LOGISTICS MANAGEMENT INFORMATION SYSTEM PERFORMANCE S OF PROGRAM DRUGS IN SELECTED PUBLIC HEALTH FACILITIES OF EAST WOLLEGA ZONE, OROMIA REGIONAL STATE, WESTERN ETHIOPIA

BY

KEFYALEW TIYE (B.Pharm)

A THESIS SUBMITTED TO THE SCHOOL OF PHARMACY, FACULTY OF HEALTH SCIENCES, INSTITUTION OF HEALTH, JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER'S DEGREE (MSC) IN PHARMACEUTICAL SUPPLY CHAIN MANAGEMENT

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JIMMA UNIVERSITY FACULTY OF HEALTH SCIENCES, INSTITUTION OF HEALTH SCHOOL OF PHARMACY

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ADVISOR: TADESSE GUDETA (B.Pharm, M.Sc.)

Abstract

Background: Proper logistics management information system across all the supply chain levels guarantees correct supply decision that increases program impact and improves efficiency & effectiveness of the pharmaceuticals supply system so that it may maintain commodity availability, improve service seeking of the community, increase professional satisfaction and morale and then better health outcome.

Objective: To assess the logistics management information system performances of program drugs in the selected public health facilities of East Wollega zone, Oromia regional state, Western Ethiopia.

Method: A facility based cross sectional descriptive study design and exploratory sequential design for quantitative and qualitative method respectively were employed to assess the logistics management information system performances of program drugs & the associated challenges in selected public health facilities of East Wollega zone ,Oromia regional state, Western Ethiopia from April 1 to May 30/ 2017.

Results: A total of 23 public health facilities (3 hospitals and 20 health centers) were included in the study of which 39% of them had automated recording system but no any installed electronic reporting system was found. With respect to data quality and facility reporting rates, about 65% & 79% of the facilities had accurate report and request format and bin-cards respectively while the facilities reporting rate was 97%. Around sixty nine percent of the facilities had timely reported and 97.8% of the reports were found to be complete. Inadequate human resource, lack of automated record format and lack of commitment from the health workers and the management group were identified as the major challenges of the logistics management information system management.

Conclusion: The study concluded that logistics management information system performances; particularly report accuracy, report timeliness and record accuracy require additional efforts for improvement while completeness of the report and reporting rate should be kept up. All the selected facilities were suffering from human power inadequacy, uncommitted facility managers & higher level supervisors to support the logistics management information system implementation.

Key words: Logistics, information, health facility, performance, program drugs, Ethiopia.

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Acronyms and Abbreviations

AIDS: Acquired immunodeficiency disease

ART: Antiretroviral therapy

CLM: Council of logistics management

CSCM: Council of supply chain management

DTC: Drug & therapeutic committee

DUs: dispensary unites

EML: Essential medicine list

ERB: Ethical review board

EWZ: East wollega zone

EWZHD: East wollege zonal health department

FMOH: Federal ministry of health

HCs: Health centers

HCMIS: Health commodity management information system

HD: Health department

HIV: Human immunodeficiency virus

HMIS: Health management information system

Hs: Hospitals

IFRR: Intra facility request & report

IPLS: Integrated pharmaceutical logistics system

KI: Key informants

LIAT: Logistics indicators assessment tool

LMIS: Logistics management information system

LMS: Logistics management system

MCH: Mother and child health

OJT: On job training

ORHB: Oromia regional health bureau

PDs: program drugs

PFSA: Pharmaceutical fund and supply agency

RHB: Regional health bureau

RRF: Request & report format

SDP: Service delivery point

SOH: Stock on hand
WoHOs: Woreda health offices

1. Introduction

1.1 Background

Complete health care requires availability of safe, effective, affordable and qualified drugs in adequate quantity at all times with appropriate dose & dosage forms. However, managing drug supply is a very complex process that requires strong organizational structure, and integrated supply chain [1]. It involves a number of interrelated logistics functions complemented by appropriate support functions in a supply chain and governed by sound policy and legal framework [2].

A supply chain is an organization of facilities and activities that support flow of products and services accompanied with two directional flow of information. It is basically a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores so that a product is produced and distributed at the right quantities, to the right locations, and at the right time, in order to maximize customer services with individual & country wide affordable cost [3].

Logistics management is a part of supply chain management that plans, implements, and controls the efficient & effective forward and reverse flow and storage of goods, services, and related information between the suppliers of supplier and ultimate user/patient [4].

Logistics services i.e. warehousing & transportation, infrastructures and the information system are the glistening components of logistics system. Logistics system integrates all its activities and coordinates them with the supply chain functions like manufacturing, marketing & finance and information technology [5].

It can be kept effective and integrated well with help of accurate and timely information from service delivery point. Logistics management information system is used to institutionalize a framework for the optimal management of health commodities at all levels and provide critical information to logistics managers to improve the health commodities supply chain [6].

Information of all activities at each level is paramount for coordination and integration of supply chain/ logistics activities throughout all the elements of supply chain. logistics management information system across all the supply chain levels; increases program impact i.e. maintains commodity availability and improves service seeking of the community, enhances quality of care,-increasing professional satisfaction and morale that, motivated staff are more likely to

deliver a higher quality of service, improves efficiency and effectiveness. It reduces losses due to overstock, waste, expiry, damage, pilferage, and inefficiency and maximizes the potential for cost recovery [7].

LMIS is a system of records and reports (whether paper based or electronic) used to aggregate, analyze, validate and display data from all levels of the logistics system that can be used to make logistics decisions and manage the supply chain [8].

The design of the logistics management information system should consider all elements of the pharmaceutical management framework/logistics cycle to maximize integration [9].

Therefore logistics records are the primary framework for every logistics system. The records are intended to capture critical logistics data at each level of the health system. The data captured on logistics records are then combined to form logistics reports, which are used for crucial decision-making about resupply quantities, forecasting, and procurement decisions [10].

A logistics management information system has to have a reporting time schedule from lower level to the respective higher level based on: how soon data are needed for decision making, how quickly reports can be received at the next level and the quantity of data to be gathered at each level. All logistics systems should be designed with feedback mechanisms to congratulate or comment facilities[11].

In Ethiopia, PFSA designed and implemented a distribution system whereby health facilities submit report & resupply format & receive their drugs on a bi-monthly cycle based on their need. This facilitates informed decision making and improves the pharmaceutical supply system [12].

IPLS integrated the management of essential pharmaceuticals including program drugs. It also standardizes and streamlines inventory management and LMIS to improve availability of program medicines in public health facilities. The implementation of the IPLS is accompanied by various monitoring and evaluation activities. These include regular and intensive supportive supervision guided by measurement of key performance indicators, progress reviews and cross sectional health facility surveys; focusing on improving infrastructure, capacity building, LMIS, insuring data quality, improving utilization of data for decision making & human resource development [13].

1.2 Statement of the problem

Logistics management information system (LMIS) plays a critical role in the ability of health system to improve responsiveness of pharmaceutical supply chain and reduce cost of satisfying demands of customers for better health outcomes. Therefore designing a supply chain system requires real time information to support all functions and integrity of the supply chain [14].

However, particularly in low resource settings, the implementation of LMIS is in its immature level i.e. in developing countries public health supply chain managers do not have regular access to reliable information for procurement and supply management decision making. Adequate LMIS and user requirement assessment, including option analysis have rarely been conducted in low and middle in-come countries [15].

In majority of the developing countries, mostly in sub-Saharan Africa, lack of access to essential health products is mostly due to lack of qualified LMIS data and real time information i.e. poor recordkeeping, poor reporting, data not moving up or down the system and data not used for decision making are the most common challenges of LMIS [16].

A Number of studies have been carried out in different developing countries of the world on logistics management information system performances & their effects on essential medicines availabilities. For instance a study done in Malawi indicated the LMIS reporting rate of the health facilities was 58%and it was with poor quality, calculation errors as well as incorrect recording of data on stock cards & LMIS reports. In addition, the study identified other external constraints of LMIS like, limited human resource, insufficient storage space, and weak information technology [17].

A study done in South Sudan have shown that the LMIS in the country was weak and did not capture all the logistics data that for instance only 39% of facilities had logistics forms, the logistics record accuracy at the facilities was 27%, percentage of staff trained in LMIS was 17; hence it uncovered that the LMIS did not support the decision making in supply chain management[18].

An assessment of logistics management system done in Ghana evidenced that lack of appropriate skill, training gaps on the system & failing to deploy the required quantity of pharmacy professionals and lack of appropriate essential data from the service center resulted in serious

consequence on the rational use of medicine, quantification and availability of medicine at health facilities of developing countries. These are the common causes of low patient compliance, client dissatisfaction and decrease confidence of health workers that further causes staff attrition and then service interruption [19].

Another study done in Ethiopia, Malawi and Rwanda highlighted that low data availability, low essential logistics data reporting rate that was with questionable quality (from service delivery point (SDP) to higher level) and the knowledge and capacity of the health workers was little that only 10% of the workers reported they were trained [20].

A study done in Addis Ababa showed that utilization of the logistics recording cards usage was limited to regional health bureaus & hospitals and majority of bin/ stock cards were not updated that their overall accuracy was 38.9%. The study also revealed only 58.8% of pharmacy professionals were trained in LMIS, 60.5% of the facilities reported that they usually run out of at least one ART monitoring and TB laboratory commodities before resupply, 37.2% of the facilities had stock outs at the time of visit for at least one laboratory commodity, only 50% of the assessed hospitals and 54% of health centers were currently using stock/bin cards for all HIV/AIDS and TB laboratory commodities [21].

Inadequate and inappropriate logistics management information system (LMIS) affects pharmaceutical supply decision which also results in a quantification, procurement and distribution not based on real demand that causes either resource wastage due to drug expiration or stock out of essential medicines[22].

Hence to provide evidence based decision in order to solve the problems on the aforementioned pharmaceutical supply management activities, effective LMIS should be there by addressing the following three major problems:

- Problems associated with its design i.e. whether LMIS collect and report the essential data items for logistics management,
- Problems on operation i.e. whether reporting procedures followed; does the data flow in a timely fashion and
- Problems on its utilization; if managers throughout the program are actually using LMIS data for decision making [23].

To address these problems, provision of reliable record & report tools and appropriate supply management information systems at all levels including service delivery point (SDP) should be ensured i.e. having integrated & efficient logistics management system (to ensure data quality & utilization of data for decision making) and carrying out in service training (to enhance competence of professionals)in health facilities have to be the prior focus[24].

Therefore assessment of LMIS provides information for targeted interventions in strengthening the system and guarantees reliability of higher level decisions for forecast and procurement.

1.3 Scope of the study

The study focuses, on logistics management information system and factors associated like personnel, facilities (infrastructures) and managerial responses from higher level. Thus the target of assessment was public hospitals and health centers' logistics management information system records & reports of program drugs, the store keeper and/ or LMS managers. The study was done on program drugs reports & records i.e. did not include laboratory commodities, medical equipment, medical supplies, & supplementary foods reports and records because of time constraint.

2. Literature review

This chapter provides review of idea and study results of LMIS performances & associated factors of different studies in different areas of the world to notice the alignments and differences with that of our study.

Logistics information management system properly supported with fulfilled infrastructure and adequate human resource guided by appropriate policy maintains the supply chain efficiency and effectiveness and then reliable availability of products with minimum resource wastage [25].

An assessment done on logistics management system in Nigeria indicated the percentage of staff trained on LMIS was 84% however the reporting rate and bin card accuracy were 12.3% & 57% respectively[26].

At facility level, the basic components of logistics system are logistics management information system (LMIS), inventory control system, and storage of pharmaceuticals. LMIS is an information system that supports: capturing accurate record with physical stock & consumption data, the whole logistics management from point of origin to service delivery point, demand forecasting, capacity planning and designing based on consumption in order to ensure adequate quantity & availability of quality essential medicines & supplies to meet patient demand[27].

Appropriately designed pharmaceutical logistics management information system (LMIS) provides the necessary data generated by pharmaceutical management activities and processes the data in to information for use in planning activities, estimating demand, allocating resources, and monitoring and evaluating pharmaceutical management operations. This information can be in the form of few performance indicators that allow staff at all levels to monitor both their own performance and that of the units for which they are responsible thus different studies focus on facilities LMIS and ways to improve the performances [28].

A properly functioning LMIS avoids supply and distribution imbalances and helps determine the stock status of facilities according to the particular max-min range i.e. used to identify which facility has adequate stock, over stock and under stock (generates information on stock in store and stock in transit) [29]

There are different factors like availability of trained human power, management support, record & report formats fortified with automation and communication networks that they have direct

impact on quality of LMIS data and the LMIS has also direct impact on the efficiency and effectiveness of the supply chain [18].

Lack of structural organization and scarcity of capacitated human resource is the main problem to perform LMIS as required to generate real data to make informed operational decision throughout the supply chain [29].

A continuous supervision and mentoring of health workers has mandatory effect on improvement of the LMIS performance. Evaluation assessment on improvement of health facilities LMIS performances done in Cameroon & Burundi by SIAPS highlighted that remarkable changes on LMIS performances had been obtained. Training and supportive supervision of staff improved the reporting rate from 35% to 62% and the logistics report data accuracy from 13% to 75% in Cameroon and timeliness of LMIS report was maintained at over 90% in Burundi [30].

A research conducted in Kenya public health facilities on factors influencing logistics management information system identified the work experience of the staffs working on LMIS that the workers having service year <= 5years were 50% and those having > 5years were 47.5% however the study did not consider the work experience as influencing factor of LMIS performance [31].

A stream of data flow in a logistics channel parallel to the products helps all the supply chain members to decide on the supply and distribution of the products. Therefore, to make the appropriate decision, the information should be time scheduled& accurate in order to correctly identify stock status, the reorder time and deploy the shipment on time [32].

Pharmaceutical fund and supply agency (PFSA) (Ethiopia) developed a strategy and designed integrated pharmaceutical logistics system (IPLS) as a primary mechanism to improve supply chain performance of essential medicines. IPLS requires a collaborative effort of managers and health workers working at all levels of supply chain that feasibly synergized by a policy of “no report no drug”. It comprises synchronized management of all logistics functions and logistics management information system (LMIS) to develop a seamless linkage between the supply chain actors that guarantees sustainability of a supply [10, 13].

The following figure illustrates the flow of pharmaceutical products and information in Ethiopia (figure 1.)

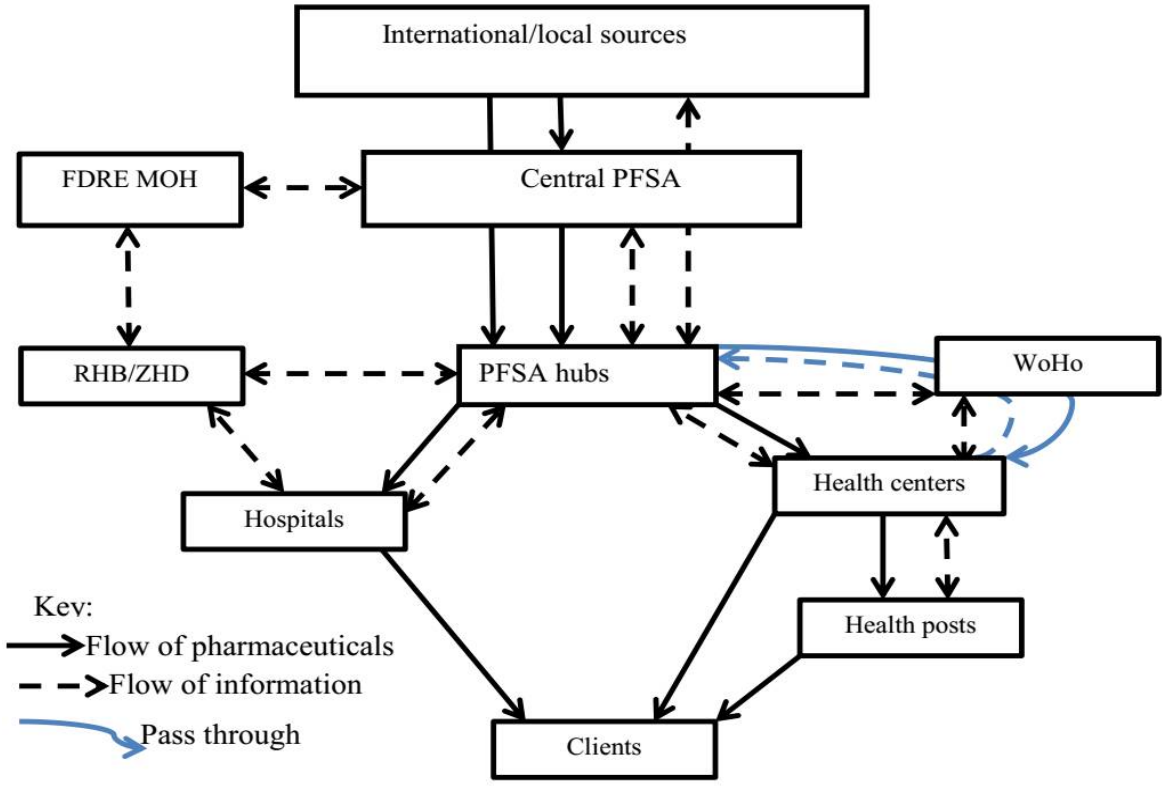


Figure2 flow of pharmaceuticals &information in the integrated pharmaceutical logistics system (IPLS) in Ethiopia. (Source PFSA 2014)

Monitoring the accuracy, completeness and timeliness of the reports& records at each level of the supply system is a pertinent way of keeping the information flow in the track [13].

A study done in Addis Ababa on LMIS showed that all the assessed health centers were using bin card and IFRR in store; The supervision frequency was 79% quarterly,17 % was bimonthly and 4% monthly and all the store keepers had got training. The qualitative result disclosed that training, availability of required facilities, supervision and staff commitment were facilitators of LMIS [33].

Another study done in the same area on storage condition of laboratory commodities in public hospital medical stores revealed that 91% of the store managers were degree holders and only 45.5% of them had received training on store management [34]

A study conducted on assessment of the IPLS/LMIS of HIV/AIDS& TB laboratory commodities in Addis Ababa, report and request forms (RRF), IFRR and bin cards were reported available in 92.6% of facilities while intra- facility report & request formats (IFRR) were reported by 84.6% of facilities. Utilization of bin cards was higher at health centers (76.5%) compared to hospitals (33.3%). Management support for IPLS implementation was significantly associated with improved data quality [35].

A study done in East Showa zone, Oromia regional state, Ethiopia on inventory management performance of essential drugs showed that only 28.5% of bin cards was accurate while the availability of record & report formats (bin card, RRF, and IFRR) was 100% but that of automated format (computer) was only 20%. [36].

To properly meet demand, information from the consumption area is determinant that the service delivery point should transfer accurate data for decision making at the higher level of supply chain. There are three essential data items required by logistics information system to make right decision: Stock on hand, rate of consumption, and losses & adjustments. However we may use other data items in logistics, these three data items are absolutely required to run a logistics system [37].

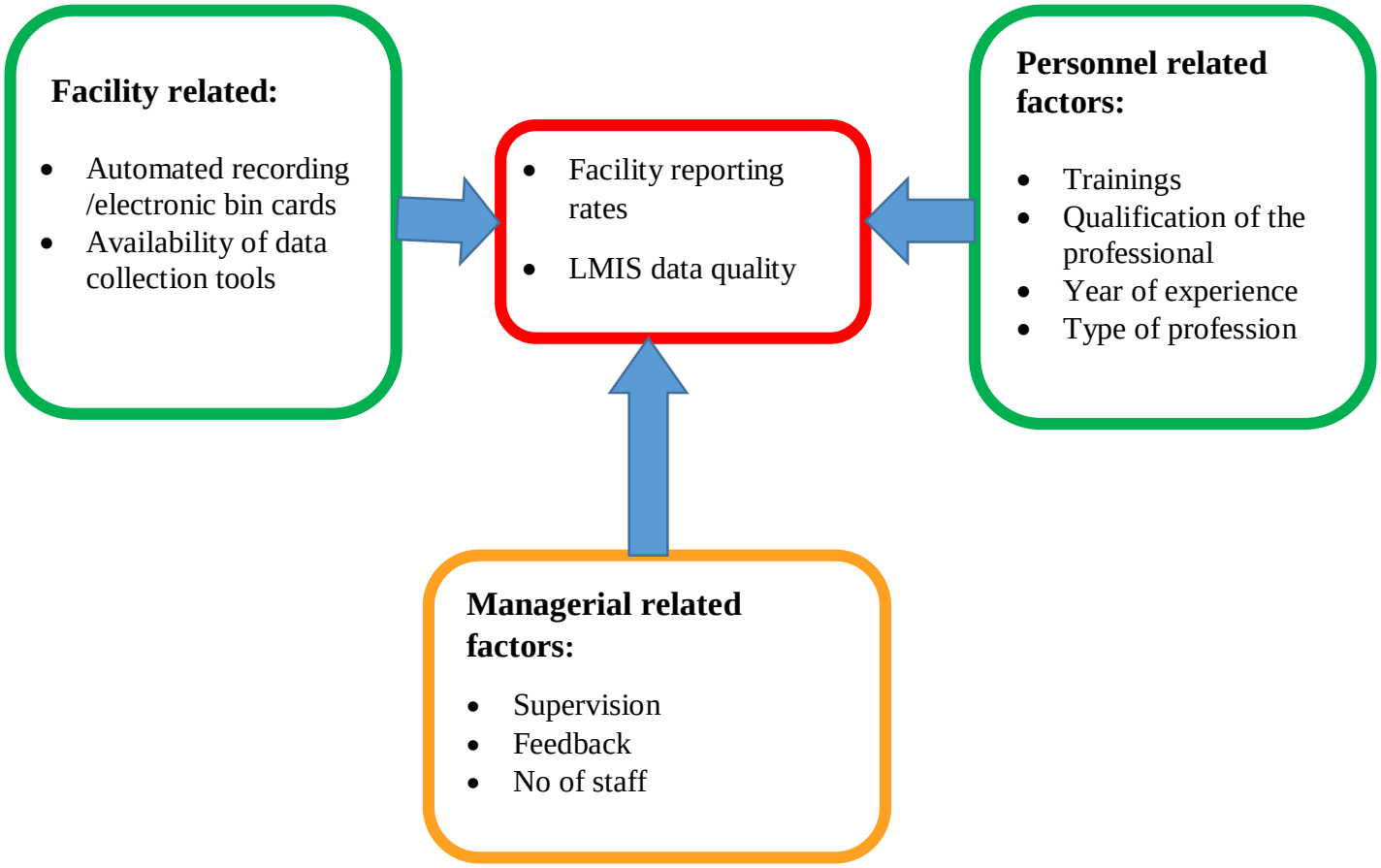
2.1 Significance of the study

Strengthening Logistics management information system (LMIS) is mandatory & determinant for effective and efficient supply chain management. Therefore measuring the performance and assessing the factors affecting of LMIS in public facilities in East wollega zone (EWZ) gives a clue to monitor and keep in truck the pharmaceuticals supply system of the program drugs.

The results of this study:

- Provide information on challenges & problems associated with LMIS in the health facilities.
- Provide supplementary information for further studies in the particular area.
- Act as a feedback for the staff working on LMIS in the facility to pay attention to reporting and reporting activities and
- The study can also help partners/ stakeholders to identify the major problem areas for intervention

2.2 Conceptual frame work:



Source: (Own sketch)

3. Objective of the study

3.1. General objective:

To assess the logistics management information system performance of program drugs in selected public health facilities of East Wollega Zone, Oromia regional state, Ethiopia

3.2 Specific objectives:

- To assess the utilization of logistics recording and reporting tools
- To evaluate data quality of logistics recording and reporting tools
- To assess the reporting rates of the selected public health facilities
- To identify challenges associated with LMIS

4. Methods and materials

4.1 Study area and period

The study was conducted in selected public health facilities of East wollega zone, Oromia regional state, Western Ethiopia. East Wollega zone covers land mass of 13820.233km^2 that is 3.97% of Oromia land coverage. It is administratively sub-divided in to seventeen woredas; it has a population of 793080 (49.97%) males, 794055(50.03%) females and total population of 1587135 according to projection by September 2016 from May 2007 census; of this 86.2 % are living in rural area while 13.8 % are living in urbane area. East wollega zone is delivering health service to the community with three Hospitals, sixty-one health centers (one NGO) and 294 health posts. It has 1093 different health professionals (40 are pharmacists & 66 are druggists), 677 health extension workers and 395 supportive (administrative) workers [source, EWZHD].

The study period was from April 1 to May 30/2017 in the selected public health facilities.

4.2 Study design

A facility based cross sectional descriptive study design for the quantitative and exploratory sequential study design for the qualitative method were employed to evaluate the logistics management information system performance of program drugs by using the LMIS indicators and also explore LMIS associated challenges in selected public health facilities of East Wollega Zone, Oromia regional state, Ethiopia.

4.3 populations

4.3.1 Source population

All public hospitals and health centers in the zone and all health workers working under pharmacy unites, all RRFs, IFRRs of one year i.e. April 1/ 2016 to March 30 /2017and bin cards in the selected facilities were the source population of the study.

4.3.2 Study population

Three hospitals and twenty health centers; a total of twenty-three public health facilities, one hundred thirty-eight RRFs, the bin cards of the products commonly found in all facilities (thirty five bin cards from each facility) and ten personnel working on LMIS were the study population.

4.4 Inclusion and exclusion

4.4.1 Inclusion criteria

- Hospitals and health centers managing all the types of program drugs and established before April 2016
- Program drugs common for all the health facilities were taken for the study in order to keep consistency of data.

4.4.2 Exclusion criteria

- Hospitals and health centers established after April / 2016, since the study was on last recent twelve months for the report documents (from April 1/2016 to March 30/2017) - the required document might not be found.
- Those facilities managing not all types of program drugs.
- Health posts, since all of logistics activities have been done by their respective health centers.
- Program drugs which were not common for all health facilities were not included in the review

4.5 Sample size determination and sampling procedure

4.5.1 Sample size determination

The sample size of the health facilities was determined based on the USAID delivery project logistics indicators assessment tool (LIAT) that recommends to take at least 15% of facilities to increase the power of generalizability [38].Accordingly twenty three health facilities were taken from a total of 63 public health facilities while all the RRFs & the bin cards of the common drugs were taken all Whereas the IFRRs were to be sampled.

4.5.2 Sampling procedure

For quantitative study:

List of the health facilities managing all the program drugs in each of the woredas and those program drugs managed commonly by all the public health facilities were identified and obtained from PFSA & EWZHD. Accordingly thirty five program drugs (were only common drugs used in all the facilities) and the number of RRFs & IFRRs prepared by the facilities in a year was identified as well and their bin cards and the RRFs were reviewed.

The three hospitals were included in the study since they were situated in different woredas and also manage all the program drugs. Since the facilities were found at different geographic areas that have different distance from the ZHD & PFSA hub and different transportation

infrastructures, the health centers were clustered based on the Woredas i.e. one health center (managing all the PDs) from each of the 17 woredas was randomly selected and the rest 3 health centers were selected based on convenience of access & capacity of managing all the PDs from each cluster until the required sample sizes was achieved.

For RRF, IFRR and bin cards:

Considering RRFs reporting was done bimonthly to the next higher level, there were six reports from each health facilities and all of them were retrospectively reviewed i.e. RRFs of April 1/2016 to March 30/2017 were reviewed.

With regard to IFRR, as we obtained the information from EWZHD, the dispensary units of the health facilities were assumed to submit report and request of products to their respective medical store at every two weeks i.e. in a given facility a minimum of 24 IFRRs per year may be sent to medical store [source EWZHD]. As a result, a total of 24×23 = 552 IFRRs were expected from all the selected facilities within a year. Therefore, to cope with time, sampling these report documents was required and the sample was obtained by using standard sampling method, single population proportion sample size estimating formula with 95% confidence interval & 5% margin of error; assuming that 50% of the facilities were poorly utilizing IFRRs due to lack of similar study.

$n = \frac{(Z_{\alpha 1/2})^2\, p(1-p)}{d^2}$ with adjustment formula for finite population; $n_f = n \div 1+n/N$

Where, N = total population = 552

n = sample size

Z = confidence interval (1.96)

p = estimated proportion taken (0.5)

d= Margin of error to be tolerated (0.05).

n_f = actual sample size

Therefore 226 IFRRs i.e. 226÷23 = 9.8 ≈ 10 IFRRs (a total of 230 IFRRs) were to be randomly selected from each facility using lottery method. However, as observed in the pretest study, the dispensary units of the facilities had not been using bin cards that we could not assess the performance except the availability and utilization of the format.

With regard to bin-cards, the sample size was based on the number of products common for all health facilities, which is also supported by LIAT guidelines that recommend taking products available (commonly found) in all the health facilities for evaluation of data quality [38]. Accordingly 60 lists of program drugs were managed in different health facilities. Of those, 35 products were common for all health facilities [source PFSA Nekemte hub]. Therefore 35 bin-cards from each facility were selected for review.

For the qualitative study:

Purposive sampling technique was employed to select those interviewees with long experience on pharmaceuticals logistics management. Accordingly ten pharmaceutical logistics managers&/ or store keepers were selected based on length of their experience on LMIS obtained from the interview i.e. from those having >5years and giving priority for the one with longest experience until the saturation of the sample size.

4.6 Study variables

4.6.1 Independent variables

- Staff training on LMIS
- The qualification of professional in charge of the LMIS;
- experience of the personnel in LMIS;
- Supervision frequency;
- Feedback report frequency; and
- Number of staffs
- Availability of automated logistics record formats

4.6.2Dependent variable

- LMIS reporting rate
- LMIS data quality

4.7 Data collection procedure

The data was collected using structured questionnaire adopted from LIAT for the quantitative data and open ended questionnaire developed by principal investigator for the qualitative data. The trained data collectors collected the data by reviewing the inventory record formats & logistics report formats with physical count of the stock on the shelves. For the qualitative part of

the study, the consent of the interviewees & appointment on their convenient time was obtained and the interview was conducted by principal investigator. The timeliness of the reports was reviewed from the date on the remained document of the report in the facilities and finally confirmed from PFSA Nekemte hub.

4.8 Data processing & analysis

The gathered data was entered into statistical package for social sciences (SPSS) version 20 to encode and analyze the data. Descriptive statistics like mean, percentage and frequency tables were used. Chi-square test was employed to determine associations between dependent and independent variables and variables with critical value $p< 0.05$ were considered as statistically significant. For the qualitative part, data was analyzed using a thematic analysis approach.

4.9 Data quality assurance

The data collectors were pharmacy professionals, who are working on pharmaceutical service and residing in different woredas of East Wollega zone. Prior to data collection, the data collectors were trained on how to complete the tools & manage any ambiguity through simulation sessions and pilot study was carried out on about 10% of the facilities to pretest the tool for its content & to avoid unclear questions and to identify problems that might occur in data collection, so that modifications were made to the questionnaires accordingly- since we observed that the DUs were not using bin cards, assessing the IFRR data quality & reporting rate would be difficult. Thus the tool was modified only to review the availability &utilization of IFRRs. Those facilities involved in pretest were excluded from the actual study. The principal supervisor was following the data collection process and was providing on-site and remote advice.

4.10 LMIS indicators

- Facility Reporting Rates: It is a measure of the percentage of facilities that submitted reports according to the defined reporting schedule.
- Timeliness: Percentage of facilities that submitted complete LMIS reports on time.
- Completeness: Percentage of facilities submitted complete LMIS report.
- Accuracy of reports and records: Percentage of facilities that had accurate LMIS report & records
- Electronic reporting rate: Percentage of LMIS reports placed through electronic ordering system.

4.11 Ethical consideration

Ethical clearance was obtained from the Ethical Review Board of Jimma University, faculty of health and the letter was submitted to East wollega zonal health department and then Permission was obtained from EWZHD and letter was written to the WoHO to obtain verbal informed consent from the responsible bodies of the facilities prior to the data collection. During the study,

professional and social ethics was maintained and the name of the facilities and personnel involved in the study was not stated on the data collection tools thus confidentiality of the information was assured.

4.12 Plan for data dissemination and utilization

The final paper will be submitted to Jimma University School of pharmacy, EWZHD, Woreda health offices in the zone and other concerned bodies in hard &/or in soft copies physically and through their Email. The result of this study will be communicated to ORHB through presentation on meetings and workshops.

4.13 Limitations

In spite of the fact that effort was made to explore all the LMIS performances, the absence of bin cards utilization in the dispensary unites was the bottle neck that the reporting rate and data quality of IFRRs was not assessed.

Limited comparative discussions because of lack of similar studies with similar scope in side &outside the country.

4.14 Operational definitions

- Accuracy: similarity of data of a product in the LMIS report with that of stock records and similarity of recorded data with physical count on the day of supervision i.e. calculated as number of accurate line divided by total lines of the products in the RRF.
- Completeness: A report is considered complete if all the expected report components are there and all the columns of the listed drugs are filled complete.
- Data quality: it is the accuracy, completeness and timeliness of a data.
- Electronic system reporting: it is preparing & sending a report through email.
- Logistics manager: is a person who records and reports the essential data items (store keeper) in a facility pharmacy team.
- Pharmaceuticals: in this study used interchangeably with products, drugs and commodities.
- Pharmacy staff: a staff with any profession working under pharmacy department
- Program drugs: in the current study are drugs used to treat or prevent TB/ leprosy, HIV/AIDS, Malaria and MCH & FP used both in health centers and hospitals.
- Record formats: are forms on which data are collected - bin cards including automated format.
- Report formats: are forms on which all essential data items of a specific facility for a specific time are compiled & moved from one level or dispensary unite in logistics system to the next higher level for decision making – RRF & IFRR.
- Supervision: is the periodic inspection of LMIS implementation and the workers' performance to help keeping in track of LMIS activities.
- Training: a training given to personnel working on LMIS/IPLS to improve their skill & knowledge on their job.
- Work experience: in this study, work experience is duration of time the worker has been on managing store; not starting from time of their employment.

5. Results

This chapter describes the quantitative and qualitative findings of LMIS management performance of program drugs and associated challenges in selected public health facilities of east Wollega zone. Twenty three public health facilities (i.e.3 hospitals and 20 health centers) were selected for this study and also logistics recording & reporting formats including RRFs, bin-cards and IFRRs were assessed and reviewed for its availability and data quality. For the qualitative part, 10 staffs working on facility LMIS were interviewed.

5.1. The socio-demographic characteristics of staffs in the health facilities

A total of 62 pharmacy staffs of different professions were working under pharmacy units of the selected facilities, of which 23(37%) (3 in Hs &20 in HCs) of them were stoke keepers engaged in managing LMIS. Most of these stoke keepers were with work experience of greater than 5 years 17(74%) and pharmacy in profession 22(95.7%). 12(52.2%) of them were degree holders and the remaining were diploma holders. (Table1)

Table2 Background of staffs working on LMIS in selected public health facilities of East Wollega zone, April1to May 30/2017 (Hospitals=3, health centers=20).

S/N	Socio-demographic variables		Types of facilities		Total (%)
			Hospital (%)	Health center (%)	
1.	Staffs working on LMIS by Gender	Male	3 (100)	18(90)	21(91.3)
		Female	0(0)	2(10)	2(8.7)
		Total	3 (100)	20 (100)	23(100)
2.	The educational qualification of staffs working on LMIS	Degree	2 (66.7)	10 (50)	12(52.2)
		Diploma	1 (33.3)	10 (50)	11(47.8)
		Total	3 (100)	20 (100)	23(100)
3.	Staffs working on LMIS by profession	Pharmacy	3(100)	19 (95)	22(95.7)
		Nurse	0(0)	1(5)	1(4.3)
		Total	3 (100)	20 (100)	23(100)
4.	Service year	<=5year	0(0)	6(30)	6(26)
		>5year	3(100)	14 (70)	17(74)
		Total	3(100)	20 (100)	23(100)
5.	No. of pharmacy professionals in the	Male	25(92.6%)	32(94.1%)	57(93.4%)
		Female	2(7.4%)	2(5.9%)	4(6.6%)

facilities	Total	27(100%)	34(100%)	61(100%)

5.2 Staff training on IPLS/LMIS & their current practice

From a total of 62 pharmacy staffs in the study facilities, 47(75.8%) were trained on IPLS/ LMIS of which 22(46.8%) of them were working on LMIS. Based on the type of facility, 18(66.7) of the hospitals' and 29(82.9%) of health centers' pharmacy staffs have received the training. Of the trained pharmacy staffs, 3(16.7%) of hospitals' and 19(65.5%) of health centers' staffs were currently working on LMIS management (Figure 2)

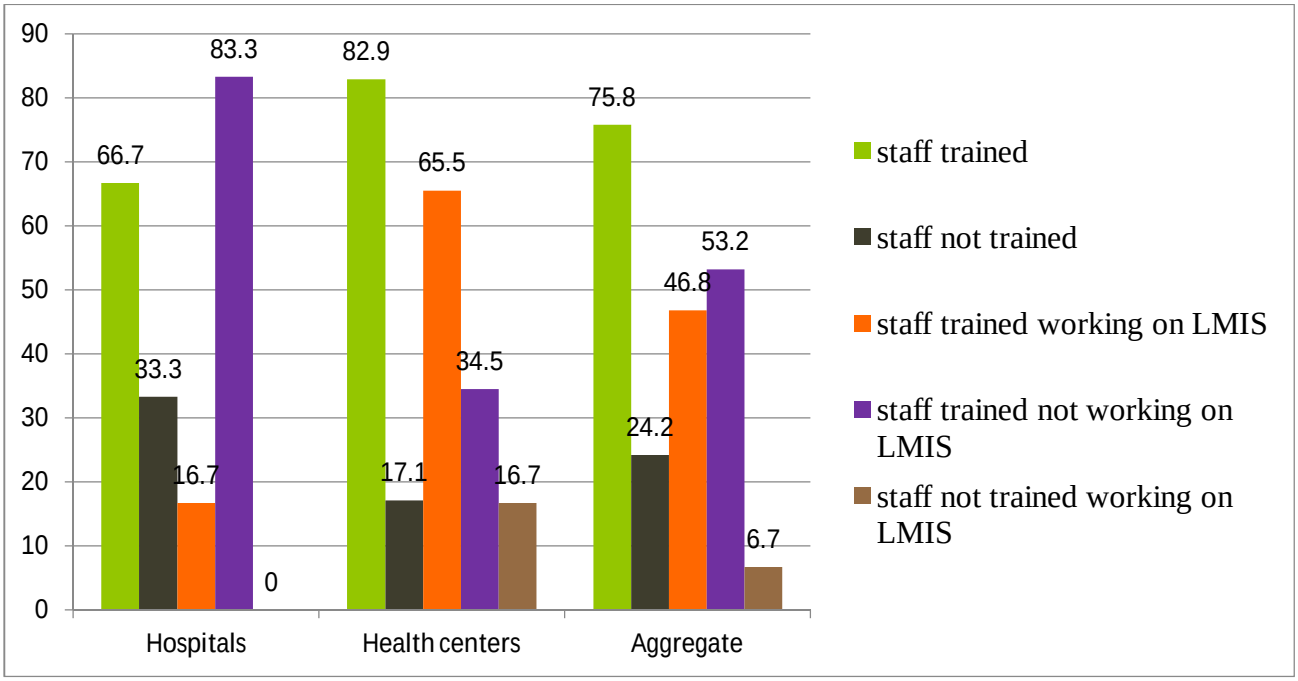


Figure.2. Pharmacy staffs training on IPLS/LMIS & their current practice in selected public health facilities of East Wollega zone in April 1 to May 30/2017 (Hospitals=3, health centers=20)

5.3 Supervision and feedback supports from higher level managements

From the interview results, 22(95.7%) (3Hs & 19HCs) of the selected facilities reported they had been receiving supportive supervision, of which 11(50%) was quarterly and 9(41%) semi-annually. 2(66.7%) of the hospitals had got supervision quarterly and 9(47.4%) and 8(42.1%) of the health centers had been supervised quarterly and semi-annually respectively. The no facilities had received feedbacks from higher level on the LMIS activities was 10(43.5%) (3Hs & 7HCs), of which 6(60%) received semi-annually and 4(40%) quarterly. The facility based data revealed

that 2(66.7%) of the hospitals and 5(71.4%) of the health centers had been receiving the feedback quarterly and semi-annually respectively (Figure 3).

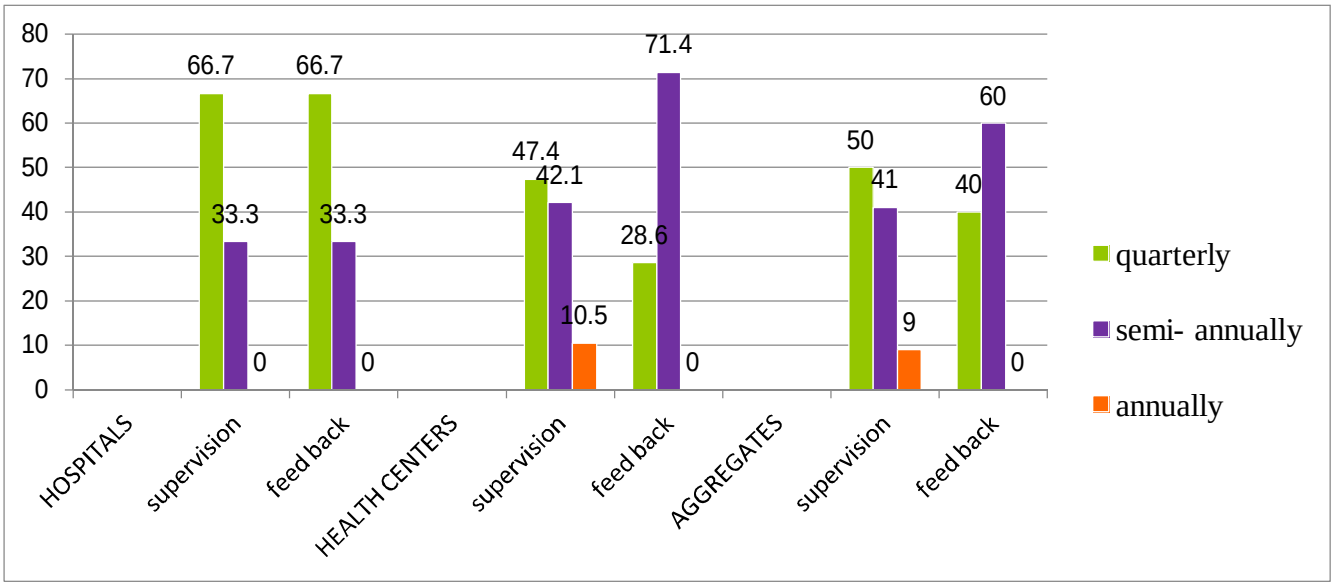


Figure3.Frequency of supervision & feedback report from the higher level management in selected public health facilities of East Wollega zone in April 1 to May 30/2017.

5.4 Availability of LMIS reporting & recording formats with their utilization

The availability and utilization of IFRR were 23(100%) and 16(69.9%) respectively, the availability & utilization of automated recording system (computer) were 9(39%) & 8(34.8%) respectively and the availability & utilization of RRFs & bin cards were 100% in the health facilities but the electronic reporting system was not found installed & not used in all the facilities.(Table2)

Table 2: Availability and utilization of LMIS reporting and recording formats in selected public health facilities of East Wollega zone in April 1 to May30/2017

S/N	LMIS report & recording formats availability & utilization		Hospitals n (%)	Health centers n (%)	Aggregate n (%)
1.	Bin card	Available	3(100)	20(100)	23(100)
		Utilized	3(100)	20(100)	23(100)
2.	RRF	Available	3(100)	20(100)	23(100)
		Utilized	3(100)	20(100)	23(100)
3.	IFRR	Available	3(100)	20(100)	23(100)
		Utilized	3(100)	13(65)	16(69.6)

4.	Computer	Available	3(100)	6(30)	9(39)
		Utilized	2(66.7)	6(30)	8(34.8)

5.5 Data quality of LMIS report and records

5.5.1. Report data quality

5.5.1.1 Accuracy of RRFs

(A) Accuracy of RRF by facility

The RRF accuracy of the assessed facilities was 3032(64.6%) and 1467(31.3%) were found to be inaccurate. From the disaggregated data, the hospitals' accuracy was 393(70.1%) and that of health centers' was 2639(63.9%) accurate. (Figure 4)

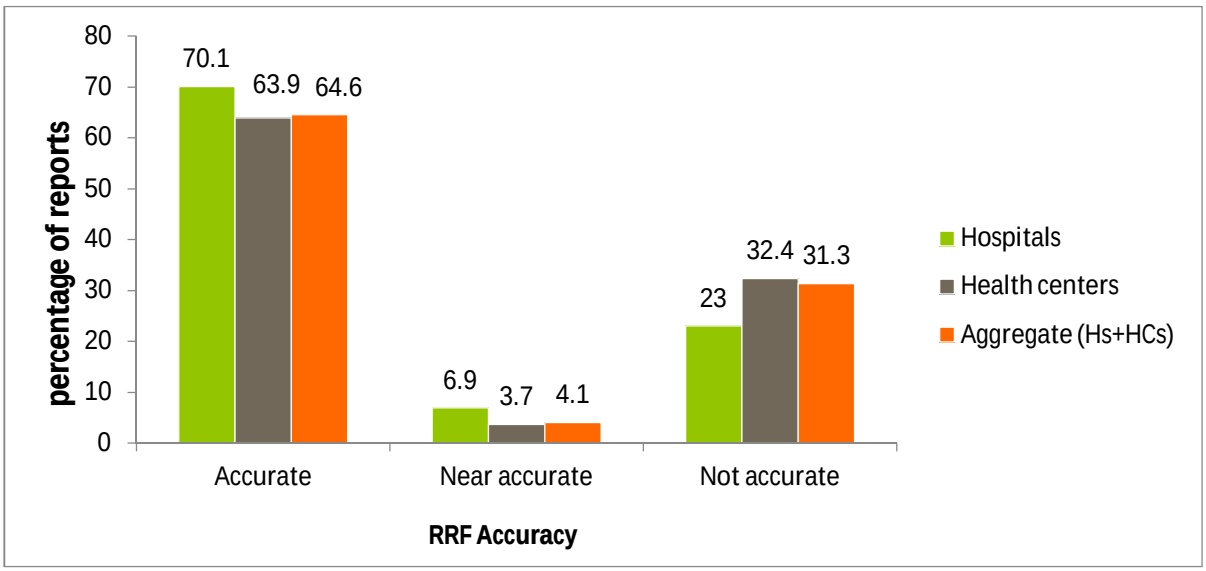


Figure 4.Aggregate and facility type accuracy of RRF data in the selected health facilities in East Wollega Zone in April 1 to May 30/ 2017 (hospitals' RRFs lines n=16×35, health centers' RRFs lines n=118× 35)

(B) Accuracy of RRF by product

Thirty-five products commonly found in hospitals & health centers were taken and their data accuracy per RRFs was displayed as follows. Data transfer accuracy of products was explored from134 reports (16 hospital RRFs &118 health center RRFs). The data transfer accuracy of the products varied across the RRFs. For instance, 14(87.5%) of AZT 10mg/1ml suspension and RH (adult) data were accurately transferred while that of EFV200mg, 3TC/TDF(300mg/300mg) and

3TC/EFV/TDF(300mg/600mg/300mg) each was 9(56.3%) in hospitals. And the accuracy of data transfer of Ethambutol 100 mg was 100(84.7%) while that of EFV600mg was 56(47.5%) in health centers. (Table 3)

Table3.Accuracy of RRF data by product in selected public health facilities of East Wollega zone in April 1 to May/ 30/2017 (hospital RRF n=16, health center RRF n=118)

RRF accuracy						
	Hospitals			health center s		
List of products	Accurate (%)	Near accurate (%)	Not accurate (%)	Accurate (%)	Near accurate (%)	Not accurate (%)
EFV 200 mg	9 (56.3)	2(12.5)	5(31.2)	68(57.6)	7(5.9)	43(36.4)
EFV 50 mg	10 (62.5)	1(6.3)	5(31.2)	71(60.2)	7(5.9)	40(33.9)
EFV600mg	11(68.8)	1(6.3)	4(25)	56(47.5)	6(5)	56(47.5)
3TC 150mg	10 (62.5)	3(18.7)	3(18.7)	62(52.5)	7(5.9)	49(41.5)
3TC SUSPENSION	13(81.3)	1(6.3)	2(12.5)	84(71.2)	2(1.7)	32(27.1)
3TC+ EFV + TDF 300/ 600/300mg	9(56.3)	3(18.7)	4(25)	70(59.3)	8(6.8)	40(33.9)
3TC +NVP +AZT 150+200+300mg	9(56.3)	2(12.5)	5(31.2)	63(53.4)	7(5.9)	48(40.7)
3TC+NVP+AZT (child dose)	10(62.5)	2(12.5)	4(25)	77(65.30	7(5.9)	34(28.8)
3TC+TDF 300/300mg	9(56.3)	2(12.5)	5(31.2)	58(49.2)	5(4.2)	55(46.6)
3TC+AZT(adult)	12(75)	1(6.3)	3(18.7)	71(60)	7(5.9)	40(33.9)
3TC+AZT (child)	13(81.3)	0(0)	3(18.7)	72(61)	6(5)	40(33.9)
NVP200MG	10(62.5)	1(6.3)	5(31.2)	68(57.6)	8(6.8)	42(35.6)
NVP SUSPENSION	10(62.5)	2(12.5)	4(25)	73(61.9)	5(4.2)	40(33.9)
AZT SUSP	14(87.5)	0(0)	2(12.5)	76(64.4)	4(3.4)	38(32.2)
Ethambutol 100mg	11(68.8)	1(6.3)	4(25)	100(84.7)	1(.8)	17(14.4)
Ethambutol 400mg	11(68.8)	0(0)	5(31.2)	80(67.8)	1(.8)	37(31.4)
INH 100mg	11(68.8)	0(0)	5(31.2)	87(73.7)	2(1.7)	29(24.6)
INH 300 mg	11(68.8)	0(0)	5(31.2)	76(64.4)	3(2.5)	39(33)
RHZE+RH KIT	12(75)	0(0)	4(25)	94(79.7)	3(2.5)	21(17.8)
RHZ (60/30/150mg.	13(81.2)	0(0)	3(18.7)	83(70.3)	2(1.7)	33(27.9)
RH (ADULT)	14(87.5)	0(0)	2(12.5)	77(65.2)	5(4.2)	36(30.5)
RH(CHILD)	12(75)	1(6.3)	3(18.7)	71(60)	3(2.5)	44(37.3)
STM 1G VIALS	12(75)	1(6.3)	3(18.7)	83(70.3)	2(1.7)	33(27.9)
Etonogestrel 68mg Impl.	12(75)	1(6.3)	3(18.7)	82(69.5)	5(4.2)	31(26..3)
CUT380A	12(75)	1(6.3)	3(18.7)	98(83)	1(.8)	19(16)
JadelleImpl.	13(81.3)	0(0)	3(18.7)	83(70.3)	4(3.4)	31(26..3)
Microgynon Cycle	11(68.7)	1(6.3)	4(25)	69(58.5)	5(4.2)	44(37.3)
Levonorgestrel 0.03mg Cycle	10(62.5)	1(6.3)	5(31.2)	71(60.2)	5(4.2)	42(35.6)
Depo Provera 150mg	11(68.7)	1(6.3)	4(25)	78(66)	4(3.40	36(30.5)
Emergency Pill/2	10(62.5)	2(12.5)	4(25)	66(55.9)	2(1.7)	50(42.4)
Condom /144	12(75)	1(6.3)	3(18.7)	88(74.6)	2(1.7)	28(23.7)
Ergometrine 2mg Injection	11(68.8)	2(12.5)	3(18.7)	74(62.7)	2(1.7)	42(35.6)
Coartem 4*6*30	13(81.2)	0(0)	3(18.7)	80(67.8)	2(1.7)	36(30.5)

Artesunate Injection	11(68.7)	2(12.5)	3(18.7)	66(55.9)	5(4.2)	47(39.8)
Quinine 300mg 10*10	11(68.7)	2(12.5)	3(18.7)	64(54.2)	8(6.8)	46(39)
Total n (100%)	**393 (70.1)**	**38(6.9)**	**129(23)**	**2639(63.9)**	**153(3.7)**	**1338(32.4)**

The associations of RRF accuracy with contributing factors were indicated using Pearson chi-square in the following table. RRF data accuracy had significant association ($p < 0.05$) with staff training, level of education, type of profession, availability of electronic bin cards, supervision and feedback; with service year, it had no significant association. (Table 4)

Table 4.The association of RRF data accuracy and the contributing factors in the selected health facilities of East Wollega zone in April1 to May30/2017

Variables	RRF data accuracy		
	Pearson chi-square		
	Value	Df	Asymp. Sig. (2-sided)
Service year	.465[a]	2	0.793
Training	37.115[a]	2	0.001
Availability of electronic bin-card	38.666 [a]	2	0.030
Level of education	90.384[a]	2	0.012
Type of profession	34.999[a]	4	0.040
Supervision	94.029 [a]	2	0.000
Feedback	21.684 [a]	2	0.045

5.5.1.2. Timeliness and completeness of RRFs

The timeliness of reports from hospitals and health centers was 13(81%) and 80(67.8%) respectively that the overall timeliness of the selected public health facilities was 93(69.4%). The completeness of the hospital reports was 15(93.8%) and that of the health centers was 116(98.3%) and the overall completeness was 131(97.8 %). (Figure 5)

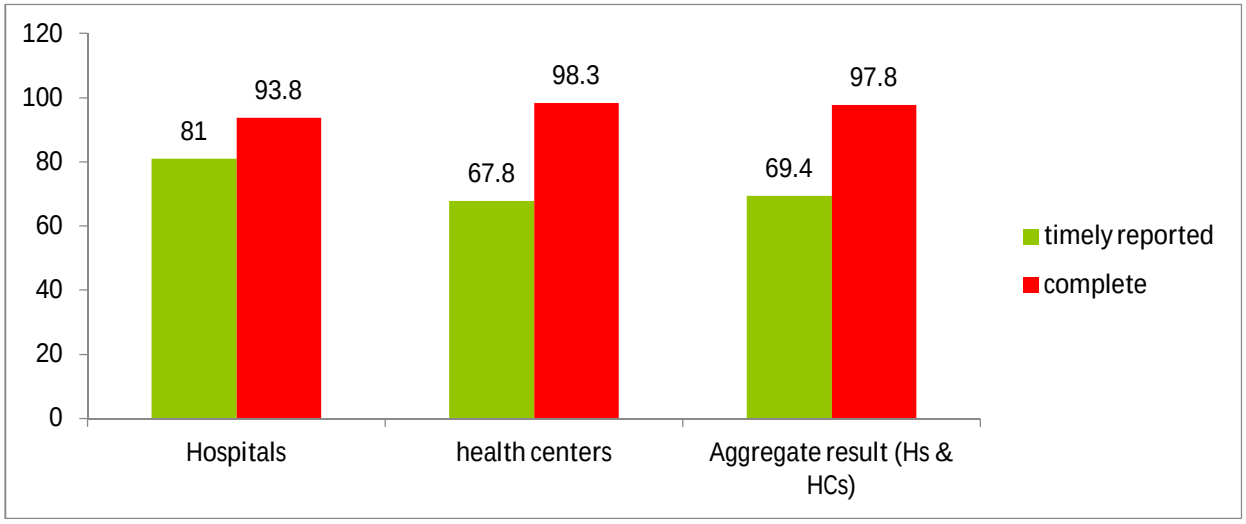


Figure 5.The timelines and completeness of RRFs by facilities & the overall aggregate results in selected public health facilities of East Wollega zone inApril1 to May30/2017(hospitals' RRFs n=16, health centers' RRFs n=118)

5.5.2. Accuracy of Bin-card data by product and facilities

(A)Bin card accuracy by facility type

The accuracy of records (bin card data) in hospitals particularly was 69(65.7%) accurate, 5(4.8%) near accurate, & 31(29.5%) not accurate while that of health centers was 568(81.1%) accurate, 30(4.3%) near accurate & 102(14.6%) not accurate; the overall accuracy of the inventory data of the facilities was; 637(79.1%) accurate, 35(4.3%) near accurate & 133(16.5%) not accurate. (Figure 6)

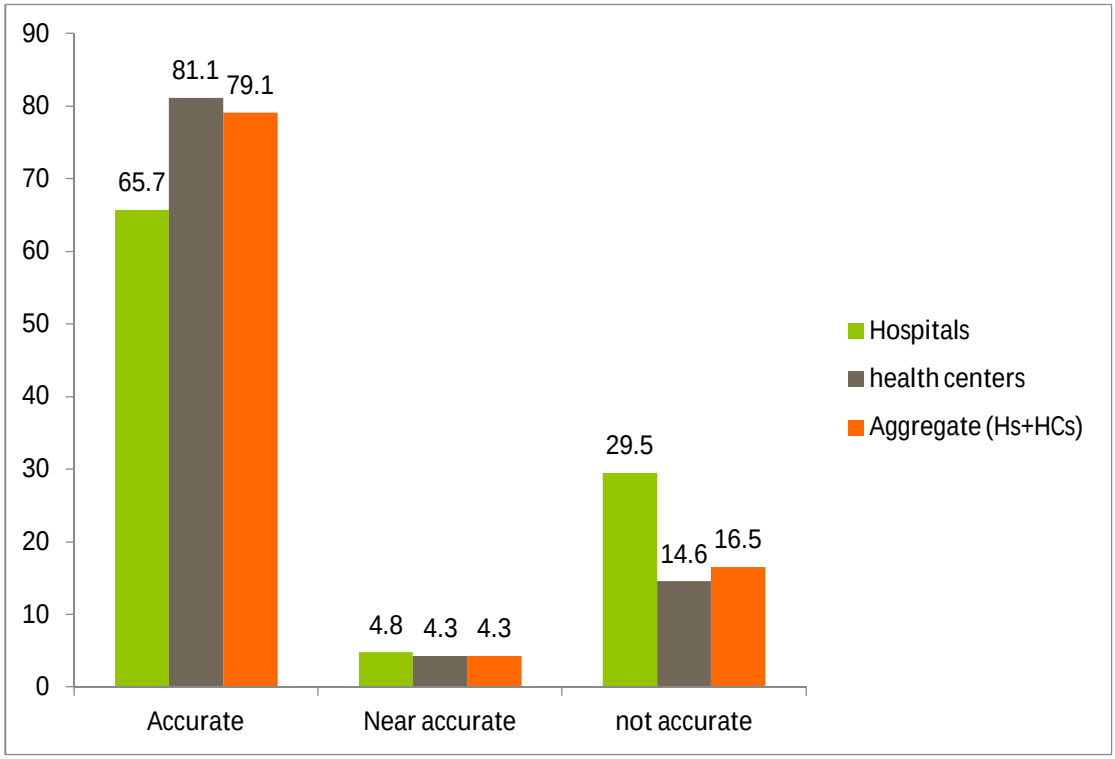


Figure 6.Accuracy of Bin-card by facility type and the overall aggregate performance of selected public health facilities in East Wollega zone in April 1 to May 30/2017 (hospitals' bin card n=105, health centers' bin card n = 700)

(B) Bin card accuracy by products

Thirty-five bin cards (from each facility) of all products found in all facilities were reviewed for their data accuracy. Some of the bin cards were accurate in all the facilities (100%) and others were accurate only in few facilities (<100%). (Table5)

Table 5.Accuracy of bin-card data by product in selected public health facilities of East Wollega zone in April 1 to May30/2017 (hospitals n=3, health centers n =20)

List of products	Hospitals			Health centers		
	Accurate n (%)	Near accurate n (%)	Not accurate n (%)	Accurate n (%)	Near accurate n (%)	Not accurate n (%)
EFV 50mg	3(100)	0(0)	0(0)	19(95)	1(5)	0(0)
EFV 200mg	1(33.3)	0(0)	2(66.7)	15(75)	2(10)	3(15)
EFV 600mg	2(66.7)	0(0)	1(33.3)	15(75)	0(0)	5(25)

3TC 150mg	1(33.3)	0(0)	2(66.7)	17(85)	1(5)	2(10)
3TC suspension	1(33.3)	0(0)	2(66.7)	19(95)	0(0)	1(5)
3TC+EFV+TDF(300/600/300)	1(33.3)	1(33.3)	1(33.3)	18(90)	0(0)	2(10)
3TC+NVP+AZT(150/200/300)	2(66.7)	1(33.3)	0(0)	15(75)	1(5)	4(20)
3TC+NVP+AZT(child)	2(66.7)	0(0)	1(33.3)	19(95)	0(0)	1(5)
3TC+TDF(300/300)	1(33.3)	0(0)	2(66.7)	17(85)	0(0)	3(15)
3TC+AZT(adult)	2(66.7)	1(33.3)	0(0)	15(75)	1(5)	4(20)
3TC+AZT(child)	2(66.7)	0(0)	1(33.3)	18(90)	1(5)	1(5)
NVP 200mg	1(33.3)	0(0)	2(66.7)	16(80)	0(0)	4(20)
NVP suspension	3(100)	0(0)	0(0)	16(80)	1(5)	3(15)
AZT suspension	3(100)	0(0)	0(0)	14(70)	2(10)	4(20)
Ethambutol 100mg	1(33.3)	0(0)	2(66.7)	16(80)	0(0)	4(20)
Ethambutol 400mg	2(66.7)	0(0)	1(33.3)	15(75)	3(15)	2(10)
INH300mg	3(100)	0(0)	0(0)	18(90)	1(5)	1(5)
INH 100mg	2(66.7)	1(33.3)	0(0)	17(85)	0(0)	3(15)
RHZE+RH kit	3(100)	0(0)	0(0)	19(95)	0(0)	1(5)
RHZ 60/30/150	1(33.3)	0(0)	2(66.7)	14(70)	1(5)	5(25)
RH(adult)	2(66.7)	0(0)	1(33.3)	14(70)	3(15)	3(15)
RH child dose	3(100)	0(0)	0(0)	19(95)	0(0)	1(5)
STM1g vial	2(66.7)	1(33.3)	0(0)	14(70)	1(5)	5(25)
Etonogestrel 68mg	2(66.7)	0(0)	1(33.3)	20(100)	0(0)	0(0)
CU T380	3(100)	0(0)	0(0)	19(95)	1(5)	0(0)
Jadelle implant	3(100)	0(0)	0(0)	18(90)	2(10)	0(0)
Microgynon cycle	1(33.3)	0(0)	2(66.7)	15(75)	2(10)	3(15)
Levonorgestrel 0.03mg	1(33.3)	0(0)	2(66.7)	12(60)	1(5)	7(35)
Depoprovera 150mg	2(66.7)	0(0)	1(33.3)	17(85)	0(0)	3(15)
Emergency pill/2	1(33.3)	0(0)	2(66.7)	9(45)	3(15)	8(40)
Condom /144	3(100)	0(0)	0(0)	18(90)	0(0)	2(10)
Ergometrin 2mg inj.	1(33.3)	0(0)	2(66.7)	14(70)	2(10)	4(20)
Coarten 4*6	3(100)	0(0)	0(0)	17(85)	0(0)	3(15)
Artesunat injection	3(100)	0(0)	0(0)	15(75)	0(0)	5(25)
Quinine 300mg 10*10	2(66.7)	0(0)	1(33.3)	15(75)	0(0)	5(25)
Total n (%)	**69(65.7)**	**5(4.8)**	**31(29.5)**	**568(81.1)**	**30(4.3)**	**102(14.6)**

The associations of bin card accuracy with contributing factors were indicated using Pearson chi-square in the following table. The record data accuracy had significant association ($p < 0.05$) with supervision and type of profession (Table 6).

Table 6.The association of bin-card data accuracy and the contributing factors in the selected health facilities of East Wollega zone in April1 to May30/2017

Variables	Bin-card data accuracy
	Pearson chi-square

	Value	Df	Asymp. Sig. (2-sided)
Service year	5.619[a]	2	0.06
Training	1.558[a]	2	0.459
Availability of electronic bin-card	1.423[a]	2	0.491
Feedback	5.187	2	0.075
Supervision	7.918	2	0.019*
Type of profession	6.394	2	0.041*
Level of education	4.394	2	0.111

5.6. Reporting rates of health facilities

The reporting rate of the facilities was 98.3% in health centers and 88.9% in hospitals and the overall reporting rate of the facilities was 97%. (Figure7)

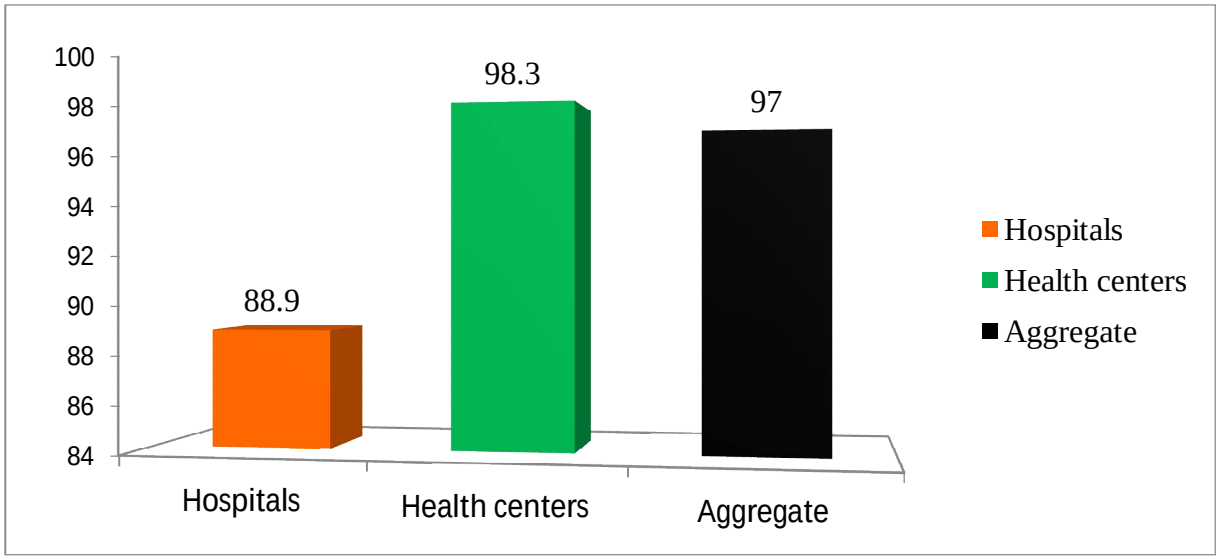


Figure7. Reporting rates of selected public health facilities in East Wollega Zone in April1 to May 30/2017 (hospitals' RRFs n=16, health centers' RRFs n=118)

5.7 Qualitative results

The data was collected by interviewing the key informants selected from the facilities involved in this study to substantiate the occurrence of the challenges of LMIS implementation. The key informants mentioned and identified various types of problems. Accordingly, the data were thematically analyzed by categorizing as per their characteristics i.e. human resource related problems, managerial related problems and required facilities related problems.

Logistics management information system (LMIS) challenges

In logistics information system, adequate human power supported with the required operational tools and properly structured effective management are imperatives to perform LMIS for better supply decision.

Human resource related problems:

Regarding the adequacy of human power in the pharmacy units, many of the respondents complained as the number of pharmacy professionals in public health facilities was not adequate. A KI explained it as follows, "…. *An individual assigned to work on LMIS also had responsibilities of carrying out other double or triple tasks in the pharmacy. For instance, I am the only person in the facility to dispense drugs and to manage store & prepare LMIS reports; no one to help me."*

In many of the health facilities, especially in health centers, the KIs complained that, personnel working on dispensary units of TB clinic, Mother and child care and FP were not using bin cards and preparing IFRR replaying that they were busy. A KI exemplified this as in the following. *"….when I ask them to use bin cards & prepare IFRR, they respond as they do not have time to prepare bin cards and formal IFRR."*

As many of the interviewees specifically in hospitals complained that, lack of commitment was another problem to perform LMIS tasks as required. A KI at a hospital said that, *"… when I ask the staff working at dispensary unites to record and report properly in order to maintain records & reports accurate and complete, they are not interested to do so, rather they feel discomfort and write application to the management to leave the work unite."*

Managerial related problems

All the facilities reported that the management group of the health management system including facility management group were not considering the LMIS as one of the health service tasks that is the attention given to the task was very low that a KI complained as follows. *"….. The issue of LMIS was not listed in the checklist of the review meetings in the health system and at facility level to discuss with; managers did not recognize as additional human power was require for LMIS other than for dispensary*."

Regarding the timely submission of report, another key- informant said, *"……even after preparation of the report, how to send is a big challenge because of transportation problem and also absence of per-diem to send the report on time. Therefore I send it through care of other non- staff passenger that may cause delay or loss of the report."*

With regard to the higher level managers, many facilities reported that the supervision was not in a teaching way and the feedback report was not indicating the mistakes or the strengths on the report. One KI criticized the supportive supervision as follows; *"……supportive supervision is important to fill gaps in LMIS performances but in our case, the supervisors from higher level management do not tell as how to properly prepare the report and does not give us constructive feedback report; they simply contact us & turn back ."*

Most of long experienced KIs complained that the way PFSA fill the requested product during product resupply time was a challenge that made them not to report accurately. A KI explained this as follows: *"…urging the facilities to prepare RRF on each resupply time is one strong side of PFSA to enhance reporting rate but the way it has been responding us is not fare; to get the required quantity of products requested, we experienced that we better request the double quantity of demand because PFSA most commonly gives us half or less than half of our request. This discourages us to report genuinely."*

Facility related problems

Many of the respondents gave their idea as availability of automated recording material (computer) is mandatory for LMIS activities that it reduces burden of work and enhances the LMIS performances. These informants did not deny as there was excess amount of manual recording and reporting formats found in each facility however many of them were complaining that they lack automated recording material (computer) with updated software. A KI disclosed

this as follows: "…*there is extra computer in each class of the woreda health office managers but facility LMIS unit suffers from lack of computer*."

6. Discussion

LMIS is the main source of information for supply chain managers to decide on supply of essential drugs to maintain sustainable and efficient pharmaceutical supply in order to improve health service out comes [28]. Hence assessing the affecting factors and performances of LMIS is important to keep in track and improve pharmaceutical supply management. This chapter discusses the major findings of LMIS management performances and associated challenges.

The current study revealed that availability and utilization of manual record &report formats was 100% in all the study facilities except the utilization of IFRR was 69.6%. This is similar with the study done in East Shewa zone on inventory management performance where the availability of manual formats was 100% [36] and it is better than that of a study done in Addis Ababa on LMIS of laboratory commodities where availability of all manual logistics formats was 92.6% and utilization of bin cards was 76.5% at health centers &33.3% at hospitals. This difference might be due to difference in the commitment of the higher level logistics managers of each particular district to supply the LMIS requirements and follow their utilization. However, the utilization of IFRR in the current study was lower than that of aforesaid study (84.6%) [35]. This could be due to the nature of the studies that the study in Addis was done only on laboratory commodities i.e. the IFRR was prepared in medical laboratory were the number of staff might be adequate. Whereas the current study was done on all program drugs excluding laboratory commodities where the dispensary units were with inadequate number of staff.

Electronic recording and reporting system enhances the logistics management information system (LMIS) performances through reducing errors, work burden and saving time that helps keeping accuracy and facilitates reporting rate [18]. In this study, the availability & utilization of automated record format was 39% and 34.9% respectively whereas the electronic reporting system was not found in all the selected facilities. The present finding is better when compared to the study conducted in East Shewa zone, Oromia regional state where only 20% of the facilities were using automated record format [36].

Regarding the electronic reporting system, this study is in line with a study conducted in Malawi on health facilities LMIS where the facilities were suffering from lack of or weak information technology [17].

Accurate report & record with completely filled data and submitting on time the reports is the basic requirement to integrate the supply chain of pharmaceuticals. Thus data quality (accuracy, timeliness, & completeness) and reporting rate are the core performance indicators of logistics management information system [7].

The present study indicated that, of the sampled RRFs, 64.6% were accurate, 69.4% were timely reported and 97.8% of the reports were found to be complete. These findings are slightly lower

than the reports obtained from assessment conducted by SIAPS in Cameroon and Burundi where accuracy and timeliness of their reports were 75% & 90% respectively [30]. The reason could be the difference in commitment by higher officials in providing regular supportive supervision and feedbacks on the facilities performances. In the present study, these managerial supports were found to be weak as also identified in the qualitative findings. On the top of this, inadequate human power was one common problem in the current study facilities that only 46.8% of the trained staffs were working on LMIS; this insufficiency of staff might cause work burden & fatigue that affected the LMIS performances. Many of the study facilities were complaining on this human resource problem and a KI exemplified this complain as follows. "…. *An individual assigned to work on LMIS also had responsibilities of carrying out other double or triple tasks in the pharmacy. For instance, I am the only person in the facility to dispense drugs and to manage store & prepare LMIS reports; no one to help me."* This was the most common problem particularly in the selected health centers where only one pharmacy professional was there.

As health service work is a team work, all the health workers in a facility should perform all tasks cooperatively [24]; whereas in the current study facilities though they have received IPLS/LMIS training health workers other than pharmacy professionals (working) were not feeling sense of owner ship of LMIS to fill the gaps occurred due to scarcity of pharmacy professionals. This indicated the selected facilities' Managers and logistics managers were not committed to the task to give training to the DUs workers and coordinate them fill the gaps in LMIS. Generally factors such as staff training, availability of electronic recording system, educational level of staffs, supervision and feedback had significant association with the accuracy of LMIS reports in the selected health facilities.

Another factor that affected particularly the report accuracy was the practical order fill rate of PFSA to health facilities that was not according to the request of the facilities. In response to that, the health facilities had been requesting exaggerated quantity of products i.e. they had not

been requesting the demanded quantity of products. One of the key informants stated this as follows, "*…to get the required quantity of products requested, we experienced that we better request the double quantity of demand because PFSA most commonly gives us half or less than half of our request"*. This enhanced deliberate distortion of information thus the report accuracy in some selected facilities with long experienced pharmacy personnel was very low.

Timeliness of the reports was affected additionally by lack of transportation & per diem caused due to lack of budgetary support to submit the prepared report on time mostly in health facilities found at remote area.

However, the finding on the completeness of the reports was admirable in the current study (97.8) and it is higher than the reporting rate finding in Ethiopian national survey on integrated pharmaceutical logistics system (85%) [10]. This difference might be due to that the survey was done in country wise coverage on 270 health facilities including health posts whereas the current study was done in a single zone on 23 facilities excluding health posts.

Regarding the reporting rate, 97% of the expected reports from the selected facilities of this study were submitted to PFSA. This is higher than that of the study done in Malawi and Nigeria where the reporting rates were 58% & 12.3% respectively [17& 26]. This difference might be due to the urging principle of PFSA that any health facility has to first prepare and submit RRF to PFSA in order to obtain its resupply of program drugs bimonthly ("no report no drug principle").

The inventory record accuracy is one of the components of data quality that supplements report accuracy. From the reviewed bin cards of the selected facilities 79.1%were accurately recorded (have similar data with physical count). This is higher in comparison to that of a study done in South Sudan on pharmaceutical logistics assessment, an assessment done in Addis Ababa on laboratory commodities logistics information system and a study done in East Shewa zone, Oromia regional state on inventory performance of key essential medicines where the inventory accuracies were 27%,38.9%&28.5% respectively [18,21&36].This is because in South Sudan, the study was done in wider geographical area (four states) and it had included private pharmaceutical sector also. In the study done in Addis Ababa, the number of study facilities might make a difference that it was done on 43 facilities whereas our study was done on 23 facilities.

The review of the record data in this study had unfortunately been scheduled at the final day of data collection in the tool. This created an opportunity for store men those assumed the data collector as a supervisor tried adjusting their record (bin card) balance with physical count of the program drugs. This might contribute for this relatively better performance of the bin card accuracy than the RRF accuracy. In fact this was prevented after review of few facilities by

shifting the schedule of reviewing bin card to the first day of contact with a study facility. This indicated that supervision from higher level managers could have made a remarkable improvement of the LMIS performances. Thus supervision was significantly associated with this inventory record accuracy.

7. Conclusion and recommendations

7.1. Conclusion

From this study we concluded that the logistics management information system performances, particularly report accuracy, report timeliness and record accuracy require improvement while completeness of the report and reporting rate should be kept up. The study finding also

uncovered that all the selected facilities were suffering from human power inadequacy, uncommitted facility managers & higher level supervisors to support the LMIS implementation. except the store men, the other workers working at dispensary unites had not been giving attention to the logistics management information system records & reports (no bin card utilization & rarely prepare IFRR). And majority of the health facilities did not have automated record formats (computer). The LMIS workers particularly at remote health facilities had not been getting continuous supportive supervision& mentorship. Factors like number of staff in pharmacy department, training of staff, availability of automated record formats, supportive supervision and feedback report were significantly associated to the RRF accuracy whereas electronic reporting system was not used in any of the selected health facilities.

7.2. Recommendations

The following recommendations are drown based on the findings of this study

- The WoHO should employ adequate pharmacy professionals at facilities.
- The health facility managers should give attention to IPLS/LMIS to facilitate conditions for all LMIS activities.
- The LMIS managers of the facilities should give continuous training for the workers at DUs in order to improve their adherence to proper recording & reporting activities.
- ZHD and PFSA should make their supportive supervision & feedback report regularly and frequently to all health facilities.
- The supervisors should be a mentor to all the LMIS personnel and the workers in each dispensary unites of the facilities in order to encourage them adhere to the regular record and reports of LMIS.
- PFSA should improve its supply capacity to avoid under requested fill rate so as to make the facility logistics managers request just the demanded quantity.
- WoHO being with the partners should search for a means to deploy automation of records & reports in all facilities LMIS unites in order to fill gaps of the LMIS performance.

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Annex I.

LMIS indicators and formula

- Facility Reporting Rates: It is a measure of the percentage of facilities that submitted reports according to the defined reporting schedule.

Formula: $\frac{\text{Number of facilities submitted a report by a certain date}}{\text{Total number of facilities required to report}} \times 100$

Or = $\frac{\text{number of reports submitted to PFSA}}{\text{Total expected reports}} \times 100$

- Percentage of facilities that submitted complete LMIS reports on time (timeliness):

Formula: $\frac{\text{total no of facilities that submitted a complete LMIS reports on time}}{\text{No of health facilities expected to report X no of reports expected from each}} \times 100$

Or

- Percentage of facilities submitted LMIS report on time:

Formula: $\frac{\text{Total no. of reports submitted on time}}{\text{Total no of reports expected}} \times 100$

- Percentage of facilities submitted complete LMIS report (completeness):

Formula: $\frac{\text{Total no of complete LMIS report submitted}}{\text{No of health facilities expected to report X no of reports expected from each facility}} \times 100$

- Percentage of facilities that had accurate LMIS report:

Formula: $\frac{\text{LMIS report count – stock record count}}{\text{Stock record count}} \times 100$

- Accuracy in keeping stock records:

Formula: $\frac{\text{stock record count – physical stock count}}{\text{Physical count}} \times 100$

❖ In this study, it is considered accurate, if the result is zero(when the difference between the LMIS report count & the bin card record count is zero); near accurate, if the difference

between 100 and the result of this formula is 1-10 and not accurate, when the difference between 100 and the result is >=10 [10].

- Percentage of LMIS reports placed through electronic ordering system:

Formula: $\frac{\text{No of LMIS reports placed(submitted) through electronic system}}{\text{Total no of LMIS reports}} \times 100$

Annex II.

Data collection tool:

Jimma University Faculty of health sciences, school of pharmacy, Pharmaceutical supply chain management post graduate program

This interview questionnaire is prepared to collect data from personnel carrying out LMIS activities with the objective of assessing LMIS performance in East Wollega zone. It is used only for the academic purpose. Therefore, the information sought will be kept confidential and will not be transferred to third party without prior consent of the respondents. Thus, your sincere cooperation in answering each question is highly important since the success of this study entirely depends upon your earnest and genuine response to the questions. So, I kindly request you to provide me your answer.

Thank you in advance!

General Instructions to data collectors:

A. Prior to the interview, the support letter from EWZHD should be presented and permission should be secured from the relevant official of the facility.
B. Make brief introduction to the respondent before starting the interview, get introduced to the respondents and make clear the purpose and objective of the study that you are undertaking.
C. Please ask the question clearly and patiently until the respondent understands (gets your point).
D. Please fill up the interview questionnaire according to the respondent reply (do not put your own opinion).
E. During the process put the answers of each respondent both on the space provided and encircle the choice or tick mark as required.

The principal investigator is working for academic purpose andI am here on behalf of the principal investigator to collect data about the logistics management information system of your facility that is needed for the above mentioned purpose.

I need your cooperation & permission first, and would like to ask you a few questions about the LMIS activities in this facility. In addition, I would like review some records & reports format and actually count selected products you have in stock today with respect to the records and reports.

Do you have any questions for clarity?

Name of health facility_____ type of health facility_____

District_____

Name of data collector (interviewer) _____ date _____

Good day. My name is _____ I am representing the principal investigator _____

I. Respondent's back ground and human resource information

1. Sex:

A. Male B. Female

2. Educational level:

A. College diploma B. BSc degree C. MSc D. Other

3. What is your Profession?

A. PharmacyB. Medical lab tech. C. Nurse D. Others -----

4. Number of years and months you have worked at this activity? Years: _____ Months: _____

5. How many staff the facility has under the pharmacy unit? Number_____

6. How many of the pharmacy professionals have got training on IPLS/LMIS? Number trained_____

II. Some managerial questions

1. was there supervision from higher logistics management team? Yes------,No-------.

2. If yes how often it was done?

A. quarterly B. six monthly C. annually

3. Was there feedback report from higher managers?

A. no, B. yes

4. If question no. 4 is yes, how often?

A. bimonthly B. quarterly C. six monthly D. annually

5. Are you using electronics like computer to record & report?

A. yes B. no

6. If question number 5 is no, why?

A. not available B. the software is not functional C. I am not trained in D. others: specify _____.

III. Data collection tools: LMIS' records & reports questions.

S.N.	Question	Code classification, yes or no	Comment
1	Are the following LMIS formats available in this facility?		
	Bin card/stock card	Yes No	
	IFRR	Yes No	
	RRF	Yes No	
2	Do you use the following stock keeping logistics forms to manage program drugs in this facility? (Physical verification is required).		
	Bin card/stock card	Yes No	
3	Does this facility compiles & send RRF to the higher level?	Yes No	
	Was the RRF sent in the scheduled time?		
	RRF1	Before 10th day after the month-------A After 10th day after the month------B	
	RRF2	Before 10th day after the month----------A After 10th day after the month---------B	
	RRF3	Before 10th day after the month----------A	

		After 10th day after the month------- B	
	RRF4	Before 10th day after the month----------A After 10th day after the month----------B	
	RRF5	Before 10th day after the month----------A After 10th day after the month----------B	
	RRF6	Before 10th day after the month----------A After 10th day after the month----------B	
	Do major dispensing units use IFRR for regular reporting? Must be verified with completed report		
	OPD dispensary unite	Yes No	
	ART	Yes No	
	MCH	Yes No	
	TB	Yes No	
4	How many of the LMIS report & resupply formats were sent through electronics system?	RRF_____ IFRR_____	

IV. Data collection tools for accuracies and completeness:

1. Tool of stock on hand data on bin card in comparison to usable SOH in the store on the day of visit.

Columns

- 1 = product on the bin card
- 2 = quantity of stock on hand on the bin card on the date of visit
- 3 = quantity of usable stock of the particular product found in the store on physical count
- 4 = the difference between SOH on bin card and usable stock found in the store on physical count
- 5 = any clarification

products		SOH on bin card	Usable SOH in the store on physical count	SOH on bin card – usable SOH on physical count on the day of visit *100/usable SOH on physical count	Remark
1		2	3	4	5
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

SOH= stock on hand

2. Table of accuracy check for RRF

Columns

- 1= List of the products on each RRF
- 2 = write Y if the product is managed in the facility, or N if not
- 3 = quantity of SOH of each product on respective RRF
- 4 = quantity of SOH of the products listed, from the bin card of the day the report prepared
- 5 = the % of difference between SOH on the bin card and SOH on the report
- 6 = comment or clarification

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy SOH in RRFs–SOHin BCs* 100/ SOH in BCs)	Remark/clarification
on RRF1	1	2	3	4	5	6

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs–SOH in BCs* 100/ SOH in BCs)	Remark/clarification
1		2	3	4	5	6

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs– SOH in BCs *100/ SOH in BCs)	Remark/clarification
1		2	3	4	5	6
Products on RRF2						

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs– SOH in BCs *100/ SOH in BCs)	Remark/clarification

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs– SOH in BCs * 100/ SOH in BCs)	Remark/clarification
RRF3						

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs– SOH in BCs*100/ SOH in BCs)	Remark/clarification
RRF4						

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs – SOH in BCs *100/ SOH in BCs)	Remark/clarification
RRF5						

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs– SOH BCs *100/ SOH in BCs)	Remark/clarification

List of the products		Is the product managed in the facility? Yes or no	Reported SOH on the RRFs	usable SOH on the bin card	% Discrepancy (SOH in RRFs– SOH in BCs *100/ SOH in BCs)	Remark/clarification
RRF6						

Key: SOH= stock on hand. RRF= report & request form BCs=bin cards

3. Tool to check completeness of RRFs and IFRRs

Columns:

- 1 = list of report formats
- 2 = availability of all the report components (ART, TB, MALARIA and FP/ MCH) according to level of the facility. If 'yes', go to column 3
- 3 = complete ness of all the columns of the drugs on the reports. If 'no' go to column 4
- 4 = no. of incompletely filled products

RRFs/HPMRRs	Is the entire report component found?		If yes, are all the columns of the products filled complete?		If col. 3 is no, how many of the products left incomplete?	Comments/ clarification
1	2		3		4	5
	yes	no	Yes	no		
RRF1						
RRF2						
RRF3						
RRF4						
RRF5						
RRF6						

V. Qualitative data (In-depth Interview) tool:

Jimma University, Faculty of health sciences, school of pharmacy, Pharmaceutical supply chain management post graduate program

Data collection tool for a research title," logistics management information system and associated factors: a case on program drugs in selected health facilities in East Wolega zone,Oromia regional state, Ethiopia." for review of LMIS records and reports in Hospitals, health centers and health post.

This data is collected by principal investigator.Prior to the interview, self-introduction will be made and the support letter from EWZHD should be presented and permission should be secured from the relevant official /individual.

This interview questionnaire is prepared to collect data from personnel carrying out LMIS activities with the objective of assessing LMIS performance in East wollega zone. It is used only for the academic purpose. Therefore, the information sought will be kept confidential and will not be transferred to third party without prior consent of the respondents. Thus, your sincere cooperation in answering each question is highly important since the success of this study entirely depends upon your earnest and genuine response to the questions. So, I kindly request you to provide me your answer in depth. May you scarify your golden minutes on your convenient time?

Thank you in advance!

Name of health facility_____ type of health facility_____

District_____

Job of the interviewee _____ date _____

Good day. My name is _____ I am the principal investigator _____

1. I think you are implementing pharmaceutical logistics management information system (LMIS) in the set up. Would you explain the use & implementation in context of health facilities?
2. Do you think that LMIS is important to improve health facility performances? If the answer is “yes”, how? If no, why?
3. Is there any challenge or problem faced in the implementation of LMIS? Probes: personnel aspect, facility aspect, or managerial aspect, resupply aspect and others?
4. What is the reason you think that LMIS reports and records are not accurate?
5. Is there any periodic supervision on facility LMIS? And do you think supervision makes a change on LMIS performance?
6. Have LMIS/IPLS personnel got any training regarding to their job including you? Was there a change on your performance after training? How about the quality of the report after the training?
7. Do you think LMIS practices require experience? Was there a relation between the quality of the data and the length of experience of the reporting personnel?
8. What are weak & strong sides of LMIS?
9. What other factors do you think affected LMIS performance?
10. What do you recommend for a better LMIS performance?

Thank you for your golden time!