Addis Ababa University

School of Pharmacy

Assessment of Pharmaceutical Logistic Management System in Amhara, Oromia and SNNP Regions of Ethiopia; the Case of Maternal Health Medicines

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Assessment of Pharmaceutical Logistic Management System in Amhara, Oromia and SNNP Regions of Ethiopia; the Case of Maternal Health Medicines

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This is to certify that the thesis prepared by Essete Zewge, entitled "assessment of pharmaceutical logistic management system in Amhara, Oromia and SNNP regions of Ethiopia; the case of maternal health medicines" and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Pharmacoepidemiology and Social Pharmacy complies with the regulations of the university and meets accepted standards with respect to originality and quality.

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ABSTRACT

Assessment of pharmaceutical logistic management system in Amhara, Oromia and SNNP regions of Ethiopia; the case of maternal health medicines

Essete Zewge

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Pharmaceutical system assessments are useful to diagnose problems and plan interventions in order to enhance performance of a logistic system. This study was conducted to assess the pharmaceutical logistic system focusing on Maternal Health Medicines (MHMs) in Oromia, Amhara and SNNP regions of Ethiopia. The study employed cross sectional study design and used both qualitative and quantitative data collection tools to collect the required information. Adopted versions of Logistics System Assessment Tool (LSAT) and the Logistics Indicators Assessment Tool (LIAT) were used to collect data. Key informant interview, document review and structured observation were used as data collection tools. Data was collected from November 6 to December 5 2013. The quantitative data was analyzed using Microsoft excel spreadsheet and the qualitative data was analyzed thematically. The MHMs were managed by revolving rug fund scheme and the assessment result of the logistic management information system showed that logistic data reports which provide information to decision makers at various levels were not used consistently. Guidelines and procedures were available for inventory control mechanisms which were being implemented mostly to program medicines integrated in to the Integrated Pharmaceuticals Logistics System (IPLS) which did not include the selected MHMs. Utilization of inventory control cards, which are the basics of proper inventory control procedures were low at the visited rural health centers. There was shortage of vehicles to

transport and distribute medicines at each level of the system. There are guidelines for storage and handling of all medicines at all levels of the supply system. However, at central and regional stores, there was inadequate storage capacity at the time of data collection. To solve this problem, new warehouses were being built both at central and hubs of Pharmaceuticals Fund and Supply Agency (PFSA). Supervisory visits were conducted at the visited health facilities although not on regular basis. Integrating MHMs fully in to the IPLS could improve quality of logistic records and reports. Stakeholders of pharmaceutical supply chain management should particularly work on integrating supervision activities and strengthening the capacity of regional, zonal and woreda health offices logistic officers in order to build their capacity.

Key words: Pharmaceutical Supply Chain Management, Maternal Health Medicines, Logistic System Assessment Tool

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ART	Anti-Retroviral Therapy
EM	Essential Medicines
EmOC	Emergency Obstetric Care
FMHACA	Food, Medicine and Healthcare Administration and Control Authority
FMOH	Federal Ministry of Health
FP	Family Planning
GPRHCS	Global Programme to Enhance Reproductive Health Commodity Security
HC	Health Center
HCMIS	Health Commodity Management Information System
HF	Health Facility
HMIS	Health Management Information System
IFRR	Inter Facility Reporting and Requisition Form
IPLS	Integrated Pharmaceuticals Logistics System
LMIS	Logistic Management and Information System
MDG	Millennium Development Goal
MHM	Maternal Health Medicines

MSH	Management Science for Health
PFSA	Pharmaceuticals Fund and Supply Agency
PLITS	Pharmaceutical Logistic Information Tracking System
PMTCT	Prevention of Mother-To-Child Transmission
RDF	Revolving drug fund
RH	Reproductive Health
RHB	Regional Health Bureau
RRF	Facility Combined Report and Requisition Form
SCMS	Supply Chain Management System
SDP	Service Delivery Point
SOP	Standard Operating Procedure
UNDP	United Nations Development Program
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
WHO	World Health Organization
WrHO	Woreda Health Office
ZHD	Zonal Health Department

1. INTRODUCTION

Good drug supply management is an essential component of effective and affordable health care services. Effective implementation of drug supply management, which considers the unique political, economic and geographical factors of a country, is important for equitable distribution of essential drugs (WHO, 1998; MSH, 2011).

Logistics management is operational component of supply chain management which includes activities of quantification, procurement, inventory management, transportation and fleet management, and data collection and reporting. Well-functioning supply chains benefit public health programs by increasing program impact, enhancing quality of care, improving cost effectiveness and efficiency (DELIVER, 2011). One of the pressing public health issues in Ethiopia is high maternal mortality rate (FMOH, 2014). Effective pharmaceutical supply chain system is crucial in order to increase availability and use of Maternal Health Medicines (MHMs) and achieve the fifth millennium development goal (MDG 5).

Pharmaceutical system assessments are useful to diagnose problems, plan major projects and interventions, monitor progress and compare the performance of one system with that on another (MSH, 2011). USAID | DELIVER PROJECT introduced Logistics System Assessment Tool (LSAT) and Logistics Indicators Assessment Tool (LIAT) in 2001. These tools have been standard methods for conducting evaluations of health commodity supply chains in the developing world since (DELIVER, 2011).

In Ethiopia, FMOH and UNFPA conduct Health Facility (HF) based surveys annually on availability of MHMs at national level. Although these assessments provide reports with figures

on stock status of MHMs, there are not many assessments done to determine what factors influence these annual survey results (FMOH, 2011; UNFPA 2012).

This study assessed logistic activities of Logistic Management Information System (LMIS), forecasting, inventory control procedures, warehousing and storage, transport and distribution and supportive supervision activities throughout the pharmaceutical supply chain particularly to MHMs.

1.1 Statement of the problem

Poor maternal health remains a significant problem in developing countries causing hundreds of thousands of maternal deaths. An estimated 273,500 maternal deaths occurred worldwide in 2011, almost all in developing countries (Ronsmans et al., 2006).

The United Nations Millennium Declaration, signed by 189 heads of state in 2000, committed world leaders to achieving MDG 5 (UNDP, 2012). Although more than half of these countries are reducing maternal mortality at an accelerated pace, few are on track to achieve the goal by 2015 (Wilson et al., 2012).

In Ethiopia, MMR, one of the MDG 5 indicators, is 676 deaths per 100,000 live births which is higher compared to the Sub Saharan African (SSA) countries MMR rate (640). In order to achieve MDG 5, the country has target of increasing Anti Natal Care (ANC) coverage from 85.1% in 2012 to 90.0% in 2015 and increasing percentage of deliveries attended by skilled health personnel from 37.7% in 2012 to 60.0% in 2015 (CSA and ICF, 2012; FMOH, 2012). To reach these goals, constant availability of essential MHMs that promote safe motherhood is needed throughout the country.

In the fourth Health Service Development Program (HSDP IV) period ending in 2014/15, the FMOH has applied multi-pronged approaches of launching basic Emergency Obstetric and Neonatal Care (BEmONC) and Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) to bring about reduction in maternal mortality in order to achieve MDG 5 (FMOH, 2011). These Emergency Obstetric Care (EmOC) services were being provided in 752 health centers and 69 hospitals (FMOH, 2011). In order to provide quality EmOC services in these health facilities, uninterrupted availability of MHMs is critical (WHO, 2009).

Efficient pharmaceutical supply chain is needed to insure this uninterrupted availability. To diagnose problems and monitor progress in the supply chains, conducting pharmaceutical system assessment is useful (MSH, 2011). A national baseline assessment conducted for emergency obstetric & newborn care showed that anticonvulsants & sedatives were found only in 54% of the surveyed HFs (Health Centers (HCs) and hospitals). Magnesium sulfate which is the drug of choice among this class of drug was available only in 3% of the HFs. Hydralazine injection which is one of the medicines used for management of severe hypertension during pregnancy was available only in 16% of the surveyed HCs (FMOH, 2008).

Furthermore the assessment showed that only ¾ of hospitals and half of HCs surveyed had drug inventory registers. Out of these registers only in 53% of the hospitals and 32% of the HCs were up-to-date. Lack of updated drug inventory registers could affect the forecasting, procurement and delivery of right quantities of products to service delivery sites because the pharmaceutical supply chain completely relies on stock data (FMOH, 2008; DELIVER, 2011).

The Global Programme to Enhance Reproductive Health Commodity Security (GPRHCS) annual report showed that although Ethiopia was one of the top developing countries with 90%

of Service Delivery Points (SDP) with 'no stock-out' of contraceptives, it was one of the countries that had SDPs with low availability of the seven life-saving maternal/ RH medicines included in the WHO list of priority life-saving medicines, for women and children. The survey also showed that this problem was more profound in rural areas than in urban areas (UNFPA, 2012).

While there are updated HF based surveys on availability of MHMs in Ethiopia, there are not many detailed assessments that identify and analyze issues and opportunities for each logistic activity (FMOH, 2008; FMOH 2010; UNFPA, 2012). This paper attempted to fill the gap by assessing the different logistic activities for MHMs at the central, regional, zonal, and woreda health office levels.

2. LITERATURE REVIEW

Ethiopia is one of the states which have signed the United Nations Millennium Declarations including MDG 5. This goal was set to improve maternal health with targets of reducing the maternal mortality ratio by three-quarters before 2015 and achieving universal access to reproductive health (UNDP, 2012).

The major complications that account for 80% of all maternal deaths worldwide are: severe bleeding (mostly bleeding after childbirth or Post-partum hemorrhage); infections (usually after childbirth); high blood pressure during pregnancy (pre-eclampsia and eclampsia) and unsafe abortion (Wilson et al., 2012).

WHO list of priority life-saving medicines for women and children contains list of medicines for prevention and treatment of these complications (WHO, 2012). All the medicines in this list except for Misoprostol are also listed in Essential drug list for Ethiopia, which is the country's primary guide for procurement of medicines (FMHACA, 2008). A well-functioning pharmaceutical supply chain is needed for these MHMs in order to achieve the MDG 5 and the goals of Federal Ministry of Health (FMOH) on decreasing MMR in Ethiopia (DELIVER, 2011).

Pharmaceuticals Fund and Supply Agency (PFSA) was established in 2007 with the aim of solving pharmaceutical supply management problems in Ethiopia (FMOH, 2006). To execute its mandate in an efficient and effective manner, PFSA implemented a reporting and distribution system called Integrated Pharmaceutical Logistic System (IPLS). Along with it, PFSA developed Standard Operating Procedure (SOP) with detailed implementation steps for the IPLS execution (PFSA, 2010).

This literature review discusses about logistic activities and pharmaceutical supply chain assessment results from other African countries. Previous studies on availability of MHMs in Ethiopia are also reviewed.

2.1 Maternal health medicines availability in Ethiopia

WHO list of MHMs puts Oxytocin and Misoprisotl for treatment and prevention of post-partum hemorrhage which is the leading cause of maternal death (WHO, 2012; Carroli et al., 2008). In Ethiopia, Oxytocin is listed under Essential drug list for Ethiopia and List of Drugs for Health Centers (FMHACA, 2008; FMHACA, 2012).

A national baseline assessment for emergency obstetric & newborn care report showed that from Oxytocics class of drug; Ergometrine Maleate injection and Oxytocin were frequently used in surveyed health facilities; 63% and 60% respectively. Oxytocin was available in 55% of HCs and 94% of hospitals (FMOH, 2008).

The second leading cause of maternal death is pre-eclampsia and eclampsia, most often detected through the elevation of blood pressure during pregnancy, which can lead to seizures, kidney and liver damage, and death, if untreated (Engender Health; 2007).

Magnesium sulfate with its antidote Calcium gluconae (Mgso4/ C12H22CaO14) is recognized by the WHO as the safest, most effective, and lowest-cost medication for treating severe Pre-eclampsia and eclampsia. But less-effective and riskier medications, such as diazepam and phenytoin are still widely used in developing countries (WHO, 2012; Wilson et al., 2012). In Ethiopia, mostly used medicine for pregnancy related cases was diazepam; available in 95% of hospitals and 46% of health centers (FMOH, 2008).

For management of severe hypertension, WHO lists Methyldopa (first line of drug) and Hydralazine (WHO, 2012; DACA, 2010). In Ethiopia, the national baseline assessment showed that from anti-hypertensive class Methyldopa, Hydralazine, Nifedipine and Labetalol were used, with availability of 78%, 76%, 21% and 2% respectively in the surveyed HFs. Availability of Methyldopa was 95% in hospitals and 72% in HCs. Similarly, Hydralazine was available in 69% of hospitals and 16% of HCs (FMOH, 2008).

For maternal sepsis, WHO lists Ampicillin, Gentamicin and Metronidazole all in injection forms (WHO, 2012). In Ethiopia, the national baseline assessment showed that up to eight types of antibiotics were available in more than 90% of hospitals and in 68% of HCs. From these Gentamicin was available in 98% of hospitals, 86% of HCs; Ampicillin capsule was available in 95% of hospitals, 87% of HCs ; and Metronidazole injection was available in 67% of hospitals; 13% of HCs and 20% of total health facilities included in the survey (FMOH, 2008).

Baseline line survey at national level on availability of maternal /RH medicines showed that more than 8 in 10 HFs were stocked with Antibiotics and other lifesaving maternal /RH medicines; from which Amoxicillin was available in 88.6% of HFs, Metronidazole in 84.7%, Oxytocin 84.7% and Mgso4 27%. Availability for MHMs varied from 69% at primary level HFs to 100% in secondary level HFs (FMOH and UNFPA 2011).

Some of the reasons mentioned for unavailability of maternal /RH at HFs in two consecutive national survey results were; no supply of the medicines, new drugs that are not well known to service providers and failure to prescribe drugs by physicians. The surveys showed that distance from supplying hub did not have any relationship to the availability of the medicines in the HFs.

However location of the HFs affected availability in which the medicines were 2-3 times more available in rural settings than urban (FMOH and UNFPA 2011; FMOH and UNFPA 2010).

UNFPA had established Global Programme to Enhance Reproductive Health Commodity Security (GPRHCS) in 2007; which is a frame work for assisting countries in planning for their own needs. In GPRHCS stream one countries which includes Ethiopia, challenges mentioned for not providing full range of MHMs included unavailability of facility's drug list, lack of refrigerators or proper storage systems and weakness in the supply chain system (UNFPA, 2012).

2.2 Logistic management activities

2.2.1 Logistic Management Information System

Information is the engine that drives the logistics cycle without which the logistics system would not run smoothly. A logistics management information system (LMIS) is the system of records and reports that are used to collect information in order to make informed decisions (DELIVER, 2011).

A computerized LMIS provides important benefits over manual LMIS in committing less mathematical errors; rapid aggregation and calculation; and rapid production of reports and graphs. Likewise, using electronic reporting has advantages of shortened lead time and decreases the possibility of a report being lost during transition (DELIVER, 2006).

According to the PFSA implemented IPLS, information flow starts from hospitals and HCs ordering pharmaceuticals from PFSA hubs using Facility Combined Report and Requisition Form (RRF). In addition to placing orders, HFs use RRFs to report on the quantities of

pharmaceuticals used, lost or transferred, and quantities of stock available. The ordering schedule is every two months and PFSA hubs deliver to the HFs accordingly (FMOH, 2010).

Assessment made in Ghana using the LSAT showed that 100% of hospitals and 98% of health centers/clinics were utilizing the Family Planning (FP) report form which enabled logistics data to effectively move through the health system. This result was reflected in the LSAT score for LMIS which was 100% for contraceptives (Colleen et al., 2006).

In Zambia, a similar assessment result on FP commodities showed that the percentage of HFs using either a monthly or quarterly forms for reporting was less than 50%. The LSAT score for LMIS was less than 10%; which suggests that the flow of information from HFs to central level was almost nonexistent (Disha et al., 2008).

A similar assessment made in Uganda on anti-TB drugs showed that the LMIS was automated only at the highest level. The LMIS had strengths of availability of reporting forms and usually timely and regular reporting. The LSAT score for this section was 82% (Paschal and Martin, 2009).

2.2.2 Quantification and Forecasting Exercises

Quantification is a process of estimating quantity, costs of products and determining delivery time. Forecasting is part of quantification process which estimates quantity of each product that will be used during each year of quantification (MSH, 2011).

There are four major types of data sources for forecasting product consumption during quantification process: consumption method; morbidity method; proxy consumption method and

service-level projection of budget requirements. Each of these types of data sources has their own limitations in regard with data quality (DELIVER, 2011).

In the assessment conducted in Ghana, the study showed that technical assistance exists for quantification and forecasting. Parallel forecasting conducted for certain medicines by whoever was supplying the funding was one of the weaknesses in the forecasting process. In addition, thin human resources and high attrition and untimely submission of reports also affected the forecasting processes (Colleen et al., 2006).

In the assessment conducted in Zambia, LSAT score for forecasting was low at 35%. At the time of the assessment, the national forecasting and quantification exercise was conducted using demographic projections along with distribution or issues data. Because the logistic system did not routinely capture consumption data, essential data items such as consumption, facility stock levels and losses and adjustments were not used for decision making. Because of lack of data from service providers, it was also not possible to validate estimated projections with actual consumption (Disha et al., 2008).

2.2.3 Inventory Control Procedures

An inventory control system informs the storekeeper when to order or issue, how much to order or issue, and how to maintain an appropriate stock level for all products to avoid shortages and oversupply (DELIVER, 2011). Stock records and reports are the foundation of effective inventory management. Poor stock record keeping leads to waste of financial resources, shortages of some essential medicines or overages of others resulting in expiration, and a decrease in the quality of patient care (MSH, 2011).

According to the SOP, HFs use two stock keeping records: the bin card and the stock record keeping card. Data from these records are used for reporting, calculating reorder quantities and monitoring stock levels using RRF. HFs also use Inter Facility Reporting and Requisition Form (IFRR) which is used by the different departments within HFs and Health Posts under HCs (PFSA, 2010).

The review/reporting period for PFSA hubs, HCs and hospitals is two months. Health posts report to their respective HCs and collect pharmaceuticals accordingly. For HCs and hospitals the maximum and minimum months of stock are 4 months and 2 months respectively with emergency order point of 0.5 months of stock (PFSA, 2010).

In the Ghana pharmaceutical supply chain, there are structures for inventory control procedures along with policies and guidelines. The LSAT score for inventory control procedures for EMs was 90% which reflected high stock card utilization. On the day of the visit, data collectors found a greater number of stock outs at health centers/clinics than at hospitals for contraceptives and Essential medicines which included Oxytocin (Colleen et al., 2006).

In the assessment conducted in Zambia for FP commodities, the LSAT score for inventory control procedures was 35%. Even though there were minimum and maximum stock levels set, staff at lower levels did not understand and follow them. In addition there were no guideline for handling overstock and redistribution of products at the district level and no mechanism existed for monitoring or calculating stock imbalances (Disha et al., 2008).

In the assessment conducted in Uganda, the score was 60%. The strengths mentioned were use of LMIS forms, inventory control policies in place, following First-to-Expire, First-Out (FEFO) inventory control procedure and staffs able to calculate maximum-minimum stock levels. The

weaknesses included significant expired drugs, use of out dated forms and lack of clarity on how to order additional forms were mentioned. Lack of regularly updating dispensing log sheets was mentioned which could be linked to lack of training and reduced prioritization because of other responsibilities (Colleen et al., 2006).

2.2.4 Storage Conditions

To provide clients with high-quality products, each facility must have safe, protected and well organized storage areas to help prevent damage and ensure efficient handling of products (Colleen et al., 2006). The SOP of the IPLS has storage guidelines for health commodities and in general, it states that supplies should be protected from sun, heat, and water and follow manufacturer recommendations while storing supplies (PFSA, 2010).

The assessment conducted in Ghana shows that, seven of thirteen storage conditions were at an acceptable level, for all of the health programs, defined as 80% of the health facilities met these storage conditions (Colleen et al., 2006).

In the assessment conducted for FP products in Zambia, the LSAT score was 69%. At the HF level, only 13% of the facilities surveyed met storage conditions for 12 or more criteria. Health facilities faced challenges in rodent and bat infestation, lack of temperature regulation, and insufficient storage space (Disha et al., 2008).

In assessment conducted in Uganda, the LSAT score was 75%. There were written guidelines for storage practices and for destroying damaged/expired products. As weakness; lack of fire safety, inadequate storage space and storage guidelines not posted at all levels were mentioned (Paschal, Martin, 2009).

2.2.5 Transportation and Distribution

Maintaining constant supply of medicines is one of the qualities of well ran distribution system. Distribution system can be pull or push based on which level of the system determines what types and quantities of medicines are needed. In pull system, the level who receives the supplies calculates the quantities of supplies required and in a push system, the level who issues the supplies calculates the quantities of supplies required (MSH, 2011).

The distribution system the IPLS recommends is pull system (PFSA, 2010). This distribution system has advantages including; the lower level has the most current information, enables pharmacy staffs at health facility level to anticipate upcoming needs especially when manual system is in use and it gives them a sense of ownership because they make decisions on quantities to order. One of the disadvantages of pull system is the pharmacy staff should allocate time to make calculations, instead of serving customers (DELIVER, 2011).

Transporting commodities through the supply chain is fundamental to the success of a health logistics system. There are two ways of moving supplies between warehouses and health facilities; delivery and collection systems. Both have their advantages and disadvantages (Colleen et al., 2006; MSH, 2011).

According to the IPLS manual, PFSA hubs deliver to HFs (PFSA, 2010). Delivery system has advantage of combining delivery and supervisor responsibilities and lesser total cost of transport if proper delivery route; order intervals and delivery schedules are kept. Demanding all these conditions and possibility of uneconomic use of larger vehicles are some of the disadvantages of delivery system (MSH, 2011).

The assessment conducted in Ghana showed that LSAT score for transport and distribution was 68% for EMs and 91% for FP commodities. At the time of the assessment, the health logistics system was in a state of transition towards integrating the vertical commodity programs within the health system (Colleen et al., 2006).

In the assessment conducted in Zambia, transport and distribution had LSAT score of 80%. This high score indicates existence of policies regarding treatment guidelines, staff monitoring and training on adherence to guidelines and existence of a distribution system. It delivers family planning products to District Health Offices (DHO) and hospitals on a monthly basis. Then, the DHO distribute to the health centers. The assessment showed that HFs use both delivery and collection systems. The most common method of transporting products during collection was public transport for health facilities. Even though there were adequate vehicles at central level, lack of sufficient number of functioning vehicles at and below the district level posed a major challenge for distributing products (Disha et al., 2008).

In assessment conducted in Uganda, the LSAT score was 72%; the supplies were usually delivered on time according to schedules and at some districts delivery was integrated with supervision to maximize use of available vehicles. In addition, partner organizations provided transportation support to some districts. The weaknesses were lack of budget for inadequate fuel supplies and vehicles maintenance at district levels and facilities used motor cycles and public transports to pick their supplies (Paschal, Martin, 2009).

2.2.6 Supervision

Supervision is an important element of quality assurance in any logistics system. It keeps managers vigilant and helps them to anticipate needed changes (MSH, 2011). According to the

IPLS, Woreda Health Office (WrHO), Zonal Health Department (ZHD) and Regional Health Bureau (RHB) have management and supervision roles for health centers and hospitals under them respectively. Additionally they have responsibilities of aggregating and sending logistic reports from HFs to the FMOH (PFSA, 2010).

In the assessment conducted in Ghana, the LSAT score for organizational support for logistics system was 89% for EMs and 97% for FP commodities. The strengths included availability of documents, guidelines and policies. On the other hand, weak implementation of policies and shortage of experts at all levels were considered as weaknesses (Colleen et al., 2006).

In each of the family planning and essential medicine programs, 70% of facilities had received a supervisory visit within the last three months before the time of the data collection. However, only 24% of family planning supervisory visits and 28% of essential medicine supervisory visits included oversight of logistic activities (i.e. stock management including checking stock cards, checking logistics reports, removing expired stock, checking supply levels and checking storage conditions) (Colleen et al., 2006).

In the assessment conducted in Zambia, organizational support had a low score of 45%. Even though there was an existing mechanism through which staffs from different levels communicate at a regular interval, there were gaps in regular supervision and lack of emphasis on skill improvements of personnel with logistics responsibilities. There were no specific guidelines or trainings on how to conduct supervisory visits which resulted in absence of supervisions at health facility levels on important aspects of product management such as accurate LMIS forms completion, storage conditions, and calculating order quantities. Around 30% of HFs received supervision within the last three months before the time of the data collection (Disha et al., 2008).

In the assessment conducted in Uganda, the LSAT score for organizational support scored 85%. Good supervision program was in place and most sites visited benefited from regular supervision. But difficult to-reach areas in rural settings were infrequently supervised. Integrating supervision with other programs and leveraging resources was recommended to increase the frequency of supervision in these areas. Most of the staff managing anti-TB drugs trained on SOP and on the job training was available for staffs. However, there were no formal trainings for newly recruited staffs on LMIS and continuing professional support for staff development. Weakness on lack of clarity on supportive supervision checklist and unclear supervision schedule were also mentioned (Paschal and Martin, 2009).

3. OBJECTIVE

3.1 General Objective

To assess the pharmaceutical logistic system in Ethiopia; specifically for selected maternal health medicines.

3.2 Specific Objectives

- To assess use of logistics management information system of maternal health medicines
- To assess forecasting practices of maternal health medicines
- To assess inventory control procedures of maternal health medicines
- To assess transport and distribution practices of maternal health medicines
- To assess storage practices of maternal health medicines
- To assess supervision practices for logistic activities

4. METHODOLOGY

4.1 Study area and facilities

Pharmaceuticals Fund and Supply Agency (PFSA) was established in September 2007 by proclamation no. 553/2007. The mandate of the agency was to be the sole provider of forecasting, procurement, storage, inventory management and distribution of pharmaceuticals to the public health sectors in Ethiopia (FMOH, 2006). The agency has core pharmaceutical supply process which represents key activities of planning, procurement, storage and distribution. This core process encompasses four basic sub processes i.e. forecasting & capacity building, procurement, storage & inventory management and distribution. Forecasting & capacity building sub process is involved in producing pharmaceuticals purchase requests based on health facilities need; whereas storage & inventory management sub process is involved in receiving, stock control, stores management and dispatching (PFSA, 2008).

PFSA supplies to the nine regions and two city administrations in the country and it gives the service through 11 major hubs. Out of the eleven major hubs administered by PFSA, seven are found in the three densely populated regions namely SNNP, Oromia and Amhara where 80% of the country's population lives. Out of the seven hubs located in the three regions the Bahir Dar, Adama and Hawassa hubs give service to largest number of health facilities located in their respective regions (FMOH, 2006).

Bahir Dar hub which supplies health facilities in Amhara region supplies six zones, and 346 health facilities under them. West Gojam zone is one of these zones with 17 woredas under it. The zone has population of 2,296,487(CSA, 2013). There are 92 public health facilities in this zone including: one public hospital; 91 HCs and one laboratory monitoring site. Bahir Dar city

administration is also served by the Bahir Dar hub covering a total of 12 public health facilities; one referral hospital, ten HCs and one regional laboratory.

The Adama hub supplies 13 zones, towns, special woredas and 279 health facilities located in Oromia region. East Arsi zone is one of the zones covered by the Adama hub. The zone has 25 Woredas and population of 3,056,372 and covers area of 19,825.22 Sq.km (CSA, 2013). There are three public hospitals and 88 HCs in the zone. Adama city administration which is also served by the Adama hub has seven public health facilities which are; one referral hospital, five HCs and one regional laboratory.

Similarly Hawassa hub supplies 18 zones and 7 special woredas in SNNPR. The total number of health facilities served under this hub is 524. Wolita zone is one of the zones served by the Hawassa hub. The zone has12 Woredas and the total number of people living in the zone is estimated to be 1,750,079. In the zone, there are three hospitals, 82 HCs and three privately owned clinics supplied by Hawassa hub (CSA, 2013). Under Hawassa city administration, Hawassa hub serves four HCs and one district hospital.

4.2 Study design

The study followed cross sectional study design and used both qualitative and quantitative data collection techniques. Key Informant Interviews (KIIs) were conducted with respondents from FMOH, central PFSA, PFSA hubs, RHB and WrHO logistic officers. The KIIs were done before visiting health facilities which helped to cross check the data collected at the interviews with the logistic activities taking place at the health facilities.

4.3 Source and Study Population

All PFSA hubs, Regional Health Bureaus (RHB), zonal and woreda health offices with hospitals and health centers under them were used as source population for the study. In addition, FMOH Urban Health Promotion and Disease Prevention Directorate and forecasting and capacity building sub process; storage and inventory management sub process directorates at central PFSA were included in the study. Selected PFSA hubs; zonal and woredas health offices and health facilities from Oromia, Amhara and SNNPR were taken as the study population.

4.4 Selection criterion

About 80% of the county's population lives in the three regions namely Southern Nations, Nationalities and People Region (SNNPR), Oromia and Amhara (CSA, 2011). Among the PFSA hubs which serve these regions, those which serve the highest number of health facilities in their respective regions were selected. These hubs are located in Hawassa, Bahir Dar and Adama from SNNPR, Amhara and Oromia regions respectively. The three regions and their respective hubs were selected purposively to assess pharmaceutical logistic system of MHMs in the most densely populated regions of the country.

From each regional hub, one zone located nearest to the hub was selected for logistics purpose using convenience sampling. From the selected zone, one route from which PFSA hub tracks take to deliver pharmaceuticals was selected except for Wolita zone where all the woredas are all in one route. The nearest and furthest woredas were selected using stratified random sampling from each selected route to check if distance has any effect on communication with the hubs and RHBs. For logistic reasons woredas with difficult road condition and above 215 Km were

excluded. Woredas included in the study were divided into quartiles according to their distance from their supplying hubs and those which fell below the first quartile and above third quartile were selected. Health centers in the near and far woreda ranges with accessible road condition were included in the study using convenience sampling.

The woredas were divided in to quartiles using the formula,

- Q1 = {0.25 (n+1)}th observation
- Q2 ={0.5 (n+1)}th observation
- Q3 = {0.75(n+1)} th observation

Where n is the number of woredas included for selection under each zone.

East Arsi is the nearest zone to Adama hub and the selected route includes 9 woredas. Three woredas ZewayDugda, Munesa and Honkolowabe were excluded because of difficult road condition. Dodota woreda fell below the first quartile (43.75 Km) which is in the near woreda range and Shirka woreda fell above the third quartile (129.5) Km which is in the far woreda range. The Health centers included were Dahre health center from Dodota woreda and Gobessa health center from Shirka woreda; both health centers are ART sites.

In Wolita zone there are 11 rural woredas and one special woreda. Out of the rural woredas Boloso Bombe and Kindo Didaye were excluded because they are at a distance of more than 215 kms; Kindo Koysha and Offa Woredas were excluded from the study because of difficult road condition. Damote Gale woreda fell below the first quartile (171.75 km) which is in the near woreda range and Duguna fango woreda fell above the third quartile (198.25 km) which is in the far woreda range. Health centers included were Gacheno and Bugae from Damote Gale woreda

which both are PMTCT sites; and Bitena, Kerche and Dimtu health centers from Dugunafango woreda; Bitena is ART site and the rest two are non-ART non-PMTCT sites.

In West Gojam zone three are five Woredas in the selected route. Out of them, Mecha woreda fell below the first quartile (37.5 km) which is in the near woreda range and Fenote Selam woreda fell above the third quartile (177.5 km) which is in the far woreda range. The health centers included in the study were Merawi, Ambomesk and WotetAbay health center from Mecha woreda and FenoteSelam health center from FenoteSelam woreda. Both health centers are ART sites.

Public hospitals found on accessible road conditions supplied by the selected hubs were included in the study using convenience sampling. These hospitals include Arsi Robe district hospital, Assela referral hospital and Abomsa district hospital supplied by Adama hub; Finoteselam district Hospital supplied by Bahir Dar hub; and Sodo Zonal Hospital and Adare district hospital supplied by Hawassa hub.

The MHMs selection was based on list of medicines used for prevention and treatment of maternal health conditions which account for 80% of all maternal deaths worldwide along with unsafe abortion. These three maternal health conditions are; severe bleeding (mostly bleeding after childbirth or Post-partum hemorrhage); infection (usually after childbirth); high blood pressure during pregnancy (pre-eclampsia and eclampsia) (Wilson et al., 2012). Selections of the MHMs were based on WHO list of Priority life-saving medicines for women and Essential Drug List (EDL) for Ethiopia (WHO, 2012; FMHACA, 2008). With the exception of Misopristol tablet which is used for prevention of Post-partum haemorrhage, all the MHMs included in the WHO list for these three conditions were included in the study. Misopristol tablet, was not

selected because it is not listed in the EDL for Ethiopia. The selected medicines are also included in the list of medicine for health centers (FMHACA 2012). A total of 10 MHMs were included in the study.

4.5 Data collection tools

The assessment of the logistics system consists of both qualitative and quantitative data collection tools; Logistics System Assessment Tool (LSAT) and the Logistics Indicators Assessment Tool (LIAT), (DELIVER, 2008; DELIVER, 2009). LSAT allows a comprehensive system level assessment of the performance of a logistic system for any health program managing health commodity. It is organized in to sections according to the components of the logistics cycle. Each section contains a series of objective and quantifiable yes or no questions, as well as open-ended qualitative questions that explore strengths and weaknesses of the logistics system. It has scoring sheet for the yes or no questions for all sections of the LSAT which is used to score core questions and synthesizes the result into numerically measured data (DELIVER, 2008). In this study, adopted version of the LSAT was used as KII guide to assess logistic activities of forecasting procedures; logistics management information system; inventory control; transport and distribution; storage and supervision practices for MHMs (Annex II). The information collected was used to identify issues and opportunities which are used to outline appropriate interventions. The quantifiable yes or no questions were separated and scored using LSAT scoring sheet (Annex III). For each scored question levels were added or deleted according to the structure of the logistic system and the total score for some questions and some sections had changed accordingly

The Logistics Indicators Assessment Tool (LIAT) is a quantitative data collection instrument used to conduct a facility-based survey to assess health commodity logistics system performance and commodity availability at health facilities (DELIVER, 2009). Adopted version of LIAT was used to collect information on availability of maternal health medicines; use of stock keeping records and reporting forms; proper storage condition and appropriate supervision in the selected health facilities using data abstraction formats (Annex IV- Annex VI). The collected information was used to strengthen the LSAT findings. To assess the storage conditions check list from LIAT user's guide was used (DELIVER, 2009).

Tape recorder was used when permission was obtained. Document review of bin cards, stock cards and report and requisition form (RRF) at health facilities were conducted using data abstraction format. Data collectors were the principal investigator and a pharmacist with MPH degree after he was familiarized with the questioner. The data collection took place from November 6 to December 5 2013.

4.6 Study participants

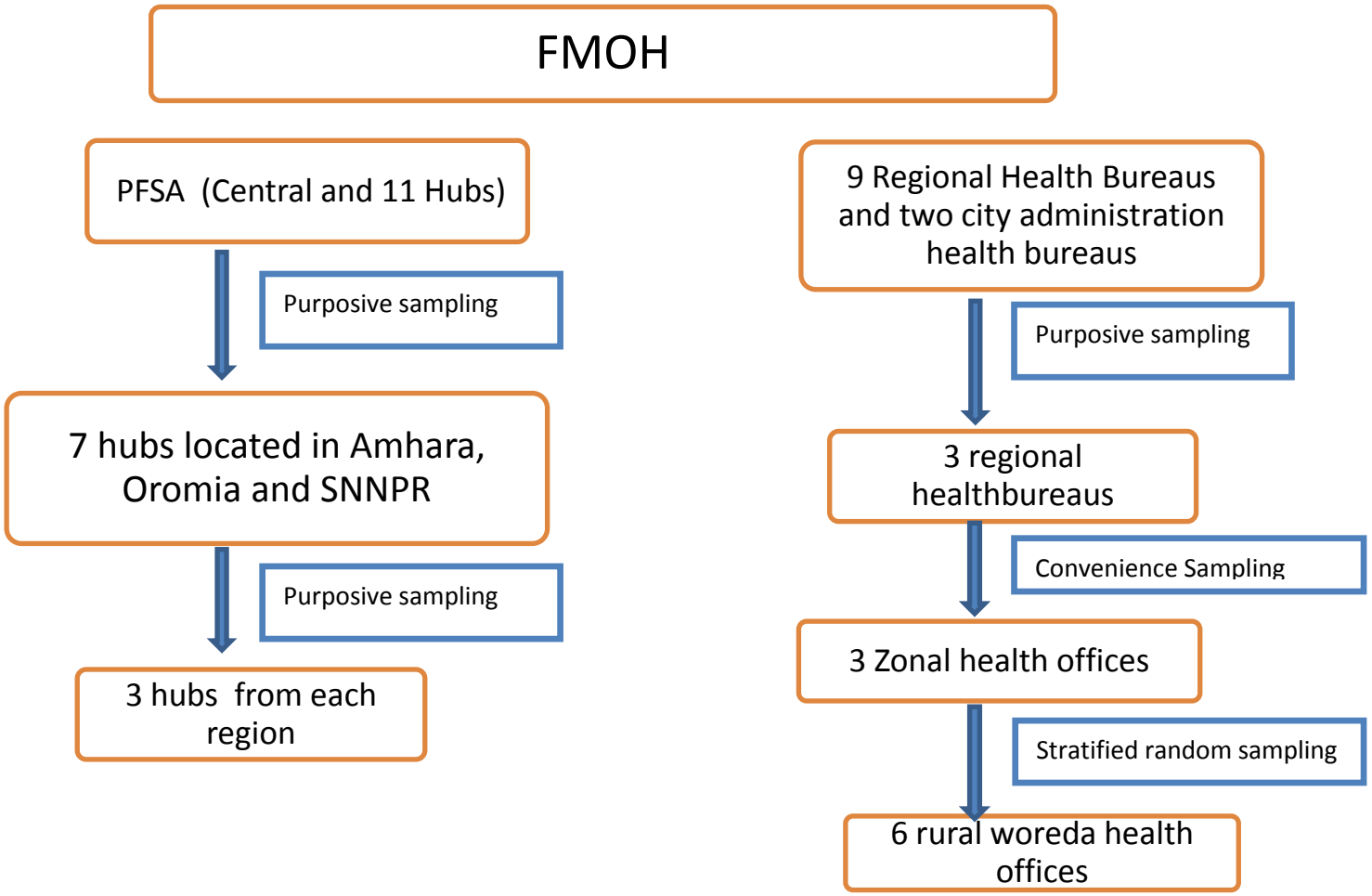
There were a total of the 19 key informant interview participants including;

- FMOH; Urban Health Promotion and Disease Prevention Directorate; one participant
- Heads of pharmacy departments of Oromia, Amhara and SNNP regional health bureaus; three participants
- Forecasting and capacity building; and storage and inventory management sub process directorate; both at central and hubs PFSA; seven participants
- Heads of pharmacy departments at selected Zonal Health Departments; three participants
- Heads of pharmacy departments at selected rural woreda health offices; five participants.

A total of 34 participated in the indicator study at the HFs including;

- 11 store men/women and 11 personnel at dispensing areas from rural HCs and
- 6 store men/women and 6 personnel at dispensing areas from hospitals.

Figure 1: Sampling Chart for the KII participants



4.7 Data quality assurance

The data collection tools for the health facilities were pretested in health facilities found in Addis Ababa and the data collector was familiarized with the data collection tools before data collection began.

4.8 Data processing and analysis

The data from the key informant interview including detailed information about logistic system process; weaknesses and strengths were transcribed and analysed through descriptive thematic analyses. The scoreable questions were transferred to the LSAT scoring sheet and processed using Microsoft Excel spreadsheet. Similarly data found using the indicator questions were analysed using Microsoft Excel spreadsheet sheet.

4.9 Operational definition

Family planning items: - Pharmaceuticals included under family planning program.

Revolving Drug Fund (RDF) items: - Pharmaceuticals which are managed by the RDF scheme

Program drugs: - Medicines which are managed vertically under different programs including Family Planning; MCH; Nutrition; EPI; TB and Leprosy; Malaria; HIV/AIDS.

4.10 Ethical consideration

Ethical approval was sought and obtained from the ethics review committee of the School of Pharmacy, Addis Ababa University. Permission was also obtained from central PFSA and its hubs; FMOH and RHBs, selected WrHOs and HFs. Participants in each facility were asked for

consent before their participation in the study. During the consent process, they were provided with information regarding the purpose of the study, why and how they were selected to be involved in the study, and what is expected of them. They were also informed that they can withdraw from the study at any time during the interview process. Participants were assured about confidentiality of the information obtained in the course of the study in that: no personal identifiers would be used and data is analyzed in aggregates. The findings of the study would be communicated to the participating institutions and health facilities, funders and different stakeholders through the appropriate channel.

5. RESULT

The study was conducted at different levels of the pharmaceutical supply chain including central PFSA, Adama, Bahirdar and Hawassa PFSA hubs, RHBs, ZHDs, WrHOs and in selected hospitals and health centres. Logistic officers from both central PFSA and PFSA hub forecasting & capacity building sub process and storage & inventory management sub process were involved in the KII. From RHBs, logistic officers working in pharmacy departments of Amhara, Oromia and SNNP RHBs also participated as key informants in the study. Logistic officers from pharmacy departments of the selected zones and Woredas were also included as key respondents for the study. From these woredas 11 rural HCs were visited for the indicator study along with 6 hospitals supplied by the three PFSA hubs. For the KII, the targeted participants were 18, but the interviewed were 16.

Table1: Background characteristics of the KII participants working at different levels of the pharmaceutical supply chain at central level and in Amhara, Oromia and SNNP regions of Ethiopia, 2013

	Profession of study participants (Number)					Experience in the position held (Years) by the study participants				Participants who took IPLS training	Total number of participants
	Pharmacist			Druggist	Other (Specify)	1-3	3-5	5-7	>7		
	B.Pharm	Msc	MPH								
FMOH		1				1				1	1
Central PFSA		1	1			1		1		2	2
Hubs	4	1				1	2	2		5	5
RHBs	3							2	1	3	3
Zones	2			1		1	1	1		3	3
Woredas	1			2	2 (Nurse)	2		2	1	3	5
Total	14			3	2	6	3	8	2	17	19

All the store men interviewed from the visited hospitals were druggists and all of them reported taking training on IPLS. The store men at the visited rural HCs consisted of one pharmacist, seven druggists and three nurses and out of them nine reported taking training on IPLS.

The study included ten MHMs used for prevention and treatment of post-partum hemorrhage, infection after child birth and high blood pressure during pregnancy along with its complication of convulsion.

Table 2: List of the maternal health medicines included in the study according to their classes of drugs

Classes of drug	Maternal health medicines
Oxytocics	Oxytocin : injection 10unit/m100%
IV-fluids	Sodium chloride: injectable 0.9% isotonic solution
	Ringer's lactate
Anti-hypertensive	Hydralazine (hydrochloride) powder for injection; 20 mg in ampoule
	Methyldopa: tablet 250 mg
Antibiotic injection	Ampicillin: powder for injection 500 mg; 1 g (as a sodium salt) in vial
	Metronidazole: injection 500 mg in 100-ml vial
	Gentamycin: injection 40 mg /ml in 2-ml vial
Antibiotic capsules	Ampicillin: capsule, 250mg, 500mg
	Metronidazole : Capsule
Anti-convulsant	Magnesium sulphate /Calcium Gluconate (antidote): injection 50% in 20ml / injection, 10% in 10ml ampoule

5.1 Logistics System Assessment Tool Result

The results from the KII using LSAT were descriptively analyzed and strengths and weaknesses of the logistics system were identified. The quantifiable yes or no questions were transferred to the LSAT scoring sheet produced the following LSAT scored for each section (Annex III).

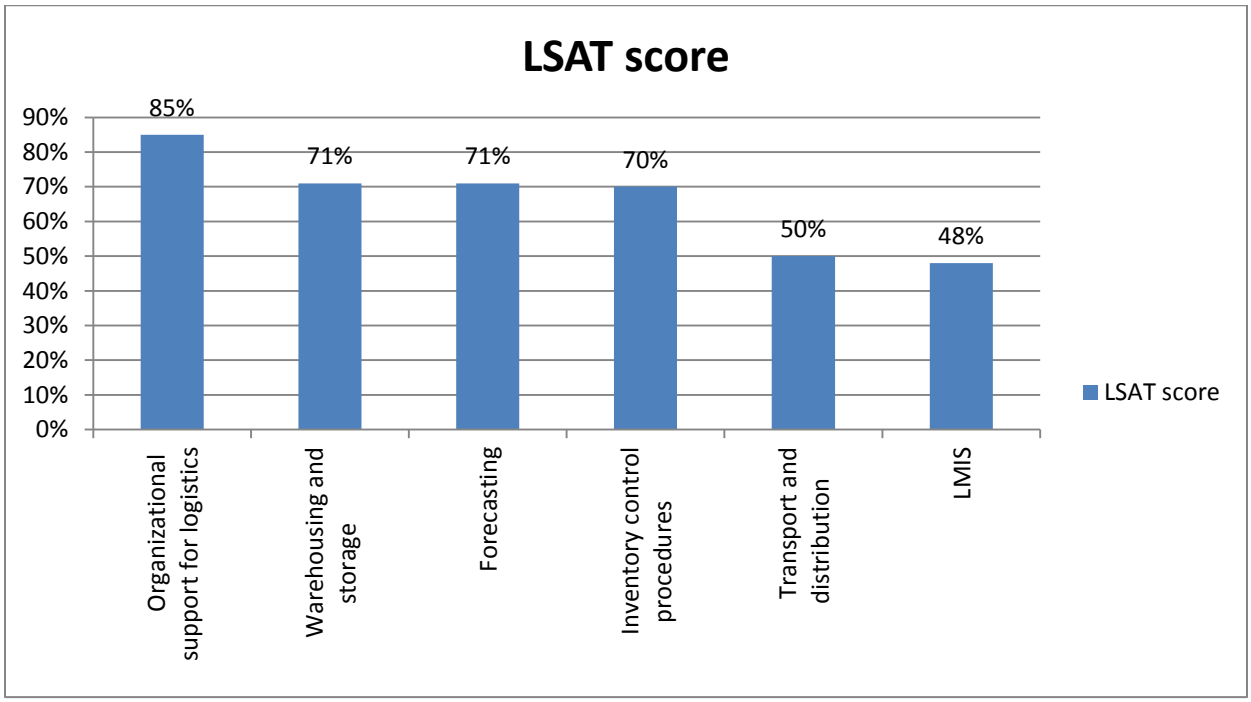


Figure 2: LSAT score results for Logistic activities of Maternal Health Medicines in Ethiopia, 2013

5.1.1 Logistic Management Information System (LMIS)

The pharmaceutical supply chain in Ethiopia has a separate LMIS from other health related data management systems. The central PFSA and all of its hubs use computerized and networked LMIS which is called Health Commodity Management Information System (HCMIS). The HCMIS runs automated stock keeping records which shows stock on hand, quantity dispensed or

issued during a specified reporting period, losses and adjustments and quantities received. It also runs automated transaction between central PFSA and its hubs.

The quantifiable yes or no core questions from LMIS section scored 48%. The result from these questions demonstrates the weakness and strengths of LMIS for MHMs. Its Strength was the LMIS uses stock keeping and transaction records at every level. The information from these records at PFSA hubs are sent to central PFSA to be used for decision making in forecasting, procurement, calculation of resupply quantities and transport/delivery of the MHMs. The LMIS also included different feedback mechanisms to health facilities on proper uses of stock keeping records, and requisition and issue records.

The LMIS weaknesses included; not capturing dispensed-to-user records at HFs and unavailability of summaries of consumption data of the HFs at levels above the HFs. This was because HFs were not using dispending registries. Moreover, reports sent to higher levels did not contain data on stock on hand, quantity dispensed or issued during a specified reporting period, losses and adjustments and quantities received.

All the MHMs included in this study, except for $MgSo_4$, were managed by Revolving Drug Fund (RDF) scheme in which health facilities purchase the medicines' from PFSA hubs using the money generated from their own health care financing system.

The flow of information for non-program items starts with health facilities sending list of items to the hubs with attached requisition letter according to their procurement schedule. Similarly, the hubs send their request to central PFSA using the same format. This resupply request from health facilities and hubs has only the lists of products requested with their units and quantities

required and it is not possible to have consumption and stock on hand information from this list. There is also no specific scheduled for the resupply request.

Even though the MHMs included in this study were not part of it, more systematized reporting and requisition system was in place for those program items integrated in to the IPLS. For these items, reports were sent to higher level of the system every two months, using the Report and Requisition Format (RRF) with pre-printed list of the program items. HFs send RRF which includes consumption, stock on hand and request data to the hub level every two months, similarly hubs send compiled RRF to central PFSA every two months. Central PFSA distributes back these program items to the hubs based on the RRF data.

For program items integrated in to the IPLS, PFSA hubs monitor stock status (adequate, over or under stocking) of HFs based on ending balance data on RRFs. For these items, most of the time the hubs report complete and timely report (1st - 10th day of the beginning of the month). The RRF forms are sent to the central level from the hubs via e-mail and the hardcopy of the same document are sent via mail because the official stamps are needed to appear on the report. If reports are not sent on time, central PFSA contacts the hubs by phone and request for the timely delivery of the RRFs.

Additional to the paper based reporting system of RRF, PFSA has launched electronic based reporting system called Pharmaceutical Logistic Information Tracking System (PLITS) which is used for capturing, aggregating and reporting health facility data to the hubs and central PFSA. However, at the time of the data collection, only program managed products were integrated in to this system. One of the advantages of PLITS is accessing logistic data of HFs whenever

needed without waiting for the manual RRF every two months. It also tracks logistics indicators like stock out rates and percentage of reporting.

Even though RDF managed items were not integrated in to the IPLS at the time of data collection, hubs reported that they received resupply requests from limited number of HFs for RDF managed items using RRFs; which enables PFSA hubs to monitor stock status of HFs. Because the RRFs have pre-printed list of items only for program managed items; staff at these HFs had to hand write on open spaces of the form when using it for RDF managed items which includes the MHMs included in this study.

One of the reasons for the limited number of HFs using the RRF for RDF managed items was because it was not a requirement for requesting re-supply as in the case of program items. The other reason mentioned by staff at PFSA hub was high turnover of IPLS trained professionals and high work load on the existing pharmacy professionals.

Different mechanisms are used to channel logistic information back to the lower levels. At the central level every three months meetings are held with hub managers, coordinators and deputy mangers. PFSA hub logistic officers also provided feed backs to HFs through review meetings and discuss on their findings and provide feedbacks during supportive supervisions. Telephone calls are also used to provide feedbacks.

PFSA gets external assistance from partner organizations to lunch and manage the computer based databases. Health Commodity Management Information System (HCMIS) was developed and launched by USAID | DELIVER PROJECT and PLITS was being launched by SCMS. These partner organizations also hire and train IT professionals to handle these databases.

5.1.2 Forecasting Practice

The central PFSA forecasting directorate prepares forecast for all the MHMs managed by RDF scheme. Similarly, FMOH urban health promotion and disease prevention directorate forecasts for MHMs including Mgso4 and Oxytocin injection which are allocated to health facilities free of charge.

The quantifiable yes or no core questions score result from forecasting section was 71%. The result from these questions showed that the forecasting practice had strengths in using distribution/issues data and stock on hand data to develop forecasts for MHMs at central PFSA. The Urban Health Promotion and Disease Prevention Directorate at FMOH uses morbidity and service statistics data to develop forecasts for the MHMs. In addition, forecasts were updated annually and prepared on a schedule that coincides with budgeting and procurement cycles. The weakness were dispensed-to-user data was not used to develop forecast and there was no forecasting validation which is done by comparing previous estimated consumption with actual consumption.

Under FMOH Urban Health Promotion and Disease Prevention Directorate three to four advisors from Maternal and child health program and commodity security participate in the forecasting process. The forecasting is carried out annually, at the end of the fiscal year. For the RDF managed MHMs, PFSA hubs aggregate data and adjust for possible service expansions and other contingency before they send it to central PFSA. Further adjustments and contingencies are considered at central PFSA level.

5.1.3 Inventory Control Procedures

The score of quantifiable yes or no core questions for the inventory control was 70%. Based on these core questions, weakness and strengths for this section were identified. The strength includes availability of guidelines and established policies for maximum and minimum stock levels at central PFSA, PFSA hub and HF levels. The supply chain also had a policy of storing and issuing stocks according to FEFO inventory control procedure at all levels. At central and hub levels, the HCMIS ran the inventory control following FEFO procedure and tracks losses and adjustments. Damaged and expired products were physically separated and removed from stock records at central and hub levels. There was also established procedure to place emergency orders which is equivalent to 0.5 months of stock.

The weaknesses include stock out among the MHMs in the 12 months before the data collection. The stock out occurred at both central and hub levels; from which MgSo4 was stocked out for the longest period of time. The reason given for the observed stock out of MHMs was the procurement process taking longer time than expected. It was also noted that there were no written provisions for the redistribution of over-stocked supplies.

At central PFSA, resupply to hubs was based on maximum and minimum stock level calculation. When central PFSA did not have enough stock level to distribute to hubs according to the stock level calculation, they provide resupplies to hubs based on consumption history of the hubs. At the time of data collection, except for Mgso4 and Metronidazole injection, all the other MHMs were at maximum stock level which is 4 months of stock.

Even if there were no written provisions for the redistribution of over-stocked supplies, the central forecasting and capacity directorate used monthly and quarterly stock status reports from

hubs to do the appropriate redistribution to the 11 PFSA hubs. The HCMIS notifies when the stock level goes below minimum and reaches to emergency level. At central PFSA, emergency orders are placed after the approval of the forecasting unit; this unit then reports to procurement unit which makes the final decision for procurement of the specific item.

On quarterly bases, hubs submit stock status report on both RDF and program managed pharmaceuticals to central PFSA. The stock status report includes information on slow moving, short expiry, and under or over stocked items with their unit and total prices. Besides the quarterly reports hubs also report monthly on stock status of vital drugs, which includes all the MHMs included in this study, for continues monitoring of stock balances on these vital drugs.

Health centers from Amhara and Oromia regions, besides procuring RDF managed items using health care financing, receive additional support from their respective RHBs to do the necessary procurement. The RHBs supported the HCs by procuring and distributing essential medicines through PFSA which included MHMs. The SNNP RHB did not provide similar support for the HCs at the time of data collection.

In the years 2012/2013 and 2013/2014, Amhara RHB procured and distributed essential medicines for HCs under the region through PFSA hubs. The initial forecasting was based on the HCs request. Resupply requests from the HCs was sent to Bahir Dar hub every three months through woreda and zone health departments and received resupplies accordingly. Even though the two organizations had an agreement which dictated delivery of RDF managed medicines by the hubs to the health facilities on quarterly basis, due to shortage of vehicles at the hub, most of the time health facilities collect their supplies directly from the hub.

Similarly, in 2012/2013, Oromia RHB procured and distributed essential medicines for the newly established HCs in the region through PFSA hubs. The quantification was made based on the request received from HCs. Adama hub distributed the medicines to WrHOs quarterly and the WrHOs distributed to their respective HCs.

5.1.4 Warehousing and Storage

For warehousing and storage, the quantifiable yes or no core questions scored 71%. The result from these questions showed that in the area of warehousing and storage the logistic system for MHMs had the following strengths and weakness. The strengths are; there are written guidelines for storage and handling of all medicines at all levels of the system which included guidelines for disposal of sharps, bio-hazardous materials and wastes. There are also written guidelines for storage and handling of all products at all levels of the system. At central PFSA and PFSA hubs, at least one physical inventory is conducted annually.

The weaknesses were; even though written procedure existed for destroying damaged and expired products, in practice the latest version of the guideline was not used at any level. It was also noted that the existing storage capacity at central PFSA and PFSA hubs were not adequate to handle products.

At central PFSA storage rooms were built according to standard specifications. However, the storage capacity at the time of the data collection was not adequate enough to handle maximum stock levels and at times they might have to store medicines against IPLS storage guidelines. At the time of data collection, there were three cold rooms at central level which fulfill the cold chain requirements. Warehouse managers monitored cold rooms using temperature log sheets daily which would be reviewed weekly.

At Adama hub, storage capacity was better than the other hubs because they had taken advantage of a warehouse found in their compound that was managed by central PFSA. But the hub's warehouse floor was not constructed according to the standard. In the other two PFSA hubs, inadequate storage capacity including cold rooms was affecting zoning and easy location of products which in turn affected maintaining the FEFO inventory control procedure. The inadequate storage space had also compromised cleanliness and organization of the store rooms both at central and hub levels.

In order to solve the major problems related to inadequate storage space faced at different levels, warehouses were being built at central PFSA at the time of data collection including cold rooms that are expected to provide service in the same year. There is also a plan to build more warehouses in the same year. Similar to what is taking place at the central level, in all the three hubs, building of new and modern warehouses construction were under way. There were plans to move in to these new warehouses within a month from the date of data collection.

The IPLS states that handling and disposal of damaged and expired products, sharps and bio hazardous materials and other medical waste should be carried out according to FMHACA guideline which is available on FMHACA website. Even though FMHACA has updated its manual that include the guide for destroying expired items, at the time of the interview, neither central PFSA nor PFSA hubs were following the new guideline

Procedure of recording complaints about product quality from all levels is handled by FMHACA. Visual quality assurance inspections of products were conducted at all storage facilities, starting from the central level up on receiving the items from the transistor, to HFs storage.

5.1.5 Transport and Distribution

The score of quantifiable yes or no core questions for transport and distribution was 50%. The result from these questions showed strengths and weakness for transport and distribution. The strengths included availability of written procedure which specifies what type of distribution system should be used to distribute products between each level and documented distribution schedule for all levels. The weaknesses were at central PFSA and PFSA hubs, the available vehicles were not sufficient enough to meet the demand of product distribution according to schedule.

Except for Magnesium sulfate, the MHMs included in the study were managed by pull distribution system. The FMOH allocated Magnesium sulfate for ear marked HFs where health professionals who took training on management of the medicine were available and the drug is distributed to those health facilities through PFSA. The rest of the medicines were distributed through the RDF scheme which was based on pull system.

Central PFSA uses delivery distribution system following the IPLS manual. Although the distribution of MHMs and other RDF managed items to hubs is not scheduled, central PFSA distribution unit attempts to synchronize the transportation of RDF managed items with program managed items which are distributed every two months. Except for emergency deliveries of medicines which are transported with smaller vehicles; during distribution the bigger tracks are almost always loaded to their maximum capacity.

At central level, the number of functioning vehicles available with petrol and drivers is not sufficient enough to meet the desired product distribution schedule. However, efforts are made to handle the shortage well. When there are shortage of vehicles which would affect scheduled

order delivery, priority is often given to those medicines needed urgently. Even though the transportation service was not out sourced at any level of the system, central PFSA rented additional tracks to resolve the vehicle shortage problem.

Similar to central PFSA, even though the numbers of vehicles were not enough at hub levels, efforts are made to handle the shortage well. As compared to the other hubs, Adama hub had better access to more vehicles and this is mainly because of available central PFSA warehouse vehicles in the compound. Partner organizations like SCMS often support transportation needs at central and hub levels by renting vehicle and covering fuel costs.

Hubs used both collection and delivery mode of distribution. For RDF managed items it was collection and for program managed items it was delivery. HFs use vehicles of WrHOs to collect RDF items from Hawassa and Adama hubs. The hubs also reported that some HFs collect products using public transportation.

For program items, hubs deliver products every two month directly to HCs which provide ART service. Hubs also deliver program items every two months to WrHOs which are then delivered to HCs referred as indirect sites. Most indirect sites were HCs which provide non-ART and non-PMTCT health services.

5.1.1 Supervision

For organizational support, the quantifiable yes or no core questions scored 85%. The result from these questions showed strengths which included; availability of IPLS guideline which states higher levels should communicate with the lower levels quarterly. This guideline helps staff carry out their logistics responsibilities based on the schedule and standard. The weakness was at

the time of the data collection not all of the logistic officers included in the study received IPLS trainings.

At PFSA hub level, a supervising team called hub based team consisting of representatives from PFSA hubs, RHBs, USAID | DELIVER PROJECT and SCMS made monthly supervision to health facilities, and present the supervision results on review meetings. According to the IPLS manual, staff from hubs should always be part of the hub based supervisory team. However most of the time, only staff from NGOs like DELIVER and SCMS carryout the supervision visits. The fact that the logistic officers from hubs are most of the time busy with other routine jobs is cited as the major reason for the absence of the PFSA hub representatives among the hub based supervisory team.

Similar to staffs at hub levels, RHBs staffs conduct supervisory visits in coordination with the hub based team. However, the supervision made by the RHB is reported to be irregular. All the three RHBs covered by this study reported facing constraints to conduct the joint supervisory visits on regular bases. Specifically in Amhara RHB it was mentioned that constraints like shortage of trained man power and other resources limits the RHB to conduct the supervisory visits to HFs according to the established schedule, which is quarterly.

Partner organizations (NGOs) communicate their supervision schedule to ZHD and pharmacy departments of the WrHOs; however, most of the ZHDs and WrHOs do not join the NGOs during the supervisory visits to HFs. The logistic officers working in Wolita ZHD reported that they sometimes join the partner organizations during supervision to HFs. However, the logistic officers from the East Arsi ZHD reported that they never joined partners during the regular supervisory visits made to health facilities.

At ZHDs, logistic activities are supervised in integration with other health management activities using the Health Management Information System (HMIS) check list. This checklist, which is different from the IPLS checklist, did not have detailed assessment questions for logistic activities which include reviewing for forecasting needs; review procedures for ordering products; observation on product storage; on physical inventory; review logistics records and reports. Other points like discussion on budgeting for logistics activities; review on changes made since last supervisory visit; provision of on-the-job training to improve job performance; discussion what is working and what is not working; discussion on what help is needed (staff, equipment, forms) etc are all missed from Health Management Information System (HMIS) check list

In Wolita zone, supervision using the HMIS check list was conducted monthly to HCs under each woreda and the logistic officers participated in this supervision regularly. In addition the ZHDs logistics officers check for data accuracy of logistic record forms and support HC logistic officers on proper usage of these forms. On the contrary, it is reported that East Arsi zone logistic officers had not been involved in the HMIS supervision for more than a year. Reasons mentioned why logistic officers at ZHDs were not involved in supervision included; having other responsibility that should be given priority like distributing medicines to woredas and hospitals and lack of budget and other logistics necessities.

West Gojam zone was serving as one of the IPLS model zones. Together with WrHOs, Supervisions to HFs under them were conducted quarterly using the IPLS check list. There were constraints to carry out the supervisory visits including shortage of skilled man power, lack of vehicles and finance for transportation.

During the supervision, if staffs at any levels were found to have knowledge and skill gaps, ZHD and WrHO logistic officers provided on-the-job trainings and in-service trainings. Trainings were provided on; completion and submission of LMIS reports, good storage practices, how to maintain appropriate levels of health commodities, as well as on how to review logistics records and reports. Feedbacks to WrHOs and health facilities regarding their reports and performance are made through telephone calls, meetings and/or during the supervisory visits.

In woredas and HCs under Wolita ZHD, there were logistic officers who did not take IPLS training. The logistic officers in Damot Gale woreda did not take IPLS trainings. In Duguna Fango woreda IPLS trainings had only been given to four pharmacy professionals. In the Wolita zone woredas supervisions were not provided in coordinated manner with other supervision teams from higher levels.

In any of the logistic activities; none of the weaknesses mentioned were related to distance between higher and lower supply chain levels. Particularly, issues related to transportation and regular supervision were similar between woredas included in the study from far and near distances. However, it should be noted that exclusion of woredas which are located above 215km from the study and in difficult to reach woredas could have affected these findings.

5.2 Logistic Indicator Assessment Tool Result

To strengthen the data found using the LSAT, selected and modified indicator questions from LIAT were used. The indicator questions were used to collect data on; availability of MHMs, use of stock keeping records and reporting forms, proper storage condition and appropriate supervision in the selected health facilities. The data was collected from 11 rural health centers and 6 hospitals.

5.2.1 Availability of maternal health medicines at the selected HFs

The store managers in all of the rural HCs visited reported that some of the MHMs were not prescribed, as a result not requested from PFSA hubs. In such cases, the MHMs are referred as not managed at the HCs. As shown in Figure 3, Magnesium Sulfate with Calcium Carbonate ($MgSo_4/C_{12}H_{22}CaO_{14}$) was reported as not managed in all of the 11 rural HCs and Metronidazole injection was reported as managed only in 1 (9%) of the HCs. Hydralazine and Methyldopa were reported as not managed in 5 out of 5 of the rural HCs visited in Wolita zone. Possibly, when mothers are diagnosed with elevated blood pressure in these HCs, they are referred to HCs located in urban areas or the nearby hospitals.

Among the HCs which manage each MHMs; Metronidazole injection, Ampicillin injection and Gentamycin injection were most stocked out at 100%, 91% and 73% of the HCs respectively. Oxytocin which belongs to the Oxytocics class of drugs was found in all of the rural HCs and IV fluids were also found in almost all of the HCs. All of the HCs had one or more of antibiotics in capsule forms, but the injection dosage forms were found only in 10% of the HCs. $MgSo_4/C_{12}H_{22}CaO_{14}$ which is the only drug included in this study form Anti-convulsants class of drug was not found in any of the visited rural HCs.

Figure 4 shows that all the MHMs except for Mgso4/ C12H22CaO14 were managed in every hospital; only two out of the six hospitals (Fenoteselam regional hospital and Sodo Hospital) manage $MgSo_4/C_{12}H_{22}CaO_{14}$. Oxytocin, Metronidazole injection, and Ampicillin injection were out of stock in 17% of hospitals (1 hospital out of the 6). Gentamicin was stocked out in 50% of the visited hospitals which made it the most stocked out MHM in the visited hospitals.

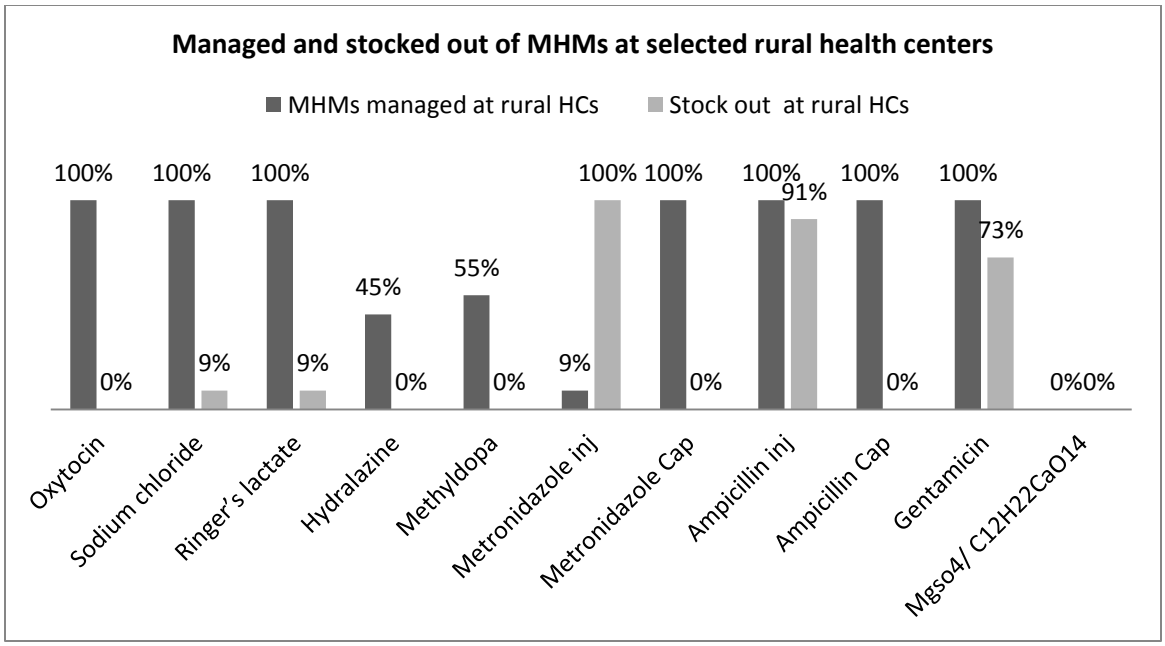


Figure 3: Percentage of rural HCs that managed the selected MHMs and were stocked out of the MHMs in Oromia, Amhara and SNNP regions, 2013.

* The data represented in this figure for percentage of rural health centers with stocked out MHMs is based on the data from the HCs that managed each MHM.

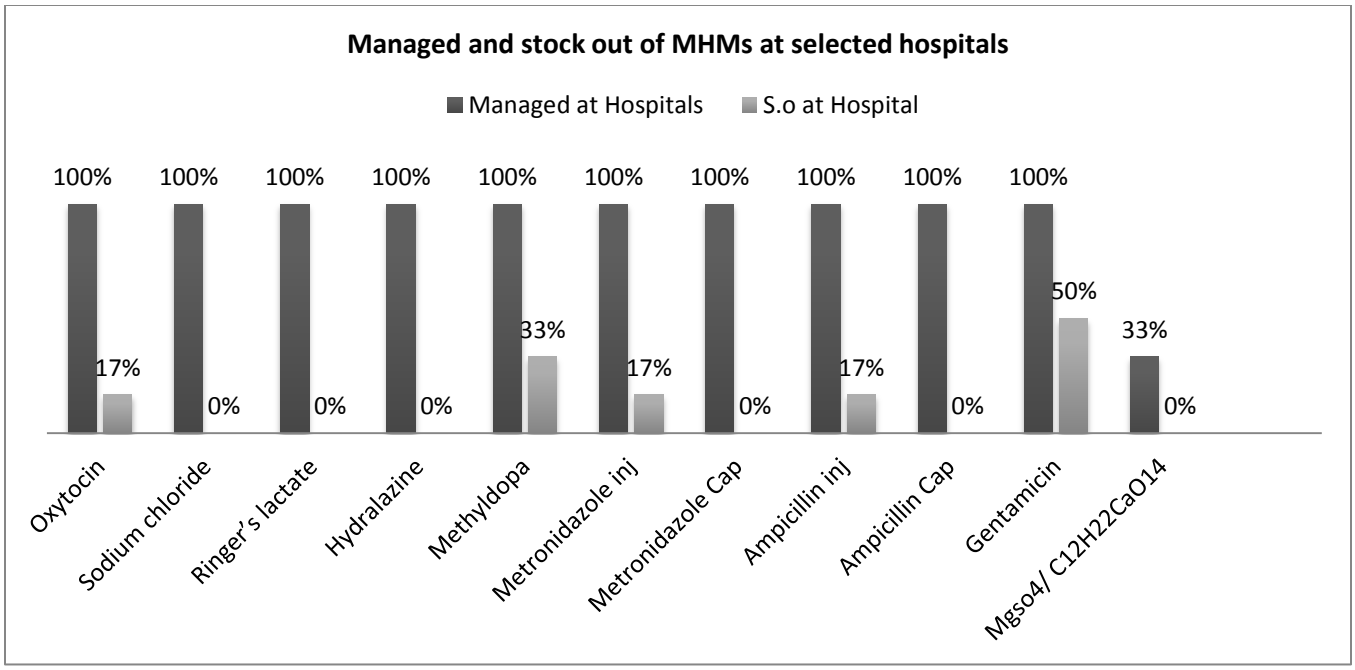


Figure 4: Percentage of hospitals which managed the selected MHMs and were stocked out of the MHMs in Oromia, Amhara and SNNP regions, 2013.

* The data represented in this figure for percentage of hospitals with stocked out MHMs is based on the data from hospitals that managed each MHM

5.2.2 Use of stock keeping records and reporting forms at the selected HFs

The stock record keeping card, which is kept at the pharmacy head's office, was found only in half of health centers and hospitals. Figure 5 shows the proportion of rural HCs with bin card for MHMs, which is kept along with each type of medicine at storage areas. Bin card availability was the lowest for Metronidazole injection (0%) and Ampicillin injection (13%); the highest was for Hydralazine (60%). Similarly, it was noted that none of the rural HCs had updated bin cards for Metronidazole injection and Ampicillin injection. On the contrary Figure 6 shows that almost all of the visited hospitals kept bin cards for all the MHMs, except for one hospital which did not

have bin card for Methyldopa and another one for Ampicillin capsule.

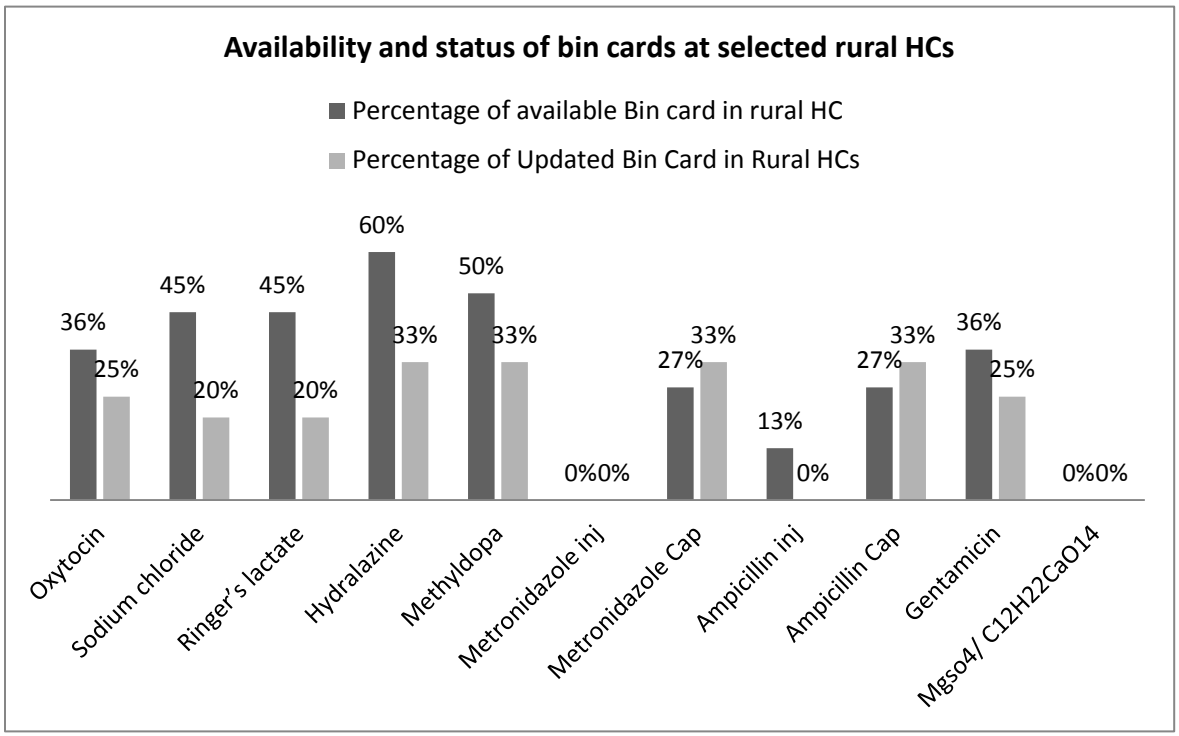


Figure 5: Percentage of availability and status of bin cards for the MHMs in rural health centers in Amhara, Oromia and SNNP regions, 2013

*The data represented in this figure for percentage of available bin cards for MHMs in rural HCs is based on the data from rural HCs that managed each MHM

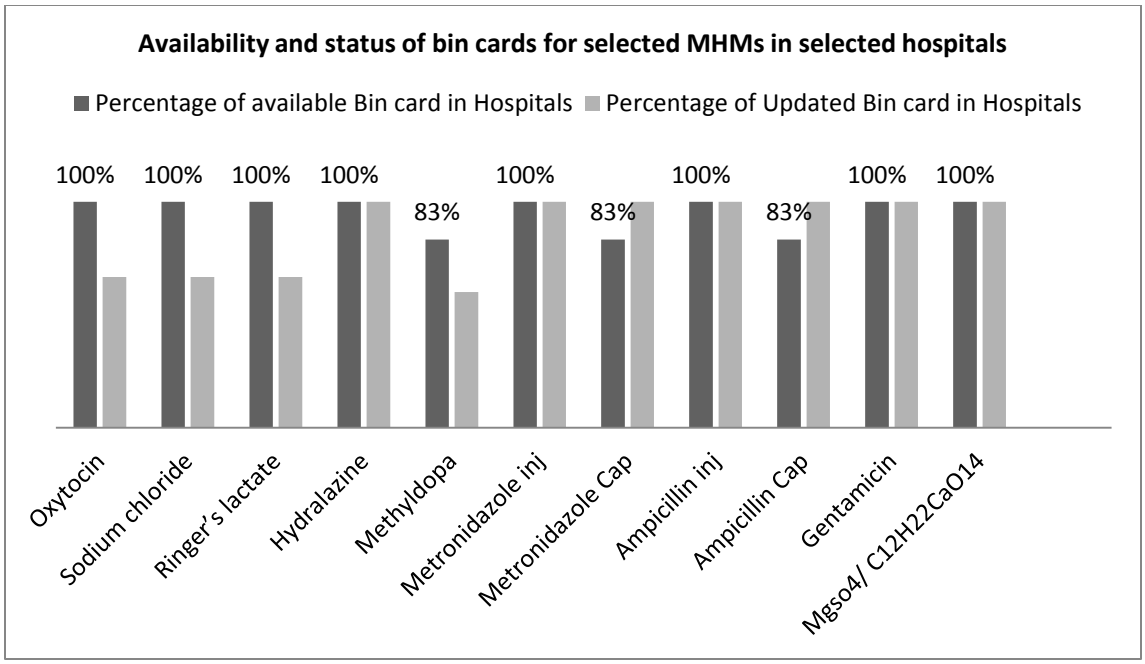


Figure 6: Percentage of Availability and status of bin cards for selected MHMs in hospitals in Amhara, Oromia and SNNP regions, 2013

* The data represented in this figure for percentage of available bin cards for MHMs in hospitals is based on the data from hospitals that managed each MHM

Table 3: Average of available and updated bin cards (had data entry in the last one month) for MHMs in rural HCs and hospitals in Amhara, Oromia and SNNP regions, 2013.

	Rural HCs	Hospitals
Total number of managed MHMs in the visited HFs	86	62
Total number of available bin cards for the managed MHMs in the visited HFs	31	61
Average availability of bin card in the visited HFs (%)	36%	98%
Total number of updated bin cards for the managed MHMs in visited HFs	18	53
Average updated bin card in the visited HFs (%)	58%	87%

Table 3 shows that for all 11 MHMs, in all of the visited rural HCs, average availability of bin cards, calculated by dividing total number of available bin cards for all of the managed MHMs in the visited rural HCs by total number of all of managed MHMs in the visited rural HCs was 36% . From the available bin cards, in average, 58% of them were updated (had data entry in the last one month). This was calculated by dividing total number of updated bin cards for all the MHMs in the visited rural HCs by total number of available bin cards in all of the visited rural HCs. In the visited hospitals, 87% of bin cards were updated which was calculated similarly.

Figure 7 shows use of RRF for MHMs which is used for reporting, calculating reorder quantities and monitoring stock levels and use of Inter Facility Reporting and Requisition Form (IFRR) by the different departments within HFs. Only one out of the 11 rural health centers (9%) was using RRF for MHMs at the time of the visit. Similarly only one out of the six visited hospitals (17%) was using RRF for MHMs. The figure also shows almost 83% (5 out of the 6 visited hospital pharmacy stores used IFRR to dispense to dispensary, delivery and MCH units within the hospital. On the other hand, 17% (2 out of the 11 visited rural health center pharmacy stores) were using IFRRs to dispense to dispensary, MCH, delivery units within the health centers and health posts under them.

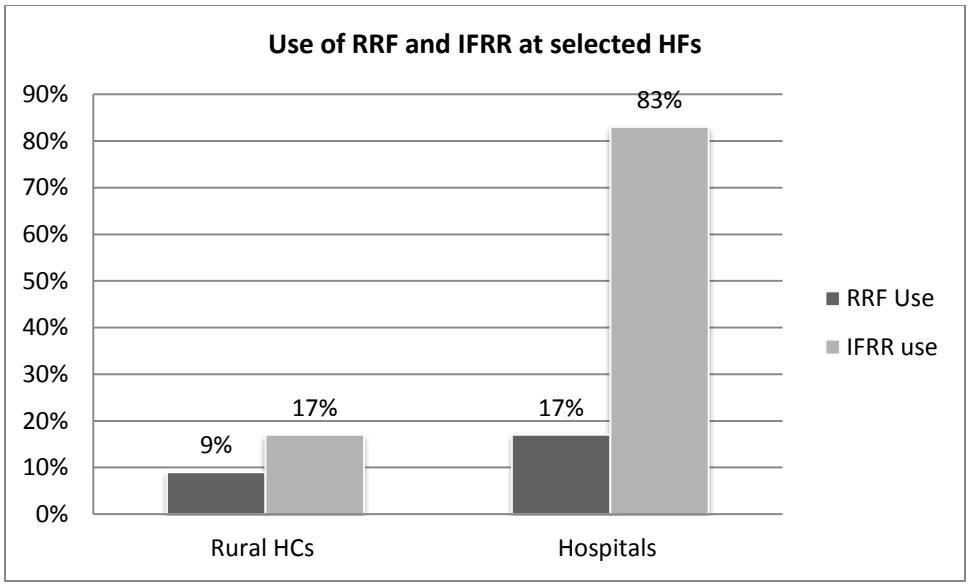


Figure 7: percentage of use of RRF and IFRR in rural HCs and hospitals in Amhara, Oromia and SNNP regions, 2013.

5.2.3 Storage condition in the selected health facilities

Out of the 14 storage conditions assessed, 5 of the conditions at HCs' store rooms and 4 of them at hospitals' store were fulfilled in less than 80% of the visited HCs and hospitals which is defined as unacceptable level in similar assessments. As shown in figure 8, storage conditions of maintained store rooms; enough storage space and availability of fire safety equipment were among the storage conditions fulfilled in less than 80% of the visited HFs. In all of the visited HFs it was observed that Oxytocin which requires cold temperature for storage was found stored according to its specification which is in a fridge with temperature of 2-8 degree Celsius.

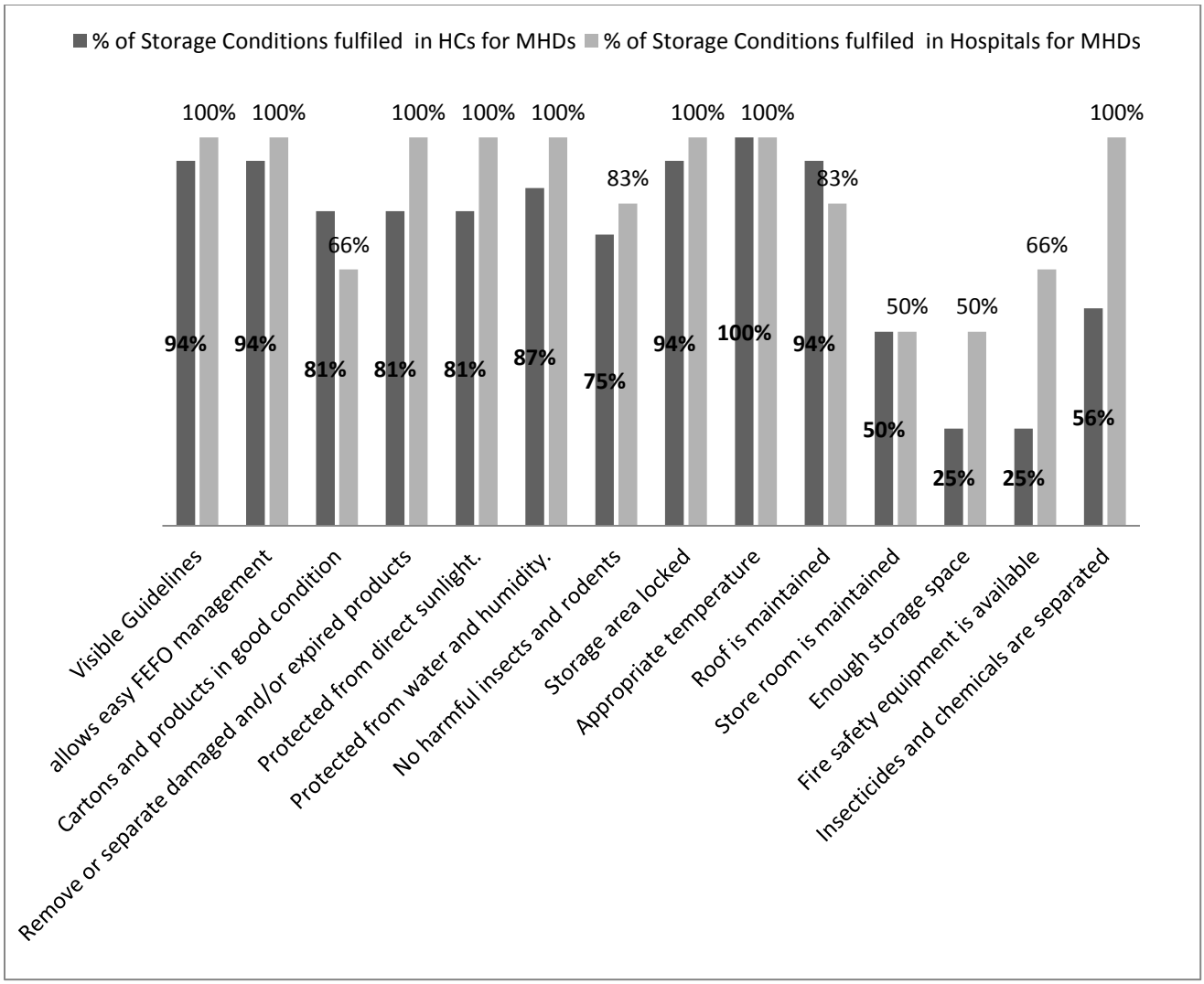


Figure.8: Percentage of rural HCs (n= 11) and hospitals (n=6) that fulfill different storage conditions in Oromia, Amhara and SNNP regions, 2013.

5.2.4 Supervisions conducted to the selected health facilities

All the HCs and hospitals visited reported they receive supervisory visits on different logistic activities. But less than half of the HFs reported they receive supervision regularly

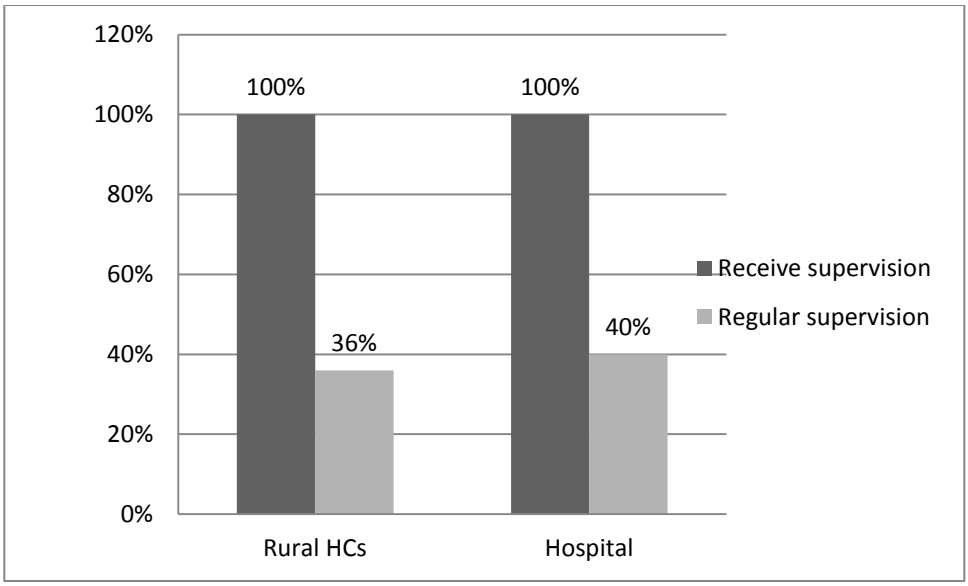


Figure9: Percentage of rural HCs (n=11) and hospitals (n=6) which receive supervisory visits and on regular basis (quarterly) in Oromia, Amhara and SNNP regions, 2013.

6. DISCUSSION

The pharmaceutical supply chain in Ethiopia has a separate LMIS from other health related data management systems and uses computerized and networked database systems at central PFSA and its hubs. Using computerized LMIS has advantages of committing less mathematical errors; facilitates rapid aggregation, calculation and rapid production of reports and graphs (DELIVER, 2006).

The standard operating procedure of the IPLS dictates that HFs and PFSA hubs submit reports and resupply requests of health commodities using the RRF every two months with ad hoc emergency requests (PFSA, 2010). However, at the time of the data collection, flow of logistic information to higher levels using the RRF did not exist for RDF managed items which included the selected MHMs in this study. As a result, incomplete reports sent to higher levels from HFs could not allow monitoring and evaluation of the program's performance.

Absence of proper reporting and requisition system from HFs to central level was one of the factors which made the LSAT score for LMIS to be low (48%). Similar result was observed in assessments conducted in Ghana and Zambia on EMs and family planning commodities respectively (Colleen et al., 2006; Disha et al., 2008). On the contrary higher use of reporting forms accounted for higher LSAT scores for LMIS in assessments conducted in Ghana for family planning commodities and in Uganda for anti-TB drugs (Colleen et al., 2006; Paschal, Martin, 2009).

The finding from the visited HFs strengths this result which shows that only one out of the 11 rural health centers and one out of the six visited hospitals were using RRF for the RDF managed MHMs; the result was similar for the use IFRR. To ensure that data collected from HFs are used

properly and the information flows correctly and consistently across the different levels of the pharmaceutical supply chain, reporting system must be in place. Its absence could ultimately hinder improving customer service, which in this case is directly related to reducing MMRs (DELIVER, 2011).

High turnover of IPLS trained professionals was one of the reasons mentioned for limited use of RRF for RDF managed items in this study. This issue was also mentioned in the assessment conducted in Ghana, where there was high attrition of staffs at HF levels who took training for completing and submission of reports (Colleen et al., 2006).

The use of electronic reporting systems was already underway for program managed items at some HFs. When RDF managed items are fully integrated in to the IPLS, not only the manual RRF will be used all the way to the central level, but also the electronic reporting and requisition form PLITS will be used. The use of PLITS would potentially shorten reporting lead time and decreases the possibility of a report being lost during transitions; which were issues in current use of RRF for program drugs (DELIVER, 2006).

PFSA used stock on hand and issue data to hubs to calculate forecasting quantities. Because of unavailability of HF level consumption data it was not possible to validate estimated projections with actual consumption. This finding is similar to the study conducted in Zambia on forecasting and quantification of family planning commodities which had only 35% LSAT score (Disha et al., 2008). Performing forecasting validation is important to check if there are discrepancies between previous forecasted quantities and actual consumption for each product and adjust the forecasting method used accordingly (DELIVER, 2009).

The Urban Health Promotion and Disease Prevention Directorate at FMOH used morbidity data for forecasting. This method could encounter limitations if essential data on population and patient attendance is unavailable, and if standard treatment guidelines are not used strictly; which could compromise the quantification processes (MSH, 2011). Among the medicines included in this study, parallel forecasting took place for Oxytocin both by FMOH and PFSA. In the Ghana study, the issue of parallel forecasting done by whoever was supplying the funding was mentioned as a weakness because forecasting and quantification process which is not based on integrated data may cause over quantification for a certain product and lead to wastage of resource (Colleen et al., 2006).

For inventory control procedures, the LSAT score for this study was 70% which is lower compared to the Ghana result which was 90% (Colleen et al., 2006). In the Ghana study, high utilization and updated stock record cards at HFs accounted for the high score. On the contrary, in this study, in the visited HCs, only 36% of the MHMs had bin cards and among these only 58% of them were updated. Similarly, the finding from the National Baseline Assessment for Emergency Obstetric & Newborn Care showed that the surveyed HCs had low available and updated logistic registries which were 50% and 32% respectively (FMOH, 2008).

The Global Programme to Enhance Reproductive Health Commodity Security (GPRHCS) report showed that MHMs were far more stocked out than family planning items at service delivery points in Ethiopia (UNFPA, 2012). Family planning items are one of the program items integrated in to the IPLS where the logistic reports collected through the RRF are used for evidence based forecasting process, procurement planning, inventory management as well as for deciding how much to resupply (PFSA, 2010). This can be one of the reasons for the difference seen between stock out rates of MHMs and family planning items at service delivery points in

Ethiopia; because proper use of inventory records and reports is basis for coordinating the flow of pharmaceuticals (MSH, 2011).

The 2011 national survey on availability of maternal/ reproductive health medicines showed that only 27% of the SDPs in Ethiopia were using Magnesium sulfate (FMOH, UNFPA 2011). Likewise, this study, it was managed only in 33% of the visited hospitals and in none of the visited rural HCs. At the time of the data collection, FMOH was distributing Magnesium sulfate to HFs only where there are health professionals who took training on management of the medicine which could explain its very low availability in the visited HFs.

The national baseline assessment for emergency obstetric & newborn care showed that 54% of the HFs used anticonvulsants & sedatives. Among these HFs, Diazepam was the most commonly used from this class of drugs; in 48% of the HFs (FMOH, 2008). Diazepam could also be the drug used instead of Magnesium sulfate in the visited HFs in this study where use of Magnesium sulfate was very limited. The problem of using more expensive and less safe anticonvulsants like Diazepam was also the case in other developing countries (WHO, 2012; Wilson et al., 2012).

Hydralazine and Methyldopa were prescribed and requested only in 45% and 55% of rural HCs respectively. Failure to prescribe drugs by physicians was mentioned as one of the reasons for not offering medicines at HFs in the national survey on availability of maternal/ reproductive health medicines (FMOH and UNFPA 2011). However, these medicines are listed in standard treatment guideline for HCs (FMHACA, 2012). Other options to treat mothers with high blood pressures admitted to these HCs needs further study. In this study, MHMs were more out of stock at the HCs (primary level HFs) than at hospitals (secondary level HFs); which is similar to the finding conducted in Ghana (Colleen et al., 2006).

At central PFSA and its hubs, inadequate storage space made the store rooms inaccessible for carrying out FEFO inventory control procedure. Similar to this study, inadequate storage space at different levels of the supply chain were mentioned in other African countries pharmaceutical logistic system assessments (Colleen et al., 2006; Disha et al., 2008; Paschal, Martin, 2009). At central PFSA and its hubs, the problem of inadequate storage space is supposed to come to an end at most within one year after the data collection period as new storage rooms were being constructed at the time of the data collection.

Similarly, at the visited HFs, the storage conditions which were in unacceptable range were directly related to inadequate storage capacity. These conditions were unmaintained store rooms; harmful insects and rodents found in storage rooms and insecticides and chemicals stored together with pharmaceuticals. With adequate storage space available, it would be easier to clean and maintain storage area which would keep away insects and rodents. It would also give enough space to separate harmful insecticides and chemicals from pharmaceuticals.

As part of the IPLS implementation, PFSA hubs bear the responsibility of transporting pharmaceuticals to HFs (PFSA, 2010). But as PFSA was in state of transition at the time of data collection, the delivery mode of distribution system was not yet effective for RDF managed medicines. Similar to the assessment conducted in Zambia, in this study, it was reported that there were some HFs where the logistic officers collect RDF managed medicines using public transportation (Disha et al., 2008).

For program managed items, which are integrated into the IPLS, delivery mode of distribution system was used. This result is similar to the assessment finding in Ghana where at the time of the survey the country's logistic system was in a state of transition and had not fully

implemented distribution mode of delivery system. It was found that the higher level was delivering EMs which includes Oxytocin only to 37% of HFs (Colleen et al., 2006).

One disadvantages of delivery mode of distribution system is inefficient use of larger vehicles during transporting products (MSH, 2011). Central PFSA and its hubs avoided inefficient use of larger vehicles during delivery of pharmaceuticals by making sure the vehicles are loaded to their maximum capacity before setting off to their destinations.

Health facilities use pull distribution system according to the IPLS manual for MHMs except for Magnesium sulfate (PFSA, 20100). One advantage of pull distribution system is health professionals at HFs decide resupply quantities, who can anticipate changes in product consumption better than hub or central level staffs. It also gives these health professionals a sense of ownership over decisions made on quantities of stock on hand which increases staffs motivation (DELIVER, 2011).

According to the IPLS; WrHO, ZHDs and RHBs have responsibilities of conducting supervision to health facilities. However, at the time of data collection, supervisions were mainly conducted by partner organizations. This issue is expected to be solved when the IPLS is integrated fully in to the system as seen in west Gojam zone which was one of IPLS model zones.

Similar to the assessment conducted in Ghana, even though there were documents, guidelines and policies on how to perform supervision activities particularly for logistic activities, supervisory visits were not conducted according to the guidelines to the visited HFs in East Arsi and Wolita zones (Colleen et al., 2006). The HFs in this study reported supervisions were not conducted regularly which is an important element of quality assurance (MSH, 2011). As recommended by the Ugandan study, leveraging resources by integrating the different

supervision activities conducted by different bodies may increase the frequency, hence regularity of supervision for logistic activities (Paschal and Martin, 2009).

7. LIMITATIONS OF THE STUDY

- The assessment did not incorporate aspects of procurement, source of finance, and product use at HF level, which would make the assessment of supply chain system more complete.
- Lack of access to more assessments done in developing countries using the LSAT which limited comparison and discussion of the result.

8. CONCLUSION

In Ethiopia, MHMs were not integrated in to the IPLS which affected reporting and record keeping practices which in turn affected forecasting, distribution and inventor control procedures. Lack of storage space was prominent at every level of the supply system. The storage problem at central PFSA and its hubs is expected to be solved with the completion of constructions of additional warehouses. The main problems observed in areas of logistic record keeping and reporting; and regular supervisions might be simplified when RDF managed items including MHMs are fully integrated into the IPLS and fully implemented throughout the pharmaceutical supply chain.

9. RECOMMENDATIONS

Based on the findings the following recommendations are suggested.

- PFSA should integrate revolving drug fund managed items including maternal health medicines into the IPLS in order to make their supply chain management organized
- The number of pharmacy professionals assigned for each level of the pharmaceutical supply chain should be reassessed and shortage of professionals resolved in order to effectively implement the IPLS.
- Stock levels of maternal health medicines should always be maintained between maximum and minimum stock levels in order to avoid risk of stock out of the medicines.
- Pharmacy departments of regional, zonal and woreda health bureaus and health offices should make integrated and regular supervisory visits to health facilities.
- Shortage of vehicles for transportation and distribution of pharmaceuticals throughout the supply chain should be resolved
- Experience sharing visits among regional health bureaus pharmacy departments should be organized.

10. REFERENCES

Carroli G, Cuesta C, Abalos E, GulmezogluAM (2008). Epidemiology of postpartum hemorrhage: a systematic review. *Best Practice & Research Clinical Obstetrics and Gynecology*; Vol (22): 999–1012.

Colleen M, Ronnow E, Shea E, Edah P, Bruce E (2006). Ghana: Quantitative and Qualitative Logistics System Assessment (LIAT and LSAT) Report. USAID | DELIVER PROJECT, Arlington, Va

CSA and ICF International (2012). Ethiopia Demographic and Health Survey 2011, Central Statistical Agency and ICF International, Addis Ababa, Ethiopia and Calverton, Maryland, USA.

DACA (2010).Standard treatment guideline for General hospitals. Drug Administration and Control Authority of Ethiopia, Addis Ababa

DELIVER PROJECT (2006). Guidelines for Implementing Computerized Logistics Management Information Systems (LMIS).Second Edition. USAID | DELIVER, for the U.S. Agency for International Development, Arlington, Va, USA.

DELIVER PROJECT (2008). Logistics Indicators Assessment Tool (LIAT), USAID DELIVER PROJECT, Task Order 1. 2008, United States Agency for International Development, Arlington, Va, USA

DELIVER PROJECT (2009). Logistics System Assessment Tool (LSAT), USAID | DELIVER PROJECT, Task Order 1. 2009, United States Agency for International Development, Arlington, Va, USA

DELIVER PROJECT (2011). The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities, USAID | DELIVER PROJECT, Task Order 1. 2011, United States Agency for International Development, Arlington, Va, USA

Disha A, Bwembya M, Collins E, Papworth D, Ronnow E (2008). Zambia: Family Planning Quantitative and Qualitative Logistics System Assessment. USAID | DELIVER PROJECT, Task Order 1 Arlington, Va

EngenderHealth (2007). Balancing the Scales: Expanding Treatment for Pregnant Women with Life- Threatening Hypertensive Conditions in Developing Countries; a Report on Barriers and Solutions to Treat Pre-eclampsia & Eclampsia.

FMHACA (2008). List of Essential Medicines for Ethiopia: fourth edition., Food, Medicine and Healthcare Administration and Control Authority, Addis Ababa, Ethiopia

FMHACA (2012). List of Medicine for Health Centers, Food, Medicine and Healthcare Administration and Control Authority, Addis Ababa, Ethiopia

FMOH (2006). Master Plan for a new Health Commodities Supply System in Ethiopia: Volume I, Federal Democratic Republic of Ethiopia Ministry of Health, Addis Ababa, Ethiopia

FMOH (2008). National Baseline Assessment for Emergency Obstetric & Newborn Care Ethiopia, Federal Democratic Republic of Ethiopia Ministry of Health, Addis Ababa, Ethiopia

FMOH (2010). Health Sector Development Program IV 2010/11 – 2014/15., Federal Democratic Republic of Ethiopia Ministry of Health, Addis Ababa, Ethiopia

FMOH (2012). Health Sector Development Program (HSDP) IV annual performance report version 1 EFY 2004 (2011/12), Federal Democratic Republic of Ethiopia Ministry of Health, Addis Ababa, Ethiopia

FMOH (2014). Health Sector Development Program (HSDP) IV annual performance report version 1 EFY 2006 (2011/12). Federal Democratic Republic of Ethiopia Ministry of Health, Addis Ababa, Ethiopia

FMOH and UNFPA (2011). National Survey on Availability of Modern Contraceptives, Essential and Life-Saving Maternal/ RH Medicines at Service Delivery Points in Ethiopia.

MSH (2011). Managing Drug Supply: third edition,Managing Access to Medicines and Other Health Technologies, Management science for Health Arlington, VA,USA.

Paschal M and Martin K (2009). Uganda National Tuberculosis Logistics System Assessment Tool (LSAT). USAID | DELIVER PROJECT, Task Order 1, Arlington, Va

PFSA (2008). Business process reengineering. Pharmaceuticals supply core process, Pharmaceutical Fund and Supply Agency, Addis Ababa, Ethiopia

PFSA (2010). Standard Operating Procedures Manual for the Pharmaceuticals Logistics System in Ethiopia, Pharmaceutical Fund and Supply Agency, Addis Ababa, Ethiopia

Ronsmans C, Wendy J, Graham W J (2006). Maternal mortality: who, when, where, and why. *The Lancet*; Vol (368):1189-1200.

UNDP (2012). United Nations millennium development goals, Available at: www.undp.org/content/undp/en/home/mdgoverview/mdg_goals/mdg4/ [Accessed on December 15, 2012]

UNFPA (2012). The Global Programme to Enhance Reproductive Health Commodity Security, Annual Report 2012, United Nations Population Fund, New York, USA

WHO (1998). Managing drug supply, essential drug monitor, Action programs on essential drugs and vaccines, double issue – No 25 & 26, World Health Organization: Geneva, Switzerland

WHO (2009). Monitoring emergency obstetric care a handbook, World Health Organization, Geneva, Switzerland

WHO (2012). Priority life-saving medicines for women and children, World Health Organization, Geneva, Switzerland

Wilson R, Kade K, Weaver A, Lorenzi A.D, Yeager B, Patel S , Ahmed K, Armbruster D, Lockwood J.B (2012); Key data and finding; medicines for maternal health.

ANNEXES

Annex I: Background characteristics of the study participants

General Information			
1	Region		Facility type ➢ Health Center ☐ ➢ Hospital ☐ ➢ PFSA HUB ☐
2	Zone		
3	Woreda		
4.	Facility / PFSA HUB Name		Distance from PFSA HUB(Kms) ☐
5	Respondent characteristics		
	1. Profession		
	2. Educational Level		
	3. Years of Experience		
6	Date of Interview		

Annex II: Modified version of the DELIVER Logistics System Assessment Tool (LSAT) used for KII guide

SECTION I: Forecasting

1.		Describe the forecasting process for maternal health medicines; *specifically addressing (a) who initiates it? (b) When does it take place? (c) How long does the process take?*			
2.		How are forecasts developed for each selected maternal health medicines *N.B. modalities are listed down for each supply availed under different supply system arrangement*			
			Y	N	Comment
	a.	Dispensed-to-user data			
	b.	Distribution/issues data			
	c.	Stock on hand at all levels			
	d.	Demographic data or disease prevalence/ morbidity			
	e.	Service statistics			
		Note: - If available ask for documents used to develop forecasting			

		Y	N	Skip	Comment
3.	Are forecasts validated by comparing previous estimated consumption with actual consumption/?				
4.	If yes, how close have most forecasts been to actual consumption of each supply?				
a.	< 10%				
b.	10 -25%				
c.	25-50%				
d.	>50%				
5.	Identify which products among the list had serious forecasts discrepancies in the past 2 years (+/- 25%) and which ones had the smallest forecast discrepancies (< 10%)? Note: - If available ask for documents used to verify the information on the validation of forecasting.				
6.	What other factors are considered in the preparation of forecasts?				
		Comment			
		Y	N		
a.	Consolidating decentralized forecasts				
b.	Seasonal & regional variation				
c.	Standard treatment guideline				
d.	National essential drug list				
e.	Stock-out period				
f.	Others				

7.	Do forecasts take into account programmatic plans?					
					Comment	
		Y	N			
a.	Expansion of service outlets					
b.	Training					
c.	IEC or behavior change campaigns					
d.	Other organization's activities					
8.	Is technical assistance provided to develop forecasts? If yes by whom?					
9.	Describe the role of regional or lower levels in the forecasting process? *E.g, RHBs & WoHOs*					
10.	Do you exercise long-term (e.g., 3 or more years) forecasts?			Y	N	Comments
	If yes, are the forecasts updated at least annually?					
	Probe, if the selected drugs are included					
	Note: - ask if documents is available which show long term forecasting					
11.	Are forecasts prepared on a schedule that coincides with local budgeting and procurement cycles?					
	Probe, if the selected drugs are addressed					
12.	**Other comments on forecasting:** ***(Strength…weakness… recommendation)***					

SECTION II: Logistics Management Information System (LMIS)

			Y	N	Skip	Comment
1.	Is there a LMIS? *If yes, go to question 3.*					
	Is logistics information collected through another information system (e.g., HMIS)? Describe briefly.					
2	Is logistics information collected through another information system (e.g., HMIS)? Describe briefly.					
3	Does the information system (LMIS, HMIS, other) include:					Comment
			Y	N		
	3.1.	Stock keeping records				
	3.2.	Requisition and issue records				
	3.3.	Dispensed-to-user records at service delivery points?				
	3.4.	Summaries of consumption data at levels above service delivery points				
	3.5.	Stock on hand?				
4	Do information system reports at all levels of the system show:					
	4.1.	Inventory balance (stock on hand)?				
	4.2.	Quantity dispensed or issued during a specified reporting period?				
	4.3.	Losses and adjustments?				
	4.4.	Quantities received?				

5	Describe the flow of information from the health facility to central level. Please include information about forms used, frequency of reporting, who's responsible, and where data is aggregated. Attach a diagram.				
6	Do LMIS or other information system reports received at the central level provide information on stock status at the health facility level (i.e., do central-level staff have accurate routine information on which facilities	Y	N		Comment

	are stocked out, under stocked, adequately stocked, or overstocked)? Please explain:				
7	How often are reports sent to each higher level of the system? Map the report flow.				
8	How do you monitor reporting rates and follow-up to obtain missing logistics reports?				
9	What is the approximate percentage of information system reports received in time to be used for logistics decisions (ordering, distribution, etc.) at the following levels: If below 100% at any level, explain why facilities don't report or don't report on time.				
10	Are information system records reconciled against physical inventories at each level	Y	N	If yes, how is this done?	How often?
11	Is the information system automated at the following levels:	Y	N	Skip	Comment
				If no to questions skip to 13	
12	Briefly describe the functions and processes that are automated.				
13	Is external assistance provided to manage the information system? Describe.				
14	Is the information system used to monitor and evaluate the program's performance?	Y	N	Skip	Comment
15	How is logistics data recorded, managed, analyzed, and used at each level?				
16	What indicators related to logistics and/or product availability does the information system track (e.g., stock out rate, percentage of reporting, rational prescribing practices, etc.)?	Who tracks these indicators?		How often?	
17	Is external assistance provided to manage the information system? Describe				
18	Is external assistance provided to manage the information system? Describe.				

19	Is the information system used to monitor and evaluate the program's performance?	Y	N	Comments	
20	How is logistics data recorded, managed, analyzed, and used at each level?				
21	What indicators related to logistics and/or product availability does the information system track (e.g., stock out rate, percentage of reporting, rational prescribing practices, etc.)?	Who tracks these indicators?		How often?	
22	What decisions are based on information system reports?	Y	N	Comment	
	A. Forecasting				
	B. Procurement				
	C. Transport/delivery				
	D. Scheduling supervisory visits				
	E. Inventory management				
	F. How much to resupply				
	G. other(Specify)				
23	Are logistics data used at each level of the system as appropriate for:	Y	N	Comments	
	A. Continuous monitoring of stock balances?				
	B. Calculating quantities for resupply?				
24	What feedback mechanisms are in place to channel logistics information back to lower levels?	Y	N	Comments	
	A. Telephone				
	B. Reports				
	C. Meetings				
	D. Supervisory visit				
	E. Other (Specify)				
	F. None				
25	Are issues data or dispensed-to-user data cross-checked against other data	Y	N	Skip	Comments

	sources (e.g., service statistics, demographic surveys, etc)				*If no, skip to 27*	
26	What type of data are they checked against?	How often are they checked against each data type				Who is responsible for cross-checking
		Quarterly	Semi-Annually	Annually	Other(Specify)	
	A. Service statistics					
	B. Demographic statistics					
	C. Survey data					
	D. Supervisors reports					
	E. Other (Specify)					
27	Is logistics information provided to the appropriate decision makers for logistics planning (e.g., Ministry of Health, PFSA Management, Ministry of Finance, UNFPA, USAID, World Bank, NGOs)?	*Y*	*N*	Comments		
	I. What information is provided?					
	II. Who provides the information?					
	III. Who receives the information?					
	IV. How often?(monthly, quarterly ,semi-annually , or annually)					
	V. How is the information used?					
28	*Other comments on the LMIS:* *(Strength, Weakness, and Recommendation)*					

SECTION III: Inventory control procedures

1.	Specify what type of inventory control system is used (e.g., push, pull, etc.) and describe the system. Please explain:			
		Y	N	Comment
2	Are the following Maternal Health Medicines considered by the program to be in full supply? Please explain:			
3	Are there guidelines and established policies for maximum and minimum stock levels at which full supply products should be maintained (please note current maximum and minimum levels in comments section)?			
3.1.	At the central level?			
3.2.	At Hub level?			
3.3.	At the district/woreda level?			
3.4.	At the service delivery point level?			
	Please explain:			
4	Are the inventory control guidelines for full supply products respected at all levels so that stock levels generally fall between maximum and minimum, if no please explain the reasons.			
5	Are stock levels (maximum and minimum) for full supply products reviewed Periodically?			
6	How are products that cannot be maintained in full supply allocated at this level			
7	Are there written provisions for the redistribution of over-stocked supplies?			
8	Does the program have a policy of storing and issuing stock according to First-to-expire, first-out (FEFO) inventory control procedures at all levels?			
9	In practice, does the program manage and issue stock according to FEFO inventory control procedures at all levels? Describe			

10	Are damaged/expired products physically separated from inventory and removed from stock records at the following levels:			
11	Do you have a system for tracking product losses and other adjustments?			
12	Are there significant losses and adjustments? If yes, how are they investigated?			
13	Are appropriate actions taken to prevent recurrence? If Yes, what actions were taken?			
14	How do you calculate resupply quantities			
15	Have stock outs occurred for any of the MHMs in the last 12 months?			
a.	What causes these stock outs?			
b.	At which levels or what parts of the country do most stock outs occur			
c.	Which products stock out more frequently?			
d.	How long do the stock outs normally last?			
16	Are there established procedures for placing emergency orders?			
17	How often are emergency orders placed by			
a.	Central			
b.	Hubs			
18	How successfully are emergency orders filled?			
	Other comments on the Inventory Control Procedures: (Strength, Weakness, and Recommendation)			

SECTION IV: Warehousing and Storage

1.		Y	N	Comments
	Does the program have written guidelines for storage and handling of all products, at all levels of the system (e.g., manuals, posters, etc.)?			
2.	Are there written guidelines for disposal of unfit Pharmaceuticals?			
3.	Does the program conduct at least one physical inventory of all products annually at storage facilities?			
4.	Are cold chain storage resources (e.g., refrigerator, paraffin/kerosene, and temperature chart) available, where appropriate?			
5.	How is the cold chain monitored to ensure that products are consistently maintained at appropriate temperatures? (Check all that apply.)			

	Y	N	Comments
A. written guidelines			
B. supervision			
C. temperature log sheets			
D. Other (Specify)			

6.	Is the existing cold chain storage capacity adequate to handle the current quantities of products?	Y	N	NA	Comments
7.	Is the existing cold chain storage capacity handle all the quantities needed to ensure that no stock outs occur? *If yes to all, skip to question 9.*				
8.	How does the program cope with inadequate storage space?				
9.	Does the program have plans for meeting storage requirements for at least the next five years?	Y	N	Comments	
	Describe the program's plans for accommodating growth (e.g.,				

	infrastructure, distribution, etc.).				
1.	Specify storage conditions that need improvement, if any (e.g., cleanliness, organization, temperature, building structure, etc.).				
2.	A. Is there a procedure for recording complaints about product quality?	Y	N	Comments	
	If yes, how are they handled?				
12.	Are visual quality assurance inspections of products conducted at the storage facility?	Y	N	How often	Comments
	1. Central				
	2. Hubs				
13.	Are there written procedures or guidelines for destroying damaged and expired products? *If no, skip to question 17.*				
14.	Describe the written procedures/guidelines for destroying damaged and expired products.				
15.	In practice, are damaged and expired products destroyed according to the program's disposal guidelines?				
16.	***Other comments on warehousing and storage:*** ***(Strengths, Weaknesses, and Recommendation)***				

SECTION V: Transport and Distribution

1.	How are products delivered from this to the other level of the system? If Delivery, How are routes determined?			
2.	Do written procedures specify what type of distribution system should be used to distribute products between each level?	Y	N	Comments
3.	Is there a documented distribution schedule/plan?			
4.	Are a sufficient number of functioning vehicles available to meet the desired product distribution schedule?			
5.	Are vehicles regularly available for field supervision?			
6.	Are vehicles available for cold storage materials?			
7.	In general, are orders delivered as scheduled?			
8.	A. Is transportation outsourced at any level of the system?			
	B. If yes, how effective has it been?			
9.	***Other comments on transport and distribution:*** ***(Strengths, Weaknesses, and Recommendation)***			

SECTION VI: Organizational support for logistics system

1.	How often do personnel at the following levels communicate?	Never	Weekly	Monthly	Quarterly	Annually	Comments
	PFSA Hubs						
	Health Facilities						
	Others(Specify)						

If never to question 1, skip to question 3.

2.	Describe what is done during meetings with staff with logistics responsibilities.			
3.	Is there a supervision system that covers logistics activities?	Y	N	Comments
4.	Is there a process in place for improving any gaps in the knowledge and skills of logistics personnel at the following levels? *If yes, please describe process.*			
	A. central?			
	B. hubs?			
	C. District/woreda?			
	D. Service delivery point?			
5.	Are there written procedures and guidelines (e.g., manuals, job aids, standards) to help staff carry out their logistics responsibilities? *If no, skip to question 7.*			
	List all procedures/guidelines that cover logistics responsibilities.			
6.	Are the procedures and guidelines distributed to staff at the following levels:			
	A. central?			

	B. Hubs?			
	C. district/woreda			
	D. Service delivery point?			
7.	Do staff who manage commodities have a written job description that includes logistics responsibilities at the following levels:			
	A. central?			
	B. Hubs?			
	C. district/woreda			
	D. Service delivery point?			

8.	Do logistics staffs have the tools and resources they need to do their jobs, at the following levels (e.g., job aids, forms, carbon paper, calculators, shelving, vehicles, funds for transport, etc.)? If not, which tools or resources are missing at the following levels:	Y	N	Comments
9.	A. Is external assistance (from other NGOs, donors, or partners) used to complete management and supervision activities?			
	B. If yes, describe the extent of the external assistance.			
10.	Describe supervisory structure by job position/title and by level. Indicate if any position receives supervision from more than one person or unit. Provide a chart if possible			
10.	Are supervisory responsibilities described in written job descriptions?			
11.	Are guidelines available for how the supervisor is to conduct the supervisory visit (e.g., introductions, positive style of interaction, follow-up)?			
12.	Are tools available that describe what to cover when conducting a supervisory visit (e.g., guidelines, a checklist)?			
13.	Do the supervisors use these guidelines and tools?			
14.	Are supervisory visits conducted at this level?			

15.	What types of activities take place during the visits:				
	Activities during supervision:		*Y*	*N*	*Comments*
	A.	Review procedures for forecasting needs?			
	B.	Review procedures for ordering products?			
	C.	Observe product storage?			
	D.	Conduct physical inventory?			
	E.	Review logistics records and reports?			
	F.	Discuss budgeting for logistics activities?			
	G.	Review changes made since last supervisory visit?			
	H.	On-the-job training to improve job performance?			
	I.	Discuss what is working and what is not working?			
	J.	Discuss what help is needed (staff, equipment, forms, etc.)?			

16.	Is there a documented schedule for supervision? *If no, skip to question 20.*				
17.	Are supervisory visits conducted according to the established schedule?	*Y*	*N*	If not, why not?	If yes, How often do they take place?
18.	Are there any constraints to conducting supervisory visits?	*Y*	*N*	*Comments*	

19.	If a staff member's performance in logistics is not satisfactory, is the person provided with:			
		Y	*N*	*Comments*
	A. In-service training?			
	B. On-the-job training?			
	C. Written instructions on how to improve?			
	D. A coach or mentor?			
	E. Other? (describe)			

20.	Does the program conduct periodic staff development activities (e.g., classroom training, coaching, on-the-job training, etc.)?	*Y*	*N*	*Comments*

21.	Has training been given to current staff at all appropriate levels, in the following areas:			
	Training given:	*Y*	*N*	*Comments*
	A. Completion and submission of LMIS reports?			
	B. Proper storage of health products?			
	C. Maintaining proper stock levels?			
	D. Determining order quantities?			
	E. Determining issue quantities?			
	F. Estimating annual needs?			
	G. Reviewing reports and records?			
	Others List			
22.	Other comments on organizational support for the logistics system: (Strengths, Weaknesses, and Recommendation)			

Annex III: Modified version of the DELIVER Logistics System Assessment Tool (LSAT) Scoring Sheet

SECTION I: Forecasting

		Yes	No	Score	Maximum Score
1.	How are forecasts developed for each selected maternal health medicines				
a	Dispensed-to-user data		✓	0	1
b	Distribution/issues data	✓		1	1
c	Stock on hand at all levels	✓		1	1
d	Demographic data or disease prevalence/ morbidity	✓		0.5	0.5
e	Service statistics	✓		0.5	0.5
2.	Are forecasts validated by comparing previous estimated Consumption with actual consumption/?		✓	0	1
3	Are the forecasts updated at least annually?	✓		1	1
4	Are forecasts prepared on a schedule that coincides with local budgeting and procurement cycles?	✓		1	1
	Note: - (Yes = 1 or 0.5 , No= 0)				
	Total			**5**	**7**
	Score For the section			**71%**	**100%**
	Score for the section = Total Score/ Maximum Total Score x 100				

SECTION II: Logistics Management Information System (LMIS)

		Yes	No	Score	Maximum Score
1.	Is there a logistic management information system?	✓		1	1
2.	Does the information system (LMIS, HMIS, other) include:				
a.	Stock keeping records	✓		0.4	0.4
b.	Requisition and issue records	✓		0.4	0.4
c.	Dispensed-to-user records at service delivery points?		✓	0	0.4
d.	Summaries of consumption data at levels above service delivery points	✓		0.4	0.4
e.	Stock on hand?	✓		0.4	0.4
3.	Do information system reports at all levels of the system show:				
a.	Inventory balance (stock on hand)?		✓	0	1
b.	Quantity dispensed or issued during a specified reporting period?		✓	0	1
c.	Losses and adjustments?		✓	0	1
d.	Quantities received?		✓	0	1
4	Do LMIS or other information system reports received at the central level provide information on stock status at the health facility level (i.e., do central-level staff have accurate routine information on which facilities are stocked out, under stocked, adequately stocked, or overstocked)?		✓	0	1

		Yes	No	Score	Maximum Score
5.	What decisions are based on information system reports? *(If all are checked, then score 1; if not all but some, then score 0.5)*				
a.	Forecasting	✓		0.5	1
b.	Procurement	✓			
c.	Transport/delivery	✓			
d.	Scheduling supervisory visits		✓		
e.	Resupply quantities	✓			
f.	other(Specify)				
6.	Are logistics data used at each level of the system as appropriate for:				
a.	Continuous monitoring of stock balances?				
	Central	✓		0.33	0.33
	PFSA Hub		✓	0	0.33
	Health Facilities	✓		0.33	0.33
b.	Calculating quantities for resupply?				
	Central	✓		0.33	0.33
	PFSA Hub	✓		0.33	0.33
	Health Facilities	✓		0.33	0.33

7.	What feedback mechanisms are in place to channel logistics information back to lower levels? *If (a) then score 0; If any other score is checked then score 1 (even if multiple choices are selected).*				
		Yes	**No**	**Score**	**Maximum Score**
a.	None		✓	1	1
b.	Reports	✓			
c.	Meetings	✓			
d.	Supervisory visit	✓			
e.	Telephone	✓			
f.	Other (Specify)				
	Note: - (Yes = 1, 0.4, 0.33 , No= 0)				
	Total			**5.75**	**12**
	Score For the section			**48%**	**100%**
	Score for the section = Total Score/ Maximum Total Score x 100				

SECTION III: Inventory control procedures

		Yes	No	Score	Maximum Score
1.	Are there guidelines and established policies for maximum and minimum stock levels at which full supply products should be maintained?				
a.	At the central level?	✓		0.67	0.67
b.	At Hub level?	✓		0.67	0.67
c.	At the service delivery point level?	✓		0.67	0.67
2.	Are there written provisions for the redistribution of over-stocked supplies?		✓	0	1
3.	Does the program have a policy of storing and issuing stock according to first-to-expire, first-out (FEFO) inventory control procedures at all levels?	✓		1	1
4.	In practice, does the program manage and issue stock according to FEFO inventory control procedures at all levels?	✓		1	1
5.	Are damaged/expired products physically separated from inventory and removed from stock records at the following levels:				
a.	Central	✓		0.5	0.5
b.	PFSA hub	✓		0.5	0.5
6.	Does the system have a system for tracking product losses and other adjustments?	✓		1	1
7.	Have stock outs occurred for any of the MHMs in the last 12 months for any of the MHMs?				
a.	Central	✓		0	1

b.	PFSA hub	✓		0	1
8.	Are there established procedures for placing emergency orders?	✓		1	1
	Note: - (Yes = 1, 0.5, 0.67, No= 0)				
	Total			**7**	**10**
	Score For the section			**70%**	**100%**
	Score for the section = Total Score/ Maximum Total Score x 100				

SECTION IV: Warehousing and Storage

		Yes	No	Score	Maximum Score
1.	Does the program have written guidelines for storage and handling of all products, at all levels of the system (e.g., manuals, posters, etc.)?	✓		1	1
2	Are there written guidelines for disposal of unfit Pharmaceuticals?	✓		1	1
3	Does the program conduct at least one physical inventory of all products annually at storage facilities?				
a.	Central	✓		0.5	0.5
b.	PFSA hub	✓		0.5	0.5
4.	Is the existing storage capacity adequate to handle the current quantities of products at the following levels?				
a.	Central		✓	0	0.5
b.	PFSA hub		✓	0	0.5
5.	Are visual quality assurance inspections of products conducted at the storage facility?				
a.	Central	✓		0.5	0.5
b.	PFSA hub	✓		0.5	0.5
6.	Are there written procedures or guidelines for destroying damaged and expired products?	✓		1	1

7.	In practice, are damaged and expired products destroyed according to the program's disposal guidelines?				
a.	Central		✓	0	0.5
b.	PFSA hub		✓	0	0.5
	Note: - (Yes = 1, 0.5 , No= 0)				
	Total			**5**	**7**
	Score For the section			**71%**	**100%**
	Score for the section = Total Score/ Maximum Total Score x 100				

SECTION V: Transport and Distribution

		Yes	No	Score	Maximum Score
1	Do written procedures specify what type of distribution system should be used to distribute products between each level?	✓		1	1
2	Is there a documented distribution schedule/plan at all levels?	✓		1	1
3	Are a sufficient number of functioning vehicles available to meet the desired product distribution schedule?				
a.	Central		✓	0	0.5
b.	PFSA hub		✓	0	0.5
4.	In general, are orders delivered as scheduled at the following levels?				
a.	Central		✓	0	0.5
b.	PFSA hub		✓	0	0.5
Note: - (Yes = 1, 0.33 , No= 0)					
Total				**2**	**4**
Score For the section				**50%**	**100%**
Score for the section = Total Score/ Maximum Total Score x 100					

SECTION VI: Organizational support for logistics system

			Score	Maximum Score
1.	How often do personnel at the following levels communicate? *Score 0 for never; score .33 for any other response*			
a.	Central-level logistics staff with staff from the next level below?	□ Never □ Weekly ✓ Monthly □ Quarterly □ Annually	0.33	0.33
b.	Regional level logistics staff with staff from the or next level below (e.g., district)?	□ Never □ Weekly □ Monthly ✓ Quarterly □ Annually	0.33	0.33
c.	District-level logistics staff with staff from service delivery point level?	□ Never □ Weekly □ Monthly ✓ Quarterly □ Annually	0.33	0.33
2.	Is there a process in place for improving any gaps in the knowledge and skills of logistics personnel at the following levels?			

			Score	Maximum Score
a.	Central	✓ Yes ❑ No	0.67	0.67
b.	PFSA hub	✓ Yes ❑ No	0.67	0.67
3.	Are there written procedures and guidelines (e.g., manuals, job aids, standards) to help staff carry out their logistics responsibilities?	✓ Yes ❑ No	1	1
4.	Do staff who manage commodities have a written job description that includes logistics responsibilities at the following levels:			
a.	Central	✓ Yes ❑ No	0.33	0.33
b.	PFSA hub	✓ Yes ❑ No	0.33	0.33
c.	Service delivery point	✓ Yes ❑ No	0.33	0.33
5.	Are supervisory responsibilities described in written job descriptions?	✓ Yes ❑ No	1	1
6.	Are guidelines available for how the supervisor is to conduct the supervisory visit?	✓ Yes ❑ No	1	1

			Score	Maximum Score
7.	Are tools available that describe what to cover when conducting a supervisory visit (e.g., guidelines, a checklist)?	✓ Yes □No	1	1
8.	Are supervisory visits conducted for staff at the following levels?			
a.	Central	✓ Yes ❑ No	0.33	0.33
b.	PFSA hub	✓ Yes ❑ No	0.33	0.33
c.	Service delivery point	✓ Yes ❑ No	0.33	0.33
9.	Is there a documented schedule for supervision?	✓ Yes ❑ No	1	1
10.	Has training been given to current staff at all appropriate levels, in the following areas:			
a.	Completion and submission of LMIS reports?	□ Yes ❑ No	0	0.25
b.	Proper storage of health products?	❑ Yes No	0.25	0.25
c.	Maintaining proper stock levels?	□ Yes ❑ No	0	0.25
d.	Determining order quantities?	□ Yes ❑ No	0	0.25
e.	Determining issue quantities?	□ Yes ❑ No	0	0.25
f.	Estimating annual needs?	□ Yes ❑ No	0	0.25
g.	Reviewing reports and records?	□ Yes ❑ No	0	0.25
h.	Others	□ Yes ❑ No	0	0.25
Note: - (Yes = 1, 0.67, 0.33 , No= 0)				
Total			**9.56**	**11.31**
Score For the section			**85%**	**100%**
Score for the section = Total Score/ Maximum Total Score x 100				

Annex IV: Check List for Storage Condition, adopted from Logistic indicators assessment tool (LIAT)

No	Description	No	Yes	Comments
01.	Products that are ready for distribution are arranged so that identification labels and expiry dates and/or manufacturing dates are visible.			
02.	Products are stored and organized in a manner accessible for first-to-expire, first-out (FEFO) counting and general management.			
03.	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 (fluorescent lights in the case of condoms, cartons right-side up for Depo-Provera®).			
04.	The facility makes it a practice to separate damaged and/or expired products from usable products and removes them from inventory.			
05.	Products are protected from direct sunlight.			

06.	Cartons and products are protected from water and humidity.			
07.	Storage area is visually free from harmful insects and rodents. (Check the storage area for traces of bats and/or rodents [droppings or insects].)			
08.	Storage area is secured with a lock and key, but is accessible during normal working hours; access is limited to authorized personnel.			
09.	Products are stored at the appropriate temperature according to product temperature specifications.			
10.	Roof is 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.	Fire safety equipment is available and accessible (any item identified as being used to promote fire safety should be considered).			
14.	Products are stored separately from insecticides and chemicals.			

Annex V: Data abstraction format for MHMs stock status at HFs

Maternal Health Medicine	Managed at the health facility (Y/N)	Stock Out at the time of the visit (Y/N)
Oxytocin		
Sodium chloride		
Ringer's lactate		
Hydralazine		
Methyldopa		
Metronidazole injection		
Metronidazole Capsule		
Ampicillin injection		
Ampicillin Capsule		
Gentamicin		

Annex VI: Data abstraction format for MHMs stock record keeping and supervision

Maternal Health Medicine	BC available	BC entry within the past 30 days	Utilization of RRF	Utilization of IFRR	Stock Card available (Y/N)	Receive supervision	Receive supervision according to schedule (Quarterly)
Oxytocin							
Sodium chloride							
Ringer's lactate							
Hydralazine							
Methyldopa							
Metronidazole injection							
Metronidazole Capsule							
Ampicillin injection							
Ampicillin Capsule							
Gentamicin							

Annex VII: Consent form

Addis Ababa University

School of Pharmacy

Department of Pharmaceutics and Social Pharmacy

ID code No.: _____

Health Center Pharmacy code: _____

Verbal consent form before conducting interview

Greeting,

Hello, my name is Essete Zewge. I am working with the research team of the Department of Pharmaceutics and Social Pharmacy, School of Pharmacy, Addis Ababa University. I would like to ask you a few questions regarding your facilities role according to the SOP of the logistic master plan. The interview would take 30-50 minutes of your time. The purpose of this study is to assess the logistic system for essential drugs used in maternal health. This will give an insight to what extent the SOP of the logistic master plan is employed in the logistic system of these drugs. Hence, the study would give an insight where to act to improve the implementation of the SOP. Your participation is completely voluntary. You can refuse to answer any questions and/or withdraw from the interview any time. All your responses will remain strictly confidential: your name will not appear on the interview guide (will not be recorded), and your responses will not be linked to your identity at any time.

If you have any questions about this study, feel free to contact:

Mob: +251913031958

E-mail: essetez@yahoo.com

You are now being asked if you are interested and if you are willing to participate in the study. I would greatly appreciate your truthful and keen participation in responding to this interview.

Yes I agree_____ No, I don't agree_____

If the answer is yes the interview will continu