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Original Article

Assessment of Implementation of Integrated Pharmaceutical Logistics System in Selected Public Hospitals, Hawassa, Ethiopia: The Case of Maternal Health Medicines

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Abstract

Background: Ethiopia started implementing Integrated Pharmaceutical Logistics System since 2009 in its public health facilities in order to solve the existing problems related to accessibility, storage, stock management of pharmaceuticals. However, the current status of implementation of this system and the challenges faced during its implementation in the study area are not well studied. The finding of this study would provide updated information to concerned authorities and stakeholders on the factors affecting effective implementation of this system in selected public hospitals in the study area.

Objective: (a) To assess the logistics management systems of maternal health medicines, and (b) identify the factors that affect supply chain performance of maternal health medicines at selected public hospitals in Hawassa city administration in 2023/2024

Method: A facility based cross-sectional study was conducted in three selected public hospitals in Hawassa city administration. The data were collected using both quantitative and qualitative methods. The quantitative data were analyzed using descriptive statistics, and described in texts and displayed in Tables and Figures. The qualitative data were analyzed thematically and integrated with the quantitative findings.

Results: The study revealed that the overall performance of the maternal health medicine supply chain to be inadequate (31.1%). The key factors associated with the poor performance were associated to low quality of service, poor organizational function, cost/financial gaps, and presence of employees' skill gaps ($p < 0.05$). Qualitative findings further revealed that paper-based Logistics Management Information System faces problems on data quality, timeliness, and consistency issues due to lack of staff training.

Conclusions: This study found that the overall performance of logistic pharmaceutical system on maternal health medicine to be inadequate due to the aforementioned factors. Therefore, a due attention is needed to improve supply and managements of maternal health medicines in the study area.

Keywords: Logistics Management Information System, Maternal Health Medicine, Public Hospitals, Hawassa City, Integrated Pharmaceutical Logistics System.

Introduction

Integrated Pharmaceutical Logistics System (IPLS) is a system that generates information, which is needed to make logistics decisions (1,2). Such decisions include selection, forecasting, procurement, training, re-supply, disposal, supervision, monitoring, and management of pharmaceuticals (3). Literature reports also described IPLS as a system that ensures access to quality, safe, affordable and uninterrupted supply of vital and essential medicines, if it is operated perfectly at different level of supply chain members (2). Its effective implementation of pharmaceutical logistic systems such as IPLS is crucial as they promote patient care by improving accessibility of drugs, and reduce costs of pharmaceuticals and minimize their wastages. The drugs could be the ones that are used to treat human diseases such as HIV, Cancer, malaria, Leprosy, TB and prevent maternal deaths (4-8).

The Federal Ministry of Health (FMOH) of Ethiopia began to use IPLS since 2009 in its health care systems to ensuring the constant availability of affordable, high-quality medications and healthcare supplies in order to reduce maternal deaths that happen due to illnesses most of which are preventable (4,5,9-14). The implementation of IPLS in the country has been mandated to Ethiopian Pharmaceutical Fund and Supply Agency (EPFA). The mandate of EPFA is to be sole

provider of forecasting, procurement, storage and inventory management and distribution of pharmaceuticals to public health sectors of Ethiopia (7). The need to fulfill the six rights of pharmaceutical supply chain management namely the right products in the right quantity, of the right quality, at the right place, at the right time, and for the right cost was the driving force for implementation of IPLS (15). Literature reports from studies conducted in different parts of the country also revealed that improvements in the recording and reporting of Logistic Management Information System (LMIS), storage practices, as well as the availability of essential pharmaceuticals at service delivery points including maternal health medicines after implantation of IPLS (6,10,15).

This study was aimed to assess logistic activities of IPLS at selected public hospitals in Hawassa city administration, Sidama Regional State, Ethiopia focusing on the logistics performance of maternal health medicines. Though there are several literature reports that reveal implementation of IPLS in different parts of the Ethiopia, there no studies conducted on the implementation of this system in health facilities found in the study area. This study was initiated to fill of information the gap about implementation of IPLS on maternal health medicines.

The findings are expected to provide information about the current status of

implementation of IPLS for maternal healthcare and would serve as foundations to develop interventions and recommendations to improve the availability and distribution of essential maternal health medicines in the study area. Ultimately, the findings are expected to enhance maternal healthcare services in Hawassa and in other areas with similar settings.

Methods and Materials

Study Area and Period

The study was conducted in Hawassa, the capital city of the Sidama region located 275 km south of Addis Ababa, Ethiopia. The data were collected from three public hospitals in Hawassa city namely Adare General Hospital, Motite Fura Primary Hospital and Tula Primary Hospital. The data were collected from November 20, 2023 to July 20, 2024.

Study Design

An institutional-based cross-sectional analytic study design was carried out using both quantitative and qualitative research methods.

Source of Population

The source population of this study were Adare General Hospital, Motite Fura Primary Hospital and Tula Primary Hospital; IPLS-related documents and health care professionals of the selected hospitals.

Study Population

The population of the study was health workers in dispensing units, store manager, and pharmacy head of each hospital selected for the study and also IPLS-related documents and bin-cards.

Eligibility Criteria

Inclusion Criteria

The study population consisted of the three selected public hospitals (Adare General Hospital, Motite Fura Primary Hospital and Tula Primary Hospital) in Hawassa city that provide maternal healthcare services, as well as randomly selected professionals involved in the logistics management of maternal health medicines at those facilities who were available during the study period.

Exclusion Criteria

Professionals involved in the logistics management of maternal health commodities with experience less than six months were not included in the study.

Sample Size and Sampling

The selected three public hospitals were found to be eligible for the study. According to the Ethiopian Integrated Pharmaceutical Logistics System (IPLS)(15,16), hospitals are expected to submit a replenishment form reports (RRF) to their respective suppliers every two months, the sample size of logistics records and reports was set by this system. Moreover, the Logistics Indicators Assessment Tool (LIAT) was used to

evaluate the RRF reports for at least six months or roughly three reports from each hospital (1 RRF bimonthly is equivalent to three RRF reports within six months) from each hospital (15-17). The 6-monthly reports (created annually) were included in the research to broaden its applicability. Thus, 18 RRF reports (3 RRF reports from each of the 3 hospitals i.e. $3 \times 6=18$) and 39 bin cards (13 drugs per hospital i.e., $13 \times 3= 39$) were reviewed. Professionals involved in the logistics management of maternal health commodities were also participated in the study.

Study Variables

Dependent Variable

Logistic management of maternal health medicine

Independent Variables

- **Health facility related factors:** Selection, Forecasting, Procurement, LMIS, Inventory management and Budget
- **Capacity related factors:** Capacity in logistics management system, number of staff members, supportive supervision
- **Health system related factors;** National Essential Medicine List (NEML) resupply

Data Collection and Instruments

Data collection instruments were adapted from the existing literature. A pretested structured interview and observation checklist was used to obtain quantitative data. The information on qualitative data were provided by the health

facility's pharmacy director and retail manager provided (Supplementary Material S1). The information on health system, health facility, and capacity-related issues were gathered through structured interviews (Supplementary Material S2). Data on the availability of the maternal health care commodities and the storage conditions were gathered using the observation checklist. Two skilled data collectors were trained for one day about data collection tools, aims of the research and their responsibilities during data collection period. The whole data collection procedures were monitored by the principal investigator.

Data Processing, Analysis, Interpretation and Presentation

The collected data were coded and checked for errors and missing data before analysis. Then the data were entered into Epi-Data software version 3.1 and analyzed using SPSS version 26 software. For the purpose of calculating the frequency count, average, and percentage outputs, a descriptive statistical analysis was utilized. Texts, graphs and texts were used to show the results depending on the type of data. Thematic analysis was used to manually analyze the data for the qualitative investigation. The availability of the commodities was ranked from extremely low to high according to the WHO's availability index (18). While, the national monitoring and evaluation framework was utilized to classify the hospitals in order to

determine the predictors of the availability of the commodities, with the expectation that they would stock > 80 of the commodities. A p-value < 0.05 was considered statistically significant.

Operational Definitions

- **Maternal health commodities:** the 13 drugs deemed by UNCOLSC to be underutilized for maternal health care are Oxytocin, misoprostol, magnesium sulphate, implants, emergency contraception female condoms, prenatal corticosteroids, injectable antibiotics, newborn resuscitation equipment, zinc, oral rehydration salt, and amoxicillin dispersible pills (19).
- **Data accuracy:** When there is no difference between the stock balances on the bin card record (manual or electronic) and the physical count, as well as between the balance on the bin card and the balance on the RRF report, the data was considered accurate; accuracy was good if greater or equal to 80% (6,20).
- **Logistics management:** is what hospitals do to pick, forecast, get, and use the 13 maternal health goods that will save lives.
- **Availability:** the proportion of drug stores where a certain drug was accessible on survey day (point availability) and during the previous six months (period availability). The availability was described using the following ranges as suggested by

WHO < 30% - very low, 30-49% - low, 50-80% - fairly high and > 80% - high (18).

- **Acceptable storage conditions:** Health facility storage condition is said to be acceptable if that facility has fulfilled at least 80% of the criteria for acceptable storage conditions (20).

Ethical Consideration

Ethical approval was obtained from Institutional Research Ethics Review Committee (IRERC) office of Pharma College Hawassa campus (*Ref. No. 03/IRERC/2024*) (*Annex 1*) before commencing the data collections. An official letter from Pharma College of Health Science's Hawassa campus was used to approach the selected medical facilities. The participants were given assurances about the confidentiality of the information gathered throughout the course of the study by not using personal identifiers and analyzing the data in aggregates. The participants were also informed about their full right to withdraw from the study at any step if they wish or not comfortable to participate. Interviewees were assured that the information they provided will only be handled by the research team and will not be disclosed to the health facility administrators or other third parties. The names of the interviewees and the health facility are not included in the data analyses.

Results

Demographic Characteristics Participants

The data were collected from health professionals (Pharmacy heads/Coordinators, Pharmacists in the dispensary units and pharmaceutical store managers) working in the selected public hospitals using structured questionnaire (Supplementary material **S1**) (Table 1). The data revealed that majority of the participants (47, 77.0%) were pharmacists working in dispensary units, 8 (13.1%) of them were Pharmacy heads/coordinators and the rest 6 (9.8%)

were store managers (Table 1). With regard to service year/work experience, 35 (57.4%) participants had work experience of 1-5 years. The rest participants, 18 (29.5%) and 8 (13.1%) had experiences of 5-10 years and > 10 years, respectively. Regarding to the educational status of the respondent's majority 50 (82.0%) have BSc level of the education. Of the participants involved in the study, only 8 (13.1%) of them got supply chain performance (SCP) maternal health medication training and the rest 53 (86.9%) were untrained (Table 1).

Table 1: The demographic characteristics of participants of the study at the assessed in the public Hospitals, Hawassa, Ethiopia, 2023/24.

Variables		Frequency (%)
Service area	Pharmacy heads/Coordinators	8(13.1)
	Pharmacists in dispensary unit	47(77.0)
	Pharmaceutical store manager	6(9.8)
Work experience	1-5 years	35(57.4)
	5 - 10 years	18(29.5)
	> 10 years	8(13.1)
Educational level	Diploma	6(9.8)
	Degree	50(82.0)
	Masters and above	5(8.2)
Employees have SCP maternal health medication training certificate	Yes	8(13.1)
	No	53(86.9)

Assessment of performance of IPLS on Maternal Health Medicines

Assessments of activities of logistic systems in a given health care facilities would help to identify existing problems and also to plan intervention strategies in order to solve the problems that ultimately enhance the performance of logistic system. In this study, IPLS of the selected health facilities was assessed by focusing maternal health medicines. The data obtained from the maternal health medicines supply chain units/Departments of the selected public hospitals are given below (Table 2). The data summarize the attributes of the SCP of maternal health medicines and ideas level of the agreement of the respondents. The results revealed that more than one-third of the respondents (24, 39.3%) gave response “agreed” and they submit reports to EPSA in scheduled time limit regularly. 27 (44.3%) of the respondents replied that the reports they submitted are complete and contains all important program products for the facility (Table 2) and, moreover, 24 (39.3%) of the respondents also replied that the product data content of the RRF are accurate. While the majority (47, 77.0%) agreed on the item “The hospital has prescription fill rate/obtainability

for program products to be adequate (> 80%)”. 59 (96.7%) of the respondents replied “disagree” on the item “The system is well performing and productive in the facility” and 47 (77.0%) of the participants responded that “the facility uses both electronic and hard copy of IPLS formats to generate necessary data and all expected reports hundred percent”. Thirty two the participants (32, 52.5%) were agreed on the item “facility uses hard copy of formats only to generate necessary data and generates all expected reports 100%”. The 33 (54.1%) of respondents replied that system improves availability of the health program products. Of the participants involved in the study, 26 (42.6%) of them replied that their hospital has adequate budget allocated for performance improvement, and 23 (37.7%) replied that top management of their hospital recognizes the best performing employees. 35 (57.4%) of respondents agreed that there are proper chain work forces (Pharmacy professionals); and 26 (42.6%) agreed on the presence of an incentive system for top performers. The 35 (57.4%) agreed the presence of an accountability system for malpractices and low performance (Table 2).

Table 2: The logistic performance of maternal health medicines at the assessed public Hospitals, Hawassa, Ethiopia, 2023/24.

Logistic performance parameters	Disagree Frequency (%)	Neutral Frequency (%)	Agree Frequency (%)
Hospitals submit reports to EPSA regularly as per schedules	24(39.3)	13(21.3)	24(39.3)
Submitted reports are complete and contains all important program products for the facility	18(29.5)	16(26.2)	27(44.3)
The product data content of the RRF are accurate	23(37.7)	14(23.0)	24(39.3)
Prescription fill rate/obtainability for program products is adequate (> 80%).	14(23.0)	0(0.0)	47(77.0)
The system is well performing and productive in the facility.	59(96.7)	0(0.0)	2(3.3)
The facility gets technical support from regional PMED for well-functioning of the system.	27(44.3)	5(8.2)	29(47.5)
The facility uses both electronic and hard copy of IPLS formats to generate necessary data and all expected reports hundred percent.	47(77.0)	0(0.0)	14(23.0)
The facility uses hard copy of formats only to generate necessary data and all expected reports 100%.	29(47.5)	0(0.0)	32(52.5)
The system improves availability of the products	16(26.2)	12(19.7)	33(54.1)
The system maximizes customer satisfaction.	32(52.5)	13(21.3)	16(26.2)
The system reduces wastage rate of products to < 2%.	33(54.1)	7(11.5)	21(34.4)
Adequate budgets are allocated by the hospital for performance improvement	26(42.6)	9(14.8)	26(42.6)
The system has higher officials that support to ensure its performance related to material	30(49.2)	11(18.0)	20(32.8)
There are incentive systems for best performers of the system	28(45.9)	7(11.5)	26(42.6)
There is accountability for malpractice or low performance in the hospitals	20(32.8)	6(9.8)	35(57.4)
The top managements recognize the best performing employees	25(41.0)	13(21.3)	23(37.7)
Essential financial supports are provided to hospitals	30(49.2)	11(18.0)	20(32.8)
The hospitals have budget for printing essential formats	28(45.9)	7(11.5)	26(42.6)
The hospital has pharmacy professional/s in the supply chain work force	20(32.8)	6(9.8)	35(57.4)
The hospital has adequate supply chain work force to exercise	37(60.7)	3(4.9)	21(34.4)
The hospital has adequately trained staff on the system	25(41.0)	15(24.6)	21(34.4)

EPSA: Ethiopian Pharmaceutical Supply Agency; IPLS: Integrated Pharmaceutical Logistics System

**Other ethnicity: Amhara, Kambata, Oromo

Assessment of Maternal Health Medicine Supply Chain Performance

In a survey in the public hospitals about the pharmaceutical maternal health drugs supply chain performance, the responses of 12 (19.7%) showed that the hospitals select products from EPSA, 7 (11.4%) replied that their hospitals forecast need of supplies, 11 (18%) respondents replied that they have update supply planning, 7 (11.4%) of respondents have accident rate plan (Table 3). Of the participants of the study, 14 (77.8%) of them replied that they have stock out rate filled, 9 (14.7%) replied that they have order fill rate properly, 49 (80.3%) said

that they have average price, 23 (37.7%) of them values of products, 12 (19.7%) replied that their hospitals have damaged products, 31 (50.8%) said they have a value of unusable products, 55 (90.2%) said that their hospital has a stock of medicines, 30 (49.2%) replied their hospitals have shortage of supplements. With regard to inventory lead time and feedbacks, 61 (100.0%) of respondents said that their hospitals have inventory control systems, 17 (27.9%) have order lead time, and 31 (50.8%) said that their hospitals have regular and formal feedbacks (Table 3).

Table 3: Assessment of maternal health drugs supply chain performance at the assessed public hospitals, Hawassa, Ethiopia in 2023/24.

Maternal health medicine supply chain performance parameters	“No” response Frequency (%)	“Yes” response Frequency (%)
Product selection from EPSA	49(80.3)	12(19.7)
Have forecasting system	54(88.6)	7(11.4)
Have updated supply planning	50(82)	11(18)
Accident rate planned	50(88.6)	7(11.4)
Stock out rate filled	57(77)	14(23)
Order fill rate properly	52(85.3)	9(14.7)
Have average price	12(19.7)	49(80.3)
Have value of products	38(62.3)	23(37.7)
Have a damaged products	49(80.3)	12(19.7)
Value of unusable products	30(49.2)	31(50.8)
Have a stock of medicines	6(9.8)	55(90.2)
Face shortage of supplements	31(50.8)	30(49.2)
Have inventory control system	0(0)	61(100.0)
Have order lead time	44(72.1)	17(27.9)
Have regular and formal feedbacks	30(49.2)	31(50.8)

EPSA: Ethiopian Pharmaceutical Supply Agency

Quality Indicators

Bin Card-Related Quality Indicators

Quality indicators for maternal health medicines in public hospitals were assessed based on the data collected from the 39 bin cards. The data collected from the cards revealed that 30 (76.9%) of the bin cards were available, 9 (23.1%) were used and updated, 19 (48.7%) were completed and reported and 9 (23.1%) had reports sent to the EPFA every two months. Moreover, 28

(71.8%) of the cards had verified calculated consumption and maximum stock quantity indicated, 20 (51.3%) had verified quantity ordered indicated, 19 (48.7%) had valid beginning balance versus ending balance of the previous report, 34 (87.2%) had beginning balance data, 15 (38.5%) had stock on hand data, 9 (23.1%) had quantity loss/adjustment data, and 29 (74.4%) had quantity received data (Table 4).

Table 4: Bin Card-Related quality indicators in public Hospitals at Hawassa, Ethiopia, 2023/24.

Quality Indicators from Bin cards (n=39)	“No” response Frequency (%)	“Yes” response Frequency (%)
Bin card availability	9(23.1)	30(76.9)
Bin card used and updated	30(76.9)	9(23.1)
Bin cards completed and reported d	20(51.3)	19(48.7)
Bin cards with report sent to PFSA in every two months	30(76.9)	9(23.1)
Verified calculated consumption indicated	11(28.2)	28(71.8)
Bin cards with verified maximum stock quantity indicated	11(28.2)	28(71.8)
Bin cards with verified quantity ordered indicated	19(48.7)	20(51.3)
Bin cards with valid beginning balance vs. ending balance of the previous reports	20(51.3)	19(48.7)
Bin cards with beginning balance	5(12.8)	34(87.2)
Bin cards with stock on hand data	24(61.5)	15(38.5)
Bin cards with quantity loss/adjustment data	30(76.9)	9(23.1)
Bin cards with quantity received data	10(25.6)	29(74.4)

PFSA: Pharmaceuticals Fund and Supply Agency

Storage Condition-Related Indicators

The data obtained in the present study on the revealed that twenty of the respondents (20, 51.3%) replied that they have products arranged and labeled with expiry date and manufacturing date, 35 (89.7%) said their products are stored in First Expired, First Out

(FEFO) manner and 28 (71.8%) replied they separated damaged and expired products. Moreover, 21 (53.8%) of the participants replied that they stored products in manners that protect products from a direct sunlight, 32 (82.1%) had cartons protected from water and humidity, 31 (79.5%) had storage areas

free from harmful insects and rodents, 24 (61.5%) had products stored at appropriate temperature, 28 (71.8%) had the storeroom in good condition, 28 (71.8%) had sufficient storeroom space, 28 (71.8%) had fire safety equipment available and accessible and 9 (23.1%) had products stored separately from insecticides and chemicals (Table 5). The

storage conditions are in very good conditions as the products are protected from humidity, moisture and direct sun light and consistent with reported storage conditions in of Pharmaceuticals in other hospitals of Ethiopia (3,15). The worrying thing, however, is that products are not kept away from insecticides and chemicals.

Table 5: The storage condition-related indicators of medicines at the assessed public Hospitals at Hawassa, Ethiopia in 2023/24.

Storage conditions	“No” responses Frequency (%)	“Yes” responses Frequency (%)
Products arranged and labeled with manufacturing and expiry dates	19(48.7)	20(51.3)
Products stored in FEFO manner	4(10.3)	35(89.7)
Damaged and expiry products are separate	11(28.2)	28(71.8)
Products are protected from direct sun light	18(46.2)	21(53.8)
Cartons are protected from water and humidity	7(17.9)	32(82.1)
Storage area is free from harmful insects and rodents	8(20.5)	31(79.5)
Products are stored at appropriate temperature	15(38.5)	24(61.5)
Store room in a good condition	11(28.2)	28(71.8)
Store rooms have space sufficient for existing products	11(28.2)	28(71.8)
Fire safety equipments are available and accessible	11(28.2)	28(71.8)
Products are stored separately from insecticides and chemicals	30(76.9)	9(23.1)

FEFO: First Expired, First Out

Factors Affecting the Maternal Health Drugs Supply Chain Performance

There are several factors that affect the maternal health drugs supply chain performance. These include financial management, staff competency, procurement processes, distribution channels, inventory management and legislation lack of training to health professionals (staff competency), transparency and accountability and auditing

influences supply chain management process (21,22). The following model and regression analyses show the correlation of some of the factors and maternal health drugs supply chain performance.

Testing Model-Data Fitness

The data were tested for normality in order to fit a linear model to the dependent variables (factors maternal health drugs supply chain performance) whether they are normally

distributed or not. The model was found to be normally distributed (Figure 1). The Kolmogorov-Smirnov test (23) is a non-parametric test that can be used to test the underlying distribution of a given random variable (Table 6). This was used to test whether the dependent variable followed a normal distribution that the Shapiro-Wilk statistic (24) 0.967 has a p-value > 0.05 , which means the study concluded that the

dependent variable followed a normal distributed. Fitting a linear model to the data collected in the present study were, thus, justified (Table 6). Furthermore, the multicollinearity was tested by checking VIF for the factors used in the study as indicated in the regression analysis fitting a linear model (Table 7). This also implies a good fit for the model.

Table 6: Test of normality of data on maternal health medicine performance at assessed public hospitals at Hawassa, Ethiopia, 2023/24.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Maternal health medicine chain supply performance	0.086	61	0.200 [*]	0.984	61	0.605

*. This is a lower bound of the true significance. ^aLilliefors Significance Correction

Regression Analyses

The above model (Section 3.5.1) was used to analyze the independent variables namely; quality of service, functioning and organizing, obtaining and receptiveness, cost/financial gap, productivity challenges and employee's deficiency and proficiency gap in order to assess supply chain performance of maternal health medicines. The analysis was made at 95% level of significance. The linear regression analysis on performance of maternal health medicine management in the selected public hospitals revealed existence of several significant factors. The model showed that quality of

service ($\beta=0.251$, $p=0.004$) to have a positive and significant association. This indicates that higher quality of services is linked to improved performance. Obtaining and receptiveness ($\beta=0.196$, $p=0.029$) also showed a positive and significant relationship suggesting that a better procurement & responsiveness to needs contributes to a better performance (Table 7). The financial gap ($\beta=-0.308$, $p<0.001$) showed a negative and significant relationship, meaning that financial constraints are major barriers to performance. Similarly, employee's deficiency and proficiency gap ($\beta=-0.192$, $p=0.031$) was also negatively and significantly related to the performance

highlighting the importance of addressing staff capacity gaps in the hospitals selected for the present study. In contrast, functioning and organizing ($\beta=0.112$, $p=0.275$) and productivity challenges ($\beta=-0.075$, $p=0.370$)

were not statistically significant predictors of performance suggesting these factors to be less critical compared to the other variables in the model (Table 7).

Table 7: The coefficients on combined variables for supply chain performance of maternal health medication at assessed public hospitals at Hawassa, Ethiopia, 2023/24.

Model	Standardized	T	Sig.	95.0% CI for		Collinearity	
	Coefficients			B		Statistics	
	Beta			Lower	Upper	Tolerance	VIF
(Constant)	3.029	12.359	.000	2.538	3.521		
Quality of service	0.251	3.013	0.004*	0.044	0.218	0.500	2.000
Functioning and organizing	0.112	1.103	0.275	-0.050	0.171	0.338	2.958
Obtaining and receptiveness	0.196	2.243	0.029*	0.009	0.166	0.453	2.208
Financial gap	-0.308	-3.775	<0.001*	-0.233	-0.071	0.520	1.921
Productivity challenges	-0.075	-0.904	0.370	-0.100	0.038	0.506	1.977
Lack of employees and efficiency gap	-0.192	-2.219	0.031*	-0.157	-0.008	0.464	2.156

^aDependent Variable: IPLS of maternal health medicine performance

Qualitative Findings

Face-to-face interviews were conducted to gather information from health professionals (Pharmacists, Pharmacy Heads and Store managers) of each hospital to identify challenges related to IPLS implementation in their respective hospitals. The qualitative findings obtained from such were found to be in line with the study's overall conclusions about challenges facing maternal health medicine supply chain performance using IPLS. The key issues included staff shortage, lack of training on new technologies, inadequate inventory control systems, instability in the supply market, and difficulties in data reporting and recording by

dispensary staff, budget problems, and high turnover of skilled Pharmacy professionals. The interviewees mentioned that problems with infrastructure, job dissatisfaction, lack of incentives, and inadequate human resources as contributing to suboptimal execution of supply chain tasks and IPLS practices. Addressing these multifaceted challenges appears to be critical in order to improve the performance of maternal health medicine supply chains. The responses of some of the interviewees are summarized as follows;

- ✓ As 40 years old PFSA manager stated that “The PFSA uses a mixed distribution system, combining pull and push

mechanisms, to supply public health facilities. They have implemented a standardized, paper-based LMIS system covering all the facilities and all major product categories, though some programs lag in consistent reporting. The LMIS collects key data on consumption, stock levels, and losses, which informs critical decisions, but there are gaps such as lead time and supplier performance data. While the LMIS forms are reasonably well-designed, challenges exist around printing, distribution, data quality, and timeliness. Training and supportive supervision for facility staff are limited, contributing to these issues. To address these problems, the PFSA is in the early stages of transitioning to an electronic LMIS, but faces hurdles around infrastructure, training, and integration. The goal is to gradually scale up the e-LMIS across all facilities in the coming years to improve supply chain visibility and performance.”

- ✓ A 34 years old male pharmacist respondent from pharmacy heads said that “The PFSA uses a mixed distribution system and has implemented a standardized, paper-based LMIS system, though it faces challenges around data quality, timeliness, and limited training for facility staff. While the LMIS collects

critical supply chain data, gaps exist and the system is seen as cumbersome by pharmacy staff. The form is prone to errors and takes time away from other duties. The facility managers also expressed frustration with the printing and distribution issues that hinder consistent LMIS reporting across all programs. To address these problems, the PFSA is in the early stages of transitioning to an electronic LMIS, but faces hurdles around infrastructure, training, and integration. The goal is to gradually scale up the e-LMIS across all health facilities in the coming years to improve supply chain visibility and performance though concerns remain about the capacity building required at the facility level and the ability to effectively integrate the new system with existing inventory management practices. Additionally, supply chain managers noted that data on supplier lead times and performance was not consistently captured in the current LMIS, limiting their ability to identify and address bottlenecks in the supply chain.”

- ✓ A 42 years old male pharmacist respondent from pharmacy heads said that “IPLS practices of the hospitals were also affected by the supply chain work force side. This includes lack of the training on the newly adopted technologies or the

software's and there is lack of the human power to arrange the inventory control system and proper handling of the warehousing and storage."

- ✓ A 41 years old male druggist pharmacy head mentioned the poor IPLS performance in the facilities as *"as to my knowledge there is instability of the market, different donor interests like technological advancements and using different softwares. There are also problems related to the staffs working in dispensing units to record and report logistics data properly, they feel discomfort and prefer to resign their job. Their main reasons are inadequate incentives, lack of electronic LMIS devices, and electric power interruptions.*
- ✓ A 27 years old female druggist respondent from pharmacy store manager of the health facility said that *"The overall IPLS performance was mainly affected availability and the accessibility of the supply of the drugs, and different forms. The major challenges were reported from the selected hospitals mainly there were economic challenges, technological challenges, and lack of trained staff or employee's deficiency and proficiency gap related challenges were reported."*
- ✓ A 35 years old male pharmacist respondent from the head of the health

facility "There were challenges to have for longer time pharmacy technicians and professionals, due to high turn-over. In addition to this, there are problems of human resource and staff's commitment."

- ✓ A 37 years old male pharmacist respondent from pharmacy heads said that *"There are different challenges in the facilities to perform as we planned. This is due to the poor infrastructures, job dissatisfaction, lack of technologies, and inadequate incentives particularly for further education discouraged employees not to execute their tasks properly."*
- ✓ A 33 years old male pharmacist respondent from pharmacy store manager said that *"Currently, in my facility, I have a responsibility of dispensing drugs, managing store and preparing LMIS reports. Thus, I could not get sufficient time to update the logistics records. I have recommended the facilities to recruit additional staffs."*
- ✓ A 35 years old male pharmacist respondent from the head of the health facility *"There are challenges on pharmacy technicians and professionals for longer time due to high turn-over. There are also problems of human resource and staffs' commitment. Since the majority of the pharmacy professionals are not satisfied with their current profession. Thus, a*

significant number of pharmacists and pharmacy technicians are shifting to other business fields”

Discussions

With respect to assessment of performance of IPLS on maternal health medicines, the findings revealed that the IPLS is not fully implemented due to several reasons that include absence of support from higher officials, financial constraints, lack of sufficient and adequately trained staff, use of no electronic IPLS materials, etc. The results also showed that the performance of IPLS in the studied hospitals to be lower than that of other hospitals in different parts of the country (14,15,20).

Among surveyed dispensing units, only 23.1% of them were found to have updated bin cards and 23.1% regularly report to EPSA. This low rate of updating bin cards might be due shortage of health professionals or lack of training of professionals to implement IPLS. This is lower than the data reported in Awi zone 50% updating bin cards regularly. The bin card utilization was found to be 76.9%. This data is higher than reported from Hospitals of Wollega (35.5%) but lower than the data in Awi zone, Amhara region (90%) (6,10,15).

These study results showed that majority of the respondents assume that performances in their respective hospitals to be limited. This

could be attributed to inadequate drug supply chain performance (mainly about logistics system performance), functioning and organizing, obtaining and receptiveness (Table 7). The major challenges were reported from the selected hospitals mainly there were economic/budget challenges, political and legal challenges, and technological challenges), and lack of top management commitment, financial gap, and shortage and efficiency gap of employees. These findings are consistent with a similar study report by Fantaye *et al.* (2022) that stated existence of challenges in the supply management of maternal health medicines, frequent stock-outs, inadequate supply and costs of medicines in Hospitals in Addis Ababa (25).

The quantitative findings of the study are also in line with the qualitative findings. The qualitative findings were summarized as; *“IPLS practice of the hospitals were affected mainly by the supplier’s side; inadequate capacity to fill the demands of the health facilities, shortage of vehicles to deliver pharmaceuticals on time, incomplete and inaccurate RRF submission by hospitals and these leads the supplier for dalliance to refill and to resupply under requisite and also problem of the trained supply chain work force turn to ensure satisfaction of the health facilities.”*

The data collected from the selected public health hospitals also revealed that there are no support from top-level management as they are not considering LMIS as a basic pharmacy service. This resulted in less motivation and commitment of employees to manage logistics data appropriately. Lack of support and constructive feed backs from top managers and also financial gap, shortage of skilled employees resulted in decrease in the maternal health medicine supply chain performances in the public hospitals selected for the study. These finding were also in line with qualitative findings that state “There are high turn-over of pharmacy technicians and lack of staff commitment and shortage of skilled and adequate skilled human resources”. The information collected from the interview of the pharmacy heads and pharmacy store manager of the selected public health facilities were also similar and summarized as “*There are challenges of availability of logistic formats, availability of medicines, storage and store organization. Some essential medicines are not available in adequate quantities due to lack budget and price inflation.*” These findings are in line with previous reports of similar studies in public hospitals in Wollega, Addis Ababa, Awi and Chagni, Amhara region (10,15,25,26).

The results of the study also revealed that an increase in employee’s deficiency and proficiency gap were found to be associated with decreases in the performance of drugs supply chain with p-value <0.05. Moreover, poor infrastructures, job dissatisfaction, lack of technologies, lack of time to update the logistics records and inadequate incentives (monetary or further education opportunity) to employees that discourage them not to execute their tasks properly are some of additional factors that negatively affect performances of drugs supply chain. These are consistent with literature reports (26).

The qualitative data support the above claims are summarized as “*The report highlighted several employee-related gaps that contribute to the challenges with the PFSA’s LMIS system. Facility staff, including pharmacists, lacked adequate training and supportive supervision on proper LMIS data collection, reporting, and use. This led to issues with data quality, timeliness, and completeness. Additionally, the report indicated that the transition to an electronic LMIS system will require significant capacity building at the facility level, raising concerns about the ability of staff to effectively adopt and utilize the new technology. Overall, the findings point to proficiency gaps among PFSA’s facility-level workforce that need to be addressed through enhanced training,*

supervision, and change management to support improvements in supply chain data visibility and performance.” The findings are also consistent with the reports studies conducted in hospitals of in Addis Ababa, Ethiopia and hospitals in other cities in Ethiopia (6,13,15,25,26)

Conclusion

The findings showed that the performances of IPLS on maternal health medicine and supply chain were inadequate in the public Hospitals of the study area. These inadequate performances could be attributed to issues such poor service quality, functioning, procurement, financial constraints and employee capacity gaps. Logistics system challenges such as poor data quality and inconsistencies in the paper-based LMIS, as well as absence of well-established electronic LMIS systems have contributed to stock-outs and incomplete performance data. To address these challenges, the administrative units (management) of the health facilities provide supervisory supports, sufficient budget allocation and also arrange periodic intensive training to fill skill gaps of professionals for effective implementation IPLS not only to maternal health medicines but also other pharmaceuticals in their hospitals Ultimately, improving service quality, procurement and responsiveness, and addressing financial and employee capacity gaps are crucial for

enhancing maternal health medicine management in public hospitals.

Based on the finding of the study, the following recommendations are forwarded:

- The public hospitals' health officials and pharmacy heads need to improve the maternal health medication supply chain performance by providing and coordinating training to their staff on LMIS, inventory control system, poor handling of the warehouse and storage.
- The hospitals' managers and focal health officials need to work to train pharmacists in order to fill skill gaps of pharmacy professionals with regard to implementation of IPLS
- Future research is recommended by incorporating other variables that affect maternal health medicines supply chain performance, covering all private and public hospitals found in Hawassa city administration to get comprehensive information to help health officers in making evidence-based health-related policies.

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Availability of Supplementary Materials

- Supplementary materials **S1** and **S2** and Annex I are available online.

Limitations of the Study

This study did not address all components of the logistics system such as distribution and drug use.

- The findings of this study are from only three public hospitals. Therefore, they cannot be generalized to other health facilities in the study area.
- The study also did not include private hospitals
- Only few IPLS activities were examined in the study. Therefore, the authors recommend that future researchers in this area to consider these limitations in their work.

Declarations

Ethics approval and consent to participate

Ethical approval letter for the study was obtained from Pharma College Institutional Research Ethics Review Committee (IRERC).

Consent for Publication

The authors have provided their full and explicit consent for the publication of this article.

Data Statement

The data has been carefully compiled and is readily accessible. If you are interested in obtaining the data, please don't hesitate to reach out, and we will provide it upon request.

Conflicting Interests

There are no conflicts of interest or competing interests disclosed among the authors contributing to this work or study.

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Authors' Contributions

Both authors actively participated in every step of the paper's development, including conceptualization, drafting, revisions, and finalization, ensuring a collaborative effort throughout the entire process.

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