

INVENTORY MANAGEMENT PRACTICES OF PHARMACEUTICALS IN PUBLIC HEALTH INSTITUTIONS OF DESSIE CITY ADMINISTRATION, ETHIOPIA: A DESCRIPTIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: This study was conducted to assess inventory management practices of pharmaceuticals in public health institutions of Dessie City Administration, Ethiopia.

Methods: The research was conducted from February 5, 2019, to February 24, 2019, in 10 health facilities with a descriptive cross-sectional study using observation checklists.

Results: Receipts, issues, losses, and adjustments were correctly recorded in seven stores. Invoices and bin cards were available in all stores. Logistic management and information system, Internal Facility Report and Resupply, and Report and Requisition Form were available in nine stores. Five stores had stock cards, but only three recorded prices correctly. The maximum, minimum, reorder, and buffer stock levels were not properly maintained (or automated). All stores had freezers but wall thermometers and lockable cabinets were absent in eight stores; seven did not use first expired, first out storage technique. Humidity and fire control mechanisms were absent in all and seven institutions, respectively. Nine institutions lack fireproof areas for combustibles, but eight stores held them with drugs.

Conclusion: The inventory management practices of the institutions were not satisfactory. It is recommended that the health facilities should comply with standard operating procedures.

Keywords: Inventory management, Inventory records, Store management, Pharmaceuticals, Public health institutions.

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INTRODUCTION

Inventory management is among the most common factors affecting pharmaceuticals supply network [1]. It is all about ordering, receiving, storing, issuing, and reordering items. It hosts storage, distribution [2], and accurate record-keeping [2-4]. It is an endless struggle [5]. Inventory control and recording are inseparable [3,4]. Common inventory recording and documentation formats are Internal Facility Report and Resupply Form (IFRR) and Report and Requisition Form (RRF) [3], Bin card (BC), and Stock record card (SRC) [2-4]. These records provide information on inventory receipts, issues, losses, orders, balances, suppliers, customers, and prices. They provide information for planning distribution and quantification [4]. Inventory control also hosts a good store management strategy [3,4,6,7]. Maintenance of appropriate storage conditions for pharmaceuticals is essential to assure quality [8] if assisted by quality audit [9]. Pharmaceuticals should be protected from sun, heat, and water [3,4,6,7]. They should always be kept in the first-to-expire, first-out (FEFO) procedure [10], and stored at their temperature requirement, and in humidity not more than 60% [6,11].

Medicines shortage crisis not only increased financial losses but also jeopardizes patients' health [12,13] through interrupted access to medicines [14], and fluctuations of stocks [15], that is, harms patient safety [16]. Stock fluctuations in Ethiopia are about 60% [17] due to inaccurate inventory records [18,19]. Expiry and stock-out of vital medicines are substantial [17]. The poor inventory control system is the main reason for wastage and shortage of essential medicines [20,21] due to stock-outs [22]. Efficient and effective inventory management is the determinant factor for healthcare success [23,24]. However, in sub-

Saharan Africa, including Ethiopia, stock-outs are the major cause of health-care service interruptions [25]. Thus, the objective of this study was to assess inventory management practices of pharmaceuticals in public health institutions of Dessie City Administration, Ethiopia.

METHODS

Study area and design

The study was conducted in Dessie City Administration, Ethiopia, from February 5, 2019, to February 24, 2019. Dessie is an administrative city in Amhara regional state. The city was selected for the study because it is the largest urban center in Northeast Ethiopia [26]. There are various private and public health institutions (two public hospitals and eight public health centers) in Dessie. Most of the populations, especially those who are at a low socioeconomic level, were being served in public institutions. Thus, all the public health centers and hospitals were included; whereas, the private institutions were excluded from the study. The research used a descriptive cross-sectional study design.

Data collection and analysis

The data were collected using an observation checklist questionnaire, which was extracted and modified from the standard operating procedure (SOP) manual for the integrated pharmaceutical logistics system in health facilities of Ethiopia, 2nd Edition [3] and SOPs for pharmaceuticals good distribution and storage practices [6], at the central stores of all institutions through direct observation and analysis of inventory transaction indicators from records, inventory record forms, and models, recording status, storage organization and arrangement, furnishing, and functionality of quality control tools in the

stores. The checklists were filled by the data collector (EMB) through reviewing recorded documents and direct observations of activities. All records and documents available have been observed and reviewed. Any technologies important for inventory management systems have been sought for availability and functionality. Data quality assurance measure was taken before, during and after data collection for the completeness, clarity, and legibility of checklists. The collected data were held confidentially. Finally, the data were analyzed and completed using Microsoft Office Excel 2010 worksheet.

RESULTS

Inventory management methods and transaction

As it is illustrated in Table 1, among the central stores of all 10 institutions, none of the stores had maintained maximum, minimum, reorder stock, and safety stock levels to prevent stock-outs. Three of the institutions did not properly record receipts, issues, losses, and adjustments. None of the institutions did have automated stock transaction methods or inventory management software in their central stores. There was an incidence of stock-outs in six institutions during the past 3 months. On the other hand, three institutions had an experience of overstocks in the past 3 months. There were also expired commodities in four institutions in the past 3 months. Two institutions did not have a standard guideline for commodities inventory management. In six of the institutions, quantities on inventory records were properly matched with the physical count. Three institutions had appropriately recorded the price of each item on SRCs.

Recording and documentation

Regarding recording and documentation status, as it is depicted clearly in Table 2, BCs and invoices (model 19 or receipt invoice and 22 or issuing invoice) were available and used in all institutions, but SRCs were available in five of them. Nine of them had and used RRF and IFRR. Six institutions had separate records for all items. Three of the institutions had detailed written inventory instructions and procedures. Logistic management and information system (LMIS) formats and job aids were available in nine institutions. Neither of the institutions had an electronic data interchange technology system nor maintained a database of their suppliers.

Store management

The store of two institutions completely controlled and operated by pharmacists and all the rest were operated by druggists. Only two institutions had functional wall thermometers to control room temperature. None of the institutions had calibrated hygrometers to control humidity. Fire extinguishers were not available in seven institutions to be used in case of a fire emergency. Only one institution had a fireproof area for combustible substances. The stores of six institutions were properly shelved, clean and dry, ventilated, and out of direct sunlight. Lockable cabinets for controlled drug storage were not available in eight institutions. All of the institutions had cold storage facilities for vaccines and biological products. Three of the institutions used FEFO storage technic to track out items. The storeroom of one institution was not protected from water penetration. In the stores of seven institutions, cartons were stacked at least 10 cm off the floor; whereas cartons in three institutions were visible on the floor. Each shelf is arranged 30 cm away from the wall and other stacks only in the stores of two institutions but arranged in others with no space between. Cartons stacked no more than 2.5 Ms high in six of the institutions, but contact of cartons with ceiling was visible in four of them. Cartons were arranged with arrows pointing up, and with identification labels, expiry dates, and manufacturing dates to be visible in five of the institutions, but arranged haphazardly in others. Damaged or expired products were properly separated, sorted, and labeled in seven institutions. Non-pharmaceutical products were stored along with drugs in four institutions. Corrosives and combustibles are held separately only in two of the institutions. Six of the institutions had sufficient space for free tracking of goods in their stores (Table 3).

Table 1: Pharmaceuticals inventory management methods and transaction in 10 public health institutions of Dessie City Administration, February 2019

Activities	Response in no.	
	Yes	No
Records reflect maximum, minimum, and reorder levels maintained	0	10
Tools dictate safety stock maintenance to prevent stock out	0	10
Receipts, issues, losses and adjustments properly recorded	7	3
Automated stock transaction available	0	10
Incidence of stock-outs during the past 3 months	6	4
Experience of overstock in the past 3 months	3	7
The presence of expired commodities in the past 3 months	4	6
Standard guide line for commodities inventory management available	8	2
Quantities on inventory records match with the physical count	6	4
Price of each item properly recorded on the SRC	3	7

SRC: Stock record card

Table 2: Recording and documentation status of the pharmaceuticals inventory management in 10 public health institutions of Dessie City Administration, February 2019

Activities	Response in no.	
	Yes	No
Availability and proper utilization of BC	10	0
Presence and utilization of SRC	5	5
Availability and utilization of RRF	9	1
IFRR formats available and filled properly	9	1
Vouchers (Model 19 and 22) available and properly used	10	0
Maintain separate records for all commodities	6	4
Detailed written inventory instructions and procedures exist	3	7
The institution maintains a database for their suppliers	0	10
LMIS formats and job aids available	9	1
Electronic Data Interchange Technology available	0	10

BC: Bin card, SRC: Stock record card, RRF: Report and Requisition Form, LMIS: Logistic management and information system, IFRR: Internal Facility Report and Resupply Form

DISCUSSION

Findings from this study revealed that records in all institutions dictate that they did not maintain the maximum, minimum, reorder, and buffer stocks levels to facilitate smooth stock-flow which hinders effective performance [27]. They did not put a benchmark to the amount of these levels by time which can result in inventory inefficiencies [28] and inadequate forecasting of requirements [29]. Similarly, an indicator-based assessment of medicine storage and inventory management in India showed that none of the institutions demarcated maximum and minimum stock levels [30]. This may be due to fluctuations in stock levels [31]. Receipts, issues, losses, and adjustments were properly recorded in most institutions (n=7) with calculation fallacies, but none of the institutions automated their transaction system which is similar to the study conducted on pharmaceutical store management in West Hararghe Zone, Ethiopia [7], that might be due to lack of finance. Similar to Hararghe Zone [7] and a study in Gondar [17], there was an incidence of stock-outs in more than half of the institutions (n=6) during the past 3 months, but unlike the study in Hararghe, which showed nil incidence of overstocks [7], there was an incidence of overstocks in the past

Table 3: Store management situation of pharmaceuticals in 10 public health institutions of Dessie City Administration, February 2019

Activities	Response in no.	
	Yes	No
Store completely controlled and operated by pharmacist	2	8
Availability of functional wall thermometer	2	8
Calibrated hygrometer available in store	0	10
Presence of fire extinguishers in case of fire emergency	3	7
Fire proof areas for combustible substances	1	9
Store properly shelved, clean, dry, ventilated, and out of direct sunlight	6	4
Lockable cabinets for controlled drugs storage	2	8
Cold storage facilities for vaccines and biological products	10	0
Storage using FEFO technique	3	7
Store room protected from water penetration	9	1
Cartons stacked at least 10 cm off the floor	7	3
Each shelf arranged 30 cm away from the wall and other stacks	2	8
Cartons stacked no more than 2.5 m high	6	4
Cartons placed with arrows up, labeled and expiry dates visible	5	5
Separation of damaged or expired products and removal from stock	7	3
Storage of non-pharmaceutical products with drugs	4	6
Corrosives and combustibles held separately	2	8
Sufficient space for free tracking of items	6	4

FEFO: First-to-expire, first-out

3 months in three of all institutions in this study which was also reported by another study in Indonesia [32]. The difference might be due to the studies were conducted at different times and places. Comparably to Hararghe [7], but opposite to a study in India [30], there were expired commodities in four of the institutions in the past 3 months.

In six of the institutions, quantities on inventory records were properly matched with the physical count but three institutions had appropriately recorded the price of each item on SRC. However, only half (n=5) half of the institutions had SRC. Most of the institutions (n=8) had a standard guideline for commodities inventory management in their stores. Opposite to a study in India, which showed absolute unavailability of BCs and SRCs [20], but similar to a study in West Hararghe Zone [7], this study found that BCs and invoices were available in all institutions; whereas SRCs were not available in five of them. RRF, IFRR, and LMIS formats were available in nine of the institutions. However, fewer of them (n=6) had separate records for all items. Three of the institutions had detailed written inventory instructions and procedures, but none of the institutions had electronic data interchange technology and a database of suppliers. Despite this, documentation is crucial in ensuring efficient inventory management, stock records provide the management with the information which is used to ensure accountability through stocktaking and stock audit exercise [33].

Only two institutions completely controlled and operated their stores by pharmacists but the rest by druggists which is opposite to a study in India at which 65% of the health centers were operated by pharmacists [20]. This may be because of the difference in the availability of the educated human resource. Slightly similar to a study in Hararghe [7], which showed complete absence, but strictly opposite to most standards, only two institutions had functional wall thermometers. Calibrated hygrometer to manage humidity and fire extinguishers in case of fire emergency was not available in all and seven institutions respectively. In contrast, only one institution had a fireproof area for combustibles.

In most institutions (n=8), secured storage of controlled drugs was absent. This is contradictory to most standards specifically to Food, Medicine, and Health care Authority of Ethiopia currently the Ethiopian Food and Drug Administration Authority [6]. This might be because of a lack of follow-up and supervision from the regulatory bodies. Most stores (n=9) were protected from water penetration, and six of the stores were properly shelved, clean and dry, ventilated, and out of direct sunlight, but opposite to a study in Hararghe [7], storage by FEFO policy was not used by most (n=7) of the institutions. However, cold storage management and maintenance were good in all institutions. Cartons were stacked at least 10 cm off the floor in most (n=7) of the institutions. Opposite to the pharmaceuticals supply and fund agency standard [3], which instructs that each shelf should be arranged 30 cm away from the wall and other stacks and no more than 2.5 Ms high, shelves were aligned in contact with each other in eight institutions and cartons touched ceiling was visible in four institutions. Cartons were arranged disorderly in half of the institutions (n=5). Unusable items were properly sorted in seven institutions which could be expected from all, but corrosives and combustibles were held with medicines in eight institutions. Six institutions had sufficient space to facilitate free and conducive stock trafficking, but not in the rest of them, similar to the study conducted in the Western Cape [34].

Limitations

The research was conducted only in central stores of public health centers and hospitals. It did not include private health institutions as well as governmental health posts and district office stores. Thus, it cannot be generalizable to both private and governmental institutions. It did not also consider factors affecting the inventory control system.

CONCLUSION

The inventory management, recording, and storekeeping practices were not satisfactory in the institutions. Calculation fallacies, recording errors, improper stock levels maintenance, lack of automatic recording, absence of wall thermometers, absence of humidity and fire control systems, absence of lockable cabinets, fail to use FEFO storage technique, and holding combustibles with drugs were found to be the major pitfalls of these institutions.

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AUTHORS' CONTRIBUTIONS

EMB designed the study, accomplished literature search and review, performed the data collection and processing, as well as analyzed and interpretation of the result. MHK was involved in the design, literature search, and provided supervision. BDW participated in the literature review and writing stage of the research. All authors approved the manuscript for submission.

CONFLICTS OF INTEREST

Nil.

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REFERENCES

1. Prasath A. Inventory management through extended star-ring supply chain network. *Asian J Pharm Clin Res* 2017;10:199-201.
2. USAID/Deliver Project. *The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities*. 2nd ed. Arlington, VA: USAID/Deliver Project; 2011.
3. Ethiopian Pharmaceuticals Supply Agency (EPSA). *Standard Operating Procedures (SOP) Manual for the Integrated Pharmaceuticals Logistics*

- System in Health Facilities of Ethiopia. 2nd ed. Addis Ababa: Ethiopian Pharmaceuticals Supply Agency (EPSA); 2015.
4. Management Sciences for Health (MSH). MDS-3: Managing Access to Medicines and Health Technologies. United States: Management Sciences for Health (MSH); 2012.
 5. Sides K. Inventory Management: Forecasting, Models, Techniques; 2019. Available from: <https://www.shipmonk.com/blog/inventory-management-forecasting-models-techniques>.
 6. Ethiopian Drug Administration and Control Authority (EFDA). Standard Operating Procedures for Pharmaceuticals Good Distribution and Storage Practices. Addis Ababa: Ethiopian Drug Administration and Control Authority (EFDA); 2018.
 7. Kassie GM, Mammo S. Assessment of pharmaceutical store management in Woreda health offices of West Hararghe zone, Ethiopia. *Int Res J Pharm* 2014;5:642-5.
 8. Tabash M, Abuqamar M. Assessment of the status of private and non-governmental pharmaceuticals supply warehouses in Gaza Strip, Palestine. *Asian J Pharm Clin Res* 2018;11:300-7.
 9. Agarwal P, Mishra A. Pharmaceutical quality audits: A review. *Int J Appl Pharm* 2019;11:14-22.
 10. John Snow Inc./DELIVER in Collaboration with the World Health Organization. Guidelines for the Storage of Essential Medicines and Other Health Commodities. Arlington, VA: John Snow Inc./DELIVER, for the U.S. Agency for International Development; 2003.
 11. Vriesendorp S, Peza LD, Perry GP, Seltzer JB, O'Neil M, Reimann S, et al. Health Systems in Action: An Handbook for Leaders and Managers; 2010.
 12. Uthayakumar R, Priyan S. Pharmaceutical supply chain and inventory management strategies: Optimization for a pharmaceutical company and a hospital. *Oper Res Health Care* 2013;2:52-64.
 13. Azghandi R, Griffin J, Jalali MS. Minimization of drug shortages in pharmaceutical supply chains: A simulation-based analysis of drug recall patterns and inventory policies. *Complexity* 2018;2018:6348413.
 14. Postgraduate Healthcare Education (PHE). Keeping up with Supply and Demand: Pharmacy Inventory Management; 2020. Available from: <https://www.powerpak.com/course/content/114338>.
 15. Dwivedi S, Kothiyal P. Inventory management: A tool of identifying items that need greater attention for control. *Pharma Innov* 2012;1:125-9.
 16. Ali AK. Inventory management in pharmacy practice: A review of literature. *Arch Pharm Pract* 2011;2:151-6.
 17. Fentie M, Fenta A, Moges F, Oumer H, Belay S, Sebhat Y, et al. Availability of essential medicines and inventory management practice in primary public health facilities of gondar town, North West Ethiopia. *J PharmaSciTech* 2015;4:54-6.
 18. Mohamed AA, Ahmed AS. Enhancing the inventory control effectiveness of a pharmaceutical distributor in Egypt: A case study. *J Supply Chain Oper Manag* 2016;14:23-35.
 19. Pallangyo NP. The Analysis of the Performance of Medical Stocks Control System: A Case of Dodoma Regional Hospital, Dissertation. Dar es Salaam, Tanzania: The Open University of Tanzania; 2014.
 20. Kokilam MB, Joshi HG, Kamath VG. Assessment of pharmaceutical store and inventory management in rural public health facilities-a study with reference to Udupi district, Karnataka. *Pharm Methods* 2015;6:53-9.
 21. Nahamya D. Assessment of Essential Drug Management in the Public Health Facilities in Uganda, PhD Thesis, University of Cape Town; 2007.
 22. Adzimah ED, Awuah-Gyawu M, Aikins I, Duah PA. An assessment of health commodities management practices in health care delivery; a supply chain perspective. The case of selected hospitals in Ashanti region-Ghana. *Eur J Bus Soc Sci* 2014;3:78-103.
 23. Hani U, Basri MH, Winarso D. Inventory management of medical consumables in public hospital: A case study. *Management* 2013;3:128-33.
 24. Oballah D, Waiganjo E, Wachiuri WE. Effect of inventory management practices on organizational performance in Public health institutions in Kenya: A case study of Kenyatta National Hospital. *Int J Educ Res* 2015;3:703-14.
 25. Leung NH, Chen A, Yadav P, Gallien J. The impact of inventory management on stock-outs of essential drugs in Sub-Saharan Africa: Secondary analysis of a field experiment in Zambia. *PLoS One* 2016;11:e0156026.
 26. Dimon M. The largest cities in Ethiopia. In: *Ethiopian Gazette*; 2018. Available from: <https://www.ethiopianguzette.com/the-largest-cities-in-ethiopia>.
 27. Ng KJ. An assessment of the factors influencing effectiveness of inventory control; ministry of state for provincial administration and internal security, Nairobi-Kenya. *Int J Bus Commer* 2013;3:33-53.
 28. Romero A. Managing medicines in the hospital pharmacy: Logistics inefficiencies. *Lect Notes Eng Comput Sci* 2013;2:1120-5.
 29. Onkundi KE, Bichanga WO. Factors influencing inventory management performance in public health sector: A case study of public health sector in Kisii county. *Eur J Bus Manag* 2016;8:158-65.
 30. Iqbal MJ, Geer MI, Dar PA. Indicator based assessment of medicine storage and inventory management practices in various public sector hospitals of district Srinagar. *Int Arch Biomed Clin Res* 2015;1:8-15.
 31. Atif M, Malik I, Mushtaq I, Asghar S. Medicines shortages in Pakistan: A qualitative study to explore current situation, reasons and possible solutions to overcome the barriers. *BMJ Open* 2019;9:e027028.
 32. Rachmania IN, Basri MH. Pharmaceutical inventory management issues in hospital supply Chains. *Management* 2013;3:1-5.
 33. Ondari LM, Muturi W. Factors affecting the efficiency of inventory management in organizations in Kenya: A case of firms in Kisii Town. *Int J Econ Commer Manag* 2016;4:1019-34.
 34. Mahoro A. Examining the Inventory Management of Antiretroviral Drugs at Community Health Centres in the Cape Metropole, Western Cape. Cape Town, South Africa: University of the Western Cape; 2013.