

Assessment of Knowledge, Practices, and Challenges of Pharmaceuticals Inventory Control Among Pharmacy Professionals Working in Selected Public Health Facilities of West Arsi Zone, Oromia, Ethiopia

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ABSTRACT

BACKGROUND: Good pharmaceutical inventory control enables health facilities (HFs) to provide complete health care by ensuring the availability of safe, effective, and affordable pharmaceuticals and related supplies of the required quality, inadequate quantity, at the required place and at all times. It boosts patients' trust in the HFs and motivates working staff. However, it needs well-trained and skilled professionals. The aim of the current study was, therefore, assessing knowledge, practice, and challenges of pharmacy professionals conducting inventory control in selected public health facilities of West Arsi Zone, Oromia regional state for the year 2016 to 2018.

METHOD: A mixed-methods study design was used to assess pharmacy professionals' knowledge, skills, and challenges in applying inventory management methods. A semi-structured questionnaire was implemented for quantitative, whereas an open-ended question was employed for key informants (KIs) to explore qualitative data.

RESULT: Ninety percent of pharmacy professionals knew about VEN analysis concepts and 70% about ABC analysis. However, none of them had a concept of FSN and XYZ analysis. Among the respondents who knew the concept, 75% had gained knowledge through formal training and 10% of them learned from on-job training. When they asked about the methods of inventory control, 60% responded as they did not hear about it. Of those who said "Yes" on being asked to mention at least 1 method of it, 80% could not able to correctly mention the methods used in inventory control. However, 44%, 62.5%, and 75% of respondents had practiced ABC, VED, and ABC-VED matrix analysis respectively. The challenges that prevented these professionals from practicing pharmaceutical inventory control in their HFs were grouped into price-related, training-related, human resource-related, and managerial-related factors.

CONCLUSION: Inventory control is the heart of the pharmaceutical supply system. Without its healthy action, HFs' goal attainment will not be viable. Problems of sick pharmaceutical inventory control are directly related to a lack of knowledge and appreciation of it by the concerned bodies. The current finding revealed almost all pharmacy professionals included in the study had little knowledge about how to manage their inventories. Managers' unwillingness to cooperate and facilitate necessary resources prevented the professionals from doing inventory control.

KEYWORDS: Pharmaceutical inventory control, knowledge, practice, challenge, West Arsi, Oromia, Ethiopia

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Introduction

Inventory is vital to an organization from a financial and operational standpoint. In health care facilities (HFs) it refers to the stockpile of pharmaceutical products kept meeting forthcoming demand—since pharmaceuticals are key elements of a well-functioning healthcare system. The wellbeing of the pharmaceutical supply systems in the HFs is dependent on the management of inventory and it plays a significant role in the improvement of patient care—as inventory management is the process of maintaining stock properly at all levels of the supply chain and at all times.¹⁻³

Good pharmaceutical inventory management keeps the balance between the service level and the stock level.¹ It enables

the provision of complete health care by ensuring the availability of safe, effective, and affordable pharmaceuticals and related supplies of the required quality, inadequate quantity, at the required place, and at all times—the 6 rights.^{3,4} It also boosts patients' trust in the HFs and inspires working staff.⁴ However, HFs' capacity to ensure that there is adequate stock of required items and an uninterrupted supply of all essential items are harmed due to poor inventory management.

Poor pharmaceutical inventory management at HFs was found as one of the major reasons for the stock-out of 37.5% of key medicines in Uganda and as one of the issues threatening Ethiopia's pharmaceutical supply chain.^{5,6} As a result, it is estimated that 4% to 9% of pharmaceuticals are wasted



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throughout the overall supply chain of the country.⁶ Poor inventory management is challenging the availability of life-saving drugs.⁷ It directly accounts for a significant portion of stock-outs in Sub-Saharan Africa, resulting in demand seasonality and facility access disruptions, as well as causing increased morbidity and mortality.^{4,8-13} The scenario worsens in developing nations as their drug spending account for 60% to 80% of population expenditures and up to 90% of people buy drugs out-of-pocket. In Ethiopia where the government is the main source of drug supply and their access to population is ensured majorly through direct out-of-pocket payment, poor inventory management stifles financial resources, leads to an increase in out-of-pocket spending, and, as a result, a decline in the quality of healthcare services.¹⁴⁻¹⁸ Therefore, inventory control analysis techniques such as ABC, VED, FSN, XYZ, ABC-VED Matrix, FSN-XYZ Matrix, HML, S-OS, and others must be used to ensure good inventory management. The purpose of this study was to assess pharmacy professionals' knowledge of these techniques, their practical skill in applying them, and the challenges they face during the application/for application/that prevent them from practicing in the West Arsi Zone of Oromia, Ethiopia.

Methods

Study area and period

The study was conducted in selected public health facilities of West Arsi Zone, Oromia regional state from 19th April 2019 to 19th May 2019. West Arsi zone covered the South and Southeast parts of the region. Administratively, there are 13 districts with a total population of over 2 million people. There are 2 public hospitals, 82 health centers, and 410 health posts (dispensing units of HCs) in the zone (West Arsi Zonal Health Department).

Study design

A mixed-methods study was conducted to assess pharmacy professionals' knowledge skills and challenges in applying an inventory management matrix. Specifically, a semi-structured questionnaire recorded the participants' knowledge and skill responses, whereas open-ended questions given to key informants (KIs) by chance focused on the challenges. The purpose of the letter was to gain a thorough grasp of the matter and to acquire responders' real-world experience.¹⁹⁻²²

Sample size determination and sampling procedure

The USAID delivery project logistics indicators assessment tool (LIAT) was employed to determine the sample size of health facilities. It recommends a minimum of 15% of the total health facilities to be considered.²³ From the study area, 17% HFs were included in the study comprising 1 hospital and 13 HCs—one from each district by simple random sampling technique.

From the selected HFs, the store manager and pharmacy head (key informants—KIs) are purposively selected for open-ended in-depth-interview. They were interviewed until the information was saturated. For quantitative data gathering, every volunteered pharmacy professional working at the outpatient pharmacy during data collection was included.

Data collection tool

To assess knowledge of professionals toward pharmaceuticals inventory control matrix analysis, a semi-structured questioner adapted from Callender and Grasman's¹⁹ study was used. The same study was also employed to know their practical experience. To dig further information about the issue, qualitative open-ended in-depth-interview questionnaire was adapted from the logistic system assessment tool (LSAT), which was designed to probe essential questions regarding the issues of the ABC-VEN matrix, FSN-XYZ matrix.^{20,24} The interview guide was prepared in English language and translated into Afaan Oromoo, the region's working language.

Data collection procedures

For the knowledge assessment, the data were collected by trained data collectors with close supervision by the principal investigators. Apart from demographic data questions, a zero (0) point was given for an incorrect answer and one (1) point was given for the correct answer. The levels of knowledge were graded as poor (0%-49%), average (50%-74%), and good (75%-100%). Criteria used for ranking these levels were: when someone scored ≤ 7 questions ranked to be of poor knowledge, on answering correctly > 8 to ≤ 12 questions designated as having average knowledge and lastly, on responding correctly to > 12 to 16 questions designated to have a good knowledge.²⁵

The qualitative data gathering was done by interviewing KIs. Two pharmacy professionals were trained to question the selected storekeepers and pharmacy heads by delivering open-ended in-depth-questionnaire through a face-to-face approach. The KIs were given enough time to respond to the questionnaire until they show they had fully expressed what they know and understand. Their response was audio recorded.

Data analysis

Analysis of the quantitative data was done by using Microsoft Excel® spreadsheets.

Qualitative data. The qualitative data were analyzed manually using the thematic content analysis technique. Accordingly, the investigators were familiarized with the audio-recorded data by listening and taking notes of the interview. Then, the data were coded using a table in an MS word document and translated into English. The coded data were organized to search for sub-themes. And, similar subthemes were combined, named, and described. Finally, the report was produced in narration form.

Data quality assurance

The collected data were checked for completeness and cleaned every day during data collection. Incomplete data were discarded and data collectors were redirected.

Inventory control techniques

The ABC analysis—based on cost. ABC analysis is a method of inventory management that determines the value of inventory items based on their cost to the company. It assists in identifying the most important items in the stock and ensuring that they are prioritized for management over those that are less valuable; and classify items as follows: “A” class—10% to 20% of items that take 70% to 80% of the overall total cost, “B” class—10% to 20% of items that take 15% to 20% of the overall total cost, “C” class—60% to 80% of items that take 5% to 10% of the overall total cost.²⁶

The VEN analysis—based on the criticality. VEN analysis, also known as criticality analysis, is significant for effective inventory management since it prioritizes medications based on their functional importance to public health as vital, necessary, and normal.²⁶ Vital drugs can save lives and are necessary for providing basic health care. Essential drugs are helpful against less severe yet major illnesses, although they are not required for basic health care. For minor or self-limiting illnesses, normal drugs are utilized.⁴

The ABC-VEN matrix analysis. ABC-VEN matrix analyses is a combined technique obtained by cross-tabulation of ABC and VEN analyses to develop a management system used for prioritization and meaningful control over the stock. The combination creates 3 categories—Category I includes all V and E items (AV, BV, CV, AE, AN); Category II includes the remaining items of the E and B groups (BE, CE, BN); and Category III includes the normal and cheaper group of items (CN).²⁷

XYZ analysis—based on stock value. The XYZ analysis is a technique for classifying items into X, Y, and Z categories based on their demand variability or closing stock values. The X-items represent regular demand, accounting for 70% of total inventory value, the Y-items represent substantial variability in demand, accounting for 20%, and the Z-items represent very irregular and difficult to predict demand, accounting for the remaining 10%.²⁸

FSN analysis—based on the frequency of issue. The FSN analysis is a strategy for inventory management that is based on the frequency at which items are issued. The technique classifies the inventory into 3 groups: F, S, and N. Fast-moving (F) items are those issued more than 15 times in a year, slow-moving (S) items are those issued 5 to 15 times, and non-moving (N) items are those issued less than 5 times.²⁸

Table 1. The socio-demographic profile of the respondents.

VARIABLES	CHARACTERISTICS	FREQUENCY (%)
Length of the year on work	1-5y	14 (44)
	6-10y	18 (56)
Profession	Pharmacist	16 (50)
	Druggist	16 (50)
	N	32 (100)
Type of training taken by professionals	IPLS	27 (85)
	LMIS and APTS	5 (15)

Pharmacist—a pharmacy professional who is certified by taking full pharmacy qualification courses for 5 years at the University level. Druggist—a pharmacy professional who took pharmacy qualification courses at the college level for 3 years and was certified.

The FSN-XYZ matrix analysis. FSN-XYZ matrix analyses is a combined technique obtained by cross-tabulation of FSN and XYZ analyses to identify the items to be discarded and the amount saved.²⁹ From the FSN-XYZ matrix, a total of 9 sub-categories will be obtained. Category I comprises FX+FY+FZ+SX+NX, category II includes SY+SZ+NY and category III has non-moving low-value items, NZ.²⁷

Result

Fourteen public health facilities were surveyed to assess the knowledge, practice, and challenges of pharmacy professionals toward these inventory control tools. From volunteered professionals for interviews half were pharmacists and the remaining were druggists. All respondents had more than a year of work experience and 85% of them took only integrated pharmaceutical logistic system (IPLS) and 15% received both logistic management information system (LMIS) and auditable pharmacy transaction system (APTS) training during their services (Table 1).

Assessment of knowledge and practice

The respondents were asked whether they had a concept of inventory management such as ABC analysis, VEN analysis, XYZ analysis, FSN analysis, ABC-VEN matrix analysis, and FSN-XYZ matrix analysis. The majority (90%) knew about VEN analysis concepts and 70% of respondents knew about ABC analysis. However, none of them had a concept of FSN and XYZ analysis.

From those who had admitted that they knew the few inventory control techniques, 75% of them had gained knowledge of VEN and ABC analysis by formal training, 10% of them learned from on-job training whereas 15% of them acquired through other means. On the other hand, they were also asked whether they knew about the methods of inventory control, most (60%) responded as they did not hear about the inventory control method. But 40% responded that they know

however on being asked to mention at least one method of it, the majority (80%) could not able to correctly mention the methods used in inventory control (Table 2).

In Figure 1, the assessment of knowledge on the purpose of pharmaceutical inventory management, 30% of the pharmacy professionals scored good, 55% scored average, and 15% of the respondents scored poor results.

Assessment of practice

Concerning the practice, 75% of respondents had practiced ABC-VEN matrix analysis. Conversely, all of them did not apply FSN-XYZ matrix analysis at all (Table 2).

Assessment of challenges

Pharmaceutical inventory management challenges were assessed through in-depth face-to-face interviews of KIs and the collected data were categorized into 4 thematic areas based on the characteristics of the result. These are price-related, training-related, human resource-related, and managerial-related factors.

Price. Key informants were asked about the medicines consumption trend and they responded as the number of items consumed was decreased each year due to the decrement in the number of items purchased. This can be exemplified by as one of the KIs stated;

“... in 2009 and 2010 the price of medicines increased but the budget allocated by the government was not increased proportionally to increment of the price of medicines. So, we reduced the number of items by eliminating some less prescribed medicines”

Training. The majority of them reported that they had taken a single training on IPLS and even a large number also responded as they did not participate in the formal training. One of the respondents reported that *“I had participated in a workshop arranged by Zonal health office. It was not given only to the pharmacy professional. There were many topics of discussion integrated with one training session. In my opinion that was not enough. I couldn't get sufficient knowledge from that session.”*

Some of them again responded that the training they took on the topic of inventory management was not adequate. Particularly, on the topic of XYZ and FSN analysis, they stressfully suggest that they need to get training on such topics. For instance, one of the respondents said that,

“I have heard about the two analyses ABC and VEN but I don't know about its application and its use. Moreover, I haven't heard about the terminologies of XYZ and FSN analysis.”

The other also reported that they had never been practicing the inventory matrix analysis. One of them said, *“Most of the time I*

Table 2. Assessment of knowledge and practice of pharmacy personnel toward inventory management, ABC, VEN, XYZ, and FSN analysis, and their ABC-VEN and FSN-XYZ matrix analysis.

QUESTIONS		FREQUENCY	PERCENTAGE
Question 1: Have you heard of the following concepts, as far as inventory management of pharmaceuticals are concerned?			
Concept of ABC analysis	Yes	22	70.0
	No	10	30.0
Concept of VEN analysis	Yes	29	90.0
	No	3	10.0
Concept of FSN analysis	No	32	100.0
Concept of XYZ analysis	No	32	100.0
Question 2: Do you know inventory control methods?			
	Yes	14	44.0
	No	18	56.0
Question 3: What is the purpose of inventory management?			
To know when to order stock	Yes	30	95.0
	No	2	5.0
To know when to issue stock	Yes	29	90.0
	No	3	10.0
To know how much stock to order	Yes	29	90.0
	No	3	10.0
To know how much to issue	Yes	27	85.0
	No	5	15.0
To know what inventory level to maintain in order to avoid shortages	Yes	14	44.0
	No	18	56.0
Question 4: Have you practiced the following inventory controlling tools			
ABC analysis	Yes	14	44.0
	No	18	56.0
VEN analysis	Yes	20	62.5
	No	12	37.5
XYZ analysis	No	32	100
FSN analysis	No	32	100
ABC-VEN matrix analysis	Yes	24	75
	No	8	25
FSN-XYZ matrix analysis	No	32	100

had been exposed to the theoretical part of the training, I had never encountered a training session that could allow us to practice.”

Human resource. Most of the KIs complained about the lack of human resources as a challenge for conducting ABC-VEN

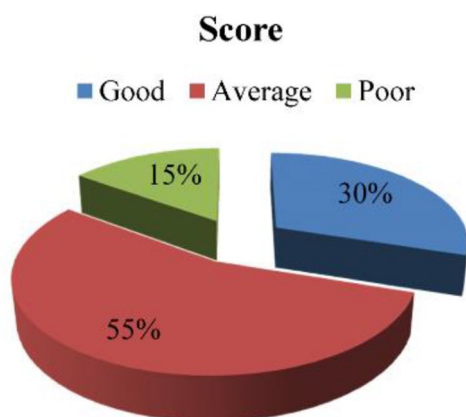


Figure 1. Knowledge rank of pharmacy personnel on inventory management system (n=20).

analysis. This can be explained as one of the HCs store manager stated:

“...I'm a store manager, but I'm also dispensing drugs for patients whenever the personnel at dispensary have night duty because he takes daybreak after night duty. So I have no time to conduct an ABC-VEN analysis. Concerning the FSN-XYZ analysis, we do not have any information and we cannot analyze it at all. We are druggists. Had we had a pharmacist he/she would have conducted this analysis.” HC store manager

Managerial. KIs also complained about the lack of top management commitment and support as another challenge for conducting the matrix analysis and upgrading their knowledge on these issues. These can be exemplified by the response of one of the KIs:

“...Our facilities management does not encourage us to conduct such analyses. They do not send us pieces of training. Even if I ask them stationary materials to conduct ABC-VEN analysis, they complain about the lack of budget. They do not consider such activities as important. So how can I conduct with my own stationeries?” HC Pharmacist.

Discussion

As being the core of the pharmaceutical supply system, and playing a determinate role in increasing the risk of stock-out and overstocking, professionals responsible for controlling inventory must track it properly.³⁰ Effective health services can only be delivered and their credibility can be sustained if it is installed and appropriately functioned.³¹ Thus, everyone dealing with pharmaceutical inventory should be familiar with inventory management techniques and have practical skills with them. However, a significant percentage of respondents (15%) in the current study were unaware of its purpose. This finding was inconsistent with the study results of Tumaini,²⁵ where 30% of the respondent did not know the purpose of pharmaceutical inventory management. It was shocking to discover such a large gap in professionals who worked in one of the most heavily used therapeutic facilities of hospitals/HCs,

the pharmacy, where a significant amount of money is spent on purchasing pharmaceutical items. This could threaten the possibility of achieving significant improvements in patient care and scarce-resource utilization.²

Almost majority of pharmacy professionals working in health settings, according to the KIs response, did not receive any training on the subject before starting their jobs. And the institutions aiming to give quality health services to the community have no continuous professional development plans for their pharmacy professionals. Besides, the emphasis on administrative and management components of pharmacy courses is modest in the curriculum.³² Practical sessions intended to familiarize students with such themes are typically passed through basic reports of field visits, attachment works, and community pharmacy service clerking, rather than through intensive and rigorous practical monitoring and assessments. So, that was why the respondents (56%) had a lesser tendency of knowing inventory controlling techniques and were unable to correctly explain their application (85%). Research is done in Tanzania also found that 85.7% of the respondents could not correctly explain the application.²⁵ None of the respondents were aware of the XYZ and FSN analyses, and their matrix.

Applying inventory controlling analysis has many benefits, patients obtain drugs promptly, stock-out can be avoided even when product deliveries are delayed, supplies can be replenished at refilled intervals and patients have confidence in the facility and seek care when they are ill.⁴ In the current study, only 44%, 62.5%, and 75% of the respondents applied ABC analysis, VEN analysis, and ABC-VEN matrix analysis in their current institution to manage inventory, respectively. The facilities lost out on benefits that may have been gained if their pharmacy professionals were familiar with XYZ, FSN, and XYZ-FSN matrix analysis and employed it to regulate stock. The health facilities had no idea what their stock closing values were and how they were moving.²⁷⁻²⁹ In the absence of such an evidence-based report, individual interests will remain at the forefront of managerial decisions. It will lead to inefficiency in allocating scarce financial recourses to drug and their significant wastage.⁶ Therefore, for effective and efficient inventory management, pharmacy professionals should get comprehensive formal training as well as regular workshops or seminars on the subject.

The challenges were immense. The main factor influencing the practicability of inventory control methods was managerial commitment and support problems. Top managements, according to KI's response, were unsupportive when asked to host training to help pharmacy workers improve their skills. They were even opposed to the start of ABC, VEN, or matrix analysis because of the financial request they expected it to consume. In other words, despite their refusal to hire enough manpower and allocation of sufficient finances for drugs, the management criticized the professionals for inventory-related messes that occurred around pharmacy services. In the dispute, inventory management decisions were made in the absence of

or with outdated inventory reports and demand forecasting information.

Furthermore, managements were ignorant of the current global economic crises and interior political upheaval of the previous 3 years (2016–2018). They, according to the respondents, were not prepared to address the realities of drug price increases induced by these issues. Their financial allocation was not proportional, it was static. This demonstrated their reluctance. The management must identify and implement solutions such as proper inventory control methods as pharmaceutical supply has become a key point for lowering the rising cost of health care.³³

Training provided by collaborators and the government were deemed to be ineffective for trainees. According to the respondents, the scope and objectives of push training were broad, intending to raise awareness and add value to reports rather than empowering trainees' performance on specific mater.³⁴ The trainee's concentration was belittled by the timing plans for training sessions, the trainer's rush to cover the content, and the perdim assigned for them.³⁵ Because it is a prescribed form of training, it plays a minor role in the development of organizations, raising performance and productivity, and eventually putting health care facilities in their best possible position. If these health facilities are serious about achieving their goals and maintaining high-quality healthcare services, they must invest in on-the-job training for their professionals.³⁶

Conclusion

Inventory control is the heart of the pharmaceutical supply system. Without its healthy action, HFs' goal attainment will not be viable. Problems of sick pharmaceutical inventory control are directly related to a lack of knowledge and appreciation of it by the concerned bodies. The current finding revealed almost all pharmacy professionals included in the study had little knowledge about how to manage their inventories. Managers' unwillingness to cooperate and facilitate necessary resources prevented the professionals from doing inventory control. Therefore, the regional health bureau, W/ Arsi zone, and partners working in collaboration with MOH should plan for capacity building on performing matrices analysis.

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Author Contributions

Tadesse Jobira conceptualized, designed, and drafted the manuscript, performed the statistical analysis, and participated in the supervision. Habtamu Abuye prepared the original draft, coordinated the study, and was involved in the analysis of the data. Awol Jemal participated in the designing and supervision

of the study. Tadesse Gudeta administered and supervised the project and reviewed and edited the final manuscript. All authors read and approved the final manuscript.

Ethical Consideration

Ethical approval was obtained from the Institutional Review Board (IRB) of Jimma University and submitted to Oromia regional health bureau along with one hard copy of the proposal. Then authorization letter was received from Oromia regional health bureau, the West Arsi zone health department, and each Wereda health office sequentially. Before data collection, permission was obtained from the hospital CEO and PHCU directors. For the qualitative study, verbal consent was obtained from each KI, and confidentiality of the information was re-assured to them.

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Availability of Data and Material

All data generated or analyzed during this study are included in this published article.

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