ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

ASSESSMENT OF SUPPLY CHAIN MANAGEMENT OF MEDICINES USED IN MASS TREATMENT OF TRACHOMA IN WOREDA HEALTH OFFICES OF NORTH SHEWA ZONE, AMHARA REGION, ETHIOPIA

BY

BELAY MEKONNEN

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS SCHOOL OF COMMERCE IN PARTIAL FULFILLMENT OF THE EQUIREMENTS FOR THE DEGREE OF MASTERS OF ART IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT.

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ADVISOR

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This is to certify that this thesis entitled with assessment of supply chain management of medicines used in mass treatment of trachoma in Woreda health offices of North Shewa Zone, Amhara region, Ethiopia*"* is carried out by Belay Mekonnen Yimenu and submitted in partial fulfillment of the requirements of the Degree of Master of Art in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Approved by Board of Examiners and advisors;

Tariku Jebana (PhD)	_____	_____
(Adviser)	Signature	Date
Berhanu Denu (PhD)	_____	_____
(Internal Examiner)	Signature	Date
Eshite Berhan (PhD)	_____	_____
(External Examiner)	Signature	Date

DECLARATION

I, Belay Mekonnen, the under signed, declare that this thesis entitled "Assessment of supply chain management of medicines used in mass treatment of trachoma in Woreda Health offices of North Shewa Zone, Amhara region, Ethiopia" is my original work and to the best of my knowledge has never been presented in any other university or college for the award of degree in any other university, that all the sources of material used for the thesis have been duly acknowledged.

Declared by:-

Belay Mekonnen Yimenu

Signature: _____

Date: _____

Statement of certification

This thesis, entitled "Assessment of supply chain management of medicines used in mass treatment of trachoma in Woreda health offices of North Shewa Zone, Amhara region, Ethiopia" is carried by Belay Mekonen Yimenu so as to obtain his second degree from Addis Ababa University School of commerce. He conducted his original thesis under my guidance and supervision. I certify that, the study is his own original work and suitable for submission of the award of MA in Logistics and supply chain Management.

Advisor:

Tariku Jebana (PHD)

Signature: _____

Date: _____

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Table of Contents

List of tables

List of figures

Acronyms and abbreviations

ANRS	Amhara National Regional State
CMS	Central Medical Store
LF	Lymphatic filariasis
FMOH	Federal Ministry of Health
GSK	GlaxoSmithKline
HC	Health center
JSI	John Snow Incorporate
LMIS	Logistics Management Information System
MDA	Mass Drug Administration
MDGs	Millennium Development Goal
NGO	Non-governmental Organization
NTD	Neglected tropical diseases
NTDDs	Neglected tropical diseases drugs
OV	Onchocerciasis
PC	Preventive chemotherapy
PFSA	Pharmaceutical Fund and Supply Agency
PMISs	Pharmaceutical Management Information System
RHB	Regional Health Bureau
RMS	Regional Medical Store
SAFE	Surgery, Antibiotic distribution, facial hygiene, environmental management
SC	Supply chain
SCM	Supply chain Management
SIAPS	System Improved Access for Pharmaceuticals Strengthening
SOP	Standard Operating Procedure
TF	Trachoma Follicular
TT	Trichiasis Trachomitis
USAID	United States aid for international development
WHO	World Health Organization
ZHD	Zonal Health Department

Abstract

Trachoma is the world's leading cause of infectious blindness. It is an infectious disease of the eye caused by the bacterium Chlamydia trachomatis. Elimination of blinding trachoma through the surgery, drug administration, facial cleanness and environmental sanitation are strategy Strategies. MDA of all affected to eliminate trachoma depend on people in endemic areas receiving the medicines or drugs they need in the places where they live, at appropriate regular intervals and this contribute paramount importance in blinding trachoma elimination. This requires efficient trachoma medicines supply chain management. Woreda health offices are crucial administrative bodies in strengthening and implementing trachoma medicines supply chain management. Therefore, it is aimed assess the supply chain management of medicines used for trachoma mass drug administration in Woreda health offices of North Shewa zone in Amhara region. A descriptive approach was employed to asses of supply chain management of medicines used in mass treatment of trachoma in Woreda health offices of North Shewa Zone, Amhara region, Ethiopia". Survey method was used to collect data. In addition, interview guides and observations were some of the tools used in the data collection process. In is found in most Woredas that there is only one logistics officer to manage Woredas store and supply management. The result indicates that most supply chain management components are not being properly managed except for keeping reporting timelines. Storage management is the most affected supply component which is probably due to workload and storage space problem. In conclusion, Supply chain management of trachoma medicines at most is not being managed as per the national and international standards which needs further studies to find out a key problem and zonal health department pharmaceuticals department have to provide continue supports and the stakeholders have to strongly support Woreda logistics officers to strengthen the supply chain to create efficient supply system.

Key word: *trachoma, supply chain management, mass drug administration, Woredas health office*

Chapter One: Introduction

Neglected tropical diseases (NTDs) are a group of 17 parasitic, zoonotic, and helminthic diseases that affect "the bottom billion" people, mostly in developing countries (Hotez et al, 2009). Of the world's poorest 2.7 billion people, more than one billion are affected by one or more NTD and these diseases not only survive and spread in conditions of poverty, they also exacerbate and perpetuate the poverty of affected communities (Gebre et al, 2008). NTDs disproportionately impact poor and rural populations who lack access to safe water, sanitation, and essential medicines (World Health Organization (WHO, 2007). They cause sickness and disability, compromise maternal health and fetal growth, inhibit children's mental and physical development, and can result in blindness and severe disfigurement. (USAID report, 2012)

Ethiopia carries one of the highest burdens of neglected tropical diseases in Africa. The first national NTD master plan for the control, elimination and eradication of targeted NTDs in Ethiopia was launched in 2013 (FMOH, 2013). The FMOH identified eight priority NTDs. NTDs prioritized for intervention are trachoma, onchocerciasis, schistosomiasis, soil transmitted helminthiasis, lymphatic filariasis, podoconiosis, leishmaniasis and dracunculiasis (Guinea-worm) *(*FMOH, 2015*).*

Trachoma is one of NTDs given highest priority globally. It is the leading cause of infectious blindness worldwide and accounts for approximately 3% of global blindness and is targeted for elimination as a public health problem by year 2020 (WHO, 2007). Trachoma is estimated to be endemic in 53 countries of which 35 have begun scaling-up or have fully implemented WHO recommended SAFE strategy for reaching the elimination targets (Ngondi et al., 2014). Trachoma is an infectious disease of the eye caused by the bacterium *Chlamydia trachomatis*. The bacteria can spread via an infected person's hands or clothing and may be carried by flies that have been exposed to discharge from the eyes or nose of an infected person (Emerson and Rotondo, 2009). Repeated infection with *Chlamydia trachomatis* can lead to a cascade of Conjunctival scarring, in-turned eyelids and eyelashes (trichiasis); and eventually blindness due to corneal opacity (WHO, 2007).

Ethiopia has the highest burden of active trachoma globally (30% of the sub-Saharan trachoma burden is estimated to occur in Ethiopia). The disease remains a major health problems and a leading cause of infectious blindness in the Ethiopia and the country has been implementing the World health organization recommended SAFE strategy for more than a decade to control

trachoma (FMOH, 2015). SAFE is an integrated package of interventions to treat, control and ultimately prevent new cases of blinding trachoma through SAFE strategy (Emerson et al., 2008). Antibiotic distribution is implemented through Mass drug administration (MDA) with antibiotics predominantly with Azithromycin as one of the four arms of the SAFE strategy. To reduce the prevalence of trachoma infection, WHO had recommended community-wide distributions of oral Azithromycin when the prevalence of trachomatous inflammation follicular (TF) is greater than 10% in children aged 1–9 years, and trichiasis prevalence in persons aged over 14 years exceeds 1% (Ritmeijer et al, 2011).

World health Organization advocates at least three mass drug administrations' with antibiotics when the prevalence of follicular trachoma (TF) in children less than 10 years is greater than 10%. Full child participation is necessary for maximizing the impact of trachoma control programs (Emerson et al., 2008). In Antibiotic distribution, Azithromycin is offered to all individuals over the age of six months. Tetracycline eye ointment should be given to children below six months of age, to older individuals who refuse or cannot receive Azithromycin and women with first trimester (FMOH, 2017). Overall coverage should be as high as possible, but treatment of 80% of the resident population should be the minimum target (Melese *et al*., 2004).

The principal goal of a trachoma MDA programme is to ensure that proper dose of medicines are provided to each eligible person within the target geographic area. Efficient supply chain management ensures that the correct drugs are available in the right quantities, in the right place, and at the right time to enable all participants to have access to the MDA (FMOH, 2017).

The focus of this study was to assess supply chain management of trachoma medicines which is by far a key for achieving blinding trachoma elimination through "A" strategy of SAFE. Efficient and effective supply chain management of donated medicines is a key activity and indeed a backbone of MDA. Unless medicines are well managed and delivered in at the right time, place, and in the right condition and cost, population at risk of trachoma well not be treated and there will be no control/elimination of blinding trachoma.

This papers assessed the supply chain management of medicines used for MDA of trachoma of Woredas in North Shewa zone Amhara region. This section encompasses background of the study, statement of the problem, objective of the study, research question, limitation and scope of the study, among others.

1.1 Background of the study

Blinding trachoma elimination through mass drug administration of preventive chemotherapy medicines is a growing concern to global public health research in low- and middle-income countries where trachoma is endemic. Implementation of MDA interventions with high coverage will ensure that by 2020 the world health organization goals for the targeted blinding trachoma is reached. Elimination of blinding trachoma through the SAFE strategy can be accentuated through integration with interventions like preventive chemotherapy (World health organization, 2007). So far, annual MDA coverage of drugs, is the driver of success of these interventions partly due to large donation of drugs by pharmaceutical companies, international donors and governments (Hotez et al, 2009).

Public health interventions using PCT to control NTDs depend on people in endemic areas receiving the medicines or drugs they need in the places where they live, at appropriate regular intervals. This precise timing is even more critical given the goals achieve to control and/or eliminate the spread of these diseases by 2020. The first and fundamental step in the process consists ensuring a high effective and efficient supply chain that the NTD drugs are of high quality and available for distribution during a mass drug administration. Supply management has several important consequences for program managers on the quantitative results from MDAs. Efficient and effective logistics management plays a critical role in ensuring that NTD medicines are delivered to the people who need them. (SIAPS, 2015).

Improving supply chains management of drugs used in treating neglected tropical disease help to meet the London Declaration 2020 goal, to "Sustain, expand and extend programs that ensure the necessary supply of drugs and other interventions to help eradicate and control" specific NTDs. (WHO, 2007).

Medicines used for trachoma MDA are obtained from the generous donations made by Pfizer of proven effective treatments and USAID NTD program provides critical funding that allows countries receiving these donated drugs to distribute them effectively and to scale up treatment to full, national scale. This donation is highly affected by the supply management as the in country stock is considered when pharmaceuticals factories are planning to provide a donation to national NTD program (Daniel et al., 2012). Because supply chain management is a set of activities linked to downstream distribution of products and to the upstream flow of information from

manufacturers to end users, there is a potential association between supply chain capacity and NTD elimination. (Schniederjans M, 2011)

In Ethiopia, Woreda Health Offices are crucial administrative bodies in strengthening and implementing trachoma medicines supply chain management. Key roles and responsibilities of the Woreda health offices in managing medicines supply management for trachoma MDA include; Advance supply planning with the regional, zonal health offices and implementing partners, receiving of medicines from PFSA, Storing medicines both before and after mass treatment, distributing medicines to health centers and health posts, provide training to all HDA and HEW involved in MDAs, ensure medicines recording and reporting formats availability prior to MDA, collect, analyze, validate and finally mass treatment send reports to zonal health department. They also monitor and evaluate distribution, redistribution, reverse logistics management of the medicine and facilitate disposal of damaged and expired medicines, manage returning of leftover medicines appropriately store, and ensure left over medicines used first during the next MDA. Left over stock of medicines which are obtained from all Woredas through Zonal health departments and regional health bureaus , at the end of the physical year, are incorporated to the nationally forecasted quantity of medicines and will be submitted to WHO for the upcoming year MDA. (FMOH, 2017). All Woredas of North Shewa zone are prevalence with trachoma. Trachoma MDA had been conducted in Woredas of North Shewa Zone starting from 2005. (Alemaehy et al., 2015)

Medicines used for trachoma MDA are transported from PFSA center to its branches and then to Woredas stores. It is Woreda health office that allocate and distribute medicines to health centers and health centers delivery to heath posts. Trachoma MDAs are conducted for five to seven days. After the MDA, left over medicines are returned to Woreda offices through health centers. Unused medicines during are stored in Woredas until the coming round of treatment. Therefore, Woredas are center of MDA medicines supply management. Woredas receive medicines allocate to health centers facilitate distribution and store medicines for longer period of time. Woredas also expect to report the stock consumption and remained quantity of medicines to Zonal health departments. If Woredas managed medicines well, trachoma program can obtain significantly advantage in saving resources and create confidence by pharmaceuticals companies then donation will be continued unit trachoma is eliminated in the country. (FMOH, 2015). Therefore, in this research the supply chain management practices of Woreda health offices is assessed.

1.2 Statement of the problem

Trachoma is the world's leading cause of infectious blindness, responsible for visual impairment of an estimated 2.2 million people, of whom 1.2 million are irreversibly blind (Pascolini D, Mariotti SP, 2010). Although effective prevention strategies and treatment are available, trachoma still remains the major cause of infectious blindness worldwide (Oswal et al. 2017). About 77% of those living in trachoma-endemic areas of the world are to be found in 29 of the countries in Africa and Ethiopia is the country most affected by trachoma worldwide (WHO, 2007). Approximately 80% of blindness in Ethiopia is believed to be avoidable; i.e., either preventable or curable (2) and trachoma is one of the major causes of low vision and blindness. (Berhane, 2011). Of the ten National Regional States in Ethiopia, the ANRS is the most severely affected trachoma endemic area of Ethiopia (Mengitsu et al., 2016). A study conducted in the North and South Wollo Zones of the ANRS indicated a 52% and 13% overall prevalence, respectively, of TF among children aged 1–9 (Emerson et al., 2008.). The antibiotic component of the SAFE strategy aims to suppress transmission in the community by treating the pool of infection found in specific groups of individuals and antibiotics treat active disease (TF or TI). (WHO, 2007). Studies have shown that when treatment coverage is higher than 90% and approaching 100%, there is a reduced chance for recurrence of infection before the next round of annual treatment. Although infection returns in severely affected villages, repeated mass treatment with azithromycin progressively reduces and may even eliminate ocular chlamydia. (Alemayehu et al., 2004)

To ensure that people have access to these essential and quality medicines, a functioning and efficient logistics management is necessary, which includes inventory management, providing adequate Supply, reliable Transportation, appropriate Warehousing and providing the right amount of medicines with appropriate information. (MSH, 2011). In opposite poor pharmaceutical SCM results in unreliable availability of pharmaceuticals that leads to stock out, shortage and treatment failure. It could also result in significant wastage of resources due to deterioration and expiration, which leads not only to the morbidity or mortality of a patient but also have socioeconomic impacts (USAID, 2011). Uninterrupted supply of safe, effective, quality pharmaceuticals at an affordable price, and rational use is crucial for the success of health program implementation (FMOH, 2010). In line with this, the FMOH prepared a standard operation procedure of NTD medicine SCM which provides a standard guidance of storage, distribution, record management, reporting, and reverse

logistics trachoma medicines which is being implemented in Woreda health offices across the country (FMOH, 2017).

SC problems like weakness of inventory control, irrational forecasting, and weakness of communication between store and outlets, wastage, stock out, delay in delivery, weak communication with facilities negatively influence the health care delivery (FMOH, 2016).

Lack of effective pharmaceutical supply chain management not only affects the availability of essential medicines, but also significantly affects efficiency. Deficiencies in selection, quantification, storage, as well as high prices, poor quality, theft, expiration of drugs, irrational prescribing, and incorrect use of medicines by patients cause losses totaling 70% of the original expenditure (MSH, 2011). In Ethiopia, studies on pharmaceutical logistics had been largely limited to specific health program drugs such as contraceptives, anti-retroviral drugs, anti-tubercular drugs and anti-malarial drugs (Daniel et al., 2012). In trachoma impact survey done to request national demand of Azithromycin for trachoma MDA in 2016, the average prevalence of active trachoma in Amhara region is 25.71% for TF (1-9 years) and 3.07% for TT. The average prevalence in North Shewa zone is TF% (1-9 years) is 28.7%, TT% is 3.7% (ANRH, 2015). Trachoma medicines SCM face similar challenges in many countries. The primary risks to full supply during MDA and to cost-effective management of the drugs, along with their impacts. They include lack of understanding of NTD SCM needs, ad hoc supply chain solutions, duplicative supply chains, lack of supply chain expertise, incomplete data reporting, resource constraints, and lack of resources for planning and implementing solutions. These challenges can lead to disruption of the supply chain, increased distribution costs, lack of accurate supply data, supply imbalances with too many drugs in some locations and too few in others, and ultimately to high levels of drug wastage and to unmet coverage targets. (Perry et al, 2015). Trachoma medicines SC is managed vertically and not integrated to existing national integrated pharmaceutical management (FMOH, 2017).

During my literature reviews, most of the researches on assessment of SCM particularly on trachoma medicines were conducted on the disease and program aspects. Researchers conducted on the SCM of trachoma medicines were very rare especially in Ethiopia. As a result, there is little insight about the SCM of these medicines. This research is to assesses SCM of medicines used in trachoma mass treatment in Woredas in North Shewa zone Amhara region focusing on the quantification, storage and inventory management, transportation, recording , reporting and reverse logistics management.

1.3 Research question

The study believed to answer the following questions;

- What are the practices of trachoma medicines quantification?
- How is recording and reporting of pharmaceuticals being performed?
- How is storage and inventory management practiced?
- What distribution management practices are employed by the Woreda health offices?
- How is reverse supply management of trachoma medicines performed?
- What disposal procedure do the Woreda health offices follows?

1.4 Research objective

1.4.1 General Objective

- To assess the supply chain management of medicines used for trachoma mass drug administration in Woreda health offices of North Shewa zone in Amhara region

1.4.2 Specific objective

The specific objectives of the study were:

- To assess current practice quantification for trachoma mass drug administration.
- To assess the storage management of trachoma medicines.
- To assess the inventory management of trachoma medicines.
- To identify existing practices of recording and reporting of trachoma medicines.
- Assess the distribution management of trachoma medicines
- To assess management reverse logistics and waste disposal management of trachoma medicines.

1.5 Significant of the study

If the supply management of trachoma medicines is not well managed, it leads to lower therapeutic coverage, wastage, expiry, theft, loss, and finally affects quality of medicines. This leads to ineffective treatment. Ineffective treatment in turn lead to insufficient coverage to reach elimination/control goals, thus requiring additional treatment, this resulted in increased cost and loss of productivity, complications, and potentially the development of resistance to current medicines. One barrier to effective elimination of blinding trachoma in the health system is that the medicines needed are often not available at time of scheduled MDA. Furthermore, access to reliable and consistent information about trachoma treatment in most is poor. Effective elimination of trachoma require that health workers and communities have access to medicines at time of MDA. Availability of these items may be influenced by a variety of factors, including poor stock control, provider experience and technical capacity, economic influences, cultural factors, storage and recording management, and the complex interactions among stakeholders of logistics management is the major one. (SIAPS, 2015)

The primary merits of the study goes to the university academics. Since there are few studies in the area, it gives a comprehensive starting point for zonal, regional and national trachoma Program managers. Public organizations, such as, FMOH, Regional Health Bureaus, Zonal Health departments, Woredas health offices, health centers, health posts and other interested organizations participating in implementing trachoma MDA will get important concepts on the overall logistics management of the pharmaceutical products and able to measure trachoma medicines supply management and will take recommendations to improve the management. This will develop awareness for the opportunities to meet the need of the customer.

The fight to eliminate blinding trachoma through MDA is under threat if factors affecting the supply chain management of medicines are not well assessed and managed particularly at Woreda level. (Umaru.F, 2015). Recommendations from this study are expected to contribute to insights to the supply chain management of trachoma medicines and which have greater contribution towards the elimination of tropical infectious diseases.

The findings have the follow practical benefits:

1. FMOH, Regional Health Bureaus, PFSA and stakeholders will see how supply chain of management of trachoma medicine is being implemented at Woreda level.

2. Stakeholders working on trachoma elimination will use the findings to improve the SCM of medicines.
3. Serving scholars as a resource for future studies in the area.

Ethiopia plan to eliminate trachoma by 2020 which is endemic to 675 Woredas and one of key strategy mass drug administration. (FMOH, 2016). This needs efficient and effective supply management of trachoma medicines and no research on supply chain management of is done. Therefore, this study is timely and important.

The result of the study benefit FMOH, PFSA, RHBs, zonal health department and stakeholders to get information on the practice of trachoma medicines supply management, identify areas that need more attentions and collaboration in the public, identify intervention areas of the supply management and identify existing reverse logistics management practices. Further this research paper can serve as a reference material to students and researchers who want to undertake further researches on the same or related topics in future.

1.6 Scope of the study

There are many problems that affect the supply chain management of medicine used in mass treatment of trachoma before, during and after mass drug administration. This study mainly focuses on assessing trachoma medicines supply management practices of Woreda health offices in North Shewa zone of Amhara region. Trachoma medicines quantification, storage, distribution, recording and reporting, inventory management, reversers logistics management practices are going to be assessed using structured questionnaire and by visiting medical stores in sampled Woredas.

1.7 Limitation of the study

The study focuses on assessment of trachoma medicines supply chain management at the Woreda health office level. Hence it didn't include overall supply management practice at the higher supplying unit (PFSA) and lower health facility level.

1.8 Definition of terms

- **Trachoma** is an infectious disease caused by bacterium *Chlamydia trachomatis*. The infection causes a roughening of the inner surface of the eyelids, which can lead to pain in the eyes, breakdown of the outer surface or cornea of the eyes, and eventual irreversible blindness if left untreated.
- **Mass Drug Administration:** is the direct administration of Azithromycin and tetracycline eye ointment to the entire population at risk in trachoma endemic area in order to eliminate blinding trachoma.
- **Medicine:** Medicine used in mass drug administration of trachoma such as Azithromycin tablet, pediatric oral suspension and tetracycline eye ointment.
- **Supply chain management:** is management of drugs encompassing quantification, storage, transportation/distribution, inventory, reporting and record management, reverse logistics management practices so as to satisfy customers.

1.9 Organization of the study

This study is organized into five chapters. The first chapter of the thesis presents information about the introductory part including background of the study, statement of the problem, research questions, objective of the study, and significance of the study, scope of the study, limitation of the study, and definition of terms.

The second chapter focuses on research design and methodology of the study. It describes the type and design of the research, detail description of samples of the study, data sources, data collection tools and procedures, methods of data analysis and the like.

Chapter three includes review of related literatures both conceptual and theoretical literature and empirical literature on supply chain management of medicines used for trachoma mass drug administration.

The fourth chapter presented results and discussions about the research. Here, the results/findings of the study summarized and interpretation as well as discussion with the use of related literature review is explained. Finally, the fifth chapter consists of summary, conclusion and recommendation of the study.

Chapter two: Methodology

2 . Description of the study area

The study was conducted in Woreas of North Shewa Zone, Amhara region. North Shewa is one of 10 Zones in Amhara Region. The Zone is bordered on the south and the west by the Oromia Region, on the north by South Wollo, Amhara region, On the northeast by the Oromia Zone, Amhara region. On the east by the Afar Region. Towns and cities in North Shewa include Ankober, Debre Berhan, and Shewa Robit. (Ege. 2010). According to the central statics agency projected population of 2,248,418. (CSA, 2013)

The zone has 24 Woredas and of these two, Debre Birhan and Shewarobit, are town administration **(**Ege, 2010**).** The study area is chosen because it had been conducting trachoma MDA for longer period of time as the MDA had been conducted starting from 2005. (Alemaehy et al., 2015) Conducting trachoma MDA for longer time in this area enabled the researcher to get supply chain practices of longer time period in the Woredas.

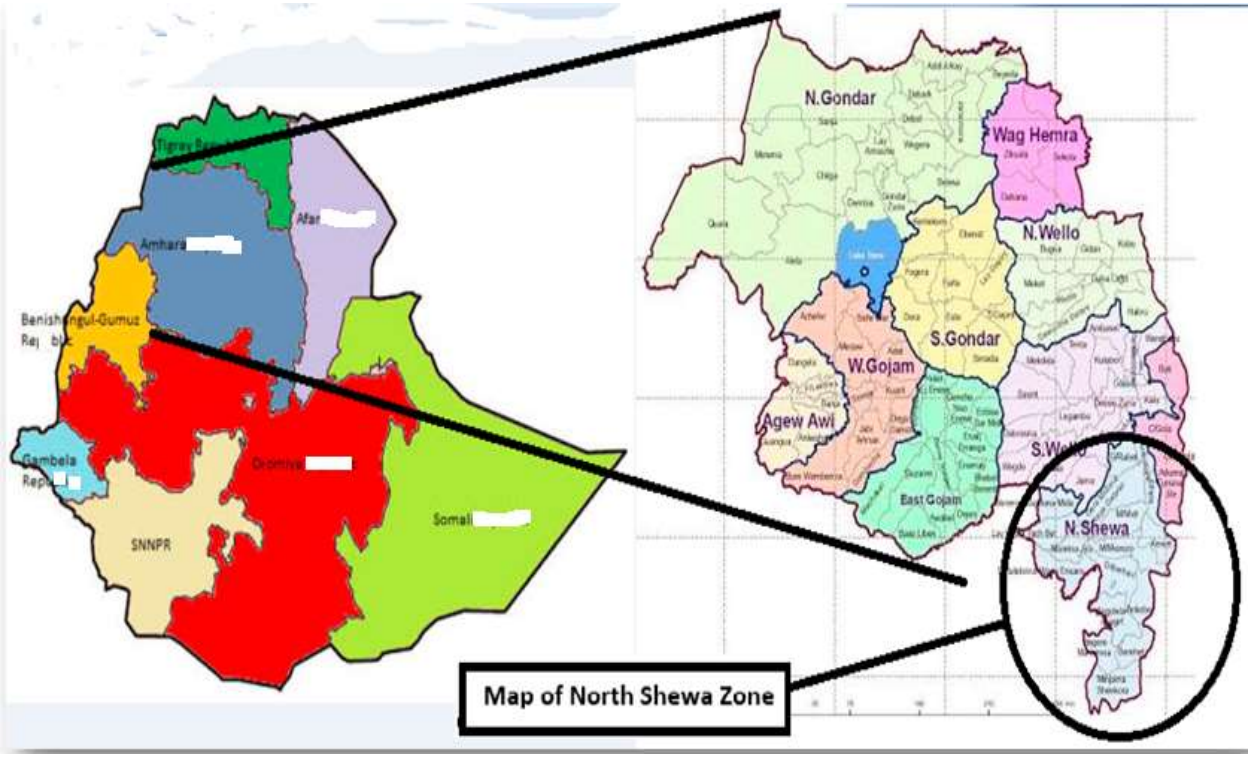

Figure 1. Map of North Shewa Zone, Amhara Region.

2.1 Research approach

In this study, a combination of qualitative and quantitative approaches of doing research was employed.

2.2 Research design

To assess the supply chain management of medicines used for trachoma mass drug administration, the researcher used a descriptive type of research design and it is a cross-sectional type.

2.3 Unit of Analysis

To ensure sustainable pharmaceuticals supply management system, advocacy and involvement of all stakeholders particularly Woreda health offices is pertinent (Shewarega et al, 2015). Woreda health offices are crucial administrative bodies in strengthening and implementing trachoma medicines supply chain management. (FMOH, 2017).

As far as the unit of analysis is concerned, Woredas were taken as unit of analysis for this particular study. Logistics officer of a Woreda were the relevant respondents for the study. Logistics officers were chosen because of the fact that they were most accustomed with and have the relevant information pertaining to the supply chain management of medicines used in trachoma MDA. The target population was one personnel form each Woreda and there were 21 in number.

2.4 Population of the Study

All Woreda health offices in North Shewa zone were sources of study. There are 24 Woredas in the Zone (Ege. 2010). Three Woredas such as Shewarobit, Berehet and Menz Gera have not been performing trachoma MDA for the last three years as they reached ultimate intervention goal of trachoma prevalence below 5% and therefore 21 Woredas were target population. Trachoma MDA had been conducted in Woredas starting from 2005 (Alemaehy et al., 2015). Therefore, twenty one Woredas that do have experience of supply chain management of trachoma medicines used in mass drug administration were targeted for the study.

2.5 Sampling Design

Survey method was employed and all 21 Woredas were used and study was undertaken in these Woredas.

2.6 Data sources and types

The study used both primary and secondary data collection methods to achieve its objective. The primary data was collected by using structured questionnaires and observation. In addition, secondary data was collected from documents, formats and performance reports of Woreda health offices, zonal and regional health bureaus for further confirmation of the findings.

In the questionnaire, the supply chain practices were grouped into eight constructs that are adapted from JSI Supply chain assessment tool (JSI, 2013). They are trachoma overview, staffing/training and organizational support, data recording and reporting, quantification and ordering, distribution/transportation, inventory management, storage/wastage management and reverse logistics activities were included in the questionnaire.

2.7 Data collection procedures

Structured questionnaire which is originally developed by John snow Inc. (JSI-2013) and locally adapted was used to collect quantitative and qualitative information from the Woreda health offices. On top of the information which was collected through interview using the structured questionnaire, observation of storage room and availability of record keeping was undertaken, and interview was conducted to logistics officers.

2.8 Ethical Consideration

Prior to launching the assessment, North Shewa zonal department and the management from the respective Woreda health offices was informed about the study. This was done using letter provided from Addis Ababa University College of commerce. During data collection, each respondent was told the purpose, scope, and expected outcome of the study. Respondent which were not interested participating in the assessment were decline. All data were anonymous; no individual or Woreda name was listed in any reports or any publication based on this study. The information collected from Woreda was also kept confidentially in order to keep their ethical value.

Woreda secured data like quantities of drug expiry, wastage and stock on hand were not among the requirements for the analysis.

2.9 Data analysis

In the assessment both qualitative and quantitative data was collected and analyzed according to its type. For the analysis of the quantitative data descriptive statistics supported by SPSS software version 20 was applied and for qualitative data document analysis was done. Descriptive analysis such as frequency and percentiles were employed to analyze the collected data. Data presentation and interpretation were made using tables in order to display the collected data in a concise and meaningful way.

2.10 Validity and Reliability

2.11.1. Validity

To test validity of the questionnaire, pilot study on two persons from Woreda logistics officer were conducted. The two persons were given twenty five minutes to complete the questionnaire and the researcher was available to assist. Respondents were asked to comment on the format and wording of the questionnaire. Few changes to the questionnaire after a pilot study was required and taken immediately. A questionnaire were tested in order to ensure that all items are clear and understandable. This was performed before the main study was conducted.

2.11.2 Reliability

The researcher ensured the data collected are reliable. This had been done using SPSS and in references to Cronbach's alpha's coefficient of reliability that gives an unbiased estimate of data generalization. An alpha coefficient of a study is greater than 0.7 (which is 0.744) and this indicates that the gathered data are reliable as they have a relatively high internal consistency and can be generalized to reflect opinions of all respondents in the target population.

CHAPTER THREE

3 Literature review

The literature of the study covers an explanation about the basic concepts which provide definition for supply chain and pharmaceutical supply chain.

The review also discussed about the general practices of logistics and the logistics management of health supply chain particularly medicines used for neglected tropical diseases in different countries health programs. The theoretical and empirical literatures are presented in combination with each other, explicitly they are not separated.

3.1 Theoretical Literature Review

3.1.1 Supply Chain Management Defined

The term "supply chain management" arose in the late 1980s and came into widespread use in the 1990s. Prior to that time, businesses used terms such as "logistics" and "operations management" instead.

Chopra and Meindl (2007) go further and state that a supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves. Within each organization, the supply chain includes all functions involved in filling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, and finance and customer service.

Over time, the profession of supply chain management has evolved to meet the changing needs of the global supply chain. According to the Council of Supply chain Management Professionals defines that supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers and customers. In essence, supply chain management integrates supply and demand management within and across companies.

Supply chain management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-

performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology (The Council of Supply Chain Management Professionals, 2009).

Supply chain management is the process of planning, implementing, managing and controlling all activities involved in sourcing, procurement, distribution, and logistics management, with the aim of satisfying the end users as efficiently as possible. Importantly, it also includes coordination and collaboration with middle-level partners who serve as a link to the end users. (SIAPS, 2015)

Customer is an integral part of the supply chain. The primary purpose for the existence of any supply chain is to satisfy customer needs, in the process generating profits for itself. Supply chain activities begin with a customer order and end when a satisfied customer has paid for his/her purchase. The term supply chain conjures up images of product or supply moving from suppliers to manufacturers to distributors to retailers to customers along a chain. Thus, most supply chains are actually networks. (Enserumu. M, 2013)

3.1.2 Pharmaceutical Supply Chain

The healthcare industry is of significant importance in both economic development and social welfare in modern economies. Healthcare is traditionally defined as the delivery of treatment and services to people in need of medical attention. Healthcare supply chain management differs from other application in term of key elements as it tends to be high costs for healthcare providers and heavy dependence on third party. There are multitudes of factors to be considered so as to ensure on-time delivery, protection and product integrity from origin to destination. This is a highly sensitive supply chain that everything less than 100% customer service level is unacceptable as it directly influences the health and safety. Effective supply chains not only help ensure commodity security, they also help determine the success or failure of any public health program. Both in business and in the public sector, decision makers increasingly direct their attention to improving supply chains, because logistics improvements bring important, quantifiable benefits. Well-functioning supply chains benefit public health programs in important ways by increasing program impact, enhancing quality of care, improving cost effectiveness and efficiency (USAID, 2011).

The availability and accessibility of medicines are the result of the proper operation of the key pharmaceutical management functions of selection, procurement, distribution, and use within the appropriate policy and regulatory environment. NTDs, which are treated through MDA campaigns, follow a different supply chain from many other public health programs. (Center for Pharmaceutical Management. 2011)

3.1.3 Role of supply Chain Management in Trachoma elimination

The goal of a health supply chain management system is much larger than simply making sure a product gets where it needs to go. Ultimately, the goal of every public health supply chain management system is to help ensure that every customer has commodity security. Commodity security exists when every person is able to obtain and use quality essential health supplies whenever he or she needs them. A properly functioning supply chain is a critical part of ensuring commodity security—financing, policies, and commitment are also necessary. If a logistics system provides a reliable supply of commodities, more people are likely to use health services. Customers feel more confident about the health program when they have a constant supply of commodities—it motivates them to seek and use services. (USAID, 2011) Well-supplied health programs can provide superior service, while poorly supplied programs cannot. Likewise, well-supplied health workers can use their training and expertise fully, directly improving the quality of care for clients. Customers are not the only ones who benefit from the consistent availability of commodities. An effective supply chain management helps provide adequate, appropriate supplies to health providers, increasing their professional satisfaction, motivation, and morale. Motivated staff are more likely to deliver a higher quality of service. An effective supply chain contributes to improved cost effectiveness in all parts of a program, and it can stretch limited resources. Strengthening and maintaining the logistics system is an investment that pays off in three ways; it reduces losses due to overstock, waste, expiry, damage, pilferage, and inefficiency. Since drugs and other Pharmaceutical items covers up to 40 % of the countries health care budget, proper supply chain management of these items is indispensable as poor management will lead to stock outs and shortage of items that would prevent access to medicines and poor health outcomes. In addition, poor management of these items may lead to overstock and wastage of items that will lead to health hazard and wastage of limited resources. (MSH, 2011)

The battle against Neglected Tropical Diseases (NTD) requires teamwork, partnerships, and collaboration across multiple organizational sectors. The pharmaceutical industry donates millions of doses of medicines each year to treat NTDs across more than 70 countries. Supply Chain Management plays a critical role in ensuring these medicines make it the many miles from their point of manufacture to the people who need them (NTD Supply Chain Forum, 2015).

Efficient supply chain management of trachoma medicines is critical given the World Health Organization (WHO) goals to eliminate the spread of these diseases by 2020. The first and fundamental step in the process consists ensuring a high effective and efficient supply chain that the NTD drugs are of high quality and available at the required quantity for distribution during a MDA. It is clear that quality of medicines cannot be ensured only at the manufacturing level by using quality raw materials and Good Manufacturing Practices rather it requires standard, effective and efficient supply chain management until the end users. (FMOH, 2015)

3.1.4 Supply Chain Functions

Effective drug supply management ensures the uninterrupted availability of quality, approved, safe and effective pharmaceuticals. Drug supply management at Woreda health offices involves the following key functions: selection, quantification, storage, distribution and use/MDA/. (FMOH, 2010). Each activity and its objective are described briefly below:

1) Quantification

Quantification answers the question, "How much should be procured and when should it be delivered?" Quantification includes both forecasting and supply planning. It is the process of estimating the quantities and costs of the products required for a specific health program (or service), and determining when the products should be delivered to ensure an uninterrupted supply for the program. Quantification takes into account the expected demand for commodities, unit costs, existing stocks, stock already on order, expiries, lead time, minimum and maximum stock levels, and shipping costs. Using this information, the total commodity requirements and costs for the program are calculated and compared with the available financial resources to determine the final quantities to procure. **(**JSI and SIAPS. 2015**)**

2) **Inventory Management:**

Inventory is total stock kept on hand at any storage point to protect against uncertainty, permit bulk purchasing, minimize waiting time, increase transportation efficiency and buffer against seasonal fluctuations. Inventory management is function of supply Inventory management **t**he function of supply management that aims to provide sufficient stocks of medicines at the lowest costs possible (PFSA 2015).

The objective of inventory planning and management is to determine and maintain the lowest inventory levels possible that will meet the customer service policy requirements stipulated in the customer service policy. The logistics of inventory planning and management includes: Forecasting, Order quantity engineering, Service level optimization, Replenishment planning and Inventory deployment (MSH, 2011). The purpose of an inventory control system is to maintain appropriate stock levels to meet the needs of patients. A well designed inventory control system informs personnel when and how much of a commodity to order and helps to reduce shortages, oversupply, and expiry of commodities. (FMOH, 2010).

3) **Distribution:**

Distribution is a division and movement of pharmaceutical products from the premises of the manufacturer of such products, or another central point, to the end user thereof, or to an intermediate point by means of various transport methods, via various storage and/or health establishments. Distribution involves administrative procedures, transport facilities, storage facilities and user facilities through which supplies move from a central point to the user facilities. (PFSA, 2015). Distribution is the process by which products are physically transferred from their point of production or upstream warehouse to the point at which they are available to the final customer. It is also called outbound logistics. The primary goal of distributing medicines is to maintain a steady supply of pharmaceuticals to facilities where they are needed, while ensuring that resources are being used in the most effective way. A good distribution system is a cost effective system that provide acceptable level of service (PFSA, 2016). Transportation physically

links the sources of supply chosen in sourcing with the customers we have decided to serve chosen as a part of the customer service policy. We reserve transportation for the fourth spot in the logistics activity list because the deliver-to points and response time requirements determined in the customer service policy and the pick-up points determined in the supply plan must be in place before a transportation scheme can be developed. The objective of transportation is to link all pick-up and delivery -to points within the response time requirements of the customer service policy and the limitations of the transportation infrastructure at the lowest possible cost. (MSH, 2011)

Distribution of NTDDs differs from regular distribution of essential drugs in that the NTDDs are required for be delivered to selected endemic target sites on a one time scheduled based on the frequency of the MDA which could be once or twice a year. The distribution for essential drugs is either a pull or push system where the requested quantity is distributed/delivered on a regular schedule such as every two months or every quarter or as requested by the recipient based on individual facility need. If products are not available at the central or regional medical store, the facilities purchase the quantity they need from the private sector. In the case of NTDDs the practice to date used to include collection by the district, health center or NGDO supporting a specified target area from the central medical store or NTD program management office for onward MDAs. This mode of distribution is different from the regular essential drug distribution as the NTDD distribution may not coincide with the regular ED schedule. There were times when a CMS had distributed NTDDs in its custody following ED distribution schedule of every two months disrupting the planned MDA. The primary distribution management goal for NTDs is to maintain high quality pharmaceuticals to the facilities where they are needed prior to MDA, while assuring that resources are being used in the most effective and efficient way. Distribution costs, which include costs related to storage and transportation, represent the bulk of the total cost to running an NTD program. Designing a system for storing and distribution of NTDDs is complex and vital to ensure proper timing and supplies for planned MDAs. Effective pharmaceutical distribution relies on a good system design and good management. (SIAPS, 2015).

4) **Warehousing/storage management**

Warehousing is one of a key supply chain function that able to keep medicines in a condition in which their quality is maintained and protected from damage, temperature and theft a good warehouse plan incorporates the needs of all the other logistics activities. Good or bad, the warehouse ultimately portrays the efficiency or inefficiency of the entire supply chain. The objective of warehousing is to minimize the cost of labor, space, and equipment in the Warehouse while meeting the cycle time and shipping accuracy requirements of the customer service policy and the storage capacity requirements of the inventory play. The logistics of warehousing includes: Receiving, Put away, Storage, Order picking, shipping. (MSH, 2011). Good storage practices are that part of quality assurance which ensures the quality of pharmaceutical products is maintained by means of adequate control throughout the storage thereof. (PFSA, 2015).

5) Reverse Logistics management

NTD medicines distributed to the community or school for the MDA might not consumed 100% and these remained unused medicines are accounted for the next MDA and cannot given for other routine treatment at the facility level. It is not logical and difficult to maintain the product quality by storing at the health center/ health post level. So, unused medicines both usable and damaged/spoiled medicines need to be collected back to the Woreda health office and stored there until the next MDA. The Woreda health office has appropriately store medicines as per the storage guideline and must record stock on bin cards. (FMOH, 2015)

FMOH, RHB and partners should allocate budget for reverse logistics management. Medicines quality should not be compromised during transportation. Rationality of storing medicines after and before MDA at Woreda health offices: relatively safe for medicines storage at Woreda health office since there are only few drugs are stored there. Helps to Prevent NTTDs from being dispensed by health facilities for routine purpose, Easy to mobilize medicines when shortage happens at some over stocked at some others and medicines half life is short to stay until the next MDA, While unused medicines are collected back to Woreda health office, Opened boxes and tins should be relabeled with how much is remained and from which health center, health post and school is the remaining, tablets from opened tins should not be physically counted at the health

centers, health posts and schools rather they should calculated by subtracting how much is used from the tin originally contain. Left over tablets from different opened tins should not be mixed. Others supplies such as dose poll have to also be kept at Woreda offices. Woredas have to ensure that opened and left over medicines are utilized first during the next campaign. (FMOH, 2016)

6) Reporting and recording

Gathering up-to-date and complete information is important to assure the delivery of standard service to beneficiaries in integrated MDA campaign, to calculate the service coverage, to conduct drug forecasting, and drug distribution. Therefore, data handling and reporting must be start from the service delivery center during MDA and aggregated at Woreda level and reported to Zonal and regional health department finally to the FMOH. In addition, in order to provide excellence MDA, activities should be supported with the recording checklists from the preparation throughout the drug distribution. (FMOH, 2016).

The country program manager is required to report final distribution figures to International trachoma initiative within 90 days of completion of the MDA campaign. Medicines stock reports received from countries will be considered when donating drugs by pharmaceutical companies. Record keeping is the most essential part of drug supply management. Medicines used for trachoma have to be recorded by two important forms such as Stock cards, bin cards and transfer forms. These forms will keep track of all the product movements in the distribution channel. All the storage facilities in the distribution channel should use these forms to record updated stock and the history of all transactions or adjustments. (i.e., product receiving, issuing).the record forms cards record all the stock received, issued, and adjustments done in a storage location. (ITI, 2010).

7**) Waste Disposal**

Medicines which are unfit for use shall not be stored for more than six months and the disposal of medicines waste shall be carried out according to the sorting procedures and recommended disposal methods by the appropriate organ. Any health institution which does not have a disposal facility approved by the appropriate organ shall not carry out medicines waste disposal (FMHACA, 2010)

Zithromax managers' guide of International trachoma initiative described that one of the following disposal methods should be used to dispose of the damaged/expired drugs based on the preferred method.

Table 1 Methods used to dispose of damaged/expired trachoma drugs

Priority scale	Disposal method	Methods
First	Country medicine disposal guideline/protocol	Find the Ministry of Health and/or environmental regulations of the country for the disposal of antibiotic tablets and POS
Second	Manufacturer recommended disposal method	Wet down to render unusable, then incinerate
Third	WHO guideline1	For solid antibiotics (tablets), suitable methods are waste encapsulation and sending to landfills • Medium or high temperature incineration (cement kiln incinerator) • For antibiotic POS, it can be diluted with water, left to stand for several weeks and then discharged to sewer

Source: Zithromax managers guide, International trachoma initiative, 2011

All the empty bottles after the distribution should be collected from the community distribution teams for disposal. After the bottles are collected, they are disposed of according to the country guideline. In absence of the guideline, there are three methods to dispose of plastic bottles in descending preference priority such as reuse, recycle, and bury. The bottles can be only reused

after they are properly cleaned and defaced using a permanent marker. The Zithromax label is pressure sensitive and cannot easily be peeled off. If the bottles are not reused then they can be sent to a plastic recycling facility if available. All the empty bottles should be buried in a closed pit or sent to landfills. (ITI, 2010).

3.2 Empirical Literature review

Like all public health programs, the success of NTD control programs is largely dependent on their ability to ensure that the right quantities of the right drugs are available in the right places when needed. Ensuring high coverage rates (i.e. 80 percent) is the driving necessity of PCT mass drug administration campaign programs, but it will not be achieved without reliable last mile supply chains. From the in-depth assessments in the three study countries such as Ghana, Malawi and Tanzania) and the broader landscape analysis, it is clear that NTD supply chains suffer design, capacity and implementation challenges that pose risks to full and uninterrupted drug availability. However, unlike most public health programs, NTDCPs do not have easy access to supply chain support required to identify and mitigate challenges to drug availability and to minimize drug wastage following campaigns. (James et al, 2015)

The Tanzania medical stores department is a well-resourced, integrated supply chain solution for all public health commodities including NTD drugs. It should be noted that the MSD is a parastatal agency with a single client, the MOHSW. MSD relies on handling fees paid by the MOHSW to fund its operation. Triggered by a national program request the NTD drugs are initially delivered from port to MSD Central then sent in dedicated MSD vehicles to either MSD Zonal stores or direct to district pharmacy stores. With relatively easy access to district medical offices' vehicles and sufficient fuel and driver per diem support for delivery and supervision, district council vehicles subsequently transport the commodities to HFs. From there, Community drug distributors and SHTs collect the products and materials for transport down to communities and schools for MDA. Transport costs at this level are unlikely to be reimbursed, representing the most significant stress point in the distribution of NTD commodities. In addition to the drugs, community drug distributers and SHTs must also collect registers, measuring cups for pediatric syrups, and measuring sticks or tapes. One SHT reported bringing students to the HF to assist with the collection of materials. Another HF reported that three islands within its catchment area were

unable to participate in an MDA due to shortage of funds for boat rentals. For 2014 they have added this cost to their budget request, but are unsure what the outcome will be. In regard to storage, capacity tends to be high. Storerooms and warehouses are generally well maintained, clean, and secured under lock and key. Drugs appeared to be protected from direct sunlight, water, and humidity; expired and unexpired products were generally separated, and storeroom managers were aware of and practiced first-expired-first-out (FEFO) principles. (JSI, 2014)

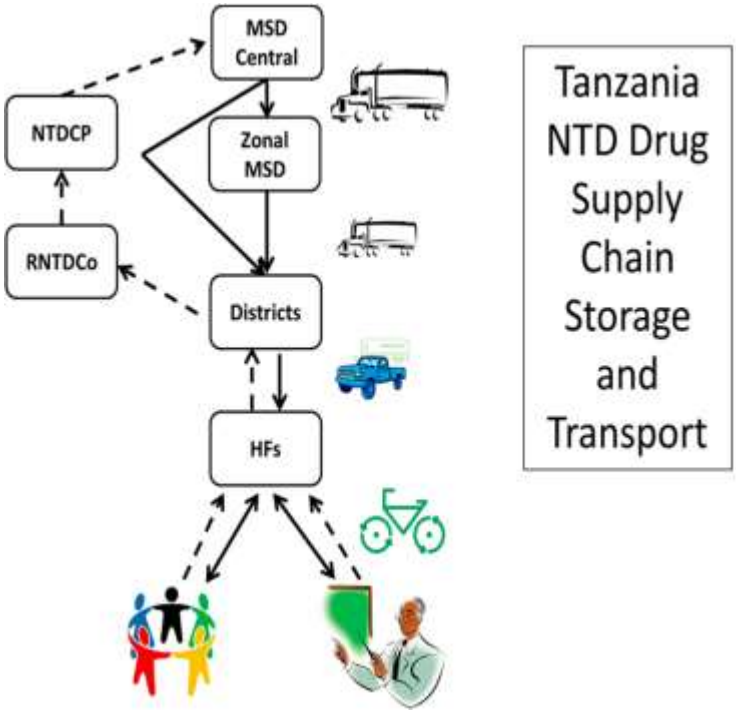

Figure 2 Tanzania's NTD Supply Chain (Perry et al, 2015)

In Cameroon Praziquantel, mebendazole, and Zithromax are received by MOH through WHO, and stored in transit by the respective program unit of the Ministry. The medicines are sent to the regions/districts according to the approved plan for MDA. In all six stores visited, there were no NTDDs received with less than six months of shelf life. The onchocerciasis program appeared better organized in terms of storage and distribution. Observations at the sites revealed that good storage practices were being adhered to, first expiry, first out was in operation, and products were well stacked. In four of the six CAPRs visited, physical stocks of available Mectizan and albendazole figures agreed with the electronic data at CAPRS. Central medical the physical stock of Mectizan and albendazole agreed with the stock cards and the electronic data. Stock received, stock issued, and closing stock data were readily accessible and verifiable. Of the three products shipped by Central medical and in CAPRs visited, all the available products had stock cards

indicating quantity received, amount issued, and quantity returned. With the support of HKI, the trachoma program ships Zithromax from the center immediately to the region, once WHO clears it from the port of arrival No stocks or stock records could be found at the center and usage figures from the regions were being compiled. The program manager indicated that these systems were now being set up by the program. As part of technical assistance, the team advised on the structure and format of the LMIS reporting tools; the proposed tools will be in line with the HKI format reviewed earlier. It is obvious that the national programs offices and the logician offices at the Delegue do not have proper storage and inventory management systems which are prerequisites for the appropriate management of pharmaceuticals. (Daniel and Kafumbe . 2013).

The Ghana NTDP is well served by the Ghana central medical store. Ghana CMS distributes health commodities from central location to Regional medical stores located in the capital cities of the ten regions. From R Regional medical stores, the drugs and materials are delivered directly to the health facility level for most public health programs. However, the NTDP has elected to utilize the districts as the lead implementing management level for the MDAs and do not take advantage of the RMS distribution to health facilities capacity and schedule. Despite RMS transport capacities having been recently strengthened with enclosed delivery trucks donated by The Global Fund to Fight AIDS, Tuberculosis and Malaria, districts report that on many occasions they are required to use district vehicles to collect the NTD drugs from RMS facilities in order to meet the campaign start dates. The drugs are received at the district health authority stores and managed by district pharmacists in coordination with DNTDCs. Immediately preceding the campaigns the drugs are distributed to the sub-districts. The ten regional medical stores do not always deliver the drugs to the districts. The 170 districts frequently collect the drugs from the RMSs and deliver the drugs to the 1,270 sub-districts. The DNTDCs rely on district vehicles and funds to both collect the drugs from the regions and to distribute them to the sub-districts. The sub-districts are required to distribute the drugs to another 2,000 health facilities nation-wide. The NTD program unit estimates that these facilities distribute NTDDs to over 21,000 primary schools for the school based (T1) campaigns and to roughly 20,000 volunteer community drug distributers for the last step of the distribution to the communities where the community-based (MDA1) NTD campaigns are implemented. In addition to the drugs, the districts, sub-districts, and community drug distributers and SHTs must also collect registers, measuring cups for pediatric syrups, and measuring sticks or tapes. (Odoom S and Kwadwo N, 2014).

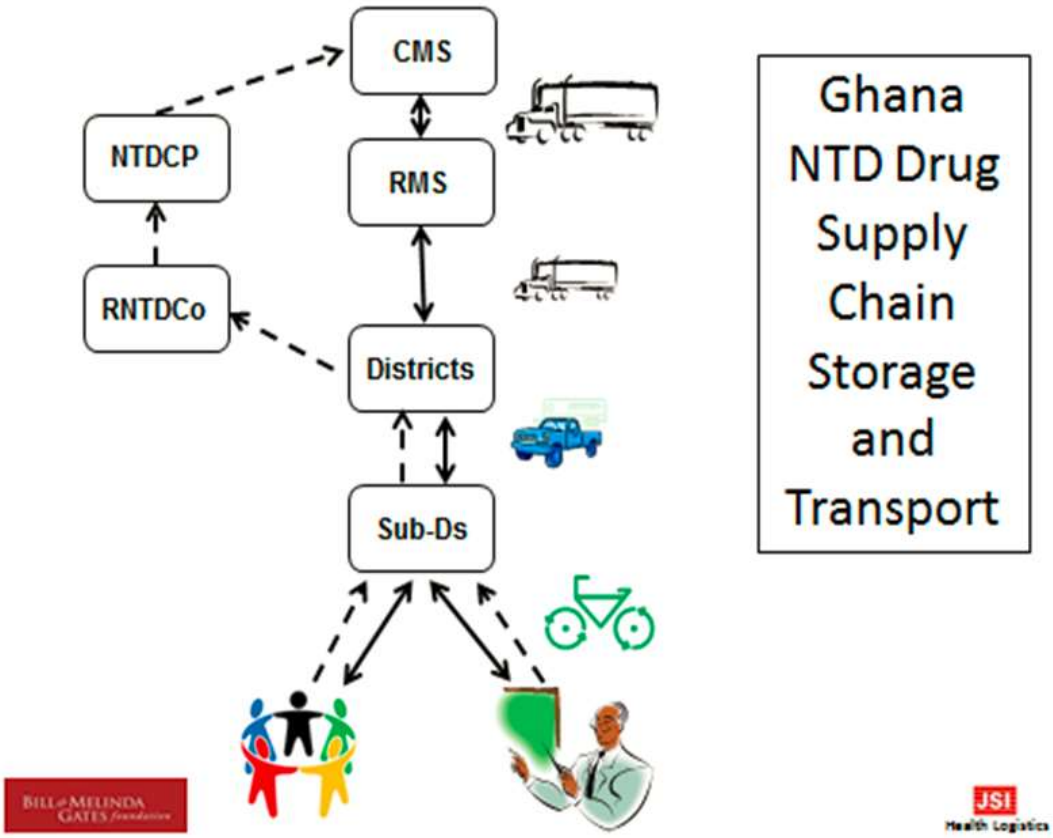

Figure 3 Ghana's NTD Supply Chain (Odoom S and Kwadwo N)

In Senegal, all NTD are quantified at the national program level. The joint request form to WHO requires that the quantities requested be justified by reporting what was received in the prior application, what was used, how many persons were treated, how much was lost/damaged, and what is left on hand. Once the application is approved and the product shipped, it is cleared through customs by WHO for trachoma medicines. Procurement of NTD drugs uses an applications for donations system where applications are initiated by the respective NTD program managers and submitted to the WHO using the joint request form. RTI ENVISION purchases all tetracycline eye ointment for MDA with support from the WHO. The districts or the health facilities that eventually supply the community drug distributers, HEW or teachers do not place orders but receive quantities determined based on the target persons determined for MDA. Stock inventory registers are often not up to date, thus rendering the estimation of real needs difficult at the regional level. In addition, the regional pharmacists were not involved in either the ordering process or the receipt of NTDDs. Supply chain–related challenges faced by the Senegal NTD program include performing accurate quantification of drug needs, ensuring reverse logistics of preventive chemotherapy NTD drugs

following MDA, and managing drug supply, including storage, tracking, inventory, and disposal. As a way of addressing these challenges, implementation of a durable and comprehensive NTDD management system, including an integrated pharmacovigilance system, is recommended to ensure safety and effectiveness of treatment (Simon et al, 2016).

Trachoma Supply management channels in Ethiopia

In Ethiopia, where all NTD medicines supply chain managed in integrated ways, the FMOH provides distribution plan of medicines to Central PFSA by Woredas as per the NTDs endemicity. At central PFSA, Woredas catchment by branch is identified and then NTD medicines are delivered to branches. The Branches considered the MDA plans and do integrated distribution of medicines to Woreda stores. Woredas in North Shewa Zone, Amhara region, are majority served by Addis Ababa branch and few Woredas are served by Dessie branch. 15 Woredas are served by Addis Ababa and remaining 9 Woredas of the zone are served by Dessie branch. Woredas use either their own store or health center's store to receive NTD medicines and after revering unused medicines. Woreda logistics experts allocate medicines to health centers. (FMOH, 2017).

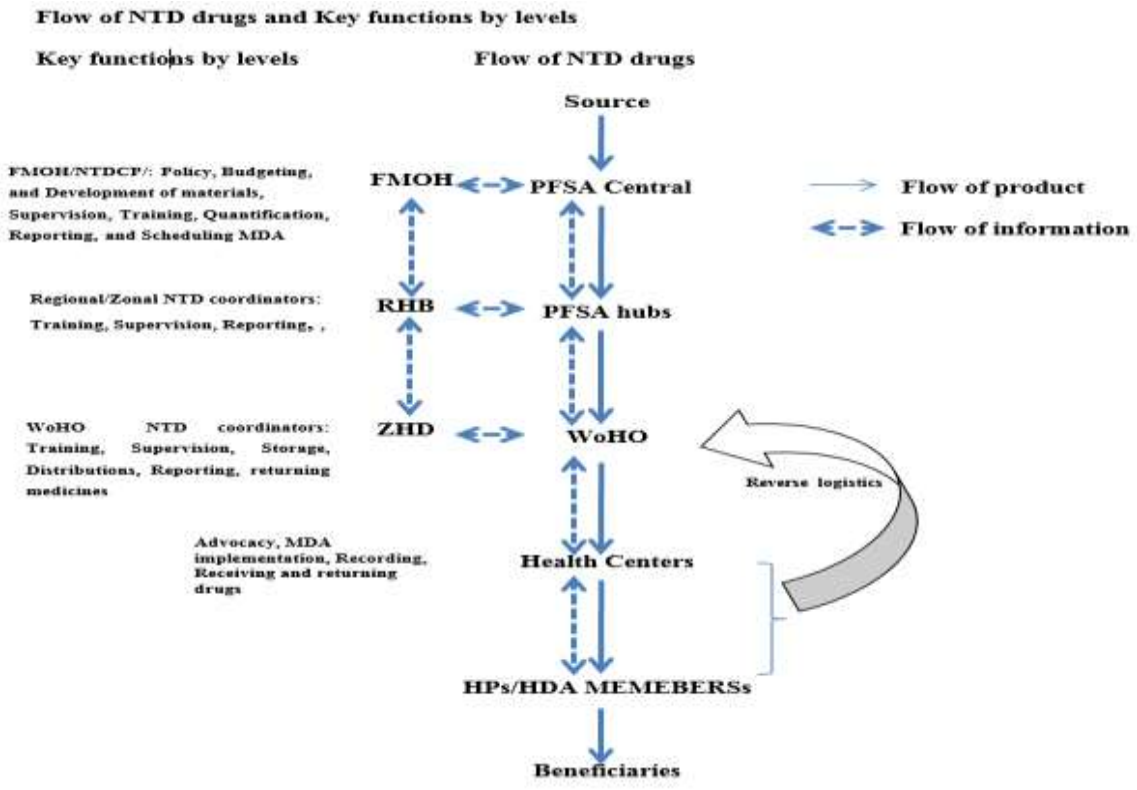

Figure 4 NTD Medicines distribution channel in Ethiopia (FMOH, 2017)

On average a health center serves five health posts. And a health post provides services to 5000 people. There is one health post per Kebele alongside two health extension workers. HEWs play a key role during MDA as coordinators and supervisors at the kebele level. (FMOH, 2016)

Training on MDAs and drug supply chain management are provided to health extensions workers then health extension workers provide orientation to health development army, MDA are of all NTDs conducted in 5 to 7 days. All residents of that Kebele as per the MDA legibility criteria will take medicines upon direct observation therapy. After MDA is completed left over medicines, recording materials and other logistics supplies are returned to health centers witiniNn5 days of period. All health centers collect medicines and delivered relevant supplies to Woredas stores this reverse logistics until Woreda offices will be completed within seven days (FMOH, 2017).

Summary and Research Gaps

This chapter reviews the various theories that are relevant to the study. In addition, the empirical literature brings out the fact that supply chain of trachoma medicines is the key, in ensuring trachoma elimination by MDA (A part of SAFE Strategy). Fewer number of studies have been conducted on trachoma supply chain. Most are short assessments which are done upon recruitment of consultants by trachoma medicines donors. Many of these short assessments propose the need to do assessment of the supply chain of trachoma medicines. In addition, many of the studies available have been carried out in developed countries. A short assessment on trachoma medicines about Ethiopia was carried out upon financial support of the donor's agent, ITI Ethiopia.

During the course of the article selection stage for the literature review, the search on Google Scholar of the terms ― trachoma medicines supply chain in Woreda offices in Ethiopia‖ or ―trachoma supply chain in Ethiopia‖ ― did not deliver any relevant articles to be incorporated to the literature review. This suggests that trachoma medicines supply chain is being understudied. In addition in the ministry of health website and databases there is no comprehensive study on the supply chain. Hence there is need to carry out a research on the supply chain management of trachoma medicines at Woreda level in the Ethiopian context.

3.3 Conceptual Frame work of the study

This part of the thesis introduces the conceptual framework that is developed for the study. The framework which is developed for this study is formulated based on approaches and concepts identified in the literature review in this chapter. Biklen stated (2003) that conceptual framework is a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation. The purpose of the framework is to explicate the conceptual logic and direction of the study. It engages leading ideas and helps to explain the significance of this study's concepts. The researcher is going to assess supply chain management practices of trachoma medicines of key operations such as quantification/allocation, storage and inventory management, transportation, as shown in the diagram below. All these functions if performed well contribute for efficient administration of medicines to public and will have greater impact eliminating trachoma. Identifying existing practices of each functions at Woreda level, which is a central actor of the SCM and point of link to upper and lower streams are critical so as to resolve poor supply chain management practices strengthen it.

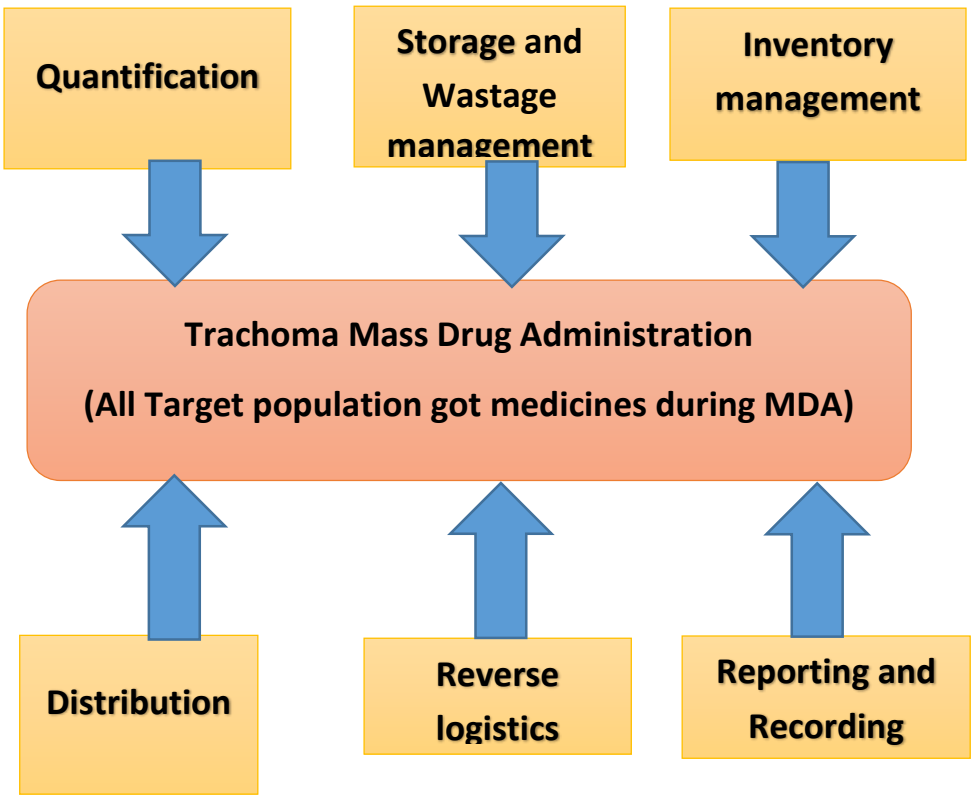

Figure 5. Conceptual framework of the study developed by the researcher

Chapter four:

4 Data analysis, Result and Discussion

4.1 Result/Findings of the study

In this part the data that were collected using questionnaires and observation are presented. The data were important to assess the supply chain management of trachoma medicines in selected Woredas of North Shewa zone. The findings and results are helpful to forward recommendations. Questionnaires were used to collect the data from logistics officer of each Woreda. In addition, documents such as recording and reporting were reviewed, and observation to Woredas storage management are done. The results are organized as follows.

4.1.1 **Response Rate and Demographic characteristics**

4.1.1.1 Response Rate and Reliability tests

From the 21 questionnaires distributed 19 (90 percent) questionnaires are filled and returned to the researcher. This reasonable response rate was made a reality after the researcher made personal calls and visits to remind the respondent to fill-in and return the questionnaires. The high response rate of 90% facilitated gathering sufficient data that could be generalized to assess the supply chain management of trachoma medicines in the zone. As cited in Worku thesis this was in line with Orodho (2009) that a response rate above 50% contributes towards gathering of sufficient data that could be generalized to represent the opinions of respondents about the study problem in the target population. This means that the response rate for this study was excellent and therefore enough for data analysis and interpretation. To check item reliability Cronbach's alpha coefficient was calculated to 36 items of the quesitionair and result is 0.74. The test results indicate that items reliability is good.

4.1.1.2 Demographic characteristics and trachoma overview

Observing the demographic trend or characteristics of our sample population before starting the data analysis is useful to make the analysis more meaningful for the reader. This part of the questionnaire requested limited amount of information related to personal and demographic status of respondents.

The importance of demographic examination in this research is to describe the characteristics of the sample, like proportion of male and female, profession and educational background and experience of respondents in the Woredas supply chain management. Accordingly these variables are summarized and described in tables shown below.

Table 2; Respondents Demographic Information, May 2018

Item	Category	Frequency	Valid percent
Sex	Male	14	73.7
	Female	5	26.3
	Total	19	100
Age	<25 years	2	10.5
	26-34 years	15	78.9
	35-44 years	2	10.5
	45-54 years	0	0
	Total	19	100
Educational background	Diploma	18	94.7
	BA/BSC	1	5.3
	Total	19	100
Profession	Pharmacy technician	18	94.7
	Pharmacist	1	5.3
	Total	19	100
Work experience after they graduated	Less than 1 year	2	10.5
	1-5 years	9	47.4
	5-6 years	5	26.3
	6-10 years	2	10.5
	More than 10 years	1	5.3
	Total	19	100
Work experiences as logistics officer in Woreda	Less than 1 year	3	15.8
	1-5 years	13	68.4
	5-6 years	2	10.5
	6-10 years	1	5.3
	Total	19	100

Number of Health Centers per Woreda	3 4 5 6 Total	7 10 1 1 19	36.8 52.6 5.3 5.3 100
Number of Health Centers per Woreda	13 15 16 20 Total	3 5 10 1 19	10.6 26.5 52.6 10.5 100

Source: Analysis of Survey data 2018, using SPSS20.s

From the above table the first item of demographic characteristics is gender. The gender distribution of respondents of the Woredas covers 14 (73.7 %) male while 5 (26.3 %) of the respondents covers female. This shows the gender distribution of sample is dominated by male. Respondents were also asked the range of their age and 15 (78.9%) of the respondents were in the age category of 26-34 years old.

Regarding educational background 94.7 % of the respondents were at educational level of Diploma while the remaining 5.3% of the respondents were at educational level of bachelor in pharmacy. This shows all Woredas trachoma supply chain management is handled by pharmacy professionals and most did have diploma in pharmacy.

The last item was work experience in after they graduated and in the pharmaceutical sector. Regarding to this 9 (47.4%) of them have total of 1-5 years while 5 (26.3%) of them have work experience of 5-6 years. When we see respondents work experiences in the Woreda, more than half (68.4%) of them had experiences of 1-5 years and 3 (15.8%) have experiences of below 1 year.

4.1.2 Staffing, training & Organizational Support

It is found from interview of respondents that majority of logistics officers, i.e., 84.2% are working as logistics officer and store manager. They have responsibilities of managing medicines such as receiving, storing, and issuing in Woreda medical stores. They are also responsible to provide technical supports to health centers and health posts. They also receive reports from lower level, compile and report to the next level. Majority of participants, i.e. 89%, had taken training on trachoma supply chain management and have participated in mass drug administration at least once a time. As obtained from a qualitative approach of data collection, level of satisfaction of

respondents on the training provided on each components of supply chain management is low. More than half of the respondents (52.6%) are neutral for their level of satisfaction on training on provided regarding quantification of medicines required for trachoma mass drug administration. Regarding to training provided on inventory management, 47.4% were satisfied on the training they have taken. Majority of respondents, 63.2%, were satisfied on the training they have provided on storage management. More than half of the respondents were satisfied on distribution and wastage/expiry management training of trachoma medicines. 47.5% of them are neutral when they were asked about their level of satisfaction concerning reverse logistics management.

Of the two key questions raised by the quesitionair were the respondents' level of satisfaction regarding lengths of days and availability of trachoma mass drug administration mass standard operating procedures. Only 36.8% of participants were satisfied on the lengths of days they have been provided prior to conducting the MDA. Majority of them (68.4%) don't have SOP at their office. 78.9% respondents were provided supportive supervision form either regional or zonal health departments.

4.1.3 Quantification

Major, i.e., 17 (89.5 percent), of respondents' have taken training on quantification and all of the respondents were replied that they had participated in quantifying trachoma medicines. The respondents were requested as "What data do you use to determine quantity of drugs needed for trachoma MDA?" 94.7% of the respondents were replied that they were using Projected population from Regional level provided from BOFED, the age category data for the population, stock of available at their Woreda, wastages/losses/expires and previous consumption patterns. Though they requested, none of them were saying they are not using projected population obtained from federal regional statistics agencies. As per the respondents replied that 47.4% of Woreda trachoma drug demand was quantified by logistics officers, 26.3% of Woredas quantification is performed by program officers and 26.3% by both logistics and program officers. As per the respondents reply, majority of Woredas (68.4%) observed excess quantity of medicines and only 31.6% of them replied that no gaps on the medicines quantified. This deviation on quantification of medicines is probably due to the training provided and the population which they are using which is the projected population at Woreda level.

4.1.4 Inventory management

In this part of the study's report, analysis conducted on data gathered to assess the inventory management practices of Woreda health offices is presented in relation to the objectives of the study. Majority of Woredas (73.7%) conducted inventory of trachoma medicines at least once a year. Only 26.5% Woredas have practiced inventory taking of twice a year. Regarding to trachoma medicines recording, only few (31.6%) of the logistics officers are using bin cards to record trachoma medicines available at Woreda stores.

4.1.5 Distribution and transportation

All logistics officers replied that PFSA delivered medicines directly to Woreda health office stores prior to the MDA. 79% of the Woredas are served by PFSA Addis Ababa branch, 16% of them obtained the medicines from PFSA Dessie and 5% from PFSA Adama branch. As per the respondents reply, the channel of distribution varies from Woreda to Woreda. 47.4% of logistics officers confirmed that it is Woreda health office that directly deliver trachoma medicines to health posts. 26.3% of Woredas delivered medicines to health centers then health centers allocate and distribute medicines to health posts. The remaining 26.3% use mixed channel of delivery, some use the first channel i.e., delivery directly from Woreda to Health posts for accessible health posts and the remaining Woredas delivered medicines to health posts. In the interview, it was found that it is the Carter Center that allocated budget for transportation and per diem for drivers. As per the qualitative data collection method, some respondents suggested that it would be more sustainable if the Woreda offices take responsibilities in of drug distribution as it makes the program more sustainability.

4.1.6 Reverse logistics management

All participants replied that medicines and other supplies left over after MDA are returned to Woreda stores and returned within 5 days after MDA completion. 57.9% of returns of medicines is done via vehicles and others return medicines by foot carry on (26.3%) and by moto cycle (15.8%). Channel of transportation is displaced in table below;

Table 3: Reverse logistics management channels in Woredas of North Shewa Zone, May, 2018

Distribution Channel	Frequency	Percent	Valid Percent	Cumulative Percent
Health post –Health center-Woreda	2	10.5	10.5	10.5
Health post to Woreda	14	73.7	73.7	84.2
Mixed type in a Woreda (use both)	3	15.8	15.8	100.0
Total	19	100.0	100.0	

Source; Survey result exported from SPSS 20, 2018

As it is displaced in the table, reverse logistics is majorly done from health posts to Woredas. 15.8% of logistics officers replied that reverse logistics is done either of the two channels. Only few of them (10.5%) replied that health posts return unused logistics to health centers and health centers collect all health posts logistics and deliver to Woreda offices. All logistics officers replied that all supplies after reversed from all lower levels in either of the channels are stored in Woreda stores until the next MDA.

Al most all respondents replied Azithromycin tablet, suspension, measuring dose pole are returned to their Woredas. Only one respondent replied that tetracycline eye ointment is returned in addition to the above listed items. During returning these medicines and supplies, majority of respondents (68.4%) use model 19, formal government model, others are using verbal records to receive (21.1%) and only few (10.5%) are receiving using letters obtained from lower level.

4.1.7 Reporting and recording

All respondents had replied that all supply reports on trachoma are reported within 5 days. Majority, 78.9%, of them believe that the report are complete and only 21.1% of them found that the report obtained from lower level, either from health centers or from health posts, is not complete. Among those who had not the report complete, 25% have found that expiry dates of medicines is the commonest report components that is usually missed in the report. As per the respondents reply, the time of sending aggregating from Woredas to zonal health bureau is similar to the timing of lower levels to Woreda health offices. 73.7% of respondents said that Woreda health offices immediately aggregate reports and send with 5 days of MDA completion.

4.1.8 Storage and wastage management

Majority of logistics officers, i.e. 84%, are working as a logistics officer of the Woreda and Woreda store manager. It is only 16% of those logistics officers working as logistics officer only. 52.6% of logistics officers answered yes for the question "do you think your store is sufficient to accommodate medicines incoming to your Woreda?" and the remaining 47.4% logistics officers believe that their Woreda have not enough storage room. Target Woredas' stores are visited and rates as very poor, poor, satisfactory, good, very good and excellent in references 14 requirements of standard guideline.

Table 4; Table storage guidelines implementation of Woreda stores of North Shewa Zone, 2018

Rate		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very poor	1	5.3	5.3	5.3
	Poor	7	36.8	36.8	42.1
	Satisfactory	4	21.1	21.1	63.2
	Good	4	21.1	21.1	84.2
	Very good	2	10.5	10.5	94.7
	Excellent	1	5.3	5.3	100.0
	Total	19	100.0	100.0	

Source; Survey result exported from SPSS 20, 2018

As shown in the above table, it observed that 36% of the store meets eight of the requirements of standard storage guideline. In cumulative, Few Woreda stores (37.1%) meet more than eleven requirements of store guideline is satisfactory (21%), good (22%), very good (10.5%), and excellent (5.3%). All logistics officers replied that unused medicines after MDA are returned from health centers and post to stored in Woreda stores.

Regarding to expiry and damaged trachoma medicines management, 57.9% of respondents replied that they have separated expired/damaged medicines from usable medicines in their Woreda store.

Only 15.8% if respondents do have expired/damaged trachoma medicines. Majority of respondents (73.7%) replied that expired medicines in their Woreda are disposed at Woreda level and the remaining are disposing in health centers disposal facilities. None of them replied health posts are not being used as center of disposal for expired and damaged medicines. More than half of respondents (68.4%) had disposed empty bottles used to pack trachoma medicines and 26.3% of respondents are using mixed approach (disposing some empty bottles and recycling it). in most Woredas (42%) there are empty bottles holding significant spaces in the store.

4.2 Discussion of the findings

Staffing, training & Organizational Support

From the interview of respondents, trainings are conducted in a cascading fashion: they begin with national-level program managers training at regional staff, who in turn train Woreda staff; Woreda staff train health center and health post staff; and health post staff then train community leaders to facilitate and organize the public for MDAs. They also claimed that two days training is not enough especially for those new staff who are taking the training for the first time. They also said that trachoma medicines supply chain training is provided together with other diseases. Few respondents, 11%, have not taken the training of trachoma medicines supply chain management. The quality and consistency of the annual training is paramount in ensuring that the right quantities of the right drugs are available in the right places at the right times. The finding of this study shows that majority of respondents (68.4%) don't have SOP at their office that will be used for their references. This is the same a study done in Ghana that there are no reference booklets/pamphlets highlighting key messages and SOPs disseminated to the lowest levels (Odoom S and Kwadwo N, 2014). However, in similar study done in Tanzania in 2014, two explanatory pamphlets distributed during the trainings along with other standardized materials including report forms and register books that used for experts for further references. (Mwingira U and Kaitaba O, 2014). The references materials allow them to manage supply efficiently and make the mass drug administration as efficient as possible. However, more than half of respondents don't have any to refer at their hand.

Quantification

Quantification of trachoma medicines is mainly based on population census obtained from central statistics agency, trachoma prevalence, and balance on hand, expiry potential, or lead time. Excess

quantity happened in majority of Woredas (68.4%) happened may probably happened as population source used not that of central CSA provided. Most of the respondents (94.7%) replied they were using projected population obtained from regional health bureau and few are using population estimated from lower level.

Inventory management

Many of the logistics officers (43%) do not maintain inventory control records for the trachoma medicines as they assumed few number of medicines are kept in the Woreda. Similar assessment done in Ethiopia in 2013 also showed that use of bin cards or stock cards for recording transaction and document balances, expiry, and batch numbers is not widely applied or not updated regularly. The study done in Ghana shows similar result but the of district logistics officers for not using is different as they consider medicines to be "pass through" products for which they have very limited responsibility.

Distribution and transportation

In Tanazania, Products arrive at the Central MSD, and are subsequently transferred to the Zonal Stores, District Medical Offices, and health facilities including dispensaries and health Centers. (Mwingira U and Kaitaba O, 2014). All Woredas got their trachoma from either PFSA Addis Ababa or Dessie or Adama hub. After the hubs delivered medicines, 47.4% of Woreda health office directly deliver trachoma medicines to health posts. 26.3% of Woredas delivered medicines to health centers then health centers distribute to health posts. The remaining 26.3% use both of the above. In a similar research done in Tanzania in 2014, Products from central medical store transferred to the Zonal Stores then to district medical Offices and final to health facilities (Mwingira U and Kaitaba O, 2014). All respondents were replied that it is Woreda office who assign vehicles for transportation of medicines for supportive supervision in MDAs and it the carter center, trachoma supporting partners who allocate budget for fuel and drivers perdiem. In a similar study conducted in Ghana district offices are responsible to arrange for vehicles and allocate funds to both collect the drugs from the regions and to distribute them to the sub-districts.

It is better if the distric/Woreda managed budget and this ensures program sustainability. So as to have efficient supply management, PFSA central deliver medicines to branches and branches distribute to Woreda offices, Woreda offices will deliver medicines to health centers and all health centers will allocate to health posts of under their cluster. (FMOH, 2017). From the finding it is found that 52.6% of distribution channel is not as per the ministries direction and standard operation procedure. Including dispensaries and health Centers. Relatively easy access to District Medical Office/Officer vehicles and sufficient fuel and driver per diem support for delivery and supervision, district council vehicles subsequently transport the commodities to HFs. From there, Community drug distributors and SHTs collect the products and materials for transport down to communities and schools for MDA.

Reverse logistics management

The finding of this study showed that medicines and other supplies left over after MDA in all Woredas are returned to Woreda stores within 5 days after MDA completion. A similar study conducted in Ghana showed that left over drugs after MDA are returned to to higher levels until they arrive at regional medical stores where they are to be counted into drug management planning. However, all logistics officers at lower have get challenges of returning medicines as no budget is allocated for this purpose. As majority of respondents are using their own foot as transportation method to return medicines, the quality of medicines may be affected during transportation. Similarly, in Ghana, in the same research, there is no systemically available compensation for public transport or public sector (fuel) facility transport to return NTD drugs s remaining after MDA campaigns. (Mwingira U and Kaitaba O)

Reporting and recording management

The finding from study shows 25% of respondents were not including expiration dates and batch number of medicines. This is lower than that of a study conducted in Tanzania in 2014 at eight districts, all districts reports found to contain Opening Balance, Number Received, Used, Lost, and Remaining, as well as the Batch number and Expiration date. As obtained by the interview, summary reports received from lower level are aggregated into Woreda reports and then summarized, sent to the zonal level. It is Standard practice for the detail from lower level reports to be attached to the higher level report. Reports from all Woreda are officially and manually

received and sent to zonal office by letter. In Tanzania in similar stud he reports are typically entered into excel templates and forwarded to the next level by e-mail. For timely delivery of reports and so as to do timely decision reports are better sent by email as Tanzanians are doing.

In the study respondents were asked for what purpose the logistics reporting used at higher level and majority of them (65%) have answered that is to create another report and to send it to the higher level. The key decisions majority of respondents (82%) were doing by using the supply data they obtained are how many drugs did not get used and are available for the next MDA, to accurately use the data to quantify drug needed, and to use re-distribute among other Woredas and to Woredas in West Amhara. This will help to reduce resources wastage and enhance efficient utilization of medicines. Pfizer, trachoma drug donating pharmaceutical company as described in ITI Zithromax manager's guide, requires that report have to include all relevant supply related information such as beginning balance, amount received, losses/adjustments, ending balance, expiry dates and batch numbers. International trachoma initiative, and trachoma medicines management delegate of Pfizer, instituted an annual application process for new country applications as well as countries applying for additional rounds of Zithromax treatments. The application requests information on up-to-date treatment distribution data, in-country inventory, and an update on prevalence data. The data collected in this process allows ITI to determine the long term Zithromax needs in a particular country as well as evaluate the progress towards the elimination of blinding trachoma. (ITI, 2010)

In the qualitative finding, they most logistics officers are not happy to receive reversed medicines and most found to prefer left over medicines to be kept at health center and health posts. The respondents were also happy if the ministry of health decided to use leftover medicines of shortest expiry to be used for routine purposes of treatment other than trachoma.

The finding of the study revealed that 73.7% of respondents did have practice of reporting Woredas aggregated data to higher level within 5 days of MDA completion, and Woredas usually get reports from lower level within two days of completion of MDAs. This finding was supported by interview as there are review meeting after completion of MDA and it during this time reports are delivered to Woreda experts. In the integrated MDA training manual, reported timeline is delineated by the FMOH as Health Extension Workers must compile the Kebele Report by collecting the registry catalog after the completion of the MDA and report to the health center within one week period.

The time to compile and deliver the report from zone to camp after MDA should not exceed seven (7) days. (FMOH, 2017). The finding shows that Woredas in North Shewa zone receive reports from lower level and send aggregated report to higher level by far earlier that what the FMOH is listed out.

Storage and wastage management

The study shows that 52.6% of logistics officers believed that their storage is not sufficient to accommodate what a Woreda is holding. Form similar study conducted in Ethiopia in 2013, 45 percent of the districts said they have adequate storage structure for the anticipated scale-up. (Daniel, 2013). The finding of the study shows most Woreda stores (62.9%) meet less than eleven requirements of store guideline and this shows Woredas storage are below standards. This result similar to a study done in 2013 in Ethiopia, the study summarized the findings as district storage (either at the district office or HC) is generally below the standard in terms of space, condition, and storage accessories such as shelves and pallets. Storage of Azithromycin at the Woreda level is limited to holding for few days before MDA. The only Zithromax® stored for relatively longer period is returned stock. Pharmaceutical storage at most districts faces challenges such as lack of organization, inadequate space, cleanliness, and commingling with nonmedical commodities. These have the potential to affect quality of the products and make inventory control difficult. In the study only 37.1% of woreda stores meet basic storage guidelines, the result is similar to done in Ethiopian in 2013 that 60 percent do not meet basic standards of medicine storage. In majority of stores (63.2%), it was found that drugs appeared to be protected from direct sunlight, water, and humidity; expired and unexpired products were generally separated, and storeroom managers were aware of and practiced first-expired-first-out (FEFO) principles. Although large quantities of expired Zithromax® do not exist, the assessment found that no standard way of empty containers management throughout the Woredas. The qualitative finding shows that there are some logistics officers who are not aware for what purpose Azithromycin is kept at their medical store. This may prone trachoma medicines to be used for other routine purpose than the MDA.

Chapter Five:

5 .Summary of Findings, Conclusions and Recommendations

This chapter gives a summary of findings of the study, conclusions and recommendations for the assessment of trachoma medicines supply chain management in Woredas of North Shewa Zone of Amhara region.

5.1 Summary of findings

According to the respondents, there is high workload to logistics officers and number of training days are found to be short and training materials to refer after training are provided to few of them. Quantification of trachoma medicines is mostly performed by logistics officers. Though drug national donation trachoma medicines are provided based on CSA projected population, none of Woredas are using this data to quantify drug demand of their population. More than half of respondent found trachoma medicines provided to their Woreda are excess in quantity.

All Woredas are taking inventory of medicines available at their hand and only one third of logistics officers are using bin cards to control their inventory. Budget for transportation is solely depends on NGO, The carter Center. Channel of transportation is dissimilar among Woredas and most Woredas are directly deliver trachoma medicines to health posts.

Reverse logistics management is timely executed and all returned supplies are returned to Woredas offices. Most respondents found the reports received from lower level are timely reported. About half of respondents have store rooms space problems. Only few Woreda stores fulfill basic warehouse standards. This affected the supply management of trachoma medicines.

5.2 Conclusions

The following conclusions were drawn based on the results of the study.

- In the study, we can conclude that there is manpower shortage at most Woreda health offices and respondents are not satisfied with the supply chain training they provided. It was also found that the two days training is not enough to undertake supply chain activities.
- Logistics officers often get supportive supervisions from regional and zonal health offices. However, reference materials are rarely provided that affects the drug supply management. It is probability due to unavailability of references materials that the supply chain management of trachoma medicines is not appropriately managed.
- Quantification is not being done using appropriate source of population as well it is not done by appropriate person.
- There is no good inventory record keeping of medicines in most Woredas.
- There is good practice of timely reporting and returning left over medicines among the levels and this have to be appreciated.
- Trachoma medicines supply reports missed to incorporate expiration dates.
- Storage management is practiced below basic standards of warehouse management and this may affect quality of medicines and might affect proper inventory taking, recording and stock tracking as well separation of expired and usable medicines.
- A big challenge observed in the study is empty bottles management as the holds significant spaces in Woreda stores.
- Reverse logistics transportation is not following appropriate performed and is not following the right channel of distribution.

5.3 Recommendations

Based on the finding the following recommendations were forwarded.

- The regional health bureau should recruit pharmaceutical logistics officers as most Woredas have one logistics officers who worked as officer and store manager.
- Supportive supervision to Woreda logistics officers focusing on trachoma medicines supply chain management need to be strongly continued from regional and zonal health departments
- The regional and zonal health office should incorporate key drug management messages (e.g., which forms to use, quantification and return of unused drugs) in the short booklets distributed to logistics officers at the time of the training.
- The NTD Summary Report format, and associated training, should be updated and available to all Woreda offices to accurately capture "Unused" drug balances in order to reduce wastage and expiration.
- Standard operating procedures prepared by the ministry should be put in place and reinforced through trainings to emphasize the necessity standardized trachoma medicines supply management and for efficient resource utilization.
- Federal ministry of health, Pharmaceuticals fund and supply agency and partners should work closely with Woredas health offices to systematically quantify annual requirement of trachoma medicines. This will contribute to avoiding stock-outs, wastages and overstocks.
- The FMOH, regional health bureaus, zonal health offices and partners should work together and mobilize resources to address the chronic storage inadequacies for handling of trachoma medicines and related medicines at Woreda stores.
- Guidance for the disposal of all expired medicines have to be given and an emphasis have to be provided for empty bottles management so that they will be either disposed or recycled.

5.4 Suggestions for Further Research

A similar study should be conducted to know the practices of trachoma medicines supply chain management practices. This will create a comparison on the findings upon which reliable conclusion can be made based on facts. Moreover, it would be interesting to investigate a key reason and gaps of supply chain management practices at higher, intermediary and lower levels of the chain. Further assessment by expanding size of samples have to be done and this will provide more insights into areas for improvement of NTD medicines supply chain management as whole.

6 References

Adams, J., Hafiz, T.A., Raeside, R. and White D., (2007). "Research Methods for Graduate Business and Social Science Students."SAGE Publications India.

Amhara Regional Health Bureau; (2015). Azithromycin application of trachoma MDA for 2016 and 2015 performance report, Bahir Dar, March 2015. P 2

Belete Mengitsu, Oumer Shafi, Biruck Kebede, Fikreab Kebede, Dagemlidet T. Worku, Merce Herero, Michael French, Biruk Kebede, Charles Mackenzie, Sarah Martindale, Zeyede Kebede, Tigist Hirpa, Hannah Frawley, Kathryn Crowley, Maggie O'Neil, Scott McPherson (2016); Ethiopia and its steps to mobilize resources to achieve 2020 elimination and control goals for neglected tropical diseases: Spider webs joined can tie a lion, *International Health*, Volume 8, Issue suppl_1, 1 March 2016, Pages i34–i52, https://doi.org/10.1093/inthealth/ihw007

Berhane Y. (2011). Prevalence of trachoma in Ethiopia. Ethiop J Health Dev. 2007;21 (3):211–5.

Alemayehu M, Koye DN, Tariku A, Yimam K. (2015). *Prevalence of active trachoma and its associated factors among rural and urban children in Dera Woreda*. Northwest Ethiopia: a comparative cross-sectional study BioMed Res Int.2015;2015:570898. doi:10.1155/2015/570898.

Cook JA, Mariotti SP (2011). Water and Sanitation-Related Diseases and the Environment: Challenges, Interventions, and Preventive Measures, First Edition. Published by John Wiley & Sons: 175-184.

Center for Pharmaceutical Management. 2011. *Center for Pharmaceutical Management: Technical Frameworks, Approaches, and Results.* Arlington, VA: Management Sciences for Health.

Council of Supply chain Management Professionals (2009). *CSCMP's Definition of Supply Chain Management [online]*. Available from: http://cscmp.org/aboutcscmp/definitions.asp [Accessed Jan 12, 2018].

Daniel, G., Kafumbe N. (2013). *Rapid Assessment of Zithromax® Management for Trachoma Treatment in Ethiopia: Final Report, September 2013.* Submitted to the International Trachoma Initiative by Center for Pharmaceutical Management Program. Arlington, VA: Management Sciences for Health.

Daniel G, Tegegnework H, Demissie T, & Reithinger R. (2012). Pilot assessment of supply chains for pharmaceuticals and medical commodities for malaria, tuberculosis and HIV infection in Ethiopia. *Transactions of the Royal Society of Tropical Medicine and Hygiene;* 106: 60–62

Emerson PM, Ngondi J, Biru E, Graves PM, Ejigsemahu Y, Gebre T, et al. (2008) Integrating an NTD with one of "the big three": combined malaria and trachoma survey in Amhara region of Ethiopia. PLoS Negl Trop Dis. 2008;2(3):e197.

ENSERMU. M. (2013). *Logistics and supply chain management*. Addis Ababa, Ethiopia February, 2013

Ege, "North Shäwa 1:100,000. Topographic and administrative map of North Shäwa Zone, Amhara Region, Ethiopia.", p. 3 accessed from http://self.gutenberg.org/articles/eng/Semien_Shewa_Zone_(Amhara) on Jan 11,2018

Eghan, K., and G. Daniel. October 2011. *Rapid Assessment of the NTD Pharmaceutical Management System in Cameroon.* Submitted to the US Agency for International Development by the Strengthening Pharmaceutical Systems (SPS) Program. Arlington, VA: Management Sciences for Health.

Federal Ministry of health (2010). *Ethiopian hospital reform implementation guideline, volume I chapter four*, Addis Ababa, Ethiopia.

Federal Ministry of health. (2010). *Ethiopian Hospitals Reform implementation guidelines volume 1*. Addis Ababa Ethiopia, September 20110 p.24-40

Federal Ministry of health. (2016). Health governance watch, Addis Ababa, Ethiopia

Federal Democratic Republic of Ethiopia Ministry of Health. (2017) .*Standard Operating Procedure for Neglected Tropical Diseases Medicines Supply Chain Management*. Addis Ababa, Ethiopia. November 2017.p6

Federal Democratic Republic of Ethiopia Central Statistical Agency Population. (2013). Projection of Ethiopia for All Regions at Wereda Level from 2014 – 2017. August 2013 Addis Ababa.

Federal Democratic Republic of Ethiopia Ministry of Health. (2016) .*Integrated Mass Drug Administration training manual.* Addis Ababa, Ethiopia. August 2017.p6-25

Food, Medicine and Healthcare Administration and Control Authority of Ethiopia. (2011). *Food, Medicine and Healthcare Administration and Control Authority of Ethiopia August 2011*. Addis Ababa, Ethiopia, 2011, p10

Hotez PJ, Fenwick A, Savioli L, Molyneux DH. (2009). Rescuing the ‘‘bottom billion’’ through neglected tropical disease control. Lancet. 2009;373:1570-6.

International trachoma initiative. 2010. *Zithromax in the elimination of trachoma, a program manager's guide. International Trachoma Initiative*. 2010 p 35, 48.

Johon W.Creswell, 2009, *Research design qualitative and mixed methods approach*,3rd Edition SAGE Publications inc .university of Nbraskalincon.

John Snow, Inc./DELIVER. 2005. *Guidelines for Warehousing Health Commodities*. Arlington, Va.: John Snow, Inc./DELIVER, for the U.S. Agency for International Development.

JSI and SIAPS. 2015. *Quantification of Health Commodities: RMNCH Supplement Forecasting Consumption of Select Reproductive, Maternal, Newborn and Child Health Commodities.* Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health. Submitted to the United Nations Children's Fund by JSI, Arlington, VA: JSI Research & Training Institute, Inc.

Odoom S and Kwadwo N. (2014). Assessment of the supply chain for NTD drugs in Ghana, John Snow Incorporate.

Mwingira U and Kaitaba O. (2014) . Assessment of the supply chain for NTD drugs in Tanzania, John Snow Incorporate.

King JD, Teferi T, Cromwell EA, Zerihun M, Ngondi JM, et al. (2014) Prevalence of Trachoma at Sub-District Level in Ethiopia: Determining When to Stop Mass Azithromycin Distribution. PLoS Negl Trop Dis 8(3): e2732. doi:10.1371/journal.pntd.0002732

Schniederjans M. (2011). Supply chain innovation and organizational performance in the healthcare industry. *International Journal of Operations & Production Management*, *31*(11), 1193–1214.http://doi.org/10.1108/01443571111178493

Management Sciences for Health. (2011). MDS-3: Managing Access to Medicines and other health Technologies.Arlington, VA: Management Sciences for Health.

Melese M, Chidambaram JD, Alemayehu W, et al. (2004) Feasibility of eliminating ocular *Chlamydia trachomatis* with repeat mass antibiotic treatments. *JAMA*. 2004;292(6):721-725.

NTD Supply Chain Forum, Febreuary 2015 accessed from http://www.thiswormyworld.org/news-blogs/blogs/the-ntd-supply-chain-forum on January 12, 2018

Pascolini D, Mariotti SP (2010). Global estimates of visual impairment. Br J Ophthalmol. 2012 May;96(5):614–8. doi: http://dx.doi.org/10.1136/bjophthalmol-2011-300539 PMID: 22133988

Oswald.W; Stewart, AE; Kramer, MR; Endeshaw, T; Zerihun, M; Melak, B; Sata, E; Gessese, D; Teferi, T; Tadesse, Z; Guadie, B; King, JD; Emerson, PM; Callahan, EK; Flanders, D; Moe, CL; Clasen, TF (2017) Active trachoma and community use of sanitation, Ethiopia. Bulletin of theWorld Health Organization, 95 (4). pp. 250-260. ISSN 0042-9686 DOI: 10.2471/BLT.16.177758

Perry. S; Laaff, Sarah; Rosenblum, Leona; Bahirai, Ellie; Rosen, James. (2015). Development Plan for Optimizing NTD Drug Supply Chains 2015–2020. Arlington, Va.: John Snow, Inc. for the Bill & Melinda Gates Foundation.

Pharmaceutical Fund and Supply Agency. (2015).standard operating procedures (SOP) manual for the Integrated Pharmaceuticals Logistics System in Health Facilities of Ethiopia First Edition Addis Ababa Ethiopai March 2015.p6

Pharmaceutical Fund and Supply Agency. (2015).standard operating procedures (SOP) manual for storage and distribution Addis Ababa Ethiopia March 2015.p6

Ritmeijer K, Dejenie A, Assefa Y, *et al*. (2011). Effects of intervention with the SAFE strategy on trachoma across Ethiopia.Epidemiol Community Health. 2011 Jul;65(7):626-31. Epub 2010 Aug 6.

SIAPS, 2015. *Supply Chain Management Manual for Neglected Tropical Diseases Health Managers, April 2015.* Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

Shewarega, Abiy, Paul Dowling, Welelaw Necho, Sami Tewfik, and Yared Yiegezu (PFSA). (2015). *Ethiopia: National Survey of the Integrated Pharmaceutical Logistics System.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4, and Pharmaceuticals Fund and Supply Agency (PFSA).

Simon G, Daniel G, and Diop K. 2016. *Assessment of the Neglected Tropical Diseases Pharmaceutical Management System in Senegal.* Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals. P 14.

USAID | DELIVER PROJECT,Task Order 1. 2011. *The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1. Second edition (First edition 1998).

USAID (2011).The Logistics Handbook. A Practical Guide for the Supply Chain Management of Health Commodities. Second edition. Arlington, USA

World Health Organization (WHO). Access to Essential Medicines as Part of the Right toHealth. Retrieved on 10 January 2018 from http://www.who.int/medicines/areas/human_rights/en/

Umaru.F.A. (2015) The Impact of Supply Chain Logistics Performance Index on the Control of Neglected Tropical Diseases in Low- and Middle-Income Countries. 2015 accessed from http://scholarworks.waldenu.edu/dissertations on January 13, 2018

USAID. (2012). Neglected Tropical Disease Control Program Final Report November 2012, USAID, Washington DC.

WHO. (2007). Global Plan to Combat Neglected Diseases 2008 - 2015. Geneva, Switzerland: World Health Organization.

7 Annexes

Data collection tool.

Trachoma Medicines Supply Chain management Assessment Tool

My name is Belay Mekonnen. I am conducting a study on assessment of supply chain management of medicines used in mass treatment of trachoma in Woreda health offices of North Shewa zone, Amhara region, Ethiopia for partial fulfillment of master's degree in logistics and supply chain management in Addis Ababa University, School of commerce. The information that will be collect from this research project will be kept confidential. Taking part in this study you will contribute towards alleviating the problem on supply chain management of trachoma medicines at Woreda health offices.

If you are willing to participate in the research, you need to understand and sign the Consent form.

Then, you will be asked to give your response to the data collector. If you have any question you

Can contact following individual and you may ask at any time you want. Your cooperation and on time response will be highly appreciated.

General Instructions

- There is no need of writing your name.
- Where answer options are available please tick (√) in the appropriate box.

Contact Address

If you have any question, please contact me with the following address (Mobile: 09-13-20-86-99) and E-mail blmekonen@gmail.com

***Section I*. General Information and Demographic Background of Respondents.**

1. Name of the Woreda _____
2. Your position in the Woreda _____
3. Gender: Male_____ Female____
4. Age : <25 _____ 26-34 _____ 35-44 _____ 45-45 _____
5. Educational Background: Technical school___ College Diploma____ Bachelor's Degree _____ Postgraduate_____
6. How long have you been working in the Woreda? Less than 1 Year____1-5 years __ 6-10 years_____ More than 10 years _____
7. Years of experience in the current position? Less than 1 Year ____ 1-5 years____ 6-10 years ____ More than 10 years ____
8. What is your profession? Pharmacist ___pharmacy technician ___Nurse ____ Laboratory___ others ___

Section II. Trachoma Overview

Please provide appropriate answers for the following questions.

1. Is trachoma endemic to your Woreda? Yes ___ No _____
2. What are the titles and responsibilities of you regarding Trachoma and NTD programs? _____
3. What percentage of your time is spent on Trachoma medicines supply management? _____
4. How may health centers are under your Woreda? _____
5. How many health posts are available in your Woreda? _____
6. How many times your Woreda conducted Trachoma MDA? _____
7. Is your Woreda undertake MDAs other than Trachoma? Yes _ No __ If yes, which NTD? ___
8. Have you participated in trachoma MDA? Yes ___ No _____
9. Do your Woreda have a written plan and budget for each MDA? Yes___ No____.
10. If your answer to the above question is yes, are there plans and funds for storage, transport or other drug distribution costs? Yes___ No____.

Section III – Staffing, training & Organizational Support

1. Have you taken training on supply chain management of trachoma medicines? Yes____ No____ (if the answer for this questions is yes please proceed to question 2)
2. Have you taken training any of the following activities, which activities you are performing? (Write √ for training taken and activities you are doing). Please indicate your level of agreement on training provided on each component of supply chain management of trachoma medicines using the following rating scales; 1= Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree**,** Please put (√) Mark in the appropriate column:

s/n	Activity / task	1	2	3	4	5
1	Quantifying trachoma medicines needed for MDA					
2	Receiving/collecting trachoma drugs					
3	Inventory management					
4	Recording and record management					
5	Storage and waste management of NTD Drugs					
6	Transportation NTD drugs to the next level					
7	Supervising the MDA					
8	On reverse and open bottle management					

9	Number of days you have taken the training					
10	Side effect management					

3. Do you have written guidelines, job aids, or SOPs for managing the storage and distribution of NTD drugs? Yes___ No_____ (select yes if you have at least one of the above documents)
4. Have you got any supervisory support on supply chain management? Yes___No____.
5. If your answer to above question is yes did the supervision include drug supply management? Yes _____ No _____

Section III - Data Recording and Reporting

1. Do you receive reports from the lower level regarding the no. of people treated, number of treatments administered at MDAs and quantity of remaining medicines? Yes____ No ____ (if yes proceed..)
2. How many days after MDA you usually receive the reports? 5 -10 days__11-15 days __ >15days___
3. Do you think the reports are complete, timely and accurate? Yes ___ No ____.
4. Do the reports include:
    - Quantities of drugs received? Yes ___ No ____.
    - Stock on hand? Yes ___ No ____.
    - Quantity used for MDA? Yes ___ No ____.
    - Losses/Wastages? Yes ___ No ____.
    - Include expiry date? Yes ___ No ____.
5. How many health centers are supposed to send drug reports to your Woreda? _____
6. How many health centers reported the previous year trachoma medicines till date? _____
7. Have you been reporting trachoma medicine related data to the zone? Yes ___No ____.
8. If your answer to above question is yes, when do you send the reports after time of MDAs? 5-10 days____11-14 days___ 15-19 days, 20-25 days_____.
9. For what purpose do you think drug supply information reports are used at higher level? _____,_____,_____.
10. Have you been reporting ADRs/SAEs? Yes ___No ____.
11. How do the reports send to the next? Hand carried_____, electronically____postage ____other_____.
12. Are there guidelines/SOPs for recording and reporting MDA data? Yes ___No ____.

Section IV - Quantification / Ordering/allocation

1. Have you quantified trachoma drug needs at this level? Yes ___ No____
2. What data do you use to determine quantity of drugs needed for the MDA?

_____, _____, _____, _____

3. Is quantity you received based on your quantity expectation? Yes ___ No____.
4. If no what usually happens? Above expectation ____ below expectation (shortage)____
5. What cause of the supply shortage and/ or shortage? _____
6. What you do when quantity is excess? _____
7. What you do when quantity is shortage? _____
8. How would you learn if you run out of NTD drugs before the end of an MDA campaign?
9. Who is responsible for quantifying and allocation each drug to ship to the level the lower level? _____, _____, _____

Section V - Distribution / Transport

1. Which organization provided drugs to your Woreda? _____
2. Who transports drugs from Woreda to health centers and or health posts? _____ _____
3. Who is responsible and who owns the transport vehicles used? _____
4. Are the trachoma drugs transported together with other program drugs? Yes ___ No____.
5. Who allocated budget for transporting medicines down the level? _____
6. What are the costs (e.g., fuel, per diem, etc.) associated with transporting the NTD drugs to the level below you? Who pays those costs? Does the district receive funds from the NTDCP to cover transport distribution costs? If no, is this a problem for the Woreda?

Section VI - Inventory Management

1. Have you been conducting inventory? Yes ___ No__.
2. If yes to above question, how many times you do inventory per year? Once ___ twice___three times _____ more than three times_____
3. Are you using inventory records for trachoma medicines drugs Yes ___ No__.
4. Is there a system, plan, or guidelines for managing NTD drugs that remain in balance after the MDA? How do you learn of "leftover" drugs after the MDAs and how are those drugs collected and used?
5. How you take inventory of opened bottle and record it? _____

Section VII - Receiving / Storing, Storage Conditions

1. Please describe/outline where the different NTD drugs are stored at this level and who is responsible for the drugs?
2. Are the drugs held in stock all year or only preceding the MDA? Are there storage capacity issues?
3. Are the MDA NTD drugs stored and managed separately from supplies of the same drugs intended for other purposes?
4. Items 1–12 should be assessed for trachoma Medicines that are ready to be issued or distributed to clients. Place a check mark in the appropriate column based on visual inspection of the storage facility; note any relevant observations in the comments column. To qualify as "yes," all products and cartons must meet the criteria for each item. The Woreda store is observed, rated and Marked (√) in the appropriate column. 1=very poor, 2=Poor 3=satisfactory 4= good, 5 =Very good 6=Excellent

s/	Description	1	2	3	4	5	6
1	Medicines that are ready for distribution are arranged so that identification labels and expiry dates and/or manufacturing dates are visible.						
2	Medicines are stored and organized in a manner accessible for first-to-expire, first-out (FEFO) counting and general management.						
3	Cartons and products are in good condition, not crushed due to mishandling. If cartons are open, determine if products are wet or cracked due to heat/radiation (e.g. Fluorescent lights, cartons right-side up).						
4	The facility makes it a practice to separate damaged and/or expired products from usable products and removes them from inventory.						
5	Products are protected from direct sunlight at all times of the day and during all seasons.						
6	Cartons and products are protected from water and humidity during all seasons.						
7	Storage area is visually free from harmful insects and rodents. (Check the storage area for traces of rodents [droppings or insects].)						
8	Storage area is secured with a lock and key, but is accessible during normal working hours; access is limited to authorized personnel.						
9	Products are stored at the appropriate temperature during all seasons according to product temperature specifications.						
10	Roof is always maintained in good condition to avoid sunlight and water penetration.						
11	Storeroom is maintained in good condition (clean, all trash removed, sturdy shelves, organized boxes).						
12	The current space and organization is sufficient for existing products and reasonable expansion (i.e., receipt of expected product deliveries for foreseeable future).						
13	Products are stacked at least10 cm off the floor. … Products are stacked at least 30 cm away from the walls and other stacks, Products are stacked no more than 2.5 meters high.						
14	Fire safety equipment is available and accessible (any item identified as being used to promote fire safety should be considered).						
15	Products are stored separately from insecticides and chemicals.						

Section VIII - Reverse logistics management

5. Does the health facility return unused drugs and MDA supplies to your Woreda? Yes ___ No__.
6. When do you receive left over medicines after MDA completion? 5 -10 days __11-15 days____>15days_____
7. What type of transportation is most often used to transport leftover drugs were transported to Woreda health offices? Facility Vehicles____, carry on by Health extension workers (on foot)_____Animal transport_____, motor cycle_____ public transport _____.
8. Do the receiving person use model 19 to receive and issuing person use model 22? Yes ___ No__.
9. Where the drugs stored after are returned? At health post____ at health center ____ at Woreda _____
10. Who is responsible to manage left over medicines after receiving it? _____
11. Are open bottles as well as unopened bottles are returned? Yes ___ No__.
12. What document is used to receive returned medicines? Model 19___verbal ____other_____not used__
13. What will be done on returned medicines after receiving? Store until next MDA _____,Use for other purpose_____transferred to other Woreda _____.

Section X – Expiry and Waste management of trachoma medicines.

1. Where do expired/wasted trachoma medicines and empty bottles stored? At health post____ at health center ____ at Woreda _____
2. Where do expired/wastage medicines disposed? At health post____ at health center ___ at Woreda _____
3. How you been disposing trachoma medicines ever? Yes_____ No_____
4. If your answer to the above question is yes where? At health post____ at health center ____ at Woreda _____
5. If the answer to question number 3 is no why not you disposed? _____
6. Are there expired and damaged trachoma medicines in your store? Yes No
7. What do you do on empty bottles? Recycles ____ disposed _____recycles some disposed some_____

Summary Analysis

1. Below, please list what works well, what does not work well, and why. What is/are the biggest risks to full supply of NTD drugs at the schools and communities for future MDAs?

   _____

   _____

2. If you were the Minister of Health, regional health bureau and zonal health department, what would you do to improve the availability of NTD drugs? **Please Describe:**

   _____

   _____