

Critical Analysis of Pharmaceuticals Inventory Management using the ABC-VED matrix (Always, Better and Control – Vital, Essential and Desirable) in a tertiary care centre in Lalitpur, Nepal

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ABSTRACT

Background

ABC-VED analysis is done to have strict inventory control over the items. Category A has 10% items consuming 70% of budget, B has 20% items consuming 20% of the budget and C has 70% items accounting for 10% of the budget. Vital, Essential and Desirable analysis states “V” is for vital items without which a hospital cannot function, “E” for essential items without which a hospital can function but may affect the quality of the services and “D” stands for desirable items, unavailability of which will not interfere with functioning. The study was done to perform ABC-VED analysis and to assess the knowledge of pharmacists regarding drug inventory control in a tertiary care hospital of Kathmandu.

Objective

To perform Always, Better and Control–Vital, Essential and Desirable matrix analysis of the drugs and to assess the knowledge of pharmacists regarding drug inventory control in a tertiary care hospital of Lalitpur, Nepal.

Method

Drug inventory record of one year (2023-2024) was reviewed retrospectively. Included items were drugs (oral, injectable, inhalational) and exclusion was done to surgical and non-drug items. ABC-VED categorization and ABC-VED matrix calculations along with grouping of drugs according to organ system was done. A questionnaire was used to assess the knowledge regarding ABC-VED and Drug Inventory Control among the pharmacists.

Result

A total of 1816407 drug items were included in which category I consumed 48.2%, category II consumed 45.8% and category III consumed 6.0% of the total budget. Category I items require topmost level of management. Category II items require top-/middle-level management and category III requires lower-level management. Antineoplastic was the most expensive group while drugs affecting central nervous system was the most inexpensive. All participants had high knowledge about ABC-VED (Bloom’s cut off score).

Conclusion

The budget expenditure according to cost and criticality was found to be good. The knowledge among pharmacist regarding ABC-VED was high.

KEY WORDS

Always, Better and Control - Vital, Essential and Desirable; Budget; Cost; Criticality; Inventory control

INTRODUCTION

The hospital pharmacy is an extensively used facility where a large amount of money is spent for purchasing medicinal items. For better and effective service management in a pharmacy, it can be accomplished by efficient inventory management of the pharmacy by controlling important drugs and deciding on priorities in purchase and distribution. These include ABC (always, better and control), VED (vital, essential and desirable) and ABC-VED matrix analysis. The ABC and VED analyses group and provide items according to cost significance, criticality value, and consumption rate respectively.¹

ABC analysis is based on Pareto principle (70-10 rule) which states that 70% of the overall consumption value (expense) is based only on 10% of the total items money value while a relatively large number of items may form a small part of the money value. VED classification is based on the criticality of the inventories. Vital (V) are the medicines that are critically needed for the survival of the patients. Essential (E) medicines have lower critical need and desirable (D) are the remaining medicines with lowest criticality.²

ABC analysis, VED analysis and thereafter, ABC-VED matrix analysis combines cost significance (ABC) with criticality (VED), we get 9 possible categories prioritizing the managerial control of the budget and to have strict inventory control. The objective of the study was to categorize the drugs based on cost and criticality aspects, identify those which require stringent managerial control and to assess the knowledge of pharmacists regarding drug inventory control in a tertiary hospital in Lalitpur district, Nepal.

METHODS

This was a quantitative cross sectional quantitative study in which the drug inventory record of one year (2080-81 B.S.) was reviewed retrospectively. The study was conducted in the department of Pharmacy, KIST Medical College and Teaching Hospital, Lalitpur. All drug items in the inventory record were analyzed and 25 pharmacy staffs who were selected randomly, participated in the knowledge assessment.

Data on the drug inventory were collected using a pre-validated ABC-VED analysis protocol and were recorded on a Microsoft Excel sheet.¹ The VED status of each item was decided, with justification, by the hospital Drugs and Therapeutic Committee, the faculty members and the pharmacy in-charge. For the knowledge assessment, a pre validated printed questionnaire regarding ABC-VED and drug inventory was given to the participants.^{3,4} The questionnaire consisted of 13 questions in total, of which six were multiple-choice questions with the option of marking only the one answer considered most appropriate,

and seven were in yes/no format.

Ethical approval for the study was obtained from the Institutional Review Committee, KIST Medical College. Written consent was obtained from the participants after the study questionnaire was explained to them, and permission was obtained from the authors of the questionnaire. Drugs (oral, injectable, inhalational) were included, whereas surgical items (surgical equipments, blades, sutures, etc.) and miscellaneous non-drug items (towels, bedsheets, medical equipment, etc.) were excluded. The items accounting for the top 70% of the expenditure were classified as category A, the next 20% as category B and the final 10% as category C. For VED analysis, the items were classified into three categories according to their criticality as Vital, Essential and Desirable. Thereafter, the number and percentage of items in each category were calculated. Knowledge was assessed using Bloom's cut-off point for knowledge, attitude and practice (KAP) studies (high above 80%, moderate 60 to 79% and low below 60%) for the yes/no part of the questionnaire.⁵ Categorization of drugs according to body organ system was also done.⁶

Statistical analysis was done using basic statistical tools such as mean and percentages, and the data were analyzed on Microsoft Excel sheet.

RESULTS

A total of 18,18,009 drugs were analyzed. In the ABC categorization, A group consisted of 8.2% of items and annual expenditure of 33.6% of the total budget. Comparatively, B consisted of 13.4% of items and 46.8% of the annual budget whereas C consisted of 78.4% of the items and comprised 19.6% of the total annual budget (Table 1).

Table 1. ABC categorization of medicines in the hospital pharmacy

	Items (%)	Annual drug expenditure (%)
A (10-20% items) (70-80% value)	8.20	33.60
B (30% items) (15-25% value)	13.40	46.80
C (50-60% items) (5-10% value)	78.40	19.60

In the Vital category, there were 7.8% of the items which comprised 21.0% of the total annual budget. Similarly, categories of essential and desirable had 67.1% and 25.1% of the total items whereas 45.23% and 33.7% of the total annual budget respectively (Table 2).

After completing the ABC-VED grouping, data from these tables were used to perform the ABC-VED matrix

Table 2. VED categorization of medicines in the hospital pharmacy

	Items (%)	Annual drug expenditure (%)
V (Vital)	7.80	21.00
E (Essential)	67.10	45.30
D (Desirable)	25.10	33.70

calculations (Table 3) using MS excel worksheet. This result was further used to interpret the cost and criticality (Table 4) of the drugs.

Table 3. Always, Better and Control–Vital, Essential and Desirable (ABC-VED) matrix.

	V	E	D
A	AV	AE	AD
B	BV	AB	BD
C	CV	CE	CD

ABC, Always, Better and Control; VED, Vital, Essential and Desirable; A, B, C, categories of ABC analysis; V, E, D, categories of VED analysis; AV, AE, AD, BV, BE, BD, CV, CE, CD, combinations of an ABC category with a VED category.

Table 4. Cost and criticality of medicines in the hospital pharmacy

Category	Items (%)	Annual drug expenditure (%)
I (Topmost level of management)	7.30	48.20
II (Top/middle-level management)	72.30	45.80
III (Lower-level management)	20.40	6.00

ABC matrix combines cost significance (ABC) with criticality (VED) which is further categorized into three categories. These categories represent the budget expenditure. Category I items should be managed by topmost level of management. Category II should be managed by top/middle-level of management and Category III should be managed by lower level of the management. The derivation of the matrix is Category I = AV + BV + CV + AE + AD; Category II = BE + CE + BD; and Category III = CD.

In this study, category I had 7.3% of items and consumed 48.2% of the total annual budget. Category II had 72.3% of the items and 45.8% of the total annual budget. Category III had comprised of 20.4% of items and 6.0% of the total annual budget.

Drug consumed in the hospital were also categorized into the highest consumption value of the total annual budget according to the organ systems involved (Table 5). In this, anti-neoplastic drugs were the most expensive consuming 19.3% of the total annual budget but had only 2.6% of the total drugs. Antibiotics consumed 14.8% of the budget and 13.4% of the total drugs. Drugs affecting the gastrointestinal

Table 5. Drug categorization according to the organ system.

System categorization	Annual drug expenditure (%)	% of drugs
Anti-neoplastic	18.69	2.71
Miscellaneous (Vitamins, minerals, supplements, etc.)	16.89	24.94
Respiratory	16.28	1.32
Antibiotics	14.4	14.09
Hormonal	12.05	9.26
Blood	9.59	7.79
Gastrointestinal system	2.96	21.20
Autocoids	2.45	0.17
Cardiovascular + renal	1.86	12.98
Central nervous system	1.83	10.44

system had the highest percentage of quantity of drugs (20.2%) but only had 3.0% of the total budget expenditure.

A total of 17 participants completed the questionnaire. There were 4 males and 13 females. The highest level of education was masters degree in pharmacy (one participant) with 13 years' experience. The other participants held a bachelor degree in pharmacy (two participants); and diploma in pharmacy (fourteen participants). All participants have received formal training in ABC-VED inventory management (Table 6).

Table 6. Demographic details of the participants.

Characteristics		Number	%
Gender	Male	4	23
	Female	13	76
Age Range	20-30	14	82
	30-40	3	17
	> 40	0	0
Educational Qualification	Diploma in Pharmacy	14	82
	Bachelors in Pharmacy	2	11
	Masters in Pharmacy	1	7
Experience	1-5 years	10	59
	5-10 years	5	29
	> 10 years	3	12

A printed questionnaire printed on paper regarding ABC-VED and drug inventory was given to the participants. Written consent was taken and explanation of study questionnaire was done. The questionnaire consisted of 12 questions in total. Out of these, 5 questions had multiple answers with the option of marking only one which they thought was the most appropriate and 7 questions were in the yes/no format (Table 7 and 8). Bloom's cut off score was used to assess the knowledge in the yes/no part. High knowledge (> 80%), moderate (60-79%) and low (< 60) were the criteria.⁵

All participants (100%) were well aware that the use of inventory models like ABC-VED helps in reducing annual

Table 7. Questionnaire regarding ABC-VED (number of participants, n = 17)

QUESTIONS	Yes (n)	No (n)
Do you know about ABC-VED analysis?	17	0
Is there any standard operating procedure for inventory control management used?	17	0
Do you have predetermined time for ordering medicines from the same store?	15	2
Are you involved in assessing or estimating the quantities of medicines required per year?	15	2
Do you have record for the purchase of medicines for the last three years?	12	5
Have you practiced any inventory-controlling tools?	17	0
Does the use of inventory control model, helps in reducing annual expenses on bulk products?	17	0

Table 8. Participants' views regarding ABC-VED (n = 17)

1. What are all the methods you use for purchasing? a) Direct manufacturer – 9 b) Medical representatives – 4 c) Online wholesalers – 4
2. What are the challenges faced by the pharmacist in managing the inventory? a) Price or budget-related – 4 b) Human resource related – 1 c) Training or knowledge – 1 d) Managerial related – 0 e) All of the above – 11
3. What is the purpose of inventory management? a) To know when to order stock – 3 b) To know how much stock to order – 3 c) To avoid shortage of products – 0 d) To avoid unwanted expenses in overstocking and damaged or expired drugs – 0 e) All of the above – 11
4. How frequently (in one month duration) do you replace or return damaged or expired products/drugs? a) Once – 14 b) Twice – 3 c) > Three times – 0
5. Why is it important to review the medication manufacturer and distributor as part of the inventory process? a) It decreases the number of times a medication is ordered and ensures automatic delivery. – 6 b) It looks at safety and value of purchases and negotiates pricing – 6 c) It aids in setting up partnerships with other organizations and standardizes dosing – 1 d) It reduces medication errors and monitors medication dispensing information – 4

expenses on bulk products. They also agreed on the use of standard operating procedure like ABC-VED and use of software's application for inventory control management. Fifteen of the participants reported they do not have predetermined time for ordering the medicines from the same store whereas twelve of the participants reported that they do not have record of purchase of medicines for the last three years. Fifteen of the participants were not involved in assessing or estimating the quantities of medicines required per year. The knowledge regarding the use of ABC-VED was high. Nine participants purchased the

drugs from direct manufacturer compared with four from online wholesalers and four from medical representatives. Four of the participants believed price/budget related problems were the major challenge faced by the pharmacist compared to eleven participants who reported various multiple factors (price, human resource, training/knowledge, managerial related). Fourteen participants reported that replacement/return of damaged or expired products are done once a month. A mixed response was received for importance of review for the medication manufacturer and distributor as part of the inventory process with six participants seeing it as decrement in the number of times a medication is ordered and ensuring automatic delivery and the other six believe it to be looking at safety and value of purchases and negotiating pricing.

DISCUSSION

This study performed ABC-VED matrix analysis of the drug inventory of a tertiary care teaching hospital and assessed the knowledge of the pharmacy staff regarding drug inventory control. Category I, II and III items accounted for 48.2%, 45.8% and 6.0% of the annual expenditure, respectively, and all participants had high knowledge of ABC-VED analysis.

A total of 18,18,009 drug items consumed during the one-year period were analysed. In the ABC analysis, category A comprised 8.2% of the items and accounted for 33.6% of the annual expenditure, category B comprised 13.4% of the items and 46.8% of the expenditure, and category C comprised 78.4% of the items and 19.6% of the expenditure. Similar studies showed variations, with category A ranging from 20.8% to 88.2%, category B from 10.4% to 49.4% and category C from 1.4% to 34.1%.^{1-3,7-18}

Each hospital has to formulate its own drug inventory analysis according to the patient population visiting it and the health problems treated. However, ABC analysis has the limitation that it is based only on the monetary value and cost of consumption of items. Some items of low monetary value are vital or lifesaving, and their importance cannot be overlooked simply because they are not in category A. Therefore, criticality was assessed as an additional parameter by VED analysis.⁷

In the VED analysis, vital items accounted for 21.0%, essential items for 45.3% and desirable items for 33.7% of the total budget expenditure. These results were similar to those of other studies in the budget allocation, in which the range was 14.4% to 40.8% for vital, 22.5% to 63.4% for essential and 20.8% to 62.2% for desirable items.^{1-3,7,8} The categorisation of items in this classification depends on the type of healthcare facility, i.e. primary, secondary or tertiary.¹⁶⁻²⁷

In the cost and criticality analysis, the overall budget allocation can be said to be good. Category I requires the

topmost level of management, category II requires top/middle-level management and category III requires lower-level management. The present findings suggest that the majority of the budget allocation was managed by the top/middle level of management. In contrast, Gupta et al. and Ahmed et al. reported that the majority of their budget allocation was managed by the middle level of management.^{3,7} The present study was similar to only one study, that of Gupta et al. while major variations were observed with the other studies.^{1-3,7,8,14-27}

In the questionnaire part, 17 pharmacy staff participated. To obtain a well-rounded viewpoint, the respondents were chosen randomly and varied in terms of gender, age, position in the pharmacy and experience. The questionnaire was developed based on the literature and Bloom's cut-off score was used for evaluation.³⁻⁵

The demographic profile was compared with that of a study in India.⁴ In our study, 13 of the 17 participants were female, whereas 30% of the participants in the other study were female (70% were male). The most senior participants in our study were in the 30-to-40-year age range (three participants), whereas 25% of the participants in the other study were above 50 years. With respect to experience, two of our participants had more than 10 years of experience, compared with 30% in the other study.⁴

All participants had knowledge about the ABC-VED inventory method, which was the same as in the study by Preethi et al.⁴ All participants believed that the use of an inventory control model helps in reducing annual expenses on bulk products. Four participants reported price or budget-related problems as the most common problems encountered while purchasing drugs, in contrast to 35% in a similar study.⁴ Regarding the time for purchasing medicines, 15 of the 17 participants believed that the time was adequate, compared with 69% in another study.³

Direct manufacturer purchasing was done by nine participants, whereas four purchased from online wholesalers and four from medical representatives. In comparison, only 20% purchased from direct manufacturers, 40% online and 40% from medical representatives in another study.³

Inventory investment, a significant portion of an organisation's budget, is often neglected due to inadequate management. This results in excess cash being tied up in long-standing stock, negatively impacting cash flow and overall financial health.^{14,19,20,23,25-27} The knowledge of inventory control management tools and methods was assessed by open-ended questions along with the questionnaire.³ Our results show that the majority of the pharmacists had adequate knowledge about inventory management using the ABC-VED procedure.⁵

Our study included only drug items and not surgical items which equally comprise of many of the vital and essential items. A hospital's inventory consists many items (surgical equipment's, non-medical items etc.) for its functioning which were excluded from our study. The study will serve as a pre-liminary base for further studies with larger data to be conducted.

CONCLUSION

The budget expenditure according to cost and criticality was found to be good as the majority of the budget is being managed by top and middle level of management. This analysis should help promote effective management of drug inventory with minimal monetary resources while maintaining required safety stocks of high-priority drugs and reduce frequency of drug supply shortage. The knowledge regarding ABC-VED was high among all the participants.

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