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Integrated Pharmaceutical Logistic System in Ethiopia: Systematic Review of Challenges and Prospects

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Abstract

Background: ***Integrated pharmaceutical logistic system is a single system of reporting and distribution pharmaceutical items by integrating various programs with the objective of improving efficiency and reduces redundancy while enhancing product availability.*** ***Method:*** ***We electronically searched from Google Scholar and PubMed using inclusion and exclusion criteria.*** ***Results:*** ***A complete of 102 sorts of literature were searched. After exclusion of redundant and irrelevant literature, 31 literatures were reviewed. Quality and availability of logistic formats, availability of medicines, storage and store organization, manpower deployment and development, infrastructure, inter-sectorial collaboration were a challenge of integrated pharmaceutical logistic system. The future priorities would be capacity building, warehouse improvement, close partnership with key stakeholders, supportive supervision and implementation follow up and creating ownership and sustainability at all levels of a supply chain.*** ***Conclusion:*** ***In the past few years integrated pharmaceutical logistic system has brought significant improvements to a supply chain of Ethiopia, although the system faced with various challenges which still remain to be addressed.***

Keywords: ***Integrated pharmaceutical logistic system; IPLS implementation; Ethiopia.***

1. Abbreviations

AIDS: Acquired Immune Deficiency Syndrome; **ART:** Anti-retro viral therapy; **FMOH:** Federal Ministry of Health, **HCMIS:** Health commodity management information system; **HMIS:** Health management information system, **HIV:** Human immune virus; **IPLS:** Integrated Pharmaceuticals Logistic System; **IFRR:** Internal facility report and requisition,

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LMIS: Logistics management information system; **PFSA:** Pharmaceutical Fund and Supply Agency; **RRF:** Report and Requisition form; **TB:** Tuberculosis

2. Introduction

Ethiopia is the most populated country within the world and therefore, the second most populated country within the African continent with a rapidly growing economy [1]. Ethiopian public healthcare sectors supply chain was poor and fragmented into different vertical systems before 2009. To deal with these weaknesses the government of Ethiopia aimed to create a robust integrated supply chain with direct delivery of all program commodities to health facilities with the target of meeting the goal of universal access of essential health commodities [2].

The Pharmaceutical Fund and Supply Agency (PFSA) and Federal Ministry of Health (FMOH) have been working to ensure efficient health supply chain system that is accessible, equitable, and affordable for all Ethiopians [3]. As part of this effort, PFSA with all actors in the sector developed and began implementing of the Integrated Pharmaceuticals Logistic System (IPLS) in 2009 [4]. Since 2010, more than 2500 health facilities have been implementing IPLS in a phased approach [5] of which more than 500 health facilities have started using automated system [3] and more than 5,000 healthcare workers have been trained on IPLS [6].

Integrated pharmaceutical logistic system is a single system of reporting and distribution pharmaceutical items. So far IPLS integrates the management of essential pharmaceuticals including pharmaceuticals used to manage Human immune virus/Acquired Immune Deficiency Syndrome (HIV/AIDS), malaria, tuberculosis (TB) and leprosy, vaccine, family planning and purchased essential drugs (PFSA IPLS SOP, 2015). The application of optimization of a supply chain cost occurred by the combinations of various suppliers [7]. Objectives of integration were to maximize efficiency and minimize redundancy while enhancing product availability [8].

Integrated pharmaceutical logistic system improves the drug supply chain by integrating distribution, drug requisition, and reporting mechanism. Facilities not utilize IPLS had a 1.5 times higher tuberculosis commodities stock out rate than health facilities using IPLS [5]. Integrated pharmaceutical logistic system also standardizes and streamlines inventory management and logistics management information system (LMIS) that would connect all levels with accurate and timely knowledge for deciding to enhance availableness of essential medicines publically health facilities [9].

The system strives to fulfil all the six rights of managing supply chain which are ensuring right type of item, of the right quality, in the right quantity, at the right place, at the right time and with the right cost [9, 10] by system designing, capacity building, close partnership with stakeholders, supportive supervision with follow up, creating ownership and sustainability [3]. Taking the empirical evidence in Ethiopia into consideration, the present review explores challenges and prospects of IPLS implementation in Ethiopia.

3. Methodology

3.1 Search strategy

To conduct this review, different literatures were obtained using Google scholar and PubMed central electronic databases, hand searches and iterative reviews of papers. From these data sources, a sort of 102 literatures (Google scholar =63 and PubMed =39) were extrapolated using the key words 'Integrated pharmaceuticals logistics system', 'IPLS', 'IPLS implementation', 'Ethiopia' and in combination. All searches were performed from August 10 - 15 2020. But most literatures were obtained to be redundant and irrelevant. Finally, 31 separate studies were selected to review, out of these 16 is published articles in different journals and 15 are unpublished papers and reports are shown in Fig.1. Table 1 describes the study characteristics of reviewed literatures.

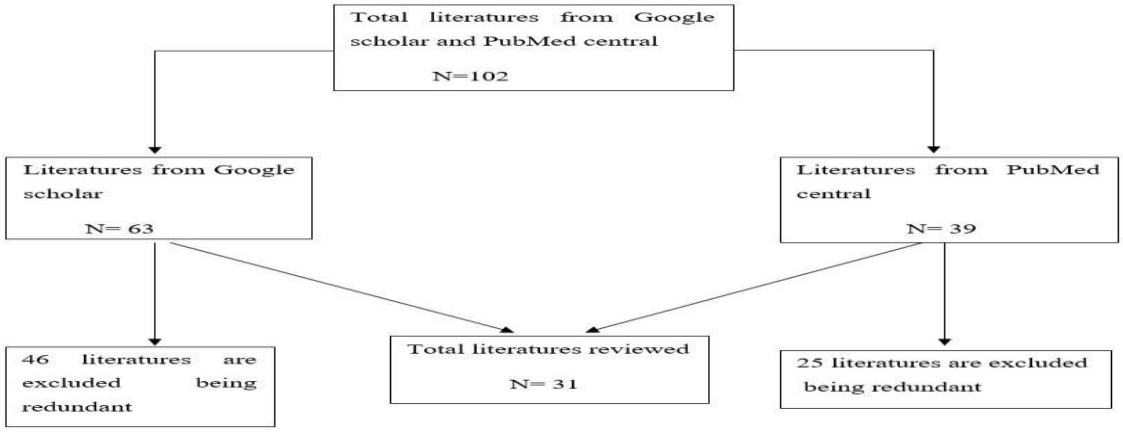

Fig. 1. Data searching process.

The inclusion criteria's were type of study: Cross sectional studies, evaluation, survey, publication: academic journal (peer reviewed) and non-reviewed reports, population: Ethiopia, time period: 2003 to present, and language: English.

3.2 Data abstraction

Screening of the articles was subjected to the exclusion and inclusion criteria. Author, year of publication, study design and the nature of the study were extracted from each study using an abstraction format.

3.3 Study characteristics

All included studies differed in study design. From these articles, three nine studies were cross-sectional studies, while one studies used Quaisi-experimental study design. The detailed description of the characteristics of individual studies is displayed in Table 1.

Table 1: Study Characteristics of Literatures.

S.No	Author/s	Study design	Year	Document type
1	Amare Sisay	Prospective	2017	Research
2	Berhe H, Dowling P, Nigatu W	Retrospective	2014	Research

3	Chandani Y et.al	Cross sectional	2012	Research
4	Daniel Taddesse	Cross sectional	2015	Research
5	Desale A et al	Cross sectional	2013	Research
6	F. Fikru et.al	Retrospective	2012	Research
7	Fenta TG et.al	Quaisi- experimental	2014	Research
8	Gabriel T, Tafesse TB	Prospective and Retrospective	2017	Research
9	Gebreegziabher SB ,Yimer SA, Bjune GA	Cross sectional	2016	Research
10	GHSC-PSM		2017	Guideline
11	Klebera R, Minnera S, Kiesmuller G	Cross sectional	2012	Research
12	Mebrhatom Tesfay	Cross sectional	2016	Research
13	Mezid Mudzteba	Cross sectional	2014	Research
14	Nigatu A et al.		2014	Research
15	Nigatu W et.al	Prospective & Retrospective	2018	Concept paper
16	P. Lezama Elguero	Retrospective	2012	Research
17	Paul Dowling, Azeb Fisseha	Prospective	2017	Concept paper
18	PFSA		2014	Report paper
19	SC4CCM	Prospective	2012	Research
20	SC4CCM project		2012	Training manual
21	Shewarega et al.	Prospective & Retrospective	2015	Research
22	Shimels Admasu	Cross sectional	2016	Research
23	SIAPS		2014	Concept paper
24	Tilahun A, Geleta DA, Abeshu MA, Geleta B, and Taye B	Cross sectional	2016	Research
25	USAID|DELIVER PROJECT	Prospective	2011	Research
26	USAID|DELIVER PROJECT	Prospective	2016	Report paper

27	USAID|DELIVER PROJECT		2014	Concept paper
28	USAID|DELIVER PROJECT		2003	Guideline
29	USAID|DELIVER PROJECT		2011	Research
30	USAIG|Global health supply		2017	Guideline
31	Wright C, Drury P, Jackson S, Thomas M,			Concept paper

3.4 Assessment of methodological quality

Critical appraisal using PRISMA flow diagram and guidance set out by the center for reviews and dissemination. Methodological validity was assessed to examine the methodological quality of reviewed articles. Moreover, two reviewers appraised the full text of each study independently and any discrepancies between the two reviewers were resolved through discussion and/or arbitration of a third reviewer. Finally, third reviewers validate the selection of articles.

4. Results and Discussion

4.1 Challenges of IPLS implementation

In the past 5 years, IPLS has brought significant improvements to a supply chain of Ethiopia, although the system faced with various challenges (Table 2) which still remain to be addressed.

Table 2: Challenges of IPLS in Ethiopia.

S.no	Challenges	References
1	Availability and quality of logistic formats	11-18
2	Availability of drugs	11-15, 19-22
3	Storage and store organization	11-13, 15,, 21
4	Manpower deployment and development	14-15, 23-25
5	Infrastructure	13, 18
6	Inter-sectorial collaboration	18, 25

National survey of the IPLS in 2015 showed that 20 % of health centers and 50 % of health posts did not have bin cards [11]. Integrated pharmaceutical logistic system formats for recording and reporting like bin cards, internal facility report and requests (IFRR), and report and requisition form (RRFs) was available at 92.6% of facilities in public health facilities of Addis Ababa [12].

Bin card data accuracy assessed in health centers and hospitals was 51 % and 10 % for health posts according to national IPLS survey in 2015 [11]. In Addis Ababa, 61.5% of public health facilities regularly update of bin cards and

higher utilization of bin cards was observed at public health centers (76.5%) compared to public hospitals (33.3%) [12]. The accuracy of keeping stock records was also less than10% for majority of non-program tracer drug [13]. Fifty percent of public hospitals and 54% of public health centers were utilize stock or bin cards for all TB laboratory and HIV/AIDS commodities in main pharmacy store. Only 25% and 20.8% of hospitals and health centers respectively had updated stock/bin cards [14]. In Black line hospital, bin card recorded is not accurate (17.6 %) with respect to physical count taken during at the time of day visit for three items [15]. Poor TB data documentation in Northwest Ethiopia was the challenge facing TB control program performance [16].

The underutilization of LMIS tools compromised the LMIS data that may show poor implementation of IPLS. In Addis Ababa, public health facilities reported that RRF and IFRR were completed by 84.6% and 92.6% facilities respectively while only 32% of public facilities had valid RRF [12], percentage of IFRR use is lower for phase III health centers (77 percent) and the average accuracy of RRF data was 46 % [11].

LMIS at public facilities were largely depend on paper [17] and hence huge paper work involved in IPLS [15]. Due to this, the data quality and data utilization for decision making compromised [3] and the problem magnified due to absence of sufficient funds to invest in information technologies [18].

Limited availability, stock outs, and shortages of essential, child health, neonatal, and maternal medicines at health facilities were the challenges for reducing child and maternal mortality [19]. Facilities using IPLS had TB drug stock out rate of 17% [5] and intermittent interruptions of laboratory commodities and absence of access to TB diagnostic tools at peripheral health institutions in West Gojjam Zone made tuberculosis control difficult [16]. Assessment of TB laboratory and HIV/AIDS supplies in public facilities of Addis Abeba showed that 92.6% health facilities showed that stock out for one or more commodities [12] and 60.5% of the facilities were stocked out for at least one ART monitoring and TB laboratory commodities [14]. The overall stock out rate in Black line hospital was 46.2% [20]. Stock outs at health post level were higher than other levels [2].

Delayed placing of delivery orders [18] with limited supply at PFSA was a major obstacle for logistic system. Order fill rate of non-tracer program drugs was 47.52% at public health centers of Addis Abeba [13]. Only 30% of public health facilities had received all the ordered quantities of anti-retro viral drugs [21]. The national survey of IPLS also showed that 60 % of facilities filled with the quantities ordered [11].

Stock outs, delivery near expiry items and lack of adequate stock at the resupplying PFSA hub during the resupply period was the reasons for stock out [15], [20]. The presence of limited budget [13] and ordering less than the required by public facilities was determinant on availability [11]. Weak selection, quantification, procurement and in adequate stock control and management, too much time spent on the purchasing procedure, and unpredicted services demand or increased patient flow were the reason for stock out [20]. Each dimension of supply chain management challenges has a negative effect on responsiveness, collaboration, flexibility and cost performances [22]. So, emergency orders were usually placed [15]. The national assessment indicated that 68 % of hospitals, 43 % of health centers and 38 % of health placed at least one emergency order in the three months [11].

The bigger challenge relates to supply chain efficiency was overstocking [2]. Expired ART commodities were availed in 73.5% of facilities [14]. As a result there was high wastage of products which demanded high resources for managing products at all levels [3].

The 2015 national survey results showed that the storage place for a significant percentage of public health facilities did not meet the criteria [11]. Adequacy storage condition was 71.8% in public health centers of Addis Abeba [13] and insufficient space of pharmaceutical storage was also the problem in Black line hospital [15]. In public health facilities of Eastern Ethiopia only half of the public facilities had appropriate storage space for existing ARV products [21].

Among the public hospitals of Addis Abeba, clear labeling of expiry and manufacturing dates, proper arrangement of the products, as well as segregation wasted and damaged medicines was 83.3% [12]. Physical inventory at most sites is only done annually and expired products are a problem at all levels, although there are no organized data to quantify it [4]. Poor arrangement of drugs and poor store organization was observed in Black line hospital [15].

High health staff turnover rates [23] might be due to lack of retention mechanism, lack of incentive plans and absence of skills certificate that could be attached to promotion or increase of salaries [24] made health facilities reported inadequacy of staffing [25]. Poor commitment of staff, lack of data clerk in the pharmacy store and absence of incentives for store managers who are laboring too much on store management activity [15], responsible for low satisfaction level among professionals may contribute to a low level achievement [23].

Availability of a supply chain expertise was limited at lower level of the supply chain, particularly at Woreda health offices and health facilities [4]. Health facilities have no staff development plans and individual job description [14]. Due to staff attrition and expanding service delivery does not match with ongoing training [6] due to limited training access for new staff [23], [25]. Technical assistances are not strong on the transfer of knowledge and skill rather they engaged the implementation by themselves as health facilities did not gave emphasis during turnover [24].

Transportation of medicines was the challenge due to bad roads especially upcountry [3,18], hence direct delivery to public facilities was limited and medicine waste management were not adequate due to limited infrastructures related to medicine waste disposal sites [13].

The linkages between various stakeholders in a supply chain were broken or missing. The responsibilities of each actor were unclear and there were non-value-adding activities at every level of a supply chain, leading to duplication of certain tasks and confusion about roles [8], [18]. Further this poor institutional collaboration hindered information sharing in providing feedback to the health facilities contributing to poor performance [25]. Even if significant effort had invested, lack of system for institutionalization of IPLS by Ethiopian government was the bottleneck for system [3].

4.2 Prospects of IPLS implementation

Integrated pharmaceuticals logistics system had already brought a significant potential improvement in a supply chain of Ethiopia and makes the system fully functioning, works expected to be done on the following priority issues in the near future (Table 3). The system will be scaled up to automation. All public health facilities shall begin to implement a system for reporting and distribution pharmaceutical. Proper implementation of the system will strengthen the linkages between supply planning, forecasting, and resource mobilization through increasing data visibility for accurate and timely decision making. Thus, essential medicines availability in health facilities will be improved and efficient use of scares resources will be realized.

Table 3: Ways to Strengthen IPLS in Ethiopia.

Sr.no	Challenges	References
1	Capacity building	17, 19, 23, 26-28
2	Warehouse improvement	29-30
3	Close partnership with key stakeholders	28
4	Supportive supervision and implementation follow up	31-32
5	Creating ownership and sustainability	33-34

The LMIS at service delivery points are largely relay on paper-based aggregate reports which has to be replaced by electronic tools consists of right combination of people, processes, and technology [17]. Currently health commodity management information system (HCMIS) applied in daily business activities of PFSA and health facilities [26]. Configuring computerized LMIS in all levels of health facilities allows an electronic data exchange among all levels in most effective way [27]. New futures incorporating all medicines and reagents should be added to dashboards to manage millions of transactions through unprecedented critical data access for decision making. Thus extensive upgrading of a computerized HCMIS and dashboard mobile application shall also be done [2].

Extending vaccine visibility to Woreda with mobile platform integrated with the HCMIS system. The system provides insight to tack and trace stock levels at all levels and reinforces use of the standard vaccine request form which allows checking their stock levels, order fill rate from supplying PFSA hubs, and issue vaccines to health facilities [19]. Cellular message technology can be applied to report key data elements from the public health facilities [17] to maximize data visibility [2].

Integration and linking of health management information system (HMIS) and LMIS data side by side by ad hoc comparison of data, capturing HMIS and LMIS in one system and electronic integration of separate HMIS and LMIS will improve logistics systems and services delivery through validating data, reducing data collection burdens and data duplication, enhancing communication, improving monitoring and evaluation [28]. A routine comparison of HMIS and LMIS malaria data provides a complete picture of malaria services and supplies in-country which allows monitoring and improving data quality [24].

Systems like pharmaceutical logistics information tracking system which automatically prepare and issues reports from public facilities to PFSA shall be designed to improve medicines and reagents management, overall performance, and data visibility [3].

Strengthen the link between supply planning, resource mobilization, and forecasting increase data visibility [4]. It's also important to analyze a sufficiency of current staff levels as public health supply chains require motivated, trained and skilled staff [2] and implement performance-based incentives to reduce staff turnover [23].

The HCMIS warehouse could be enhanced to support visibility/traceability of health commodity by getting information on physical activities related to physical products using critical tracking events [29]. Pharmaceuticals demands had to be satisfied through maintaining appropriate storage conditions and reverse logistics should be practiced [30].

All stakeholders working in supply chain of Ethiopia expected to have better collaboration and communication for efficient work [1], [28]. Scaling up training approach would be essential for improving product availability. In addition, training with follow-up support to public health facilities resulted in better training coverage and a supply chain tool availability [31], [32].

Build sustainable capacity is a vital component of a robust health supply chain [2] as a result Ethiopian government should develop strategies and approaches to ensure sustainability and local ownership [3], [33]. By reducing several of levels and consolidating responsibility of various stockholders of tasks into PFSA transform system into more responsive and efficient [8]. Implementing evaluation and monitoring indicators of system allows for further strengthening the system [34].

5. Conclusion

Limited availability, shortages, and stock outs of essential medicines as a result of stock outs, delivery near expiry items, delayed placing of delivery orders with limited supply at PFSA was a major obstacle for logistic system. Weak selection, quantification, procurement and in adequate stock control and management, delay in the purchasing procedure, and unpredicted services demand or increased patient flow were a challenges of IPLS. As a result, public health facilities usually place emergency orders. In addition, overstocking resulted high wastage of products.

Integrated pharmaceuticals logistics system had already brought a significant improvement in the supply chain of Ethiopia and the system will be scaled up to automation resulting in improving efficient use of scares resources and availability of essential commodities.

6. Consent for Publication

None

7. Conflicts of Interest

The authors declare there is no conflicts of interest.

8. Funding

None

9. Competing Interest

The authors declare that they have no competing interests.

10. Authors' Contribution

All authors made substantial contributions and gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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