pharmacy N=5	Kenema Pharmacy N=3	Total
Sex						
	Male	38 (69.1%)	3 (75.0%)	4 (80.0%)	2 (66.7%)	47 (70%)
	Female	17 (30.9%)	1 (25.0%)	1 (20.0%)	1 (33.3%)	20 (30%)
Age range (years)						
	25-34	14 (25.5%)	1 (25.0%)	3 (60.0%)	1 (33.3%)	19 (28.4%)
	35-44	18 (32.7%)	1 (25.0%)	1 (20.0%))	0 (0.0%)	20 (29.9%)
	45-54	14 (25.5%)	2 (50.0%)	1 (20.0%)	2 (66.7%)	19(28.4%)
	55-60	9 (16.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	9 (13.4%)
Age (Mean years)						
		42.3	39.8	35.4	45.3	41.76
Education						
	Diploma	1 (1.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.5%)
	Bachelor's	52 (94.5%)	5 (100%)	5 (100%)	3 (100%)	64 (95.5%)
	Master's	2 (3.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (3%)
Experience in Pharmacy profession overall Mean (years)		17.3	15.0	11.0	14.3	16.56

(Source: Own Survey, 2017)

4.3. Availability of Selected Essential Medicines

In this study an assessment was conducted on outbound logistics of medicines in private pharmacies in Addis Ababa. The most important outcome of a logistics system is stock availability. Stockouts in any health system represent a critical failure of the logistics system. They can result in patients without life-saving medicines and a reduced level of confidence in the health system (McLaughlin *et al*., 2007). In this study data on both stock availability and stockouts on the day of the visit and in the past three months were collected for thirty selected essential medicines in a representative sample of private pharmacies. The 30 essential medicines were selected from the WHO/HAI global core medicines list. The list of the selected essential medicines includes a standard list of 14 WHO core medicines commonly used to treat a range of conditions that cause substantial morbidity and mortality and 16 supplementary medicines of local importance (WHO/HAI, 2008; WHO, 2010; Ewen *et al.,* 2017). The selected essential medicines are also available in the essential medicine list 5th edition (FMHACA, 2015[b]). The WHO/HAI and LIAT were tailored specifically for private pharmacies were used to assess outbound logistics of medicines in private pharmacies (JSI, 2005; WHO/HAI, 2008; WHO, 2010; Ewen *et al.,* 2017, McLaughlin *et al*., 2007). In order to ensure that a representative sample was chosen for the study, a total of 67 private pharmacies were randomly selected across Addis Ababa.

Table 4: Comparison on availability of essential medicines

Availability during visit					Availability in the past three months				
	N	Mean	Std. Deviation	P-value		N	Mean	Std. Deviation	P-value
Independent	55	82.36	4.74	0.003	Independent	55	84.97	4.96	0.002
Chain	4	83.33	2.72		Chain	4	91.00	6.38	
Hospital	5	90.66	3.65		Hospital	5	92.00	5.57	
Kenema	3	85.55	5.09		Kenema	3	90.00	0.00	
Total	67	83.18	5.034		Total	67	86.11	5.49	

(Source: Own Survey, 2017)

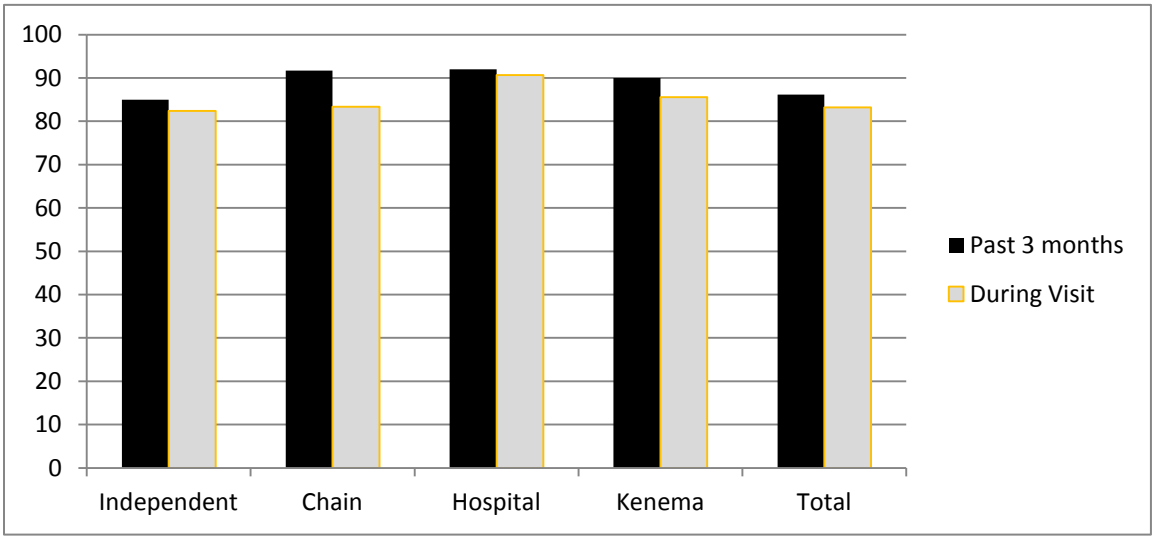
The overall availability of selected essential medicines during visit at private pharmacies was 83.18% (SD±5.04). As indicated in table 4, the mean availability at Hospital, Kenema, Independent and Chain pharmacies was 90.66% (SD± 3.65), 85. 55 (SD± 5.09), 82.36% (SD±4.74), and 83.33%

(SD±2.72) respectively. ANOVA indicated that there was a significant difference among the pharmacy groups (P=0.003); and compared to other pharmacy groups, hospitals had better availability (90.66% (SD±3.65) of medicines during visit, Post hoc analysis using, Tukey test showed that the actual difference was between Independent and Hospital pharmacies (p=0.002).

As reported by private pharmacies, the mean availability of selected essential medicines in the past three months was 86.12% (SD± 5.49) (Table 4). There was statistically significant difference between the pharmacy groups with respect to mean availability of selected medicines in the past three months (P=0.002). Higher availability of medicines was reported by Hospitals, 92% (SD=±5.57) followed by Chain, 91.67%. The availability at Kenema and Independent pharmacies was 90% and 84.96% respectively. Though the ANOVA test indicated that there was a statistically significant difference among the pharmacy groups, post hoc analysis (Tukey test) showed that the actual difference was between Independent and Hospital pharmacies (p=0.019).

As indicated in the below figure 1 availability of selected essential medicines was decreased during visit compared to the past three months particularly for Chain and Kenema pharmacies.

Fig 1: Comparison of availability of selected essential medicines



(Source: Own Survey, 2017)

This study found out that the overall availability of selected essential medicines during visit at private pharmacies in Addis Ababa was 83.18%. Elamin *et al* (2010) has reported higher average availability of selected essential medicines at private pharmacies in Sudan, 93.9% (overall) and 95.8% (in the capital Khartoum). Considering the WHO's voluntary target of 80%, the average availability in our private setups is acceptable, though the figure is lower than the ideal value of 100 % (Cameron *et al.*, 2011, Bazargani *et al.*, 2014; Ewen *et al.*, 2017).

However, the findings of this study is higher compared to the report by Kasahara (2015), which was 64% availability at private pharmacies in Afghanistan for 30 sampled essential medicines. Moreover, based on the data obtained from national and provincial facility-based surveys undertaken in 23 countries using the WHO/HAI methodology, Bazargani *et al* (2014) has reported that the median availability of essential medicines was 78.1% in the private sector which ranged from 68·8% to 86·7% across all regions in the study including Africa. Moreover, in secondary analysis of data from 30 surveys in low- and middle-income countries, conducted from 2008-2015 using the WHO/HAI methodology, the median availability of any product type across all medicines in private sector was 66.7% in low-income countries, 68.6% in lower-middle income countries and 90.0% in upper-middle income countries (Ewen *et al.*, 2017). An analysis of findings from price and availability surveys conducted in 36 developing and middle-income countries in 2009 found the average availability of generic medicines was 64 % in the private sector (Cameron *et al.*, 2009).

This study found out statistically significant difference in average availability of selected essential medicines ($p < 0.05$) among the private pharmacy groups in Addis Ababa at the time of visit and in the past three months. In both occasions, Hospital pharmacies had better availability of medicines, 90.1% (± 3.65)) (during visit), and 92.0% (± 5.57) (in the past three months) compared to other pharmacy groups. This study also found out that Chain pharmacies had better availability of medicines compared to the independent pharmacies. In agreement with our finding, Sharma *et al* (2016) and Alsuwaidi *et al* (2015) reported higher availability at Chain Pharmacies than independent pharmacies. However, findings by Kotwani (2013) revealed that availability of medicines were similar at independent pharmacies and chain pharmacies.

Stockout of selected essential medicines

One of the problems in the entire supply chain management of pharmaceuticals is shortage/stock-out of essential medicines. Stock-outs demonstrate one outcome of a poorly functioning logistics system (McLaughlin *et al*., 2007). In the present study, stock-out was calculated by asking the respondents which medicines were not available or stocked out during visit and in the past three months. A medicine was considered in stock if it was available in generic or branded form.

The mean percent stockout of selected essential medicines during visit at private pharmacies was 16.8% (SD±5.04). Higher stockout was noted at Independent pharmacies, 17.6% (SD±4.74) followed by Chain and Kenema pharmacies with stockout rate of 16.7% and 14.4%, respectively. ANOVA sowed that there was a statistically significant difference in the mean medicine stockout among the pharmacy groups (P = 0.003) with stronger difference was between Independent and Hospital pharmacies (p=0.002) as per the Tukey test (Table 5).

The overall mean value of stock-out for the past three months in private pharmacies for selected essential medicines was 19.65% (SD± 7.09). The mean stock-out value for Independent pharmacies was 20.61% (SD± 6.92) and this was statistically significantly higher compared to other groups (P = 0.009). Hospitals had the lowest stockout with mean value 12.0% (SD± 7.67). Although there was a statistically significant difference among the pharmacy groups, post hoc analysis revealed that the stronger difference was between Independent and Hospital pharmacies (P=0.042) (Table 5).

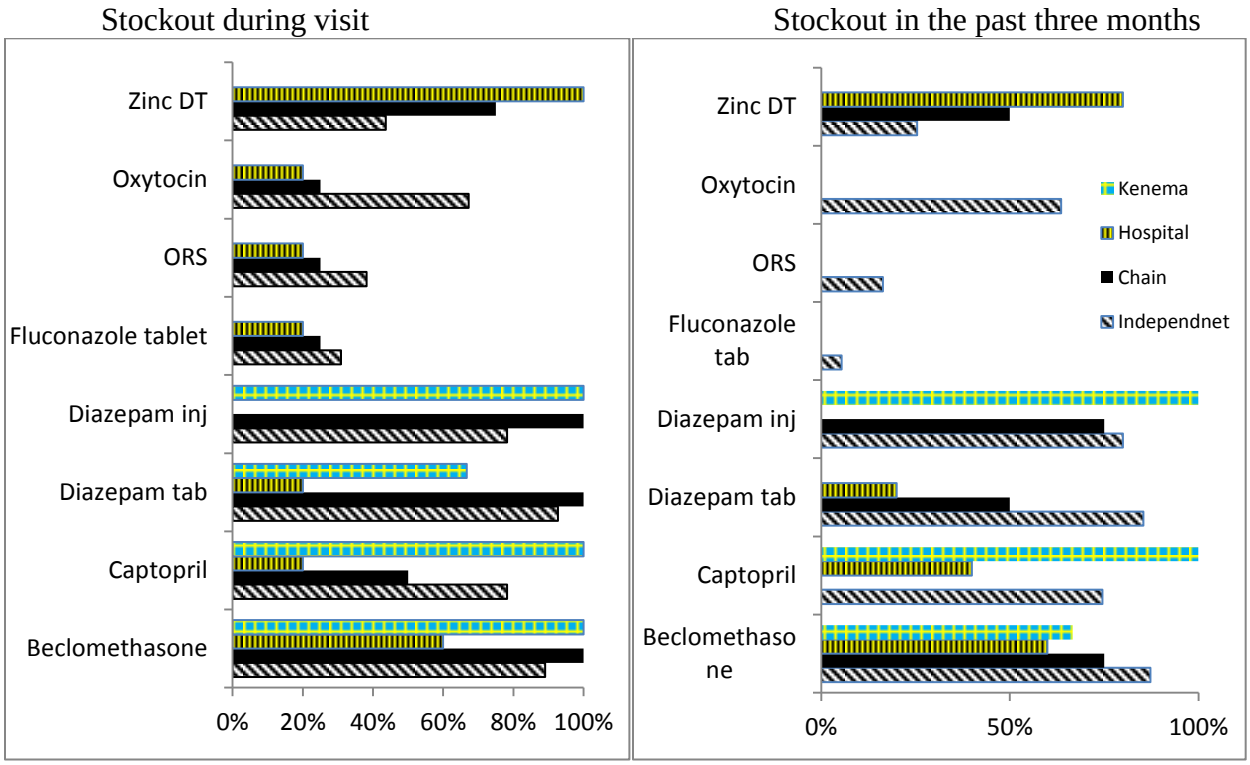
Table 5: Comparison on stock out of essential medicines

Stockout during visit					Stockout in the past three months				
	N	Mean	Std. Deviation	p-value		N	Mean	Std. Deviation	p-value
Independent	55	17.63	4.74	0.003	Independent	55	20.61	6.91	0.009
Chain	4	16.67	2.72		Chain	4	19.17	3.19	
Hospital	5	9.33	3.65		Hospital	5	12.00	7.67	
Kenema	3	14.44	5.09		Kenema	3	15.56	5.09	
Total	67	16.81	5.04		Total	67	19.65	7.09	

(Source: Own Survey, 2017)

As can be seen in the figure below, there was no Zinc Dispersible Tablet (DT) at all hospitals and most of the Chain pharmacies and also significant number of Independent pharmacies at the time of visit. There was also high stock-out of diazepam at Independent, Chain and Kenema pharmacies compared to most Hospital pharmacies with no stockout report. All Kenema pharmacies and most of the Independent pharmacies had no Captopril and Beclomethasone during visit.

Fig 2. Stockout of selected essential medicines



(Source: Own Survey, 2017)

Figure 2 above depicts the comparison of stockout of selected medicines during the current visit as compared to the past three months. As can be seen, the stockout of medicines at the time of visit was higher when it is compared to the past three months. Stockout was particularly higher for such products including Zinc DT, ORS, Oxytocin and Fluconazole. On the other hand, in the past three months, only Independent pharmacies reported stockout of Oxytocin, ORS and Fluconazole. However, during the current visit, stockout was reported in all pharmacy groups except Kenema pharmacy.

It was found that 19.65% of the private pharmacies had stock-out in the past three months and the highest stock-out was reported by independent pharmacies with 20.61%. Moreover, the average stock-out during the current visit was 16.82% with higher (17.64%) stock out recorded for independent pharmacies followed by chain pharmacies. This study identified that there was stockout of ORS and Zn DT despite the presence of Acute Watery Diarrhea (ATET) which will be a challenge in its management. There was high stock-out of Zinc DT at independent and Chain pharmacies compared to ORS. On the other hand, there was no stock-out of ORS at Kenema pharmacies. Moreover, there was no stockout of Zinc DT at Kenema pharmacies compared to hospital pharmacies with100% stockout for Zinc. Both ORS and Zinc are jointly indicated in the management of acute diarrhea. Hence co-packing the products may result in improved uptake of commodities, improved treatment adherence, and potential for promotion of a "treatment kit" in the private sector. In order to ensure both products are available and the recommended dosage is adhered, co-packing options is recommended.

This study revealed that Beclomethasone inhaler was rarely available in the private pharmacies of Addis Ababa with 11.9% overall mean availability during visit with 10.9% at independent and 40% in private hospital pharmacies. On the other hand, it was not available at all in Chain and Kenema pharmacies. Beclomethasone inhaler, required for management of persistent bronchial asthma had also poor availability in the private sector in Bangladesh (55%), Malawi (38%) and Nepal (16%) (Mendis *et al.*, 2007). Kotwani (2009) has also reported poor availability of Beclomethasone (10-65%) in India. However, good availability of Beclomethasone was reported in Pakistan (82%) and in Sirilanka (98%) (Mendis *et al.*, 2007).

Moreover, in the present study low level of availability (26.9%) of Captopril was documented during visit in private pharmacies of Addis Ababa. This finding is in agreement with the study conducted in Nepal and India where the availability of Captopril 25 mg cap/tab was reported to be (5%) and 10%, respectively (Mendis *et al.*, 2007; Kotwani, 2013). However, better availability of Captopril was observed in Bangladesh (75%), in Brazil (100%), in Malawi (63%), in Pakistan (100%) and in Sirilanka (98%) (Mendis *et al.*, 2007).

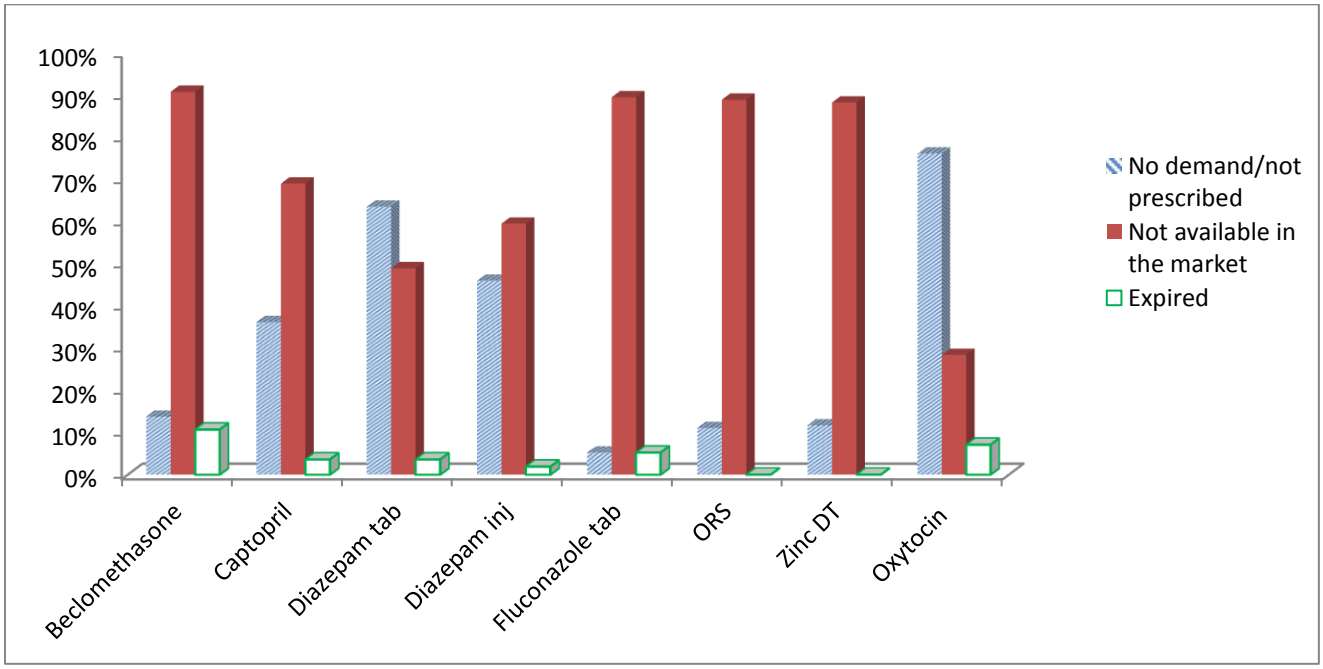
As identified by Birabwa *et al* (2014), the availability of Metformin and Oxytocin at private pharmacies in Uganda was 93% and 45%, respectively. However, the present study obtained higher percentage availability for Metformin (98%) and relatively low overall availability for Oxytocin

(41.8%) and 32.7% Oxytocin availability at independent pharmacies since most of them did not stock Oxytocin during visit. Moreover, the IPLS survey indicated that the overall availability of Oxytocin at public health facilities was 94% (97% at public hospitals, 93% at health centers) which is higher than the findings of the present study at private pharmacies (Abyi *et al.*, 2015).

Reasons for selected essential medicines with high stockout

As shown in figure 3, the most common reason for stockout of Beclomethasone, Captopril, Fluconazole, ORS and Zinc DT was related to unavailability in the market. However, Oxytocin stock out was caused by factors more related to no demand. For Diazepam, both non-availability and no demand were contributing for stockout as reported by private pharmacies.

Fig 3. Reasons for stock out of medicines with high stockout



(Source: Own Survey, 2017)

The common reason for stock-out of Beclomethasone, Captopril, Fluconazloe, ORS and Zinc DT was related to non-availability in the market. However, Oxytocin stock out was caused by factors related to no demand. For Diazepam, both non-availability and no demand were contributing for stock-out as reported by private pharmacies. A study from Tanzania mentioned lack of funds, out of stock at supplier, and changing treatment guidelines, medicines not commonly used was mentioned

as reasons (factor contributing) for stock out of medicines. Lack of funds to procure the medicines was one of the major factors contributing to stock outs (Kagashe & Massawe, 2012).

Mendis *et al* (2007) indicated that in Malawi and Sri Lanka, the availability of locally manufactured medicines was generally better than medicines that were not produced domestically, indicating the potentially important role local manufacturing may have in increasing the supply of medicines (Mendis *et al.,* 2007). However, the availability of ORS (65.6%) and Zinc (52.2%) in this study which are produced locally were low which may reflect the importance of foreign currency for raw material. Stock-outs due to foreign currency shortage is possible explanation as per the respondents; however, the specific causes of poor availability require further investigation (Mendis *et al.,* 2007).

4.4. Inventory Management

This study also assessed the inventory management practice of private pharmacies in Addis Ababa. The supply of medicines needs to be managed efficiently in order to prevent all types of wastage including overstocking, pilferage and expiry (Kagashe & Massawe, 2012). Unavailability of a product when needed may cause the pharmacy to lose a customer and may adversely affect patient's wellbeing especially when the product is an essential lifesaving one (Ali, 2011).

As indicated in table 6, all pharmacies under Chain, Hospital and Kenema as well as 60% (33) of the independent pharmacies had inventory management system in place. In few of the pharmacies the system was automated for the purpose of dispensing, storage and/or expiry tracking. Fifty eight percent (32) of the independent and all private pharmacies under other groups utilize either bin card or stock card for their stock management.

As shown below in table 6, majority of the pharmacies (86.6%) across the group mentioned maintenance of supply as a reason to keep inventory followed by seasonal supply (67.2%). Moreover, pharmacies keep inventory to complement prescriptions and as a generic substitute. However, purchase economies were mentioned by small percentage of the two pharmacy groups (9 independent and 1 hospital) while most of the chain and Kenema pharmacies mentioned purchase economies as a reason to keep inventory.

All the private pharmacies responded that prescription pattern (100%) was the major factor in determining level of inventory (how much to stock) followed by customer demand (73.1%), expiration date (53.7%), and seasonality or seasonal demand (53.7%). However, lifesaving potential was considered as an important factor by Hospitals (100%) compared to others (Table 6).

Table 6: Inventory management

	Independent N=55		**Chain** N=4		**Hospital** N=5		**Kenema** N=3	
Inventory Management in place	33	60%	4	100%	5	100%	3	100%
The LMIS system automated	N=33							
	15	45%	3	75%	4	80%	1	33%
LMIS tools availability								
Bin card or stock card	32	58%	4	100%	5	100%	3	100%
Daily Register	15	27%	3	75%	5	100%	2	67%
Expiry/defective format	20	36%	3	75%	2	40%	3	100%
Reasons to keep inventory								
Supply Maintenance	46	84%	4	100%	5	100%	3	100%
Seasonal supply	34	62%	4	100%	4	80%	3	100%
Complementarity	35	64%	3	75%	2	40%	2	67%
Speculative purchase	32	58%	4	100%	3	60%	2	67%
Substitute supply	29	53%	4	100%	4	80%	3	100%
Safety stock	34	62%	2	50%	1	20%	3	100%
Purchase economies	9	16%	4	100%	1	20%	2	67%
Transportation savings	1	2%	1	25%	0	0%	2	67%
Determining level of inventory (how much to stock?)								
Prescription pattern	55	100%	4	100%	5	100%	3	100%
Customer demand	41	75%	4	100%	2	40%	2	67%
Expiration date	34	62%	4	100%	4	80%	1	33%
Seasonality	26	47%	4	100%	3	60%	3	100%
Customer type	20	36%	2	50%	3	60%	1	33%
Lifesaving potential	15	27%	2	50%	5	100%	1	33%
Storage requirement	5	9%	1	25%	0	0%	1	33%

(Source: Own Survey, 2017)

In the present study, it was found out that 67.16% (45) private pharmacies had claimed inventory management system in place. Having inventory management in place is very important for private pharmacies since managing inventory control can directly affect business performance. The reason for having inventories or stocks is to buffer against demand and supply. Having too much inventory on hand means high holding cost, and having too little leads to a rise in ordering cost. Therefore, inventory management should be in place in order to achieve the lowest possible total cost since the goals for controlling inventory are minimizing the total cost and maximizing service level by balancing demand and supply (Sarpong, 2012).

Logistics records serve as the backbone of every logistics system. They are designed to capture critical logistics data at each level of the health system which are crucial decision making about resupply quantities, forecasting and procurement. The stock card, the most fundamental of all logistics records, captures essential inventory data such as stock balance, receipts, issues/consumption, and losses/adjustments. Inventory information kept on the stock cards/bin cards allows facilities themselves to make informed decisions about what and how much to order each time (McLaughlin *et al*., 2007; Abyi *et al.,* 2015). In our study, 65.67% (44) of the private pharmacies have been found to use bin card or stock card for their stock management, on which they record quantity received, stock on hand and quantities issued or dispensed. Inventory information kept on the stock cards/bin cards allows facilities themselves to make informed decisions about what and how much to order each time (Abyi *et al.,* 2015).

All hospitals, Chain and Kenema pharmacies as well as 58% (32) of the independent pharmacies were using bin cards or stock cards. This result is higher compared to the findings of two previous studies conducted in Addis Ababa, where 50% public hospitals and 54% of health centers (PFSA, 2010) and 33.5% public hospitals and 76.5% health centers in Addis Ababa reported utilization of bin cards (Tilahun *et al.,* 2016). However, Elamin *et al* (2010) reported in their study that there were no data or records available about inventory control at pharmacy level in both public and private sectors in Sudan (Elamin *et al*., 2010).

It was also found that 34.33% (23) private pharmacies had automated inventory system for the purpose of dispensing, storage and/or expiry tracking indicating that large proportion of the pharmacies manages their inventory data manually. Previous studies have reported similar findings

(Monton *et al.,* 2014; Manivel & Ranganathan, 2016). It was indicated that large proportion of pharmacies follow manual records as their inventory records and only very few private pharmacies stated that they maintain inventory with the help of software. Herist *et al* (2011) and Sarpong (2012) reported that some private hospitals in Ghana had also computerized their inventory systems, while majority had not. Although setting up automated system may require extra finance, its advantages outweigh its cost. Using computer in keeping records instead of manual methods can help in improving inventory management (Kagashe & Massawe, 2012) because it can decrease workload, personnel time, and administrative budget, made inventory functions faster and easier. Automated inventory control could also provide identification of inventory and track transactions in real time as they occur in pharmacies (Herist *et al.,* 2011) In this regards, there appears that private pharmacies in Ethiopia and other set ups in Africa are lagging much behind in terms of automating their inventory management.

This study also revealed that the reasons to keep inventory in private pharmacies in Addis Ababa include maintenance of supply 86.57% (58), seasonal supply 67.16% (45) and/or to complement prescriptions 62.67% (42) so that not to lose sells by not having one of the prescribed medicines. Pharmacies also keep inventory as a generic substitute (40%) in case the patient is unable to afford or get the expensive brand or to give choice to their patients. It is important for private pharmacies to ensure enough inventory on hand and hence ensure patients' needs are met (Herist *et al.,* 2011). Protection from uncertainties is also another reason for holding inventory. Having stock on hand can reduce risk of shortage or stock out situation which might lead to lost sales and lack of reliability and customer can possibly buy products from competitors instead. Balancing supply and demand is another important reason for having inventory (Sarpong, 2012).

This study also found out that that 67.16% (mentioned above) (45) of private pharmacies mentioned seasonal supply as one of the reason to keep inventory. This is considered good approach because, if supply is seasonal, inventory can help meet demand when materials or products are not available. Vice versa, if there is an occurrence of seasonal demand, firms must accumulate inventory in advance to meet demand in the future (Sarpong, 2012). In managing inventory, monitoring the adequacy of inventory levels and balancing this with expected demand is required. This is especially important for products or services that fluctuate seasonally such as for influenza (Herist *et al.,* 2011).

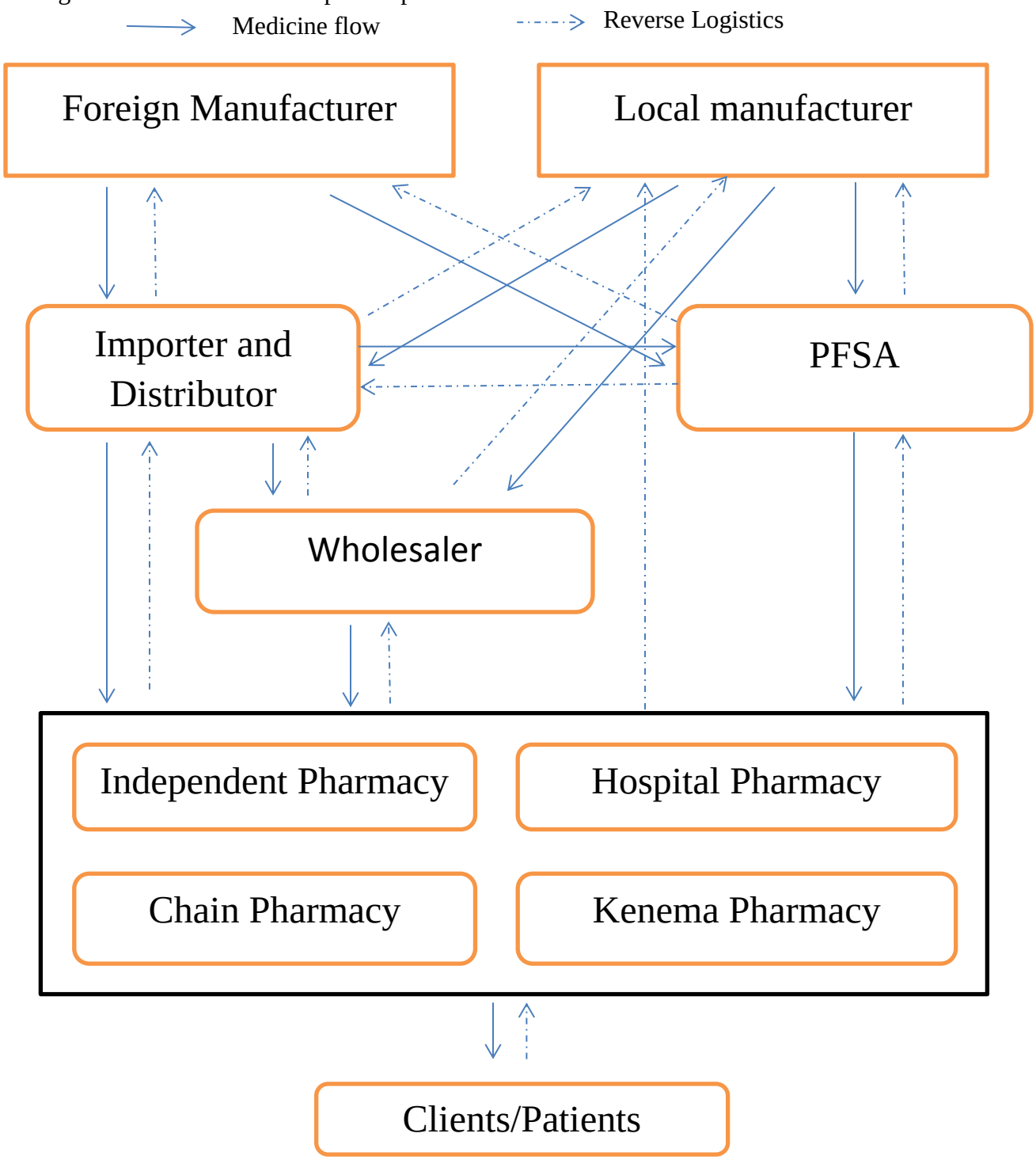
The respondents from chain pharmacies consider purchase economies as one of the reason to keep inventory in contrast to the 16% of the independent pharmacies. This could be evident from their nature of acting as chain in purchasing for all the branch pharmacies under the chain. Economies of scale can be obtained by purchasing large volumes which allows cost reduction of per unit fixed cost (Sarpong, 2012). Moreover, respondents from the independent group described the competition with other pharmacies particularly those which are affiliated with chain pharmacies are able to get medicines on a much cheaper price as compared to the independent pharmacies because of bulk purchase. Therefore, such chain pharmacies sell medicines to their customer at lower prices hence attracting more customers and taking away the business from the independent pharmacies. Other studies also supported such claim as reported by Hassali (2014).

Moreover, 59.75% (40) of the private pharmacies mentioned safety stock as a reason to keep inventory. Not having a medication in stock, in any pharmacy arena, has expensive costs associated with it. These costs are the final basic inventory cost, stock-out costs. Stock outs may be avoided by maintaining a safety stock, or minimum amount to always be on hand. It is determined in relation to expected usage as well as any delivery lead times. Although there are carrying costs associated with safety stock, the potential cost of damaging customer relations and future business usually exceeds them and justifies having a cushion of safety stock (Herist *et al.*, 2011).

This study also revealed that prescription pattern is the major factor in determining level of inventory (how much to stock) followed by customer demand (73.1%), expiration date (53.7%), and seasonality or seasonal demand (53.7%). However, lifesaving potential is considered as an important factor by Hospitals (100%) compared to others. Customer type is mainly associated with the type of hospitals or their service. All the respondents in private pharmacies (100%) in this study mentioned prescription pattern as a factor in determining the level of inventory of medicines. This is in line with the report by Sarpong (2012) who indicated that Physicians' Prescription protocols are important in the determination of the drug to purchase or in determining what to order from Suppliers. Meeme *et al* (2015) had also indicated that on determining the quantity of drugs to be ordered, majority of respondents in their study indicated that past Consumption 33(61.1%) was the main criteria used, request from users 12 (22.2%) and availability of funds 9 (16.7%) were other ways of determining quantity of drugs needed in facility.

The relationship between private pharmacies and their suppliers is shown in figure 4 and table 7 below. Figure 4 depicted the flow of medicines in private pharmacies

Fig 4: Flow of medicines in private pharmacies



(Source: Own Survey, 2017)

The direct suppliers of medicines to private pharmacies include wholesalers, importers and distributors, as well as PFSA. Local manufacturer's deliver their product through distributors, wholesalers and/or PFSA while foreign manufacturers avail their product to private pharmacies through importers and distributors directly or via wholesaler or PFSA. As per the respondents the backward flow of medicines or reverse logistics mainly works for products that have quality defect and sometimes damage identified during receiving. The reverse logistics will be dealt in section 4.6. on Disposal of Medicines and Reverse Logistics.

The sources of procurement for chain, hospital and Kenema pharmacies (100%) as well as majority of independent pharmacies (74.5%) include importers, Wholesalers and PFSA. However, 14 (25.5%) independent pharmacies procure from importers and wholesalers only excluding PFSA. All of the Pharmacies across the group reported that the suppliers except PFSA are responsible for transporting medicines to their pharmacy. Moreover, most of the respondents mentioned that their suppliers are engaged in promotion to prescribers and provision of trainings (Table 7).

The inventory control system used by all the pharmacies in this study was pull system, though there are conditional pushes from their suppliers including PFSA. All the independent and Kenema pharmacies and 3 Chain and 4 Hospital pharmacies reported conditional push by their suppliers. All of the pharmacies also reported that they are performing physical inventory.

In this study, Chain pharmacies have reported the least average lead time of 1.38 days (minimum=1 and maximum=2 days) followed by Hospitals (1.75 days with min=1 and max=2). While, independent pharmacies had a mean of 2.74 days (with Min=0.5 and Max=10) and Kenema pharmacies reported 4.33 days (with Min=1 and max=7). The major factors that affect delivery lead time reported in this study was shortage of the product at the supplier as mentioned by all groups of pharmacies (77.6%) while followed by demand for the product in the market (55.2%). Moreover, chain pharmacies delivery lead time is highly affected by order quantity (100%) followed by hospitals (60%). However, transportation seems not to affect much in private pharmacy delivery lead time (Table 7).

Table 7: Relationship with suppliers

	Independent		Chain		Hospital		Kenema	
	N=55		N=4		N=5		N=3	
Sources of procurement								
Wholesaler only	0	0%	0	0%	0	0%	0	0%
Importer and wholesaler	14	25%	0	0%	1	20%	0	0%
Importer, wholesaler & PFSA	41	75%	4	100%	4	80%	3	100%
Post transaction service provided by supplier								
Training	23	42%	4	100%	4	80%	2	67%
Promotion to prescribers	17	31%	2	50%	4	80%	3	100%
Inventory control system								
Pull	55	100%	4	100%	5	100%	3	100%
Conditional push by supplier	55	100%	3	75%	4	80%	3	100%
Perform physical inventory	55	100%	4	100%	5	100%	3	100%
Transport responsibility is for the Supplier except PFSA	55	100%	4	100%	5	100%	3	100%
Lead time (average days)	2.74		1.38		1.75		4.33	
Factors that affect delivery lead time								
Shortage at suppliers	40	73%	4	100%	5	100%	3	100%
Demand for the product in the Market	28	51%	4	100%	3	60%	2	67%
Concentration of pharmacies in the Area	17	31%	3	75%	2	40%	2	67%
Order Quantity	15	27%	4	100%	3	60%	1	33%
Transportation availability	16	29%	0	0%	0	0%	0	0%

(Source: Own Survey, 2017)

The sources of procurement for all chain, hospital and Kenema pharmacies as well as 74.5% of independent pharmacies include importers, Wholesalers and PFSA. However, the supply from PFSA is not frequent and private pharmacies are not happy in both time and full requirement. Moreover, 14 (25.5%) independent pharmacies procure from importers and wholesalers excluding PFSA. All of the Pharmacies across the group reported that the suppliers except PFSA are responsible for transporting medicines to their pharmacy. This will reduce burden on the side of the private pharmacies in arranging transport and important for their success in availing medicines to their customers since fundamental to the success of a health logistics system is the ability to reliably move commodities through the supply chain so they are available for use for patients at facilities when needed (McLaughlin *et al.*, 2007). Moreover, this study identified that suppliers of private

pharmacies in Addis Ababa are engaged in promotion to prescribers and provision of trainings to both prescribers and dispensers in order to boost the sale of their product.

The inventory control system usually used by all the pharmacies is pull system though there are conditional push form their suppliers including PFSA. All the independent and Kenema pharmacies and 3 Chain and 4 Hospital pharmacies reported conditional push by their suppliers which will lead to accumulation of unwanted items that lead to expiry. However, the pull system they implement, which is used in response to confirmed orders, is important since communication carried out in pull system is usually interactive and based on both parties demand (Sarpong , 2012).

Moreover, all of the pharmacies across the group also reported that they are performing physical inventory. This could enable the private pharmacies to compare the quantities of products in their document against with what is actually on their shelves. By virtue of this approach, potential variances owing to fluctuations in supply and demand could be identified and corrected, and the accuracy of pharmacy's financial records could be evaluated and verified (Ali, 2011).

Lead time analysis showed that Chain pharmacies had a mean lead time of 1.38 days followed by Hospitals (1.75 days). While independent pharmacies had a mean lead time of 2.74 days and Kenema pharmacies had mean 4.33 days. The short mean lead time (1.38 days) observed in Chain and Hospital pharmacies could be due to the fact that chain and hospital pharmacies can follow medicines requests easily and also in good purchase quantity; for independent pharmacies supplier may require to coordinate their supply to all the pharmacies in the same route since their requirement is small. Kenema pharmacies, since they are under Addis Ababa City Administration Health Bureau, may face some bureaucratic challenges to process such issues.

This study identified the factors that affect delivery lead time for most of the private pharmacies including shortage of the product at the supplier and demand for the product in the market. Chain and Kenema pharmacies delivery lead time was reported to be highly affected by order quantity. However, transportation seems not to affect much in all pharmacy groups delivery lead time since the responsibility, except for PFSA, of the transportation is for the supplier.

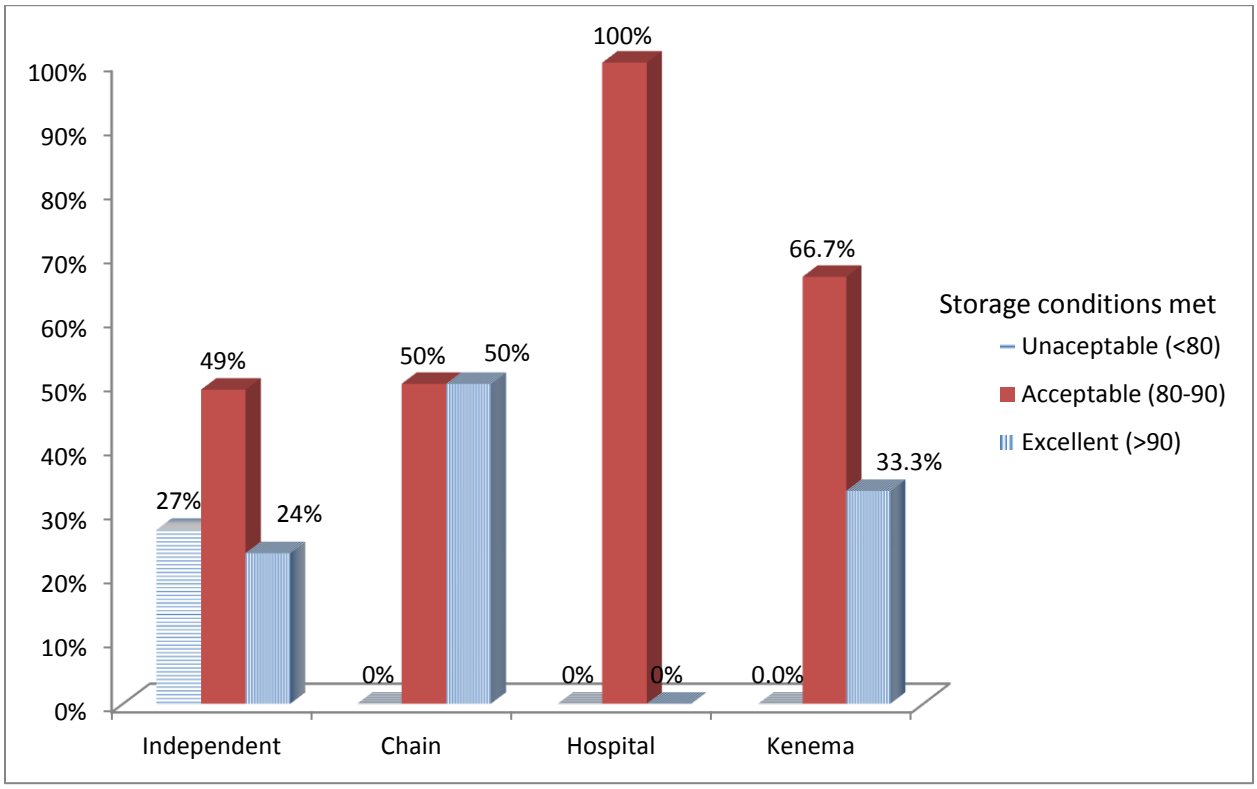
4.5. Storage Condition of Private Pharmacies

Storage conditions could affect the quality of the pharmaceuticals being stored. Proper storage procedures help to ensure that storage facilities maintain the shelf life of products, that only high-quality products are issued, and that there is little or no waste due to damaged or expired products (PFSA, 2015). To provide clients with high-quality products, each facility must have safe, protected and well organized storage areas to help prevent damage and ensure efficient handling of products (Abyi *et al.,* 2015; McLaughlin *et al*., 2007).

In assessing storage areas, this study utilized criteria which were modified from the universally-recognized guidelines for proper storage (McLaughlin *et al*., 2007). However, one of the criteria, availability of storage guideline, was excluded from the calculation of percentage adherence to storage conditions. This was because it is not common and not a requirement by FMHACA among private pharmacies, though its benefit cannot be undermined. Moreover, six independent pharmacies reported that they were not handling Narcotic and Psychotropic medicines at all and this was considered during calculation. Data collectors observed the adherence of each pharmacy to each storage conditions in the prepared checklist. To avoid potential refusal for the observation of pharmacy store as per the understanding from the pretest, store observation request was presented and observation was conducted at the end of other questions of the study.

As can be seen from figure 5, all pharmacies under Chain, Hospital, Kenema and 73% (40) of the independent pharmacies had at least an acceptable level of storage condition as evaluated by data collectors.

Fig 5: Acceptability of storage conditions



(Source: Own Survey, 2017)

When observing storage conditions of private pharmacies, this study found out that, for larger proportion (77.61%) of the private pharmacies, the storage conditions were at acceptable level (score ≥ 80), based on storage condition criteria. While the storage condition of 27% of the independent pharmacies were observed to be unacceptable (scored <80%) and their storage practice was inadequate. This study revealed that all pharmacies under Chain, hospital and Kenema pharmacies had at least an acceptable level of storage condition as evaluated by data collectors. The findings of this study is comparable to the results of the IPLS survey at public health facilities in Ethiopia in which more than half of the assessed facilities (55%) met at least 80 percent of the storage criteria; with health center, hospitals and health posts satisfied 63%, 43% and 29%, respectively, of the acceptable storage conditions (Abyi *et al.*, 2015). According to Tilahun *et al* (2016) large proportion of the health centers in Addis Ababa met most of the standard storage criteria.

As shown in the table below, most of the private pharmacies in each group fulfill the storage condition criteria as observed by data collectors. However, large proportion of the pharmacies in each group were not monitoring and regularly recording their store room temperature. Moreover, only few pharmacies have written medicine storage and handling guideline (Table 8).

Table 8: Storage conditions met by Pharmacy groups

Storage conditions criteria		Independent		Chain		Hospital		Kenema	
Store room is dry, clean and in good condition	Yes	52	94.5%	4	100.0%	5	100.0%	3	100.0%
Store has sufficient light and well ventilated	Yes	48	87.3%	4	100.0%	5	100.0%	2	66.7%
Commodities are protected from direct sunlight	Yes	55	100.0%	4	100.0%	5	100.0%	3	100.0%
Commodities are arranged in some order	Yes	47	85.5%	4	100.0%	5	100.0%	2	66.7%
FEFO is implemented	Yes	51	92.7%	3	75.0%	5	100.0%	2	66.7%
All commodities are placed on the shelf /pallet	Yes	43	78.2%	4	100.0%	3	60.0%	2	66.7%
Medicines are protected from water and humidity	Yes	49	89.1%	4	100.0%	4	80.0%	3	100.0%
Expired/damaged/ quality defected items are separated from usable products	Yes	47	85.5%	4	100.0%	5	100.0%	3	100.0%
There is a room thermometer in the store	Yes	52	94.5%	4	100.0%	4	80.0%	3	100.0%
Store room temperature is monitored and recorded regularly	Yes	15	27.3%	0	0.0%	0	0.0%	1	33.3%
There is refrigerator in the pharmacy	Yes	54	98.2%	4	100.0%	5	100.0%	3	100.0%
There is thermometer in the refrigerator	Yes	54	98.2%	4	100.0%	5	100.0%	3	100.0%
The thermometer in the refrigerator is monitored and recorded regularly	Yes	41	74.5%	3	75.0%	4	80.0%	3	100.0%
Narcotic and Psychotropic medicines kept locked in a cabinet	Yes	48	87.3%	4	100.0%	5	100.0%	3	100.0%
NPS not available	Yes	6	10.9%	0	0.0%	0	0.0%	0	0.0%
Storage area is visually free from insects/pests and rodents	Yes	51	92.7%	4	100.0%	5	100.0%	3	100.0%
Fire extinguisher available and accessible	Yes	37	67.3%	4	100.0%	4	80.0%	3	100.0%
Has sufficient space for all commodities	Yes	44	80.0%	4	100.0%	5	100.0%	2	66.7%
Has written medicine storage and handling guideline	Yes	7	12.7%	0	0.0%	2	40.0%	0	0.0%
Storage area is secured with a lock and key; access is limited to authorized personnel	Yes	41	74.5%	4	100.0%	5	100.0%	3	100.0%

(Source: Own Survey, 2017)

Storage conditions for medicines are very critical since some products are heat sensitive and can deteriorate very fast under a slight change of temperature. According to PFSA recommendation, temperatures in the storeroom should not exceed 25^0C (PFSA, 2015). So it is important to maintain the temperature at the required level (Kagashe & Massawe, 2012). For the best quality and efficacy of drug during storage period, the temperature control and temperature monitoring equipment are very necessary (Monton *et al.,* 2014). Extreme heat and exposure to direct sunlight can degrade drugs and other pharmaceuticals and dramatically shorten shelf life.

All the pharmacies in this study protected medicines from direct sunlight. Most of the pharmacies, except three independent and one hospital pharmacies, had room thermometer in their store; however, the store room temperature was monitored and recorded only in few independent pharmacies and one Kenema pharmacy. Both Hospital and Chain pharmacies in this study had no practice of monitoring and recording room temperature. Many drugs require storage below 25^oC. Moreover, cold storage or refrigeration (2 to 8^0C) is essential for maintaining the shelf life of certain pharmaceuticals that require it (PFSA, 2015). These items are irrevocably damaged if the cold chain is broken. Oxytocin is one of the medicines that requires cold storage and only available as an injectable and therefore requires specific storage conditions. This study revealed that all pharmacies except one independent pharmacy had refrigerator in their pharmacy and majority have monitored and recorded refrigerator temperature regularly compared to room temperature. However, In Afghanistan, approximately 85% (n=748) did not have a working refrigerator, although 65% (n=488) sold medicines needed refrigeration (Kasahara, 2015).

Water can destroy both supplies and their packaging. If the packaging is damaged, the product is still unacceptable to the patient even when the pharmaceutical is not damaged. Some products like Fluconazole are also sensitive to water (PFSA, 2015). In this study, six independent and one hospital pharmacy did not fulfill the criteria related to protection of commodities from water and moisture which may lead to damage of pharmaceutical products and their package.

Moreover, stopping a fire before it spreads can saves expensive supplies and the storage facility. The right equipment should be available. Availability of fire safety equipment is vital for locations where essential drugs are stored. It is important to place well-maintained fire extinguishers at suitable positions in the store room. Staff should also be trained in the use of the available fire

safety equipment (Meeme *et al.,* 2015; PFSA, 2015). This study revealed that about 67% of the independent pharmacies have no fire extinguisher or fire safety equipment or was not accessible as observed at the time of the visit. However, as indicated above fire safety equipment should be available, accessible and functional though checking functionality of the equipment is beyond the scope of this study.

Ninety one percent of the private pharmacies in this study were practiced FEFO which is higher than the 88.3% of health centers stores in Addis Ababa as reported by Tilahun *et al (*2016). It is expected that private pharmacies are more curious about expiry of their product before they sell it to patients, this study found out that four independent, one chain and one Kenema pharmacies store organization was not suitable for FEFO implementation. Products should be stored and organized in a manner accessible for FEFO counting and general management (McLaughlin *et al*., 2007) to minimize expired drugs since it allows for shorter shelf life products to be used before the new one (Monton *et al.,*2014).

Another criterion in the assessment of storage condition was related to the practice of separating damaged, quality defected and/or expired medicines from usable medicines. In this regard, it was identified that all pharmacies under Chain, Hospital and Kenema pharmacies put useable medicines separated from damaged/expired products. Other studies have documented similar findings, since damaged and expired drugs should be separated and disposed without delay (John Snow Inc., 2000; Meeme *et al.,* 2015). However, about 15% of the independent pharmacies did not adhere to this criterion. This could be due to space shortage as 20% of the independent pharmacies store in this study has no sufficient space for all their commodities. Expired drugs, received or currently in a pharmacy's inventory, should be removed immediately and separated from the rest of the pharmacy inventory to be handled appropriately. This helps to ensure that the expired drugs are not available to be erroneously dispensed to patients (Wijayawickrama *et al.,* 2015).

Storage guidelines provide general direction on how to manage store for pharmaceuticals. If proper storage procedures are followed, customers can be assured that they have received a good quality product (PFSA, 2015). This study revealed that only 7 out of 55 independent pharmacies and 2 out of 5 hospital pharmacies have written medicine storage and handling guideline compared to Chain and Kenema pharmacies, that both have none. Monton *et al* (2014) recommended standard

procedure for handling and storage of products should be assigned and improved to maintain product stability. Written SOPs that document accepted practices for ordering/requisitioning, receiving, inventory management including storage and stock control, issuing and disposing of expired stock should be available at all levels of health care system (Walkowiak *et al.,* 2008; Meeme *et al.,* 2015).

Moreover, storage area should be secured with a lock and key and access should be limited to authorized personnel. All studied pharmacies except 25% of the independent pharmacies fulfill this condition. The guidelines for good storage of essential drugs recommend that the storage space should be a secure, lockable area which should be accessible to the people needing the health commodities (Walkowiak *et al.,* 2008; Meeme *et al.,* 2015). A pharmacy's location, as well as the location of the drugs it houses, should be restricted through physical access controls. Individuals who are able to enter the pharmacy should be limited to only licensed professionals who require access. Without sufficient physical access controls, unauthorized access to drugs can occur, which can lead to misuse, theft and patient safety threats (Wijayawickrama *et al.,* 2015).

4.6. Disposal of Medicines and Reverse Logistics

Medication disposal is a hot topic in pharmacy today and it is rapidly gaining the attention of professionals and consumers. Medication wastes pose an environmental and a public health risk (Chasler & Subramaniam, 2011) since it increases the chance of uncontrolled use of the medication and subsequent poisoning, contribute to the development of antibiotic resistance and interfere with human hormonal system (Jonjić & Vitale, 2014; Barnett-Itzhaki *et al.*, 2016). The environmental impact of improper medication disposal is expected in countries with poorly functioning waste management schemes: Middle Eastern, Asian and African countries (Paut Kusturica *et al.*, 2017).

In the last 6 months, 58 pharmacies (86.6%) across the different pharmacy groups faced expired, damaged or quality defected products. The main reasons associated for expiry or damage of products was no demand to the product 46(79.3%) and pushes of near expiry 27 (46.6%) products. During the current visit, majority of pharmacies (92.5%) across all groups stocked/had expired, damaged or quality defected products with them. Most of the pharmacies in this study also claimed that they have reported the presence of expired medicines with them to FMHACA, RHB, or Sub cities (Table 9).

Though majority of the pharmacies across all the groups had expired, damaged or quality defected medicines with them as described above, only 3 of the independent pharmacies and 2 hospitals have the FMHACA's medicine waste disposal guideline. Moreover, only 20 (36.4%) of the independent pharmacies know disposal facility whom they think is approved by FMAHCA (appropriate body) compared to the majority of pharmacies in other groups. In addition, only 12 (22%) of the independent pharmacies had history of conducting disposal while all of the kenema and chain pharmacies had a history of disposal of expired medicines.

As shown in table 9 very few pharmacies (4 independent and 1 hospital pharmacies) have responded that they received expired medicines from patients; however, larger proportion of the pharmacies across the groups have reported history of receiving damaged/quality defected medicines. In addition, larger proportion of the pharmacies across the groups described that they are willing to collect damaged /quality defected medicines; however; only 6 independent and 2 hospital pharmacies were willing to collect expired medicines. Similarly, 13 independent and 3 hospital pharmacies claimed that they are willing to collect unused medicines which are not expired.

Table 9: Responses on disposal and reverse logistics (*Only Yes results are presented*)

	Independent		Chain		Hospital		Kenema	
Expired or damaged in the past 6 months	46	84%	4	100%	5	100%	3	100%
Reason for expiry or damage								
No demand	37	80%	3	75%	3	60%	3	100%
Receiving/push of near expiry	25	54%	0	0%	1	20%	1	33%
change in prescribing pattern	15	33%		0%	2	40%		0%
Overstock	7	15%	0	0%	0	0%	1	33%
Experienced expired, damaged/unfit for use medicines	52	95%	4	100%	5	100%	3	100%
Have expired/damaged product currently	52	95%	3	75%	5	100%	2	67%
Have system to track damaged or expiry	50	91%	3	75%	5	100%	3	100%
Report expired medicines	46	84%	4	100%	4	80%	3	100%
Disposed expired/damaged product before	12	22%	3	75%	2	40%	3	100%
By who the disposal was conducted								
By the pharmacy itself	9	16%	0	0%	0	0%	0	0%
By health facility on behalf of the pharmacy	3	5%	3	75%	2	40%	0	0%
By RHB on behalf of the pharmacy	0	0%	0	0%	0	0%	3	100%
Know approved disposal facility	20	36%	3	75%	3	60%	2	67%
Have medicine waste disposal guideline	3	5%	0	0%	2	40%	0	0%
Reverse logistics								
Returned expired medicines to its - supplier before	33	60%	2	50%	4	80%	3	100%
Returned damaged/quality defected meds	23	42%	2	50%	3	60%	3	100%
Received expired medicines from patients	4	7%	0	0%	1	20%	0	0%
Received damaged/quality defected meds	29	53%	1	25%	2	40%	2	67%
Received unused medicines from patients	10	18%	0	0%	2	40%	0	0%
Willing to collect expired medicines	6	11%	0	0%	2	40%	0	0%
Willing to collect damaged medicines	34	62%	2	50%	5	100%	2	67%
Willing to collect unused medicines	13	24%	0	0%	3	60%	0	0%

(Source: Own Survey, 2017)

This study revealed that 93% of the private pharmacies across the different pharmacy groups have expired, damaged and/or quality defected medicines at hand due to push of near expiry products and/or no demand to the product. Moreover, significant numbers of pharmacies have reported to the appropriate body about the availability of these medicine wastes but the majority do not have guideline and do not know approved disposal site though medicines which are unfit for use shall not

be stored for more than six months (FMHACA, 2011). FMHACA has issued medicine waste disposal guideline in 2013 (FMHACA, 2013) but the majority of the pharmacies do not have the guideline as indicated above. Hence, FMHACA should also provide and communicate guidelines and resources that can be used for medicine waste disposal. Lack of the adequate information and clear instructions on proper manners of drug disposal was reported in many surveyed countries: USA, New Zealand, Bangladesh, Malta and Ireland (Paut Kusturica *et al.,* 2017). Similarly, since the pharmacies in this study do not have medicine waste disposal guideline, they may not have adequate information and clear instruction on proper disposal.

Incineration is the best disposal option available for waste medications (Seehusen & Edwards, 2006) but it is not available and accessible to private pharmacies in Addis Ababa. In this study, some of the independent pharmacies (22%) have reported their previous experience of disposal was through flushing down the toilet, rinsing them down the sink and/or throwing with trash. Similarly, reports from other studies also indicated that the most common method of disposal of unwanted medicines by pharmacists was inappropriately throwing in trash, sink and toilet (Barnett-Itzhaki *et al.,* 2016; Chasler & Subramaniam, 2011). These practices are similar to the practices followed by the public (Seehusen & Edwards, 2006, Abahussain and Ball, 2007; Abahussain *et al.,* 2012); However, FMHACA has issued pharmaceutical waste disposal guideline and prohibit such inappropriate method of disposal in Ethiopia which leads to current accumulation of expired medicines at private pharmacies.

Even though FMHACA prohibit such practices, the pharmacists in the studied premises were complaining since there is no mechanism for private pharmacies to dispose their accumulated medicine wastes properly. Moreover, only 20 (36.4%) of the independent pharmacies in this study know disposal facility which they think is approved by FMAHCA (or appropriate organ). Chain and Hospital pharmacies claimed that they utilize other government health facilities for their disposal. Kenema pharmacies disposed their expired medicines by RHB on their behalf. However, inappropriate disposal might have been looked at by the pharmacist as an indicator of their unprofessional conduct. Therefore, some of the respondents might have been reluctant to state the actual practice and therefore an underestimation of inappropriate disposal might have resulted (Abahussain *et al.,* 2012). Though most of the pharmacies across all the groups have challenges with respect to disposal of expired medicines as described above; surprisingly, out of the 67 private

pharmacies surveyed, only 3 of the independent pharmacies and 2 hospitals have the FMHACA's medicine waste disposal guideline. Understanding this gap and realizing the importance of the guideline to the firms, we have shared soft copy of the guideline to the study respondents during the data collection survey.

Increasing disease incidence and prevalence necessitate healthcare practitioners to prescribe and dispense different medications. However, unused medications may be possibly leftover or returned due to patient death, change in prescription, adverse effects, alteration of dosage, self-discontinuation, patient non-compliance, expiry, promotional practices by manufacturers', physicians' prescribing practices, or dispensers' practices (Chasler & Subramaniam, 2011; Abahussain *et al.,* 2012; Bashaar *et al.,* 2017). However, studies indicated that only few patients returned medications to the pharmacy (Barnett-Itzhaki *et al.,* 2016; Chasler & Subramaniam, 2011). Studies conducted in Tigray and Gondar have shown that there was prevalence of household medicine storage including expired medicines which were kept at home inappropriately labeled or stored and also indicated the importance of correct disposal of leftover drugs (Wondimu *et al.,* 2015; Teni *et al.,*2017).

In this study, few pharmacies have history of receiving unused, damaged or expired medicines from patients. Moreover, this study revealed that most of the pharmacies are not willing to collect expired medicines from their clients. The reason respondents mentioned for not willing to collect expired or damaged medicines form patients include difficulty of disposal as they have also faced for their own. Even those who are able to dispose raised disposal site payment issue and health facilities willingness as a challenge in addition to regulation issues as FMHACA does not allow to hold medicines which are not in their invoice list and unknown sources are unacceptable and considered as contraband. Some respondents also mentioned that collecting expired or unfit for use medicines may cause risk for abuse and malpractice at private pharmacies for opposing collection of unused and expired medicines. Pharmacists in Kuwait also did not receive returned medicines from the public because they were concerned about what to do with these unused medicines in the absence of policies allowing pharmacists to accept returned unused medicines from the public. This might be common in different parts of the world, where reverse distribution systems to take back unused medicines from the public are not available, including countries in the Middle East (Abou-Auda, 2003; Abdo-Rabho *et al., 2009*; Kheir *et al.,* 2011; Abahussain *et al.,* 2012).

However, refusing to accept returned medicines may lead to accumulation of unused and expired medications in households which will potentially expose the public to hazards due to uncontrolled use of medications. Most of the expired or unused medications that accumulate in households (household medical waste) is thrown to the garbage or flushed down to the sewage, potentially contaminating waste-water, water resources and even drinking water. In Ethiopia, there is no legislation regarding household medical waste collection and disposal. Similarly there is no clear legislation or law regarding collection of household medical waste and no organized pharmaceutical waste collection and disposal schemes in Egypt, Lebanon and Saudi Arabia. However, Egyptian NGOs collect unused medications and distribute them to low income families and only few of the public return unwanted medications to pharmacies (Barnett-Itzhaki *et al.,* 2016). However, there are legislation and/ or programs for household collection of expired or unused medicines in many countries around the world including Australia, Colombia and Europe: Sweden, Germany, Iceland, Estonia, Belgium, UK, Denmark, Lithuania, Lichtenstein, Norway, France, Hungary and Croatia, UK, Israel. Furthermore, in many countries, medication producers and pharmacies pay for the collection and destruction of household medical waste, following the "polluter pays" principle (Barnett-Itzhaki *et al.,* 2016; Paut Kusturica *et al.,* 2017).

Medication waste disposal requires the collection of unwanted medicines by a third party. Hence, it is important to design community drug take-back programs or household hazardous waste collection events to collect unused prescription drugs and arrange for them to be safely destroyed. It is important to consider establishing drug take-back program in Ethiopia. If community drug take back program is not possible in the meantime recommendations should be provided to patients for disposing of unused medications properly in households through flushing or with the trash.

FMHACA should design strategy on how to engage the community on proper medicine waste disposal. FMHACA should formulate policies and programs to organize the disposal of medicines in an environmentally friendly manner since the proper collection and disposal of unused medicines through a well-run disposal system and collection programs are paramount in ensuring safety of humans and the natural environment. This will provide the legal support and resources to allow patients and the public return unused medicines to be disposed of safely. Pharmacies can play a central role in collecting medicines from patients or the public if they are recommended to return

unused medicines to the pharmacies. Some form of drug collection system on the national, state or local levels is implemented in about 30 countries (Glassmeyer *et al.,* 2009; Abahussain *et al.,* 2012).

According to FMHACA, any stock returned from patients to the pharmacy should not be taken back as stock, but should be destroyed (FMHACA, 2015[a]). However, this study identified returning of unused usable medicines were practiced by few (7.9 %) of the pharmacies depending on high price or if it is purchased recently, like the day before. Moreover, if the patient's prescription changed by the prescriber they may substitute patients by other prescribed medicines. One of the reasons mentioned by respondents not to receive medicines once sold was associated with organization financial system that is difficult to change once transaction has been made. This was particularly true for Kenema, chain and some hospital pharmacies. However, some of them reported that they support patients to sell to other patients. Hospitals also claimed to return back from inpatients in their hospital since no official financial transaction is done.

According to Bashaar *et al (*2017) robust, safe and cost-effective pharmaceutical waste management program supported with media campaign is needed. Barnett-Itzhaki *et al* (2016) recommended considering different approaches to tackle medicine waste disposal issue. Local legislation and regulation needs to be ratified to enable a variety of institutes to collect household medical wastes, implementing the "polluter pays" principle and enforcing medical products' manufactures and importers to pay for the collection and destruction of household medical waste. Moreover, raising awareness of patients, pharmacists, other medical health providers and government officials regarding the health and environmental risks of accumulation of drugs and risk of throwing them to the garbage, sink or toilet. It was also recommended that specific instructions be added in the medication label and leaflet regarding disposal of the drug, examining incentives for returning medications to pharmacies and examining drug collection from deceased in retirement homes and hospitals. These kinds of approaches can also be applied in Ethiopia.

4.7. Challenges of Private Pharmacies

Pharmacy personnel at private pharmacies were asked to mention the challenges they are facing while they are running their pharmacy. Accordingly, the result revealed that 'difficulty of obtaining continuous supply' was the frequently mentioned challenge by 88% of the respondents. It was also possible to document other challenges including, disposal challenge (75%), unethical business practice (66%), forced push/conditional push (55%), competition (52%) and client inability to pay (45%) (Table 10).

Table 10: Challenges of private pharmacies in Addis Ababa, 2017

Challenges	Independent N=55		Chain N=4		Hospital N=5		Kenema N=3		Total N=67	
Difficulty of obtaining continuous supplies	47	(85%)	4	100%	5	100%	3	100%	59	**88%**
Disposal challenge	47	(85%)	0	0%	3	60%	0	0%	50	**75%**
Unethical business practice	37	67%	4	100%	1	20%	2	67%	44	**66%**
Forced push/conditional push	34	62%	0	0%	2	40%	1	33%	37	**55%**
Competition from other pharmacies	29	53%	2	50%	2	40%	2	67%	35	**52%**
Client inability to pay	22	40%	4	100%	3	60%	1	33%	30	**45%**
Excessive government regulations	20	36%	0	0%	1	20%	0	0%	21	**31%**
Staff turnover	13	24%	2	50%	1	20%	3	100%	19	**28%**
Unknown demand	12	22%	1	25%	2	40%	1	33%	16	**24%**
Regulatory staff capacity and weak regulation implementation	14	25%	1	25%	0	0%	0	0%	15	**22.4%**
Public awareness about Pharmacy	13	24%	1	25%	0	0%	0	0%	14	**21%**
FMHACA's frequently changing standards and requirements	10	18%	0	0%	1	20%	0	0%	11	**16%**
Lack of access to financing	9	16%	0	0%	1	20%	0	0%	10	**15%**
Lack of marketing skills	6	11%	1	25%	1	20%	2	67%	10	**15%**
Lack of training	7	13%	0	0%	1	20%	2	67%	10	**15%**
Exclusion by PFSA	10	18%	0	0%	0	0%	0	0%	10	**15%**
Product quality	4	7%	1	25%	1	20%	1	33%	7	**10%**
Inadequate storage facilities	6	11%	0	0%	0	0%	1	33%	7	**10%**

(Source: Own Survey, 2017)

In this study, it was found that the challenges of private pharmacies facing while running their pharmacy include difficulty of obtaining continuous supply, disposal, unethical business practice,

conditional push, competition from other pharmacies and client inability to pay. Within the context of retail pharmacy business, there are multiple challenges that a pharmacist has to face in day-today operations (Hassali, 2014). Sulzbach (2009) reported that the greatest challenges for private pharmacies were difficulty in obtaining continuous supplies (56%) and client inability to pay (40%). The same author also reported that lack of access to financing, staff turnover, lack of business training, lack of pharmaceutical training and lack of marketing skills as challenges of private pharmacies (Sulzbach, 2009); Similarly, in the present study, continuous supply of medicines was mentioned as major challenge, however, compared to the finding reported by Sulzbach (2009) (56%), continuous supply challenges was observed to be significantly higher claimed by 85% of independent and all pharmacies in other groups.

Disposal challenge, which was not mentioned by Sulzbach (2009) in the study conducted in Ethiopia including Addis Ababa, now considered as one of the challenges by 85% of the independent and 60% of hospital pharmacy respondents. This could be due to the fact that disposing of expired medicines has been taken seriously by local regulatory body. Nowadays, FMHACA does not allow simple disposing unlike previous times. However, Kenema and Chain pharmacies did not mentioned disposal challenge, which may be due to the practices of Kenema and Chain pharmacies disposing their wastes with their respective chains and their central office is coordinating the disposal process. Moreover, conditional push is higher at independent pharmacies compared to others which may be related to their capacity and fear of expiry. Though there is forced push for other pharmacy groups, they did not consider it as a challenge.

Competition was one of the challenges identified by respondents in this study. Similar issue has been reported by Sulzbach (2009). Price war is among one of the elements of competition among others. As identified by Hassali (2013, 2014), 'pharmaceutical price war' is one of the main obstacles to ethical practice among many retail pharmacists in Penang, Malaysia. The price war is mentioned by independent pharmacies in this study in relation to the chain pharmacies. Unethical practices were also identified as one of the challenges in private pharmacies in Addis Ababa. The unethical practices include pharmaceutical related practices by private pharmacies themselves as well as clinics which are not allowed to hold medicines except few emergency medicines. Basak & Sathyanarayana (2010) reported that majority of medicines were dispensed or supplied without a prescription and inappropriate dispensing and over the counter dispensing of many drugs including

anti-infective products was common. In this study, respondents were also complaining dispensing without prescription including antibiotic request fulfilment without prescription as one of the unethical practices. Unethical business practices were not reported by previous study in the challenges of private pharmacies in the four regions of Ethiopia (Sulzbach, 2009). Further investigation may be required to identify why unethical business practices become one of the major challenges of private pharmacy practices.

Another challenge identified by private pharmacies in Addis Ababa (45%) was client inability to pay for medicines. In another study by Sulzbach (2009), 40% mentioned similarly. Price is a key obstacle for consumer access to essential drugs, especially in developing countries (Hassali, 2014). This study also identified that 45 % of respondents perceive client inability to pay is one of the challenges in running their pharmacies. Similarly, Hassali (2014) reported that price is a key obstacle for consumer access to essential drugs. Hence, the lack of purchasing power will cause difficulty for community pharmacists to negotiate lower acquisition cost with manufacturers to maintain an adequate supply of product in their retail outlet.

Most of the pharmacists (85%) in this study did not mention lack of access to financing as a challenge. However, majority of the pharmacists in State of Penang reported that lack of capital has an impact on the success of their business (Hassali, 2014). Moreover, staff turnover challenge was also mentioned by 28% of the respondents in this study compared to 14.3% report by Sulzbach (2009). Moreover, all Kenema pharmacies mentioned staff turnover as a challenge since Kenema pharmacies are under Addis Ababa city Administration and the government structure may not provide attractive benefit package like other groups of pharmacies.

Patients require a reliable supply of affordable medicines. In the absence of such a supply, avoidable mortality and morbidity will occur. A range of policy options and technical options exist to enable governments to ensure that medicines are consistently available and affordable (Mendis *et al.*, 2007). However, government couldn't able to solve such issues only through the public sector. In this regard, private pharmacies could contribute a lot if they are supported through government policy and strategy but the FMOH failed to mention any strategy for the private retail pharmacy sector in its Health Sector Transformation Plan 2015/16-2019/20 (FMOH, 2015). An increased commitment by governments to meet the medicine needs of its citizens through the engagement of the private pharmacies is required.

Chapter 5: Summary of Major Findings, Conclusions and Recommendations

5.1. Summary of Major Findings

- Results of the present study revealed that the overall availability of selected essential medicines at private pharmacies during visit was 83.18%.
- Non-availability of pharmaceuticals in the market was the major reason for stock out of essential medicines in studied private pharmacies and there was stockout of ORS and Zn DT despite the presence of Acute Watery Diarrhea (ATET).
- In this study 67.16% of private pharmacies had inventory management system in place and 65% of private pharmacies use stock card/bin card for inventory control.
- Prescription pattern was the most important factor that determines level of inventory (order quantity) in studied pharmacies in Addis Ababa.
- The inventory control system used by all the pharmacies in this study was mostly pull system, though there are conditional pushes from their suppliers.
- The major factors that affect delivery lead time in this study was shortage of the product at the supplier as mentioned by all groups of pharmacies (77.6%) while followed by demand for the product in the market (55.2%).
- When observing storage conditions of private pharmacies, this study found out that, for larger proportion (77.61%) of the private pharmacies, the storage conditions were at acceptable level (score $\geq$ 80) based on storage condition criteria.
- This study revealed that majority (92.54%) of the private pharmacies across the different pharmacy groups had medicines wastes at hand and 85.7% had reported to regulatory body.
- Most of the private pharmacies in this study were not engaged in reverse logistics of medicines particularly in receiving unused and expired medicines from patients. They are not also willing to collect expired medicines from their clients since there is difficulty of disposal in addition to regulation issues as FMHACA does not allow holding medicines which are not in their invoice list and unknown sources are unacceptable and considered as contraband.
- The study also identified that the three most important challenges affecting SCM of private pharmacies were difficulty of obtaining continuous supply, disposal challenge and unethical business practice.

5.2. Conclusions

Based on the finding of this study it can be concluded that the availability of selected essential medicines at private pharmacies in Addis Ababa was acceptable and meets the WHO's target of 80%. Hospital pharmacies have better availability of medicines compared to other private pharmacy groups in this study. Moreover, problems associated with stock out of essential medicines that arise due to non-availability of pharmaceuticals in the market were observable in the study set up. Stockout of medicines like ORS and Zn DT will be a challenge in the management of diseases with public health importance like Acute Watery Diarrhea (ATET).

In general, inventory management of private pharmacies in this study requires improvement since it could affect the performance of their business as well as their service to the public. Prescription pattern was the major factor in determining level of inventory. Hence, private pharmacies should understand the prescribing behavior in their catchment and also consider other factors that could affect their level of inventory. Storage condition was also acceptable for 77.66% of the private pharmacies which implies that medicines are placed appropriately to protect the intended quality, safety and efficacy in these pharmacies.

Private pharmacies based in Addis Ababa were also found to accumulate medicines wastes. The problem can be substantiated as the respondents were complaining that there are no 'disposal firms' for private pharmacies to dispose their accumulated medicine wastes. Consequently, disposal challenge, together with difficulty in obtaining continuous supply and unethical business practice, was identified as the three most important challenges affecting SCM of private pharmacies based in Addis Ababa. In general, Private pharmacies in this study were neither engaged in reverse logistics of expired medicines nor willing to collect expired medicines from their patients which may lead to accumulation of medicine wastes or inappropriate disposal at households.

5.3. Recommendations

This study found out that the overall availability of selected essential medicines during visit at private pharmacies based in Addis Ababa was 83.18% which is acceptable considering the WHO's voluntary target of 80% but lower than the 100% target of FMOH. Moreover, the major challenge mentioned was continuous availability of medicines in the market. Hence, there is a need to ensure the continuous availability of needed pharmaceuticals at private pharmacies to provide adequate patient care. Private pharmacies based should be supported through government policy and strategy. In this study, there was high stockout of Zinc compared to ORS which are important to manage diarrhea (e.g.) Acute Watery Diarrhea (ATET) which is a public health challenge in Ethiopia currently; hence availing ORS and Zinc Co-pack is recommended to ensure both products are available.

Inventory management system including use of stock card/bin card in this study requires improvement. Private pharmacies based in Addis Ababa should improve their inventory management system and documentation. Moreover, fifteen (27%) of the Independent pharmacies, did not met at least 80% score of the storage conditions criteria. There is a need to ensure private pharmacies improve and maintain acceptable storage conditions to safeguard the quality, safety and efficacy of medicines.

This study revealed that most of the private pharmacies across the different pharmacy groups had accumulated medicines wastes at hand; and are complaining absence of 'disposal firms'; hence, it is recommended that the government should support the establishment of environment friendly medicine disposal firms in Ethiopia. Refusing to accept returned medicines from the public may lead to accumulation of unused and expired medications in households which will potentially expose the public to hazards due to uncontrolled use of medications. In Ethiopia, there is no legislation regarding household medical waste collection and disposal. FMHACA/FMOH should formulate policies and programs for public drug take-back program involving pharmacies to take back and properly dispose of unused medicines.

5.4. Limitations of the Study

In this study, the availability data was only for 30 specific lists of medicines with specific dosage forms and strengths for most as per the WHO/HAI recommendations and did not account for other strengths, dosage forms or therapeutic alternatives. Nevertheless, the WHO/HAI methodology has been validated and has been considered the standard for measuring. The limited number of Chain, Kenema and Hospital pharmacies surveyed compared to the independent pharmacies may raise concerns regarding comparability of the four pharmacy groups. This limitation is partly due to the fact that there are limited numbers of such pharmacies and the method used was proportionate sampling. Nevertheless, a total of 67 private pharmacies were randomly selected across Addis Ababa in order to ensure that a representative sample was chosen for the study; therefore, provide a reasonable estimate of the overall situation. Moreover, this study was conducted in Addis Ababa where most of the suppliers (manufacturers, wholesalers, importers and distributors) reside and the results of the study may not reflect the countries situation outside Addis Ababa; however it provides an initial reference point for future studies to be conducted in Ethiopia.

5.5. Areas of Future Research

- This study found out that the overall availability of selected essential medicines during visit at private pharmacies based in Addis Ababa was 83.18% which is acceptable considering the WHO target of 80%. However, researches should be conducted on affordability of these medicines to ensure they are accessible to the public.
- It is also important to consider establishing community drug take-back programs or household hazardous waste collection events to collect unused medicines and arrange for them to be safely destroyed. Research on feasibility of drug-take-back program in Ethiopia is recommended.
- In this study, respondents were reported existence of unethical business practices as a challenge to their pharmacy. Further investigation may be required to identify the extent and why such unethical business practices become one of the major challenges of private pharmacy practices.
- This study was conducted in Addis Ababa where most of the suppliers (manufacturers, wholesalers, importers and distributors) reside and the results of the study may not reflect the countries situation outside Addis Ababa; though it provides an initial reference point for future studies to be conducted in Ethiopia. It would be of interest to conduct similar studies in other parts of Ethiopia to compare with this study and get the full picture of the country.

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Appendices

Appendix A: Informed Consent Form

My name is Seid Ali, a post graduate student from Addis Ababa University, College of Commerce. First of all I would like to thank you for giving me your precious time. I am very interested to hear your valuable opinion on SCM practices of private pharmacies. The purpose of this study is to investigate the outbound logistic management practice of private pharmacies in Addis Ababa focusing on availability of essential medicines, inventory and store management, disposal practice and challenges faced by private pharmacies. The study is purely for academic purpose and will remain confidential and not to be used to assess your performance; thus not affects you in any case. Your participation is voluntary and you have the right not to answer any question and stop the interview at any time if you have any doubt. Moreover, your name will not be written and your responses are identified only by codes. However, your genuine, honest and timely response is vital for successfulness of the study. Therefore, I kindly request you to respond to each items of the question very carefully.

Would you be willing to participate?

1. Yes. Thank you! Let's begin.
2. No. Thank you!

Appendix B: Respondents and their pharmacy profile

Respondent's Sex	Male…….. …… 0 Female…….……1
Respondent's age	…… ……years
Respondent's educational qualification in Pharmacy	Bachelor degree ……....0 Master's degree …….1 Other (specify)…….…….
Respondent's Work experience in the profession	…….. years
Respondent's Work experience in this pharmacy	……years
Additional trainings taken by the Pharmacy head related to logistics/SCM?	
When was the pharmacy established?	In …… E.C.
Total number of Pharmacy professionals currently working in the pharmacy	Total # of pharmacy professionals..... Full-time Pharmacist …… Druggist……. Part-time Pharmacist ……Druggist……
Do the staffs have job description? (if yes, note to whom?)	Yes..... 1 No……...……0
What kind of services the pharmacy is providing?	Dispensing…….... 0 Compounding.....1 Weight measurement.....2 BP measurement…….....3 Cosmetics sale……..4 Others (specify)…….
Does the pharmacy have?	Medicine dispensing area……0 Medicine storing area…….……1 Medicine compounding area …….....2 Office……...……....3 Toilet ……...……..…….....4
Does the pharmacy have its own specific medicine list?	Yes..... 1 No……..0

Appendix C: Availability assessment checklist for selected essential medicines

SN	List of Medicines	Available now Yes=1 No=0	Available in the past 3 months Yes=1 No=0	Stock out in the past 3 months? Yes=1 No=0	Reason for stockout
1	Albendazole 200/400 mg tablet				
2	Amitriptyline 25mg capsule/tablet				
3	Amoxicillin 125/250mg/5ml suspension				
4	Amoxicillin 500mg capsule/tablet				
5	Atenolol 50mg capsule/tablet				
6	Beclomethasone inhaler				
7	Captopril 25mg capsule/tablet				
8	Ceftriaxone 1g/vial injection				
9	Ciprofloxacin 500mg capsule/tablet				
10	Condoms (male)				
11	Co-trimoxazole 8+40mg/ml Suspension				
12	Co-trimoxazole capsule/tablet				
13	Diazepam 5mg capsule/tablet				
14	Diazepam injection				
15	Diclofenac 50mg capsule/tablet				
16	Enalapril tablet				
17	Fluconazole capsule/tablet				
18	Glibenclamide 5mg capsule/tablet				
19	Ibuprofen				
20	Insulin (injection)				
21	Metformin 500mg tablet				
22	Metronidazole 250mg tablet/capsule				
23	Omeprazole 20mg capsule/tablet				
24	Oral contraceptive pills (combined)				
25	Oral Rehydration Salt (ORS) sachet				
26	Oxytocin (injection)				
27	Paracetamol 24mg/ml suspension				
28	Salbutamol 0.1mg/dose inhaler				
29	Simvastatin 20mg capsule/tablet				
3	Zinc 20mg Dispersible Tablet				

Reason for stock out:

0. Not required at this time (seasonal)
1. Not prescribed
2. No demand
3. Not available in the market
4. Has no profit
5. Expired
6. Ordered but supplier not delivered yet
Others (specify)

Appendix D: Inventory management assessment Questionnaire

Is there Logistic Management Information system (LMIS) in the Pharmacy? (Recording, reporting, tracking…)	Yes..... 1 No 0
Is the LMIS system automated?	Yes..... 1 No 0
If there is an automated system in the pharmacy, its purpose is?	For dispensing/counselling purpose?.....0 For storage purpose?.....1 For financial transaction?.....2 Other (Specify)……3
Are the following LMIS tools available and used in this pharmacy? *Verify through observation.*	Bin card (paper)..... 0 Bin card (electronic) ..... 1 Stock record card (paper)..... 2 Stock record card (electronic) ..... 3 Daily Register (paper)..…….... 4 Daily Register (electronic)…….... 5 Expired /Defective item recording format ……l..6
Do the LMIS forms include	Quantity received..... 0 Stock on hand ..... 1 Quantities dispensed/issued ..... 2 Loses and adjustments ..... 3 Other (specify).....
Is logistic data used for decision making?	Yes..... 1 No 0
Are there certain commodities that you frequently stock out of before resupply? (from above list asked for availability)?	Yes..... 1 No 0
List the commodities you stock out of most frequently (up to 3 products; name, strength, dosage form). (from above list asked for availability)?	1. 2. 3.
Why do you maintain or kept sufficient inventory?	Purchase economies…….0 Transportation savings……..……...1 Safety stock..……...2 Speculative purchases……...3 Seasonal supply…….4 Maintenance of supply……..5 Substitute supply…….……...6 Based on complementarity of the product…….7 Others (Specify)……

How do you determine your level of inventory (how much to stock)?	Based on customer type?.....0 Based on Lifesaving potential?.....1 Based on Storage requirements? ……..2 Based on Expiration date?.....3 Based on Customer demand?.....4 Based on prescription pattern.....5 Based on Seasonality?.....6 Others (Specify)……
How are your order quantities determined?	Inventory control policy ..... ……0 Speculation…..……..……....1 Value……..……...……..2 Hedging ……..3 Simple observation…….....4 Other means (specify) ..... ……..
On average, approximately how long does it take between ordering and receiving products from your supplier?	Average lead time in days/hrs if push modality…… Average lead time in days/hrs if pull modality ..... ……
What affects the delivery lead time?	Order quantity……..……..0 Price…….. 1 Demand for the product in the market..…….……...2 Shortage at supplier ..... ……3 Concentration of pharmacies…….……4 Other (*specify*) .....
What type of inventory control system is **usually** used by the pharmacy?	Pull..... 0 Push 1
Is there conditional push from your supplier?	Yes ..... 1 No 0
Do you perform physical inventory?	Yes ..... 1 No 0
How frequent the physical inventory is done?	Annually ..... 0 Semi-annually ..... 1 Cyclic..... 2
Do the pharmacy practice periodic stock reconciliation by comparing the actual (physical inventory) and recorded stocks?	Yes ..... 1 No 0
How frequent the reconciliation is done?	Annually ..... 0 Semi-annually ..... 1 Cyclic..... 2
Is there any kind of long term forecasting?	Yes ..... 1 No 0
Is the pharmacy performing forecasting with the suppliers?	Yes ..... 1 No 0
Is the pharmacy procurement based on the forecast?	Yes ..... 1 No 0

The source of procurement for the pharmacy include: *(circle all that apply)(*	Directly from Local Manufacturer..... 0 Importer ..... 1 Distributor/wholesaler ..... 2 PFSA..... 3 Others Specify……..
Who is responsible for transporting medicines to this pharmacy? ***(for medicines list mentioned for availability)*** *(circle all that apply)*	Supplier..... 0 The pharmacy collects ..... 1 Other (*specify*) _____
The Pharmacy collects if the supplier is?	Local Manufacturer..... 0 PFSA..... 3 Distributor/wholesaler ..... 2 Importer ..... 1 Others Specify……..4
What kind of post transaction service is provided by the supplier?	Training ..... 0 Return of expired items..... 1 Support in stock redistribution..... 2 Promotion to prescribers..... 3 Others Specify……..
How much is the retail markup price in this pharmacy?	…… to …….%

Appendix E: Storage condition observation checklist

Do you have separate store?	Yes……1 No……..0	
SN	**Instructions to data collector:** *Check the pharmacy's store room or area that serve as storage area for medicines and mark the responses that best describes the storage conditions.*	Yes=1 No=0
1	Store room is dry, clean and maintained in good condition (sturdy shelves and organized boxes)	1 0
2	Store has sufficient light and well ventilated	1 0
3	Commodities are protected from direct sunlight (windows panes are painted or there are curtains/blinds to protect against sun)	1 0
4	Commodities in the store are arranged in some order (Medicines are stored in a systematic way (e.g. alphabetical, pharmacological)	1 0
5	FEFO is implemented (Products are stored and organized in a manner accessible for first-to-expire, first-out (FEFO) management)	1 0
6	All commodities are placed on the shelf or on a pallet (Medicines are not stored directly on the floor)	1 0
7	Cartons and products are protected from water and humidity during all seasons. Area is free from moisture (e.g. leaking ceiling, roof, drains, taps, etc)	1 0
8	Expired/damaged/ quality defected items are separated from usable products	1 0
9	There is a room thermometer in the store	1 0
10	Store room temperature is monitored and recorded regularly	1 0
11	There is cold storage /refrigerator in the store/pharmacy	1 0
12	There is thermometer in the refrigerator	1 0
13	The thermometer in the refrigerator is monitored and recorded regularly	1 0
14	Narcotic and Psychotropic medicines kept locked in a cabinet	1 0
15	Storage area is visually free from harmful insects/pests and rodents. (Check the storage area for traces of droppings or insects)	1 0
16	Fire extinguisher or Fire safety equipment is available and accessible	1 0
17	The store room has sufficient space for all commodities	1 0
18	The pharmacy has written medicine storage and handling guideline	1 0
19	Storage area is secured with a lock and key; access is limited to authorized personnel.	1 0

Appendix F: Disposal of expired/damaged or unfit for use medicines and reverse logistics Questionnaire

In the last six months, were any medicines:	Yes No [A] Expired 1 0 [B] Damaged 1 0 [C] quality defected 1 0
If "Yes" is marked in above, What is/are the reason/s that the medicine was expired, damaged, or defective? *Mark all responses mentioned.*	Over stock..... 0 Receiving/Push of near expiry..... 1 No demand..... 2 Poor storage ..... 3 Other (*specify*) _____
Have you ever had expired/damaged/ unfit for use medicines in this pharmacy?	Yes ..... 1 No 0
Do you have expired, damaged/unfit for use medicines in your pharmacy currently?	Yes ..... 1 No 0
Do you have system to continuously track and analyze damaged, expired, or unfit for use medicines?	Yes ..... 1 No 0
Did the pharmacy ever report expired medicines to the appropriate body?	Yes ..... 1 No 0
If yes in above, to whom the pharmacy reported expired/damaged/unfit for use medicines? *(circle all that apply)*	FMHACA (central)……...….0 FMHACA, Addis Ababa Branch……..….1 Woreda Health Office…….....2 Sub city Health Office…….....3 Addis Ababa City Administration HBureau.....4 PFSA……...5 FMOH…….....6 Others (specify)……..
Have you ever disposed expired/damaged/unfit for use medicines before?	Yes ..... 1 No 0
If the answer above is Yes: By who the disposal was conducted?	By the pharmacy itself……...0 By health facility on behalf of the pharmacy…...1 By Woreda HO on Behalf of the pharmacy…….2 By Sub city on behalf of the Pharmacy……3 By RHB on behalf of the pharmacy…….4 Others (Specify)……....
If yes above, Where did you dispose expired medicines? *(specify place, town and region)*	……..
Have you ever used a disposal facility approved by the appropriate organ (FMHACA) to carry out medicines waste disposal of this pharmacy?	Yes ..... 1 No 0
Do you know a disposal facility approved by the appropriate organ to carry out medicines waste disposal in Addis Ababa? (please mention)	Yes ..... 1 No 0
Do you know a disposal facility approved by the appropriate organ to carry out medicines waste disposal somewhere else in Ethiopia? (please mention)	Yes ..... 1 No 0

How your supplier compensates for expired medicines? • Local manufacturer……. • Importer ……. • Wholesaler……. • PFSA……. *(write all applicable above from 0,1,2,3,and/or 4)*	In kind……...0 In Birr ……...1 Support re-distribution……..2 No compensation…….....3 Other (specify)……..4
Is there a regular visit by the FMHACA to the pharmacy?	Yes .....1 No 0
If Yes, How frequent their visit is?	Every quarter.....0 Every 6 months .....1 Every year .....2 Never.....3 Others (specify)……
Do you have FMHCA's Medicine waste disposal guideline?	Yes .....1 No 0
Does your pharmacy practice reverse logistics? [A] Have you ever returned expired medicines to your supplier before? [B] Have you ever returned damaged/quality defected medicines to your supplier before? [C] Have you ever received expired medicines from your patients/customers? [D] Have you ever received damaged/quality defected medicines from your patients/customers? [E] Have you ever received unused medicines from your patients/customers? [F] Are you willing to collect expired medicines from your patients/customers? [G] Are you willing to collect damaged medicines from your patients/customers? [H] Are you willing to collect unused medicines from your patients/customers?	Yes No [A] 1 0 [B] 1 0 [C] 1 0 [D] 1 0 [E] 1 0 [F] 1 0 [G] 1 0 [H] 1 0

Appendix G: Questionnaire on challenges of private pharmacies

What kind of challenges is your pharmacy facing to run the pharmacy smoothly? *(Do not read the responses. Just circle or write based on responses from the respondent)*	Difficulty obtaining continuous supplies ……0 Client inability to pay ……......1 Competition from the public sector …….....2 Competition from other private pharmacies…….....3 Lack of access to financing…….…….4 Unethical business practice……..5 Staff turnover……...6 Unknown demand……7 Product quality…….….8 Invoice and real product information inconsistency…9 Excessive government regulations……..10 Lack of Marketing skills……..11 Lack of knowledge for good storage practices……...12 Lack of business training…….....13 Lack of pharmaceutical training…….…….……14 Inadequate storage facilities…….....15 Other (Specify)……. …… …… …… …… …… …….