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Research Article

Integrated Pharmaceutical Logistics System Implementation in Selected Health Facilities of Ethiopia: the Case of Four Wollega Zones

Tamirat Alemu[1]*, Awol Jemal[2], Fanta Gashe[2], Sultan Suleman[2], Ginenus Fekadu[1], Sagaram Sudhakar[1]

[1]Department of Pharmacy, Institute of Health Sciences, Wollega University, Nekemte, Ethiopia; [2]School of Pharmacy, Institute of Health Sciences, Jimma University, Jimma, Ethiopia

ABSTRACT

Background: The pharmaceutical supply chain management system of the Ethiopia had several problems including non-availability, poor storage, weak stock management and irrational use. However, little studies on progress and challenges towards implementation of Integrated Pharmaceuticals Logistics System (IPLS) in the study area. Therefore, this study aimed to assess progress and challenges towards the implementation of IPLS in selected health facilities in the Wollega zones of Oromia region, western Ethiopia.

Methods: A cross sectional quantitative and qualitative studies were conducted in selected health facilities from February 15 to March 15, 2015. The calculated sample size was 31 health facilities calculated for a 20% margin of error and 90% confidence interval. The Logistics Indicator Assessment Tool (LIAT) was used to collect the information from selected health facilities; while an in-depth interview was held with chief pharmacist from the selected facility to collect qualitative data. Correlation and multiple linear regression analysis were used at significance of 90%CI for independent variables and dependent variables.

Results: The average availability of bin cards for the selected products was 83.9% for hospital, 75.4% for health center, and 70.6% for health post. On average, hospitals had an updated bin card for 43.8% of the product while health center and health post had an updated bin card for 32.9% and 32% of their products, respectively. On average the exact accuracy of request and resupply form (RRF) data for hospital and health center were 45.6% and 37.1%, respectively. IPLS implementation was related with health facility stores infrastructures (40.1%), Logistics Management Information System/LMIS (32.2%), stock availability and status (31.9%), storage condition (17.7%), and order fill rate (14.1%). Multivariable regression revealed the LMIS (std. β=2.539, p=0.022), stock status (std. β=0.848, p=0.049) and availability of tracer medicines (std. β=0.212, p=0.013) were positively associated with IPLS implementation.

Conclusion: There have been significant improvements in supply chain indicators in the availability of essential health commodities since IPLS has been implemented, with some variation by level of facility and product type. Involvement of all stakeholders is necessary to sustain the system. There needs to be more focus on monitoring and evaluation of IPLS including more studies.

Keywords: Integrated pharmaceutical logistics system; IPLS implementation; Health facility; Wollega zones; Ethiopia

Abbreviations: AIDS: Acquired Immunodeficiency Syndrome; ART: Antiretroviral Therapy; FMOH: Federal Ministry of Health; HC: Health Center; HEWs: Health Extension Workers; HIV: Human Immunodeficiency Virus; HP: Health Post; HPMRR: Health Post Monthly Report and Resupply form; IFRR: Internal Facility Request and Resupply Form; IPLS: Integrated Pharmaceutical Logistics System; LIAT: Logistics Indicator Assessment Tool; LMIS: Logistics Management Information System; LMIC: Low and/or Medium Income Countries; LSAT: Logistics System Assessment Tool; OJT: on Job Training; PFSA: Pharmaceutical Fund and Supply Agency; RDF: Revolving Drug Fund; RHB: Regional Health Bureau; RRF: Report and Requisition Form; SCMS: Supply Chain Management Systems; SDP: Service Delivery Point; TB: Tuberculosis; TOT: Training of Trainer; UNFPA: United Nations for Population Fund; WHO: World Health Organization; WoHO: Woreda Health Office; ZHD: Zonal Health Department

Correspondence to: Tamirat Alemu, Department of Pharmacy, Institute of Health Sciences, Wollega University, Nekemte, Ethiopia, Tel: 251917813938; E-mail: tamiratalemu@yahoo.com

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INTRODUCTION

The provision of complete health care necessitates the availability of safe, effective and affordable drugs and related supplies of the required quality, in adequate quantity at all times. Despite this fact, in the past, the pharmaceutical supply Chain management system of the Ethiopia had several problems including non-availability, unaffordability, poor storage, weak stock management and irrational use [1]. Pharmaceuticals need to be managed properly because Pharmaceuticals constitute up to 40% health care budget, poor medicine management obstructs access to medicines; results in wastage and health hazard, medicines are part of the link between the patient and health services. The issue of medicine is not the responsibility of only health workers. It has political, economic and social dimensions [2].

To address these challenges, the federal ministry of health (FMOH) initiated a comprehensive supply chain strategic planning process, emphasizing integration of all products into one supply chain [3]. Active implementation by Pharmaceutical Fund and Supply Agency (PFSA) of Integrated Pharmaceutical Logistics System (IPLS) began in early 2009 to execute its mandate in the area of pharmaceuticals supply in an efficient and effective manner [4]. IPLS is the term applied to the single pharmaceuticals reporting and distribution system based on the overall mandate and scope of the PFSA. To be successful, the system must fulfill the six rights of supply chain management by ensuring the right products, in the right quantity, of the right quality, at the right place, at the right time and for the right cost. IPLS at facility level includes the basic logistics functions: logistics management information system, inventory control system, and storage of pharmaceuticals [1]. Routine monitoring reports show that IPLS is improving information recording and reporting, storage and distribution systems, as well as the availability of essential commodities at service delivery points [5-7].

The World Health Organization (WHO) estimates that about one-third of the world's population lack access to essential medicines and diagnostics. In the poorest parts of Africa and Asia, this proportion increases to 50%. The causes of poor access and availability of medicines were complex and some of the contributing factors for these problems were irrational use of medicines, unaffordable price, unsustainable financing mechanisms, and unreliable health and supply systems to deliver medicines to users [8]. In developed countries, medicine supply chains and availability is almost a given as well as performance focuses on efficiencies and quality. A common metric of supply chain performance in developed countries is order fill rate the proportion of orders filled within a determined period of time. By contrast with developing countries where stock levels are measured in months due to infrequent order cycles and long lead times [9].

Non-availability of medicines is a major factor in poor health outcomes in Low and middle income countries (LMICs). The most common metric of supply chain performance in developing countries is stock out rate: the proportion of locations stocked out of a particular item on the day it is surveyed [10]. The study of medicine prices, availability, and affordability in 36 developing and middle-income countries indicated that, for a basket of core medicines, mean availability in the public sector ranged from 38.2% in sub-Saharan Africa to 57.7% in Latin America and the Caribbean [11].

There is an increasing awareness of the need to focus on human resource requirements for healthcare supply chains. A study by Global Pharmacy Workforce 2008 and WHO 2010, indicated that the issues of insufficient staff numbers, appropriate training, geographical and professional isolation in rural and remote environments, a lack of supervision/contact with supervisors, inadequate professional and personal facilities, pay and conditions, and workload are all significant issues that affect staff satisfaction, turnover, and the ability of staff to complete their job satisfactorily [12,13]. An assessment of the pharmaceutical sector in Ethiopia by the FMOH/WHO found that there is no proper stock management in health facilities as revealed by absence of stock control tools such as stock card in 60% of the surveyed health facilities, the national average for availability of key essential drugs in public health facilities was 70%, average stock out durations in public health facilities were 99.2 days, 86% of prescribed drugs are dispensed in public health facilities as compared with the ideal value of 100%. Challenges in the public pharmaceuticals supply chain management are disorganized forecasting, redundant procurement, non-need based donation and procurement, substandard storage & distribution facilities, high pharmaceuticals wastage rate greater than 8% [14].

A baseline assessment of the supply chain for Health extension workers (HEWs) conducted by supply chain management (SCM) in 2010 identified the following key problems like low product availability at resupply points, Lack of basic SCM knowledge and skills among HEWs and some supervisors, lack of reported logistics data from HEWs to higher levels to support decision making, poor storage conditions and inappropriate use of storage space at health post (HP) level, transportation challenges in general, especially of bulky and slow-moving products to health posts [15]. For public health facilities of Ethiopia: the case of four Wollega zones, the magnitude of pharmaceutical supply chain management challenges such as drug stock outs, unavailability of certain drugs, poor storage conditions, weak stock management and wastage rates, are not well known. Even though IPLS was improving information recording and reporting, storage and distribution systems, as well as the availability of essential commodities at service delivery points; to the knowledge of the investigator, there were no studies done on progress and challenges towards the implementation of IPLS in health facilities in the Wollega zones of oromia region, western Ethiopia.

As a research, the primary merits of the study goes to the university academics. Since there were no studies in the area, it gives a comprehensive starting point for more to assess the progress made and challenges towards the implementation of the IPLS using key performance indicator in the public health facilities of Ethiopia. Therefore, the purpose of this study was to assess progress and challenges towards the implementation of integrated pharmaceutical logistics system in selected health facilities of Ethiopia: the case of four Wollega zones.

RESEARCH METHODOLOGY

Study area and period

The study was conducted in selected health facilities (hospitals, health centers and health posts) in the four Wollega zones, Oromia Region, west Ethiopia. The four Wollega zones were named East

Wollega zone, Horro Guduru Wollega Zones, West Wollega Zone and Kellem Wollega Zone. There are 9 hospitals, 219 health center and 1193 health posts in the four Wollega zones (A report from each of four Wollega zones health departments, 2015). IPLS was implemented in 213 health facilities (A report from Nekemte PFSA Hub, 2015) [unpublished data]. The study was conducted from February 15 – March 15, 2015.

Study design

This study was used both quantitative and qualitative study design. For the quantitative study a facility based descriptive cross sectional study was conducted in all selected health facilities to assess IPLS implementation/practice. While for the qualitative design, phenomenological study and an in-depth interview were held with logistic officer or chief pharmacist (professionals in charge of IPLS in case of health post) of the selected facility in order to assess the challenges during practice.

Study population

The source populations were constituted of all the health facilities of Wollega zones and all professionals in charge of pharmaceuticals service in those health facilities. The study population was those selected health facilities in which IPLS practice was implemented and those pharmacists or logistic officers in charge of pharmaceutical logistic activities.

Eligibility criteria

Inclusion criteria and the scope of the study: The study included health facilities in which IPLS practice was implemented and pharmacists, or other professional in charge of integrated pharmaceutical logistic systems. The scope of the study covered the situation for supply chain management including availability of tracer commodities; Public health supplies with a focus on essential medicines that include both program and revolving drug fund (RDF) commodities; public-sector health facilities: hospitals, health centers, and health posts; and all four Wollega zones of Oromia region of Ethiopia.

Exclusion criteria: The study excluded health facilities in which IPLS practice is not implemented and other professionals, who are not in charge of integrated pharmaceutical logistic systems. Due to many factors including resource, the study did not cover other levels of the supply chain above the health facility. Although IPLS consider health posts as one of dispensing units of the resupplying health centers, limited numbers of health posts were included in the study.

Study variables

Independent variables

- **Personnel, training, and supervision related factors**
- Training on IPLS
- Supervisor visit to facilities
- **Practice related factors**
- Availability of tracer medicines and supplies
- storage condition
- logistics management information system(LMIS)
- Availability of inventory control management
- Logistics system performance(order fill rate, stock status)
- Health facility infrastructure

Dependent variables: IPLS Implementation

Indicators: A set of standard indicators were selected to provide a broad measurement of supply chain performance and stock status of tracer commodities. Specifically, the assessment collected quantitative information on the performance of the logistics system, and the availability of selected essential commodities. The study also assessed specific activities, such as ordering, reporting, monitoring and supervision, and storage conditions.

Sample size determination and sampling techniques

The sampling frame used was the complete list of 213 health facilities (hospitals and health centers) implemented IPLS in the four Wollega zones. IPLS was implemented in 9 hospital and 204 health centers in the four Wollega zones. In many situations, the margin of error and confidence level may be relaxed to allow for an attainable sample size. A more realistic margin of error and confidence level for a Logistics Indicators Assessment Tool (LIAT) survey might be **20%** (**+/-10%**) and **90%,** respectively [16,17]. For generating representative samples for a LIAT survey, it is recommended that evaluators set a margin of error at or below 20% and a confidence level at or above 90%.

Accordingly, to determine the sample size required for the assessment the 90% confidence interval, 20% margin of error, and 10% non-response rate were taken as an input. The estimation formula for the sample size is [16].

$$n = \frac{t^2 \times p\,(1-p)}{m^2}$$

n=17 Health facilities

Where:

n=required sample size

t=the value of the confidence level you have chosen (at 80%, t=1.28, 90%=1.64, 95%, t=1.96)

p=estimated prevalence of the indicator. (The product of p and [1-p] is maximized when p=0.5. Therefore, when prevalence is unknown, 0.5 should be used.)

m=margin of error we wish to allow in estimating the prevalence, expressed as a decimal (at 20%, m=0.2, at 10%, m=0.1, at 5%, m=0.05). Here we estimated set availability of essential medicines and supplies 50% with confidence interval of p ± 0.2p, at the 90% level of confidence. Then relative error or coefficient of variation is 20%, or 0.2.

However, where there is a predetermined population (e.g., total number of facilities in the zones), the sample size generated from the above equation needs to be multiplied by the Finite Population Correction (FPC) factor. For our purposes, the formula can be expressed as [16].

New n = n

1+ [(n-1)/N]

Whereas, n=16 health facilities, visits to 16 facilities among a population of 213 facilities implemented IPLS. The calculated sample size was 16 health facilities. Since 20% margin of error and 10% non-response rate were used, the sample size was increased by 30% to narrow the margin of error. Thus, the sample size became 25 health facilities.

In addition, although IPLS consider health posts as one of dispensing units of the resupplying health centers, they have some unique characters. Thus, 8 health posts were included in the sample using purposive sampling. The final sample size was 33 health facilities. Due to limited resources and inaccessibility of some facilities, the sampled size was scaled back to 31 health facilities. The sampling procedure adopted in this study was the probability sampling method, which provides each member of the target group with equal non-zero probability for being selected in the sample. Hospitals and health centres were stratified by zone using simple random sampling, from each zone one hospital and one proximate health centers was included in the study unit. While stratified random sampling technique was used to select the remaining 31 health facilities from the zone.

Accordingly each zone was divided in to four stratum (south, north, west and east) based on geographical locations. Then, the health facilities (2 health centers from each stratum) was selected by simple random sampling whereby, in each district all health centers (sampling frame) were assigned number from 1 to the last number of the health facilities on piece of paper. Then the two health centers were selected using lottery methods. At least two of the health posts supplied by selected health centers from each zone with a total of eight health posts were selected using the purposive sampling method. Sample sizes were typically small in qualitative work to avoid saturation of words data. Though each of the chief pharmacist or logistics officer from 31 health facilities are likely to generate data only half (fifteen) logistic officer or chief pharmacist of the selected health facilities were included for an in-depth interview by purposive sampling.

Data collection and management

Data collection instruments: Observational checklist and structured, pretested questionnaire was used to collect the data. The LIAT, which is a standardized quantitative da ta collection tool developed by the DELIVER project (observational checklist), was modified to the Ethiopian context and used to collect the information from selected health facilities. The instrument included a set of indicators assessing the performance of the logistics system and the availability of essential commodities.

Data collection process: The necessary data on major areas of IPLS were collected by using observational checklists while the qualitative part was obtained by using semi-structured face-to-face interview with key informants. Pharmacists were recruited to collect the data after giving a three full day training supported by practical skill on the purpose of the study and how to fill the check lists. Those data collectors were selected from facilities which are not involved in the study. An assessment team consisting of 3 data collectors and the principal investigator as a supervisor were proceed the activities

Data quality assurance: Standard assessment instrument was selected for collecting the data. The checklist and interview questionnaire were pre-tested on 5% of similar facilities (which are not included in the study facilities) to test its validity and reliability before finalization. Following pre-test result necessary modification was made. Intensive training was provided to data collectors and the collected data were checked for completeness every day at the end of data collection by principal investigator. Several quality safeguards were incorporated into the data entry program. Once data were transferred into the SPSS database, all questionnaires were reviewed again to ensure accuracy of data entry.

Data analysis and interpretation

After the data had been collected from each facility, the results were disaggregated by type of facility. Then the data were entered in and analyzed by using SPSS 20 software. Descriptive statistics including frequencies cross tabulation, averages and percentages were the main output for the analysis. Prior to analysis linear regression assumptions were checked. Simple linear regression analysis was carried out to assess association between each dependent and independent variables and to identify candidates for multivariate linear regression analysis. Variable having p-value less than 0.1 was subjected for multivariate linear regression analysis. Then, multivariate linear regression analysis was performed to get the final model. Statistical significance association was considered at p-values less than 0.1 and 90% confidence interval was used.

Both tabular and graphic presentations were used from the quantitative data. Possible associations between independent and dependent variables were investigated and interpretations were made accordingly. Bar graphs and tables were created using Microsoft Excel. The qualitative data were transformed into categories related to the topics that were discussed and coded on paper individually in order to identify themes and patterns for thematic analysis. Findings from different key informants were triangulated to increase the reliability and validity of the analysis.

RESULTS

Logistics system management and inventory management practices

Availability of blank logistics recording and reporting formats: The results indicated that availability of blank bin cards, internal facility request and resupply form (IFRR) and request and resupply form (RRF) were 100%, 83% and 100%, respectively at hospitals. At health centers the availability of blank bin cards, IFRR and RRF were 100%, 82% and 94%, respectively. However, availability of the recording and reporting formats decline as we move down the supply chain. The availability of bin cards was 75% at the health post level. Similarly, Health Post Monthly report and resupply form (HPMRR) was available in 82% of health centers and 75% of health post. The IPLS standard operating procedure (SOP) manual was available in 67% of hospital and 35% of health centers. Though 75% of health post had job aids/flip books, they had no IPLS SOP manual on a day of visit (Figure 1).

Utilization of logistics recording and reporting formats: Across all facility levels, the average availability of bin cards for the selected products was 83.9% for hospital, 75.4% for health center, and 70.6% for health post. On average, hospitals had an updated bin card for 43.8% of the product while health center and health post had an updated bin card for 32.9% and 32% of their products, respectively (Table 1).

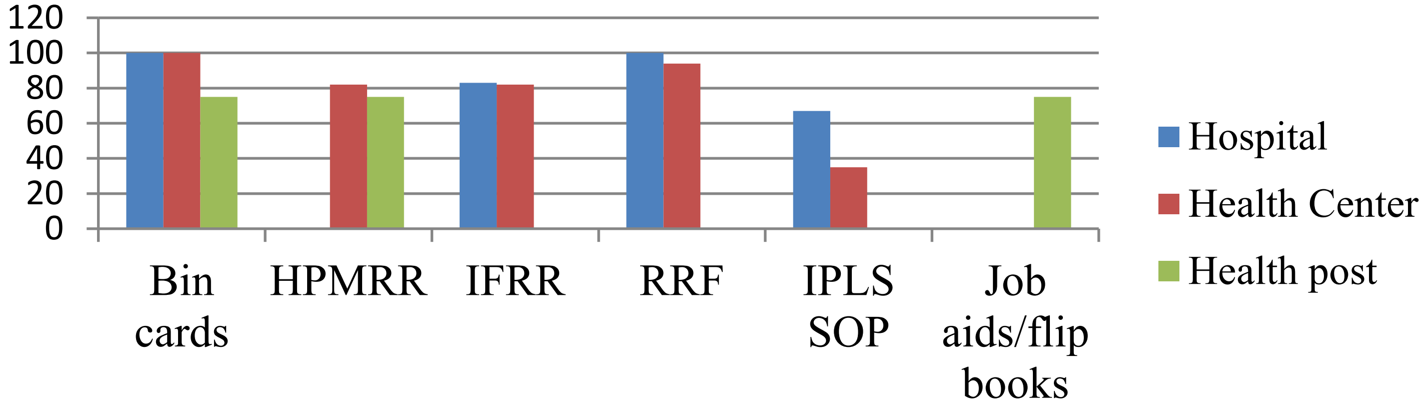

Figure 1: Percentage of facilities with blank logistic recording and reporting formats, SOP and job aids/flip books to manage products by facility types.

Table 1: Percentage of facilities where bin cards are available and updated by product and facility types.

Product	Hospital		Health Center		Health Post	
	Available	Updated	Available	Updated	Available	Updated
Amoxicillin 500 mg /250 mg Capsule	100	83	100	65	NA	NA
Arthmeter + Lumfanthrine – 20 mg + 120 mg tablet (any packing)	100	33	76	6	88	38
Ceftriaxone 1 gm/500 mg injection	100	50	100	29	NA	NA
Ciprofloxacin 500 mg tablet	100	50	100	18	NA	NA
Co-trimoxazole 240 mg /5 ml suspension, 100 ml	100	83	100	29	100	50
Dextrose in normal saline with giving set	100	33	100	35	NA	NA
Gentamycin 80 mg /2 ml ampoule, injection	100	67	100	47	NA	NA
Mebendazole tablet	100	33	100	18	75	50
Oral Rehydration Salt (ORS)	100	67	100	18	75	6
Oxytocin 10units/ ml in 0.5 ml and 1 ml ampoule injection	100	50	94	24	NA	NA
Paracetamol 500 mg tablet	100	50	100	41	NA	NA
RHZE-150 mg /75 mg +400 mg +275 mg -	100	17	100	18	NA	NA
Medroxyprogesterone Acetate 150 mg/ml in 1 ml vial (Depo-Provera) Injection	100	83	94	100	100	50
Ethnogestril 68 mg Implant or Levonorgestrel 75 mg implant	100	17	94	6	75	6
Lamivudine + Zidovudine + Nevirapine (150 mg + 300 mg + 200 mg) tablet	100	50	94	41	NA	NA
Nevirapine 10 mg/ml oral suspension	100	50	94	29	NA	NA
Efavirenz 600 mg capsule	100	100	100	94	NA	NA
Pentavalent vaccine	50	0	0	0	NA	NA
PCV 10 vaccine	33	17	35	6	NA	NA
Ferrous sulphate +Folic acid	83	50	100	88	88	38
Arthmeter injection	17	17	35	18	NA	NA
Giemsa stain 0.76% solution	33	0	35	0	NA	NA
KHB	83	83	94	76	63	25
Acid alcohol 1% solution	50	0	26	6	NA	NA
Blood Lancet	83	33	53	29	63	25
Microscope slide	50	33	35	18	NA	NA
EDTA tubes	83	33	35	29	NA	NA
Average	83.9	43.8	75.4	32.9	70.6	32

Some differences were observed in the levels of accuracy among commodities by facility level. At hospitals, accurate balances ranged from 16% (ceftriaxone) to 83% (ferrous sulphate + folic acid); with an average of 30.3%. At health centers, the lowest accuracy balance was 6% for arthmeter+lumefantrine and implant and the highest (88%) for efavirenz and ferrous sulphate+folic acid. The level of accuracy for health posts averaged 27.8% for the nine products assessed, with the highest for DMPA (63%). However, the result shown an increase for near (within 10%) accuracy. On average, 69.7% of hospitals and 69.5% of health centers had bin cards within 10% accuracy. For health posts, the average was 72.2% (Table 2).

The study result indicated that from 6 hospitals and 17 health

Table 2: Percentage of health facilities that had accurate or near accurate balance bin cards entries by product and facility types.

Product	Hospital		Health Center		Health Post	
	Accurate Balance	Near Accurate (+/-10%)	Accurate Balance	Near Accurate (+/-10%)	Accurate Balance	Near Accurate (+/-10%)
Amoxicillin 500 mg /250 mg Capsule	33	67	65	35	NA	NA
Arthmeter + Lumfanthrine – 20 mg + 120 mg tablet (any packing)	33	67	6	94	38	62
Ceftriaxone 1 gm/500 mg injection	16	84	29	71	NA	NA
Ciprofloxacin 500 mg tablet	50	50	18	82	NA	NA
Co-trimoxazole 240 mg /5 ml suspension,	67	33	29	71	50	50
Dextrose in normal saline with giving set	17	83	35	65	NA	NA
Gentamycin 80 mg /2 ml ampoule, injection	50	50	53	47	NA	NA
Mebendazole tablet	50	50	24	76	50	50
Oral Rehydration Salt (ORS)	33	67	18	82	12	88
Oxytocin 10 units/ ml in 0.5 ml and 1 ml ampoule injection	17	83	24	76	NA	NA
Paracetamol 500 mg tablet	33	67	41	59	NA	NA
RHZE-150 mg /75 mg +400 mg +275 mg -tab	17	83	18	82	NA	NA
Medroxyprogesterone Acetate 150 mg/ml in 1 ml vial (Depo-Provera) Injection	50	50	47	53	63	47
Ethnogestril 68 mg Implant (Implanon) or Levonorgestrel 75 mg implant (Jadelle)	17	83	6	94	12	88
Lamivudine + Zidovudine + Nevirapine (150 mg + 300 mg + 200 mg) tablet	0	100	41	59	NA	NA
Nevirapine 10 mg/ml oral suspension	50	50	29	71	NA	NA
Efavirenz 600 mg capsule	67	33	88	12	NA	NA
Pentavalent vaccine	0	100	0	100	NA	NA
PCV 10 vaccine	0	100	6	94	NA	NA
Ferrous sulphate +Folic acid	83	17	88	12	38	62
Arthmeter injection	17	83	18	82	NA	NA
Giemsa stain 0.76% solution	0	100	0	100	NA	NA
KHB	50	50	76	24	0	100
Acid alcohol 1% solution	33	67	6	94	NA	NA
Blood Lancet	17	83	29	71	0	100
Microscope slide	17	83	12	88	NA	NA
EDTA tubes	0	100	18	82	NA	NA
Average	30.3	69.7	30.5	69.5	27.8	72.2

Accurate=no discrepancy between the bin card and the physical count; Near to accurate=having less than a 10% discrepancy between the bin card and the physical count; NA - Products are not assessed at the health post level

centers, the percentage of facilities utilizing IFRR in at least one DU was 5(83%) in hospital and 14(82%) in health center. Among facilities utilizing IFRR in their DUS, When the data was further analyzed to measure the use of IFRR in at least 80% (four out of five) of the major DUs —OPD, ART, MCH, Lab and TB— the percentage shows similar among hospitals DUs (83% for OPD, ART, Lab and TB respectively) except 67% for MCH. But there was a variation and decline in use of IFRR in health center DUs (76% for ART, 65% for TB, 59% for MCH, 47% for LAB and 41% for OPD). The result of the study shows that, among facilities reported using IFRR at least in one DU, 5(83%) of hospitals and 14(76%) of health centers have a resupply schedule posted and 3(50%) of hospital and 6(35%) of health center strictly follow the schedule for resupply.

The percentage of facilities utilizing RRF for report and request to nearby PFSA hub were 100% for hospitals and health centers. Only 75% of the health posts assessed used HPMRR to report and request to the supplying health center. The study result indicated that among facilities sent their report to the next higher level, 83% of hospitals, 35% of health centers and 38% of health post were received feedback that includes LMIS/Drug management related feedback such as stock transfer facilitated, stock status of priority products (vital pharmaceuticals), number of stock outs, reporting rate, consumptions trend, errors of reporting, performance measurement compared to other facilities in their area (Supplementary Table 1).

The study result indicated, the completeness of RRF were vary by type of facility and programs. The levels of completeness of RRF report at hospitals were 100% for ART, 83% for OI, 67% for TB and FP. While in health centers, the completeness of RRF report were 94% for TB, 88% for family planning, 82% for ART, and 76% for OI. The use of RRF for malaria products was low both at hospitals (50%) and health centers (53%).

At hospitals level, the exact accuracy of RRF data was between 17%

and 67% for most of the products; with the average of 45.6%. At health center level, the exact accuracy of RRF data was between 18% and 65% for most of the products; with the average of 37.1%. A relatively better percentage of exact accuracy (67%) was recorded for amoxacillin and efavirenz at hospitals, and 65% for gentamycin at health center. However, on average the result is almost increased (52.4% for hospitals and 69.2% for health centers) when the calculation is adjusted to near accurate—within 10% accuracy (to account for logical rounding to minimum unit of issue pack size at PFSA) (Table 3).

Transport and distribution: The study result found that in most health facilities 75% of the hospitals and 68% of health centers program commodities are usually delivered to their stores via delivery from a higher level, while the majority of the health posts (72%) usually collect their products from the supplying health center. As expected, in the case of RDF commodities, facilities themselves (95% of hospitals and 80% of health centers) collect from the suppliers primarily from PFSA (Supplementary Figure 1).

The study also assessed means of transportation used by facilities that collect their products. Facility vehicles were reported to be the primary means of transport in 83% of hospitals; while 17% of hospitals used private vehicle. Health centers reported using private vehicle (41%), woreda health office vehicle (23%) and/or facility vehicle (6%) to collect products (Supplementary Figure 2).

The study also assessed problems/constraints regarding regular transportation of medicines and supplies by facility types. Hospitals reported inadequate facility vehicle (50%), high transportation cost of private vehicles (33%), and insecurity (17%) as constraints. Health centers reported inadequate facility vehicle (82%), high transportation cost of private vehicles (14%), and long distance from the source supply (4%) as problem of transportation. Health posts reported high transportation cost of private vehicles (38%), Long distance from the source supply (25%), and difficulty of land topography (13%), seasonality (12%), and poor state of roads (12%) were a problem of transportation.

Supervision and training on logistics management: The result of the study revealed that most facilities were receiving support from higher levels through supportive supervision. Among those facilities 33%, 37% and 24% percent of hospitals, health centers and health posts were reported receiving of supportive supervision within the last three months. Health facilities received supervision visit in the previous month were 76% in health centers, 67% in hospitals, and 63% in health posts.

The focus of the visits were also addressed an important element and a useful indicator in assessing system management. Of the facilities that had received a visit, all of the hospitals (100%) and health centers (100%) indicated that the supervision included store management or logistics issues. At the health post level, among those received supervision, only 38% of them reported the supervision included logistics related issues. The study result revealed that all of pharmacy personnel and HEWs managing products had received training on how to calculate the order quantities. Among all facilities assessed, 83% of hospitals and 88% of health centers pharmacy personnel received their training through the national IPLS training program (Supplementary Figure 3).

Stock status information within the system

Overall, the majority of the health facilities had most of the essential pharmaceuticals in stock on the day of the visit: average availability for the basket of commodities were 93% for hospitals, 87% for health centers, and 70% for health posts. There was very little variance between types of facilities across all essential pharmaceuticals assessed. At health posts, availability were generally

Table 3: Percentage of health facilities that had accurate or near accurate balance RRF data by product and facility types.

Product	Hospital		Health center	
	Accurate Balance	Near Accurate (+/-10%)	Accurate Balance	Near Accurate (+/-10%)
Amoxicillin 500 mg /250 mg Capsule	67	33	53	47
Arthmeter + Lumfanthrine – 20 mg + 120 mg tablet	17	83	29	71
Ceftriaxone 1 gm/500 mg injection	50	50	47	53
Ciprofloxacin 500 mg tablet	50	50	35	65
Co-trimoxazole 240 mg /5 ml suspension, 100 ml	50	50	41	59
Dextrose in normal saline with giving set	50	50	18	82
Gentamycin 80 mg /2 ml ampoule, injection	50	50	65	35
Mebendazole tablet	33	67	29	71
Oral Rehydration Salt (ORS)	50	50	47	53
Paracetamol 500 mg tablet	17	83	47	53
RHZE-150 mg /75 mg +400 mg +275 mg -tablet	33	67	35	65
Medroxyprogesterone Acetate 150 mg/ml in 1 ml vial (Depo-Provera) Injection with 1 ml syringe and needle	33	67	18	82
Lamivudine + Zidovudine + Nevirapine (150 mg + 300 mg + 200 mg) tablet	67	33	35	65
Nevirapine 10 mg/ml oral suspension	50	50	29	71
Efavirenz 600 mg capsule	67	33	29	71
Average	45.6	54.4	37.1	62.9

Accurate= stock on hand reported in the RRF equals to stock on hand on the bin card on the date that the RRF report was completed. Near accurate= having less than a 10 percent discrepancy between stock on hand reported in the RRF and stock on hand on the bin card on the date that the RRF report was completed.

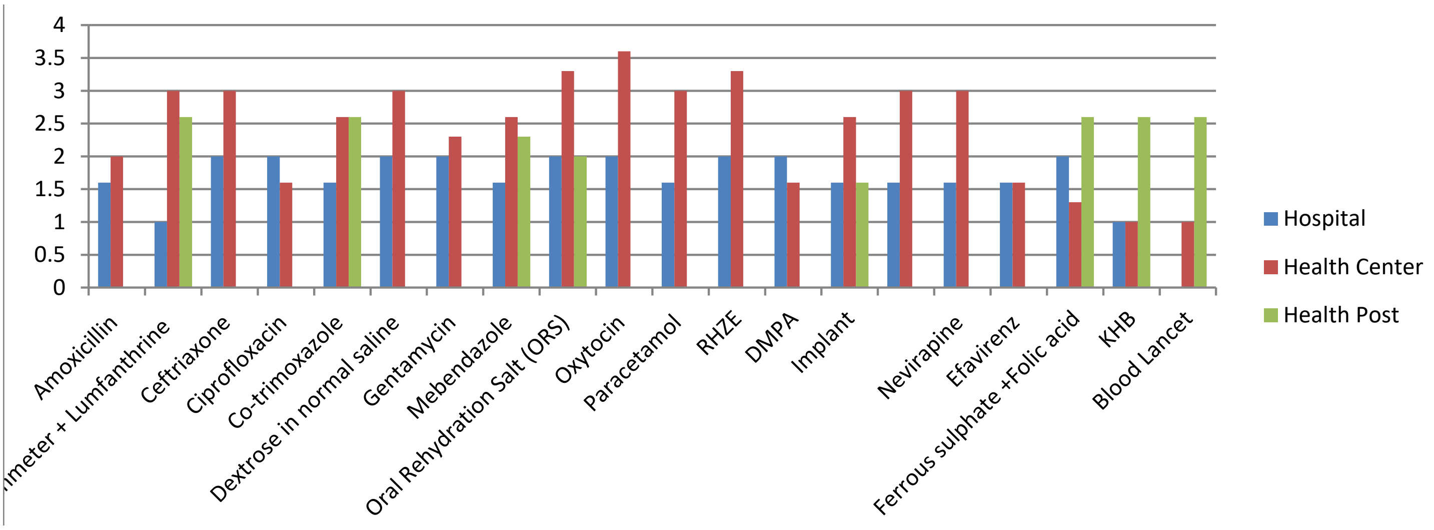

Figure 2: Frequency of stock outs within the last six months prior to the survey by facility type.

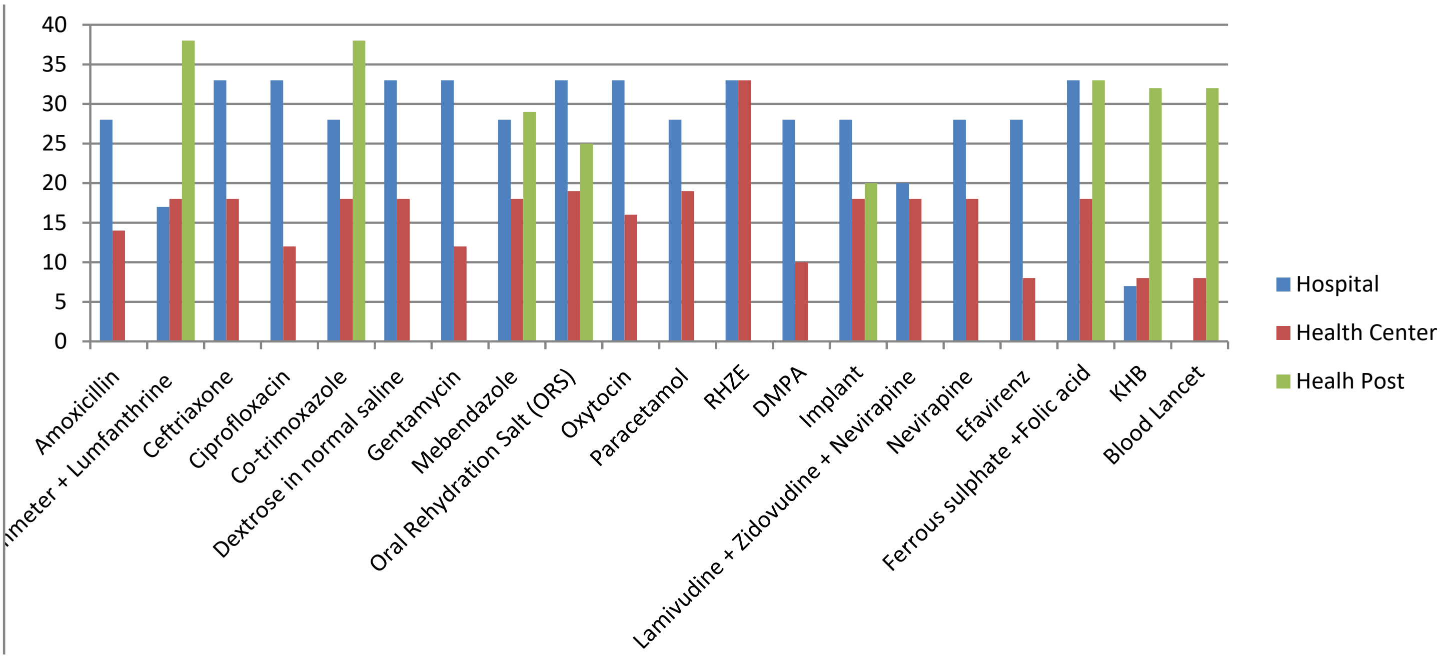

Figure 3: Duration of stock outs within the last six months prior to the survey by facility type.

lower (Table 4).

Average availability for the basket of items during six months was 86% for hospitals, 85% for health centers, and 65% for health posts. During the last six months, Lamivudine + Zidovudine + Nevirapine, Efavirenz, blood lancet, microscopic slide, and EDTA tubes were the most available products at the hospitals and health centers. Stock outs for artemether + lumfanthrine, oxytocin,and arthmeter injection were relatively high compared to other products (Table 5).

The study assessed facilities that had a stock out of a product at least once in the six months prior to the study. Across all levels of the facility, the frequency of stock out was similar for most of the products: approximately 0.5 times. Stock outs of oxytocin in health centers and ferrous sulphate + folic acid in health posts were more frequent: they occurred, on average, 3.5 and 2.5 times, respectively (Figure 2).

The average duration of stock outs varied widely across facility type and product. At hospital, the duration of stock out ranges from 7days for KHB and 33days for most of the products; while at health centers duration of stock out range from 8 days for blood lancet and 33 days for RHZE. At health posts, duration of stock outs was longer than health centers or hospitals. The duration of stock out ranges from 20 days for implant and 38 days for arthmeter+lumefantrine at health posts (Figure 3).

Most facilities were not stocked according to the recommended two to four months of stock. The percentage of facilities stocked correctly ranges between 4% for oxytocin and 96% for mebendazole. In almost all products assessed, overstocking (ranges between 9% for gentamycin and 57% for Lamivudine + Zidovudine + Nevirapine) were more likely than under stocking (ranges between 13% for KHB and 52% for ORS) (Figure 4).

The six conditions met most often by facilities of all levels were logically arranged, unwanted items separated, FEFO, protection from sun light, keeping the storage area locked, and free from harmful insects and rodents; while the least satisfied were labels & dates visible, and sufficient space. products are stored in good conditions—clean, no trash, sturdy shelves, and boxes well-

Table 4: Availability of Essential pharmaceuticals on day of visit by facility type.

Product	Hospital	Health Center	Health Post
Amoxicillin 500 mg /250 mg Capsule	100	100	NA
Arthmeter + Lumfanthrine – 20 mg + 120 mg	83	71	63
Ceftriaxone 1 gm/500 mg injection	100	71	NA
Ciprofloxacin 500 mg tablet	100	94	NA
Co-trimoxazole 240 mg /5 ml suspension, 100 ml	100	94	75
Dextrose in normal saline with giving set	100	88	NA
Gentamycin 80 mg /2 ml ampoule, injection	100	100	NA
Mebendazole tablet	83	100	63
Oral Rehydration Salt (ORS)	83	76	88
Oxytocin 10 units/ ml in 0.5 ml and 1 ml ampoule	50	71	NA
Paracetamol 500 mg tablet	100	94	NA
RHZE-150 mg /75 mg +400 mg +275 mg -tablet	83	88	NA
Medroxyprogesterone Acetate 150 mg/ml in 1 ml vial (Depo-Provera) Injection with 1 ml syringe	100	100	100
Ethnogestril 68 mg Implant (Implanon) or Levonorgestrel 75 mg implant(Jadelle)	100	88	88
Lamivudine + Zidovudine + Nevirapine (150 mg + 300 mg + 200 mg) tablet	100	88	NA
Nevirapine 10 mg/ml oral suspension	100	94	NA
Efavirenz 600 mg capsule	100	100	NA
Pentavalent vaccine	100	94	NA
PCV 10 vaccine	100	94	NA
Ferrous sulphate +Folic acid	33	35	25
Arthmeter injection	100	71	NA
Giemsa stain 0.76% solution	100	100	NA
KHB	100	88	50
Acid alcohol 1% solution	100	88	NA
Blood Lancet	100	94	75
Microscope slide	100	88	NA
EDTA tubes	100	82	NA
Average	93	87	70

Table 5: Availability of essential pharmaceuticals in six months prior to the survey by facility type.

Product	Hospital	Health Center	Health Post
Amoxicillin 500 mg /250 mg Capsule	83	94	NA
Arthmeter + Lumfanthrine – 20 mg + 120 mg tablet (any packing)	83	35	75
Ceftriaxone 1gm/500 mg injection	83	94	NA
Ciprofloxacin 500 mg tablet	100	88	NA
Co-trimoxazole 240 mg /5 ml suspension, 100 ml	83	82	50
Dextrose in normal saline with giving set	100	76	NA
Gentamycin 80 mg /2 ml ampoule, injection	83	71	NA
Mebendazole tablet	83	100	63
Oral Rehydration Salt (ORS)	100	82	75
Oxytocin 10units/ ml in 0.5 ml and 1 ml ampoule	67	65	NA
Paracetamol 500 mg tablet	83	100	NA
RHZE-150 mg /75 mg +400 mg +275 mg -tablet	100	94	NA
Medroxyprogesterone Acetate 150 mg/ml in 1 ml vial (Depo-Provera) Injection	83	100	100
Ethnogestril 68 mg Implant or Levonorgestrel 75 mg implant	83	100	63
Lamivudine + Zidovudine + Nevirapine (150 mg + 300 mg + 200 mg) tablet	100	100	NA
Nevirapine 10 mg/ml oral suspension	100	94	NA
Efavirenz 600 mg capsule	100	100	NA
Pentavalent vaccine	100	94	NA
PCV 10 vaccine	100	94	NA
Ferrous sulphate +Folic acid	83	76	50

Arthmeter injection	17	18	NA
Giemsa stain 0.76% solution	67	100	NA
KHB	83	76	50
Acid alcohol 1% solution	67	100	NA
Blood Lancet	100	100	63
Microscope slide	100	100	NA
EDTA tubes	100	100	NA
Average	86	85	65

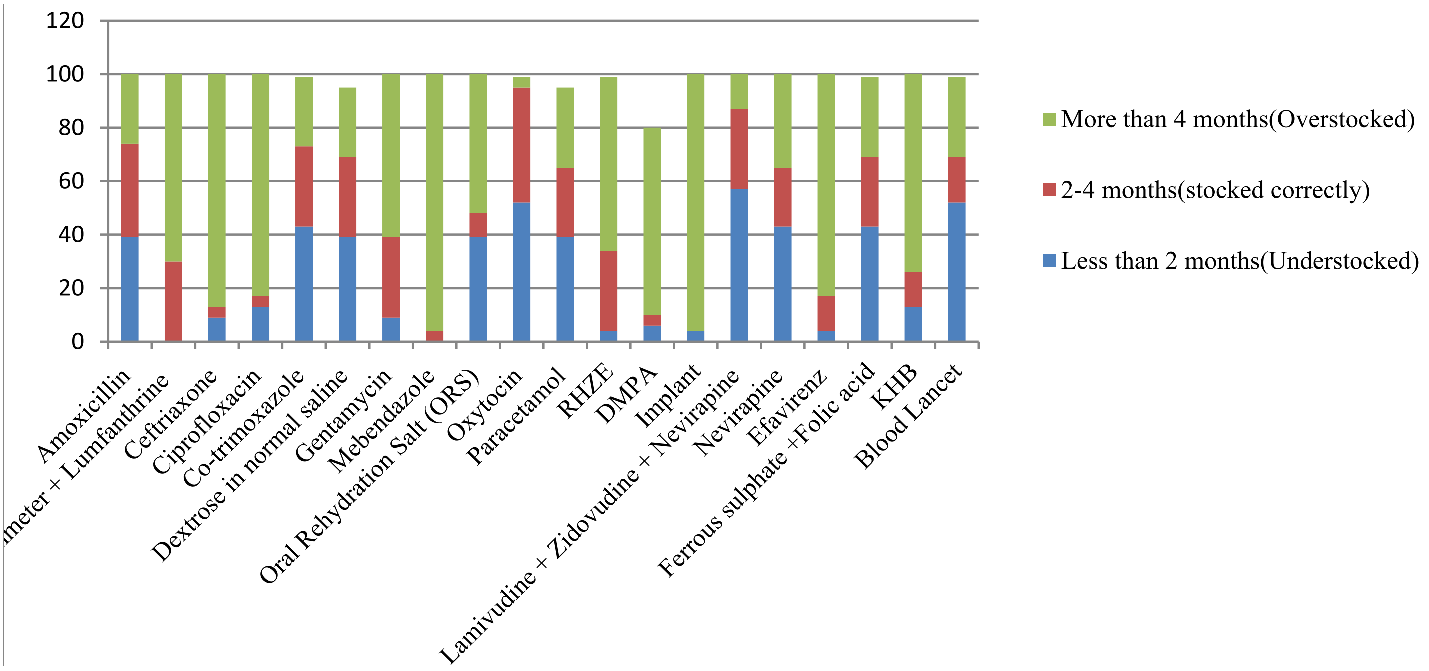

Figure 4: Essential medicine stock on hand on the day of the visit by product.

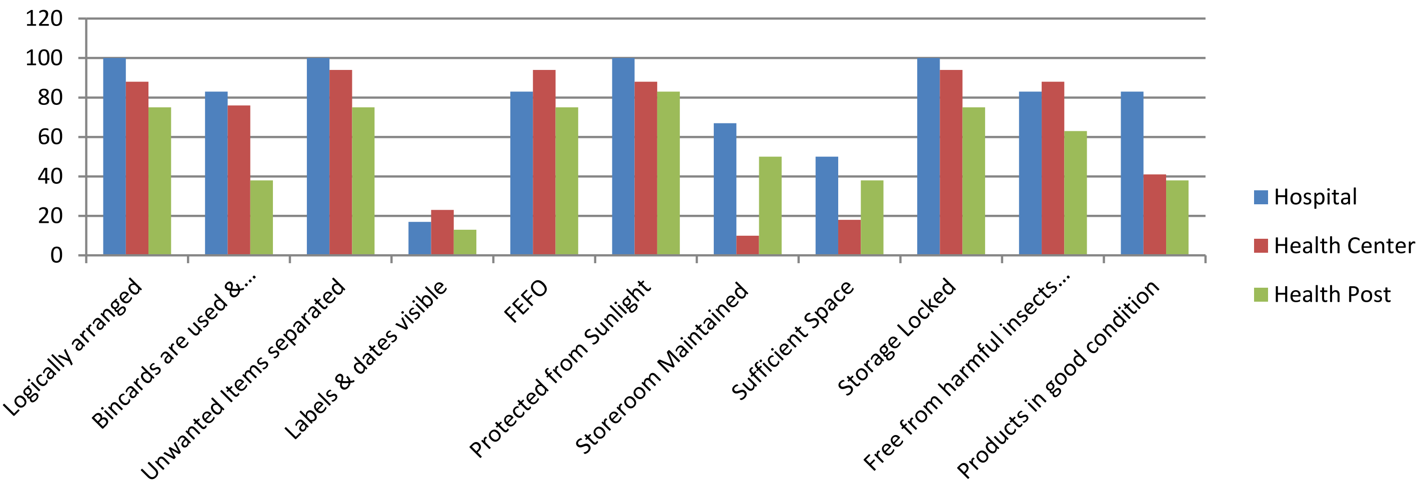

Figure 5: Percentage of facilities meeting specific acceptable storage conditions by facility type.

organized—and storeroom maintained were least satisfied by health centers and health posts. In almost all cases, health posts scored the poorest for storage conditions, followed by health center (Figure 5).

Logistic system performance within the system

The result shown that, regardless of the type of product, 50% of hospitals and 47% health centers say they usually receive products requested within one month or less time from PFSA. About 33% of hospital and 29% health centers receive products requested within two weeks or less time. Only 24% of the health centers and 17% of hospital reported waiting for one to two months to receive products after placing orders. Majority of the health post (88%) receive products requested within two weeks or less time, while 12% of health post receive products requested within one month or less time from supplying health center.

However, the perceived order fill rate for program products found to be high compared to RDF products was found to be low. For program commodities, on average 78% of facilities; with highest percentage of hospital (83%) reported usually receiving the quantity they ordered. The rate for RDF products is even lower; with less than 33% of hospitals and 35% of health centers reporting receiving the quantity requested. The study result from the facility respondent interview reported on average reasons for not having perceived order fill rate were: the resupply point does not have adequate supply (47%), the resupply point was stocked out (29%), Order amount changed at the resupply point (24%).

For most products assessed, the percentage of facilities resupplied with the quantity ordered was above 40%, both at the hospital- and health center–level. At the health center,Amoxacillin, ORS, DEMPA,and Lamvudine+zidovudine+ nevirapine were resupplied in more than 60% of facilities. At hospitals, four products (mebendazole, DEMPA, lamvudine+ zidovudine + nevirapine, and nevirapine) out the 15 products analyzed were resupplied in about 80% of the facilities. At both the hospitals and health centers, the resupply with the requested quantities was low for ceftriaxone (17% at hospitals and 24% at health centers) and Arthemeter+lumfantrine (33% at hospitals and 29% at health centers) (Supplementary Figure 4).

The study result from an interview with facility personnel indicated that of the facilities placed at least one emergency order in the three months preceding the assessment; 76% of health centers, 50% of health posts, and 17% of health posts placed emergency order one times. The percentage of facilities that had placed emergency order two times were 38% in health post, 33% in hospitals, and 12% in health center. Only 6% of health centers placed an emergency order three times. Of those facilities who placed emergency orders in the three months prior to the survey, on average 17% of facilities used letters, while 53% of health center, 50% of hospital and 13% of health posts used the standard RRF/HPMRR format. In addition to that 31.7% of facilities also placed an order over the telephone; while 25% of health post and 12% of health center placed an order by orally.

Challenges of IPLS implementation

The study result from an interview with facility personnel indicated that challenges of IPLS implementation at facility level were categorized into facility management related factors; human resource management for SCM factors, LMIS related factors, and health facility infrastructure related factors. With regard to facility management related factors, majority of the respondents reported that challenges of IPLS implementation were health facility management did not follow up implementation and progress of IPLS; RHBS, ZHD, WoHOs, facility managers did not internalize their roles and responsibility in IPLS; the finance section of the facility did not recognize IFRR as previous good requisition voucher (model 19); and IPLS is not integrated in to facility Key performance indicators.

A number of respondents reported that challenges of IPLS implementation with regard to human resource management for SCM related factors were: lack of commitment by pharmacy professionals and DUs heads resistance to fill IFRR, as IPLS is not incorporated in to performance measurement of pharmacy professionals and other professionals in charge of IPLS; Inadequate pharmacy man power especially at health center level; IPLS was too much work for facility staff, and was too much paper work; IPLS trained staff turnover; lack of data clerk at pharmacy store; lack of incentives for store managers, and other professionals considers IPLS as only a job description of pharmacy.

Some of the respondents reported that challenges of IPLS implementation with regard to LMIS related factors were: lack of formal IPLS training for HEWs and other professionals in charge of IPLS; lack of TOT for pharmacy heads and store managers to give IPLS orientation/on job training for other staff; duration of IPLS training(usually 3days) was not enough to learn applied IPLS knowledge and lack of an updated IPLS trainings; Resistance to make and update bin cards at DUs and store; unavailability of IPLS format especially at health post; non -compliance of DUs to their re-supply schedule; and DUs were not interested to fill bin cards and IFRR.

The respondents also reported those challenges of IPLS implementation with regards to health facility infrastructures were insufficient storage space and poor health facility infrastructure; unavailability of fax, internet to send LMIS report to next higher level on timely; inadequate transportation and difficulty of state of roads to deliver HPMRR to health center on timely.

Among 17 health center, 6 hospitals and 8 health post assessed; the result of the study indicated 94% of health center, 67% of hospitals, and 75% of health posts of facilities management were not incorporate IPLS in to performance measurement of pharmacy staff and other professionals in charge of IPLS, and were not follow up the implementation and progress of IPLS/Pharmaceuticals are managed by pharmacy professionals in all of the hospitals (100%) and health centers (76%). Only 24% of health center manage pharmaceuticals by nurses (Supplementary Table 2).

Among 6 hospitals, 17 health center and 8 health post assessed the study result shown that the availability health facility infrastructures decreases as moves down the level of health facilities; with poorest health facility infrastructure at health post level. All of the facilities had functional waste disposal equipment. At health centers, there was lower proportion of availability of functional facility vehicle (18%), functional emergency generator (47%) than hospitals (100%). Only 71% of health centers had operational water in the building on a day of visit (Supplementary Figure 5).

In addition to the whole health facility infrastructure, the study was also assessed health facility pharmacy infrastructure. About 33% of hospital and 18% of health center had functional fire extinguisher; while 33% of hospital and 24% of health center had functional temperature control system in their pharmacy store. The percentage of functional refrigeration system at health center was only 24%, which was critical problem for cold supply chain at this level of facility. All most all facilities did not have internet access; with lower percentage of operational computer in the health center pharmacy store (35%) while 59% of health center had adequate shelves and pallets.

Predictors for IPLS Implementation

Multiple linear regression were used at 90% confidence interval ($p<0.1$) to identify predictors for progress and challenges of IPLS Implementation. The dependent variable used was IPLS implementation. The independent variables: order fill rate, LMIS, stock status, storage conditions, availability of tracer medicines, and health facility store infrastructure were statistically significant ($p<0.1$), predictors that are associated with IPLS implementation.

Correlation analysis was used to identify the interdependence among independent variables, and the association between the dependent variable and the independent variables.

Correlation/Interdependence among independent variables: As it can be seen from Table 6 below the interdependence of order fill rate, LMIS, stock status, storage conditions, availability of tracer medicines and health facility store infrastructure has been stated well. As such, LMIS has been shown to have positive interdependence with order fill rate with a coefficient of 0.217, showing LMIS had a positive in put in the improvement of order fill rate by 21.7%.

Stock status has been shown a positive interdependence with order fill rate (33.7%), and LMIS (44.5%). Storage conditions had a positive interdependence with order fill rate (7.1%), LMIS (71.1%), and stock status (26.5%). Availability of tracer medicines had a positive interdependence with order fill rate (13.4%), LMIS (31.8%), and stock status (99.3%). Finally health facility stores infrastructures has been shown a positive interdependence with order fill rate (7.7%), LMIS(44.1%), stock status(57.6%), storage condition(27.1%), and availability of tracer medicines(60.3%) (Table 6).

Correlation between the dependent variable and independent variables: There was weak association between IPLS Implementation and the independent variables; such as Order fill rate (p=.056), LMIS (p=.022), stock status (p=.049), storage conditions (p=.082), availability of tracer medicines (p=.013), and Health facility stores infrastructures (p=0.076) but, they are significant predictors for the dependent variable. IPLS implementation was associated with: health facility stores infrastructures (40.1%), LMIS (32.2%), stock availability and status (31.9%), storage condition (17.7%), and order fill rate (14.1%) (Table 7).

Multiple linear regressions between the dependent variable and independent variables

The result of the study indicated that, health facilities which had implement IPLS were 8.5% more likely to have order fill rate than those had not implement IPLS. Health facilities had logistics records and formats (LMIS) available were 64.8% more likely to implement IPLS than those had no logistics records and formats. On the other hand, health facilities with IPLS implemented had 17.3% more likely proper stock status than those had not implement IPLS. With regard to tracer medicines availability, Health facilities which had adequate tracer medicines and supplies were 21.2% more likely to implement IPLS than those had no availability of tracer medicines (Table 8).

With regard to storage conditions, health facilities which had acceptable storage conditions were 3.4% more likely to implement IPLS than those had no acceptable storage conditions. Health facilities with IPLS implemented had 12.9% more health facility store infrastructure than those had not IPLS. Multivariable regression revealed the LMIS (std. β=2.539, p=0.022), stock status (std. β=0.848, p=0.049) and availability of tracer medicines (std. β=0.212, p=0.013) were positively associated with IPLS implementation (Table 9).

Table 6: Correlation matrix showing the interdependence of order fill rate, LMIS, stock status, storage conditions, availability of tracer medicines, and health facility store infrastructure.

Variables	Order fill rate	LMIS	Stock status	Storage conditions	Availability of tracer medicines	Health facility stores infrastructures
Order fill rate	1.000					
LMIS	0.217	1.000				
Stock status	0.337	0.445	1.000			
Storage conditions	0.071	0.711	0.265	1.000		
Availability of tracer medicines	0.134	0.318	0.993	0.195	1.000	
Health facility stores infrastructures	0.077	0.441	0.576	0.271	0.603	1.000

Table 7: Correlation between the IPLS implementation and the independent variables.

Variables	IPLS Implementation	Order fill rate	LMIS	Stock status	Storage conditions	Availability of tracer medicines	Health facility stores infrastructures	P-Value at 90CI
Order fill rate	0.141	1						0.056
LMIS	0.322		1					0.022
Stock status	0.319			1				0.049
Storage conditions	0.177				1			0.082
Availability of tracer medicines	0.319					1		0.013
Health facility stores infrastructure	0.401						1	0.076

Table 8: Model summary of multiple linear regressions between the dependent variable and independent variables.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.794[a]	0.631	0.492	0.08326

a. Predictors: (Constant), Health Facility store infrastructure, order fill rate, availability of tracer medicines, storage condition, stock status, LMIS

R=0.794 Degree of association between the overall independent variables and the dependent one. Adjusted R square=0.492, the overall independent variables on the dependent one.

Table 9: Multiple linear regression between the dependent variable and independent variables at 90%CI.

Model		Unstandardized Coefficients β	Unstandardized Coefficients Std. Error	Standardized Coefficients β	t	Sig.
1	(Constant)	1.304	0.790		1.650	0.018
	Order fill rate	0.070	0.155	0.085	0.454	0.056
	LMIS	0.679	0.267	0.648	2.539	0.022
	Stock status	0.624	0.735	0.173	0.848	0.049
	Storage condition	0.027	0.182	0.034	0.151	0.082
	Availability of Tracer medicines	0.782	0.603	0.212	1.296	0.013
	Health Facility store Infrastructure	0.042	0.058	0.129	0.730	0.076

a. Dependent Variable: IPLS Implementation at a significance level of 90%

DISCUSSION

Since there were no studies done in the areas of IPLS, comparison could only be made for a few variables. Limited comparison was also made with other related studies when indicators are believed to have been collected in similar manner. The assessment result indicated that availability of blank bin cards, IFRR and RRF is high at hospitals (close to 100%) and health centers (at least 80%). However, availability of the recording and reporting formats decline as you move down the supply chain. Clearly more has to be done to improve availability of formats: all facilities should have a plentiful supply of these, while the situation at health posts is of particular concern. A similar study done in Dominican Republic, and other countries on pharmaceutical logistics system assessment using LIAT found that the availability of blank logistics recording and reporting in health facilities was only 39% [18,19]. The IPLS 2015 assessment result shown at different levels of facilities on average an increase from 39% to 90% of health facilities had logistics forms.

The utilization of RRF was high (about 100%) in hospitals and health centers. Only 75% of the health posts assessed used HPMRR to request commodities from the resupplying health center every month; which could also be attributed to the low level of format availability and the limited support they received. An assessment of the integrated logistics management information system in Malawi in 2013 found that the reporting rate from service delivery points was only 58% of health facilities reported their LMIS data for the month [20,21]. The result of the 2015 IPLS assessment indicated a better reporting rate, which was 100% for hospitals and health centers, and 75% for health posts.

The study, in addition to checking the use and updating of bin cards, was also used to assess the quality of data by cross-checking the accuracy of the bin card balance with the physical count for each of the selected products on the day of the visit. On average for the selected products, accurate balances on bin cards were 30.3% for hospitals, 30.5% for health centers, and 27.8% for health posts. However, the data show a significant increase for near (within 10%) accuracy. On average, nearly 69% of hospitals and health centers had bin cards within 10% accuracy. For health posts, the average was about 72% [22]. The IPLS 2015 assessment result shown at different levels of facilities on average an increase from 27% to 30.3% of health facilities had accurate logistics on bin cards compared to south Sudan Pharmaceutical logistics system LIAT 2011 survey.

The study result found that in most health facilities (75% of the hospitals and 68% of health centers) program commodities are usually delivered to their stores via delivery from a higher level, while the majority health posts (72%) usually collect their products from the supplying health center. As expected, in the case of RDF commodities, facilities themselves (95% of hospitals and 80% of health centers) collect from the suppliers primarily from PFSA compared to south Sudan LIAT 2011 survey, the IPLS 2015 assessment result shown at different levels of facilities on average an increase from 54% to 75% of program pharmaceuticals are delivered to health facilities store [22].

In facilities that had a stock out of a product at least once in the six months prior to the study, the study assessed the number of times a stock out occurred. Across all levels of the facility, the frequency of stock out was similar for most of the products: approximately 0.5 times. Compared to south Sudan LIAT 2011 survey, the IPLS 2015 assessment result shown at different levels of facilities an average decrease from 89% to 83% of facilities had all tracer medicines in stock on a day of visit, from 27% to 17% of health facilities experienced stock outs at the time of the visit compared to 2011 LIAT assessment [22].

An assessment of the pharmaceutical sector in Ethiopia by the FMOH/WHO in October 2010 found that, the national average for availability of key essential drugs in public health facilities was 70%, average stock out durations in public health facilities were 99.2 days. But, the 2015 IPLS result found that on average an increase of product availability from 70% to 83% at health facilities and a decrease of average stock out duration in health facilities [13].

According to the result presented, most facilities were not stocked according to the recommended two to four months of stock. In almost all products assessed, overstocking is more likely than under stocking. A similar study on assessment of HEAL-TB/RHB in 2012 to Determine the Effect of IPLS on TB Drug Supply Management in reducing TB stock outs in 687 public health facilities of Ethiopia's Amhara and Oromia Regions found that IPLS implemented in 229 health facilities (33% of the HEAL TB-supported facilities) in Ethiopia, Facilities not using IPLS had TB drug stock out rate of 23%, facilities using IPLS had TB drug stock out rate of just 17%, Facilities not using IPLS had a 1.5 times higher TB drug stock out rate than health facilities using IPLS [23-26].

To consider bin cards up-to-date, they had to be updated within the previous 30 days. In addition, if the bin card was last updated with the balance of zero and the facility has not received any of those products since the date of that entry, it is also considered updated. Although a higher percentage of hospitals and health centers utilized bin cards for the assessed products, the percentage of updated bin cards was found to be similar and low across all health facility levels. Similarly, a study done on assessment of laboratory LMIS practice for HIV/AIDS and tuberculosis laboratory commodities in selected 43 public health facilities in Addis Ababa in 2013 found that 50% of the assessed hospitals and 54% of health centers were using bin cards for all HIV/AIDS and TB laboratory commodities in main pharmacy store. Among these only 25% and 20.8% of them were updated with accurate information matching with the physical count done at the time of visit for hospitals and health centers respectively [27].

Supervision helps to improve individual and system performance and can alert managers to potential problems at the facility level such as stock outs, under stocks and overstocks, poor storage conditions, and products near their expiry dates. Building the capacity of health facility staff has been a major focus of PFSA and its partners in IPLS implementation. Among all facilities assessed, more than 83% of hospitals and 88% of health centers pharmacy personnel received their training through the national IPLS training program, while 75% of HEWs working at the health posts reported received on the job training. Only 25% of HEWs reported receiving formal training on logistics. Compared to south Sudan LIAT 2011 survey, the IPLS 2015 assessment result shown at different levels of facilities on average an increase from 17% to 82% of health facilities had staff with trained to use logistics forms [22]. A study in 43 health facilities in Addis Ababa, 2013, from a total of 114 professionals involved in laboratory commodity management, 71 (62.3%) were trained in logistics management information system (integrated pharmaceutical logistics system or Ethiopian laboratory logistics system). of these, 67 (58.8%) were pharmacy professions and 4 (3.5%) were laboratory professionals [27]. The study result of 2015 IPLS assessment in selected health facilities of four Wollega zones indicated a better LMIS training coverage (more than 83% of hospitals and 88% of health centers pharmacy personnel received their training through the national IPLS training program) than previous study

The availability of most products is usually high (between 65% and 95%), although the percentage of stock outs has increased, as compared to data on the day of the visit. Average availability for the basket of items during six months was 86% for hospitals, 85% for health centers, and 65% for health posts. A study done in Ethiopia in 2011 found that, availability on the day of the visit was 75% and 54% for DMPA and Implants respectively. The IPLS 2015 assessment result shows on average an increase of more than 31 percentage points (100% for DMPA and 92% for Implants) compared to 2011 LIAT. The relatively recent FMOH/UNFPA Survey (October 2012) also demonstrated significant reduction in stock out rates; the percentages of facilities with "No Stock Out" at the time of the survey were 96.4% for DMPA and 75.4% for implants [10,28]. Similarly, IPLS 2015 assessment result shown; the percentages of facilities with "No Stock Out" at the time of the survey were 100% for DMPA and 92% for implants

On average, about 68.7% of the facilities met acceptable storage conditions (80% of the criteria or more). Hospital stores (79%) did better than health center (70%). Only 57% of health posts had acceptable storage conditions. Compared to south Sudan LIAT 2011 survey, the IPLS 2015 assessment result shown at different levels of facilities an average increase from 35% to 68.7% of health facilities maintained acceptable storage conditions [22].

The perceived order fill rate the percentage of items that are actually filled according to ordered quantities with the correct products for program products found to be high compared to RDF products was found to be low. For program commodities, at least over 70% of facilities; with highest percentage of hospital (83%) reported usually receiving the quantity they ordered. The rate for RDF products is even lower; with less than 33% of hospitals and 35% of health centers reporting receiving the quantity requested. Compared to south Sudan LIAT 2011 survey and other studies, the IPLS 2015 assessment result shown at different levels of facilities an average increase from 24% to 34% of health facilities received the quantity of RDF medicines ordered [29,30].

The study result from an interview with facility personnel indicated that challenges of IPLS implementation at facility level were categorized into facility management related factors; human resource management for SCM factors, LMIS related factors, and health facility infrastructure related factors. A similar study by Global Pharmacy Workforce 2008 and WHO 2010, indicated that: Issues of insufficient staff numbers, appropriate training, geographical and professional isolation in rural and remote environments, a lack of supervision/contact with supervisors, inadequate professional and personal facilities, pay and conditions, and workload are all significant issues that affect staff satisfaction, turnover, and the ability of staff to complete their job satisfactorily.

LIMITATIONS OF THE STUDY

The focus of this study was the progress and challenges of IPLS implementation and the availability of medicine at health facilities; it did not look at system implementation or availability at the PFSA. The emphasis was on essential medicines for public health—it did not look at the availability of specialty items or items for tertiary care at hospitals: the investigator suggests that these require their own specialized survey. Because a representative survey of supply chain status prior to IPLS implementation was not done, it is difficult to compare current and previous performance. The study attempts to compile data from various sources to provide as much comparative analysis as possible.

CONCLUSION

The study provided valuable information that can help measures the level of IPLS implementation at public-sector health facilities of four Wollega zones. However, in considerable percentage of facilitates, data quality is an issue. The perceived order fill rate for RDF products was found to be low compared to program for most health facilities. Regardless of facility levels, majority of the health facilities have had most of the essential medicines in stock on the day of the visit. However, for the products assessed, availability was lower at the health post level than higher levels of facilities. Across the products and level of facilities, most facilities are not stocked according to the recommended 2-4 months of stock. In almost all products assessed, over stock is higher than under stock causing a concern of wastage and expiry.

The study result from an interview with facility personnel indicated that challenges of IPLS implementation at facility level were categorized into facility management related factors; human resource management for SCM factors, LMIS related factors, and health facility infrastructure related factors. Overall, regardless of facility levels, there have been significant improvements in supply chain indicators and in the availability of essential health commodities since IPLS has been implemented, with some variation by level of facility and product type

Improving Availability of formats, The quality of record keeping needs to improve, More needs to be done for health posts, HEWs and other professionals in charge of IPLS need formal training, IPLS Trainings needs reinforcing/incorporated in to curriculum, Overstocking is a concern, Involvement of all stakeholders is necessary to sustain the system, No standard system for documenting and reporting expiry data from facilities. Pharmacy man powers have to be increased at health facility level, Health facility stores need improvement, Direct distribution is reaching few percent of facilities but needs to reach more, Improving availability of transportation and automated transportation management, Medicine availability is generally good and has improved dramatically, More have to be done to increase perceived order fill rate, Health facility infrastructure needs improvement, Pharmacy store needs expansion/re-innovation, There needs to be more focus on monitoring and evaluation of IPLs including more studies.

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CONSENT TO PUBLISH

Not applicable.

COMPETING INTERESTS

No competing interests exist.

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None.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted after obtaining ethical approval from college of health science, Jimma University. Then based on that official letter of support from Jimma University post graduate co-ordination office was produced and given to the Zonal Health Departments and management of the respective facilities with verbal description of the purpose of the study by principal investigator. Based on their consent the study was commenced. During data collection, each respondent was informed about the purpose, scope and expected outcome of the assessment. All data were anonymous and no individual or facility was identified in any reports or other publications arising from the study.

AUTHORS CONTRIBUTIONS

TA, AJ, and FG involved in design, selection of articles, data extraction. SS and GF participated in statistical analysis and manuscript writing. All authors involved in developing the initial drafts of the manuscript, revising subsequent drafts and prepared the final draft of the manuscript. All authors read and approved the final draft of the manuscript.

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