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A study on inventory management by ABC, VED and ABC-VED matrix analysis in pharmacy department of a tertiary care teaching hospital

Binu Mathew*, Lovely Panavila, K.Sindhu, P. Rajaneesh, V.Bharath, H.Doddayya

Department of Pharmacy Practice, N.E.T Pharmacy College, Raichur, Karnataka, India.

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***Corresponding author:**

Email : binum2@gmail.com
Tel.: +91 - 8971698943

ABSTRACT

Background: Approximately 35.0% of annual hospitals budget is spent on buying materials and supplies, including medicines. We can bring about substantial improvement in the hospital inventory and expenditures by the inventory control techniques. The health care in modern days has become more complex sophisticated and more expensive in terms of cost of drugs.

Objective: To study the drugs stored in pharmacy department according to their assessed criticality.

Materials and Methods: This study was conducted retrospectively in pharmacy department for a period of 6 months. Data were collected by checking the stock records and the bills of the supplies of main drug store. The study analyzed the annual consumption; the expenditure incurred for the drugs and developed a matrix based on ABC and VED analysis to narrow down the group of the drugs for managerial monitoring.

Results: The total number of the drugs at the pharmacy was 886 drugs. The total annual drug expenditure (ADE) on these drug items was Rs.101595164.24. ABC analysis revealed 21.22%, 27.65% and 51.13% items as A, B and C category items, respectively, accounting for 68.50%, 21.91% and 9.59% of ADE of the pharmacy. VED analysis showed 12.30%, 15.80% and 71.90% items as V, E, and D category items, respectively, accounting for 19.49%, 17.55% and 62.99% of ADE of the medical store. On ABC-VED matrix analysis, 25.40%, 30.36% and 44.24% items were found to be category I, II and III items, respectively, accounting for 70.38%, 19.36% and 10.26% of ADE of the pharmacy.

Conclusion: Our study revealed that there is a need for conducting such analysis regularly, and applying the inventory management tools for effective and efficient management of the pharmacy, along with close supervision on items belonging to important categories.

INTRODUCTION

The pharmacy is one of the most extensively used therapeutic facilities of the hospital and one of the few areas where a large amount of money is spent on purchases on a recurring basis. This emphasizes the need for planning, designing and organizing the pharmacy in a manner that results in efficient clinical and administrative services[1].

The supply of medicines needs to be managed efficiently in order to prevent all types of wastage including overstocking, pilferage and expiry. This wastage reduces the quantity of medicines available to patients and therefore the quality of health care they receive. Both under stocking or overstocking and expiry of medicines highlight problems within the supply chain activities which include selection, quantification, procurement, storage, distribution and use[2].

Among the essential eight roles of the pharmacist that are described by the World Health Organization and the International Pharmaceutical Federation, managing resources (money, material, manpower, time, and information) is a key factor to professional success on individual level, as well as organizational level[3].

In pharmacy operations, inventory is referred to the stock of pharmaceutical products retained to meet future demand. Inventory represents the largest current asset, as well as liquid

asset in pharmacy practice and its value continues to rise because of the growth in variety and cost of pharmaceutical products[3]. From both financial and operational perspectives, efficient inventory management plays a great role in pharmacy practice. From financial viewpoint, efficient inventory management enhances gross profits and net profits by reducing the cost of procured pharmaceutical products and associated operational expenses. In addition, cash flow will improve upon saving on purchasing and storing less costly products. Such cash flow can be used to pay operational expenses and invest in other services. From operational viewpoint, effective inventory management ensures meeting customer and patient demands [4].

ABC analysis is an important tool used worldwide, identifying items that need greater attention for control. ABC analysis is a method of classifying items or activities according to their relative importance. The analysis classifies the items into three categories: the first 10-15% of the items account for approximately 70% of cumulative value (cost) (category A), 20-25% are category B items that account for a further 20% of the cumulative value and the remaining 65-70% are category C items, amounting for a mere 10% of the total value[5-8]

The limitation of ABC analysis is that it is based only on monetary value and the rate of consumption of the item.Therefore, another parameter of the materials is their criticality[6].

VED analysis is based on critical values and shortage cost of the item. Based on their criticality, the items could be classified into three categories: vital, essential and desirable. There could be serious functional dislocation of patient care services in hospital when vital drugs are not available even for a short period. If essential items are not available beyond a few days or a week, the functioning of the hospital can be adversely affected. The shortage of desirable items would not adversely affect patient care or hospital functioning even if shortage is prolonged. A combination of ABC and VED analysis (ABC-VED matrix) can be gainfully employed to evolve a meaningful control over the material supplies. Category I includes all vital and expensive items (AV, BV, CV, AE, AD). Category II includes the remaining items of the E and B groups (BE, CE, BD). Category III includes the desirable and cheaper group of items (CD)[9].

The shortages of drug products often lead to delayed or cancelled procedures, prolonged hospital stay, increase cost of therapy, and can impact negatively on patient care. As a result, pharmacists spend valuable time communicating with manufacturers and suppliers during drug shortages. To minimize adverse effects on patient care and health-system costs, guidelines on managing drug product shortages in hospitals and health systems have been developed to help in preparing and planning for drug product supply. The causes of drug shortage can be categorized either as demand or supply reasons [10].

Pharmacists cannot take the impacts of inventory mismanagement lightly. Improper management of pharmacy inventory has deleterious impacts on patient safety. Pharmacists should consider details pertaining to pharmacy inventory management when assessing a potential medication error or other drug therapy problems[11].

From both financial and operational perspectives, efficient inventory management plays a great role in pharmacy practice. Several other studies have shown that inventory control techniques when made a routine practice in health care could bring about substantial improvement not only in patient care but also in optimal use of resources by judicious practice of these methods[11].

In this context, the study entitled **"A study on inventory management by ABC, VED and ABC-VED matrix analysis in pharmacy department of a tertiary care teaching hospital"** was undertaken to do economic analysis of pharmacy department.

MATERIALS AND METHODS

A retrospective study was carried out for a period of 6 months from December 2013 to May 2014 in Pharmacy unit of Navodaya Medical College Hospital and Research Center, Raichur.Data collection was carried out by checking the stock records and the bills of the supplies of main drugs.

The research group visited the main drug stores daily on working days and the items were recorded on predesigned and pretested performa developed for the same purpose. The data include only those drugs which were provide by the hospital and does not include the drugs for sales counter, surgical items, disposables and dressing items. A specially designed data entry form was used to enter all the details which include the inventory of drug stored as well as characteristic like cost per unit, unit stored as well as the total cost for each drug. The performa also categorized drugs in accordance with VED analysis.

Data Analysis

The data for annual consumption and expenditure incurred on each drug of the drug store, for the financial year 2012-2013 was collected and fed into MS Excel spread sheet. The drug indent for the financial year 2012-2013 consisted of 886drugs. Annual drug expenditure (ADE) was calculated for the financial year 2012-2013 by adding the expenditure incurred on each item. ABC analysis of all the drugs in the inventory was done. For this, the annual expenditure of individual items was arranged in descending order. The cumulative cost of all the items was then calculated. The cumulative percentage of expenditure and the cumulative percentage of number of items were calculated. This list was then subdivided into three categories: A, B and C, based on the cumulative cost percentage of 70, 20 and 10%, respectively.

The VED criticality analysis of all the listed items was performed by classifying the items into vital (V), essential (E) and desirable (D) categories. The items critically needed for the survival, are part of national programmes and those that must be available all the times as their non-availability can seriously affect the image of the health centre were included in the V category. The items with a lower criticality need and those, whose shortage can be tolerated for a short period at the health centre, were included in the E group. The remaining items with lowest criticality, the shortage of which would not be detrimental to the health of the patients, were included in the D group. The VED status of each item was discussed with justification by a faculty member, a senior resident and a postgraduate student. According to criticality, the items could be classified into three categories: Vital, essential and desirable, i.e., VED.

A combination of ABC and VED analysis (ABC VED matrix) can be gainfully employed to evolve a meaningful control over the material supplies. Category I includes all V and E items (AV, BV, CV, AE, AD). Category II includes the remaining items of the E and B groups (BE, CE, BD). Category III includes the desirable and cheaper group of items (CD).In these subcategories, the first

alphabet denotes its place in the ABC analysis, while the second alphabet stands for its place in the VED analysis.The data was then transcribed in an MS excel spreadsheet. The statistical analysis was carried out using MS statistical functions.

RESULTS

The present study was conducted in pharmacy unit of Navodaya Medical college & Research Centre, Raichur (a 1000 bed tertiary care teaching hospital), to identify the categories of drugs needing strict management control. The data was analysed based on following parameters.

Annual drug expenditure (AED)

The drug formulary of the hospital comprises of 886 items. The total annual expenditure of the medicines in 2012-13 was Rs.101, 595, 164.24. The ADE of first 10% of the drugs when arranged in decreasing order of their expenditure, was 7.9% of the total expenditure (Rs. 8, 033, 132.00) as against cost 10% of the drugs which constituted 9.7% (9, 755, 577.12) of the total ADEas shown in Table.1.

ABC Analysis

ABC analysis revealed that, 21.22% (188), 27.65% (245), 51.13% (453) items represented A, B and C category items, respectively, amount for 68.50% (Rs. 69, 583, 246.00), 21.91% (Rs.2, 256, 314.12) and 09.59% (Rs. 9, 755, 577.12) of annual drug expenditure of pharmacy as illustrated in Fig.1.

VED Analysis

About 12.30% (109), 15.80% (140), 71.90% (637) items were found to be V, E and D category items, respectively, amounting for 19.46% (Rs. 19, 764, 626.00), 17.55% (Rs. 17, 828, 315.12) and 62.99% (Rs.64,002,223.12) of annual drug expenditure of pharmacy as shown in Fig.2.

ABC-VED Matrix Analysis

ABC-VED matrix analysis is depicted in Table 2. This matrix yields 9 different subcategories (AV, AE, AD, BV, BE, BD, CV, CE and CD) and further these subcategories were coupled into three main categories, categories I, II and III.

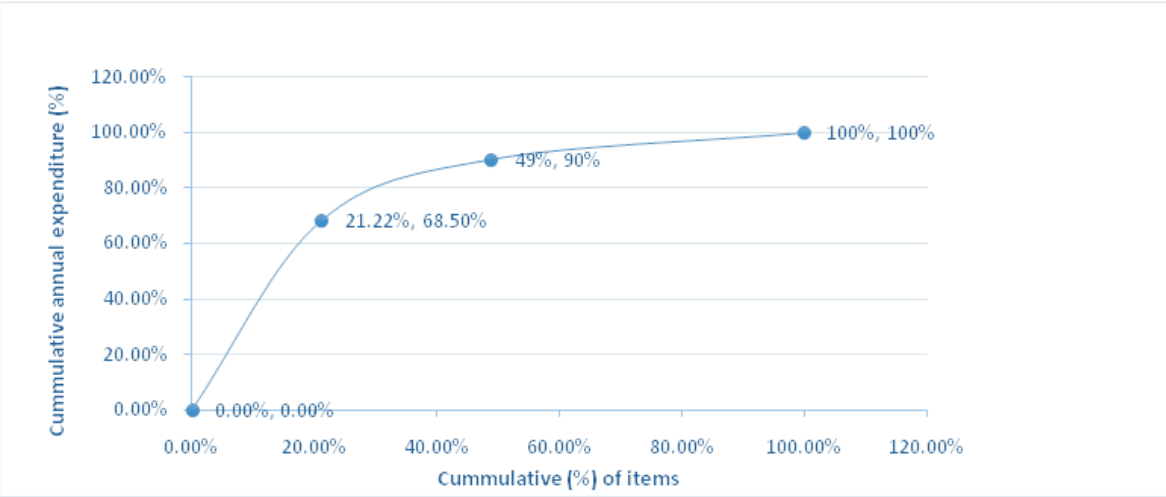

Fig 1. : Always (A), better (B) and control(C) analysis cumulative curve (n=886)

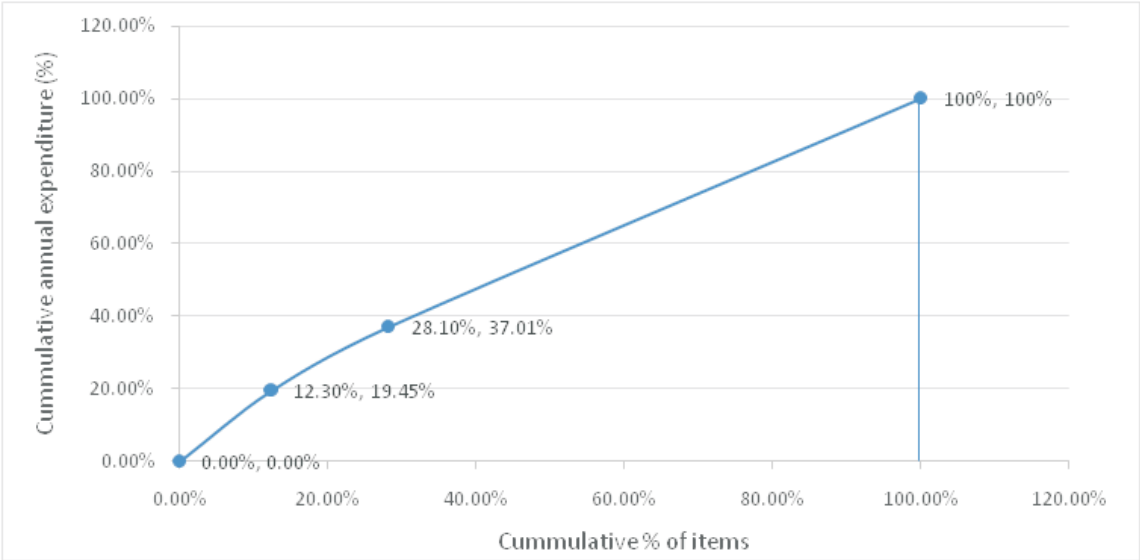

Fig 2. : Vital (V), essential (E) and desirable (D) analysis cumulative curve(n=886)

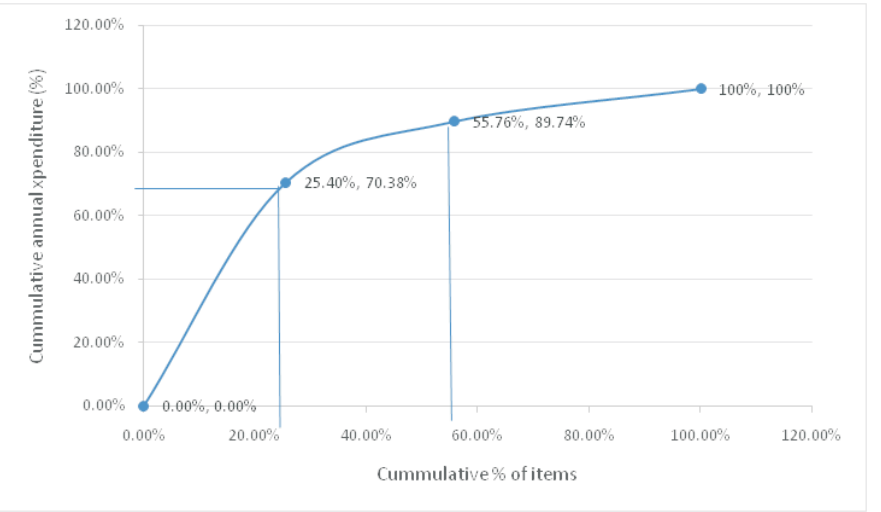

Fig 3. : Always, better and control vital, essential and desirable matrix cumulative curve (n=886)

Table 1. : Percentage of drugs in incremental order against annual drug expenditure(n=886)

Cumulative percentage of drugs	Cumulative number of drugs	Cumulative ADE (rupees)	Cumulative ADE (%)
10	3	8, 033, 132.00	7.9
20	12	17, 055, 884.00	16.7
30	28	26, 348, 534.00	25.9
40	50	36, 694, 406.00	36.1
50	81	47, 126, 899.00	46.3
60	125	57, 648, 470.00	56.7
70	188	69, 583, 246.00	68.5
80	282	79, 995, 695.00	78.7
90	434	91, 839, 587.12	90.3
100	886	101, 595, 164.24	100

Table 2. : ABC-VED Matrix (n=886)

Category	V	Percentage	E	Percentage	D	Percentage
A	72	8.13	29	3.27	87	9.82
B	27	3.05	60	6.77	158	17.84
C	10	1.13	51	5.75	392	44.24
Total	109	12.31	140	15.79	637	71.90

AV+BV+CV+AE+AD=CATEGORY (I)

BE+BD+CE=CATEGORY (II)

CD=CATEGORY (III)

There were 225 (25.40%) items in category I, 269 (30.36%) items in category II and 392 (44.36%) items in category III, amounting for 70.38% , 19.36% and 10.26% of annual drug expenditure of pharmacy, respectively. Table 3 shows the cumulative annual expenditure in percentage (according to various classifications i.e. ABC, VED and category I, II and III) vary with the cumulative percentage of items.

DISCUSSION

The fundamental purpose of inventory analysis is to keep the stock of items at such a level that there is a balance between the costs which increase or decrease with the size of the inventory. This needs determination of

1) Quantities that should be ordered each time

2) The time at which this order should be placed so that both inventory carrying costs and the losses arising out of stock outs are kept at the minimum. Thus inventory control identifies the categories of drugs needing strict management control[12].

On ABC analysis 21.22 per cent items were found to be A group drugs and accounted for almost 70 per cent of the drugs budget, while C group drugs (51.13 per cent) accounted for only 10 per cent of the expenditure. Around 12.30 percent drugs were classified as vital, 15.80 percent as essential, and the remaining 71.90% as desirable. There could be serious functional dislocation of patient care when vital drugs are not available even for a short period. Therefore, this should always be stocked in sufficient quantity to ensure their constant availability. The shortage of essential drugs can be tolerated for a short period. If these essential drugs (like antibiotics) are not available beyond a few days or a week, the functioning of the hospital can be adversely affected. These drugs should also be controlled and monitored carefully. The shortage of desirable drugs (like vitamins) would not adversely affect patient care or hospital functioning even if shortage is prolonged.

Thawani et al. (2004) in their analysis in a teaching hospital reported that around 23.8 per cent of drugs (53 items) were vital,

Table 3. : The cumulative percentage of items and cumulative annual expenditure for various categories of the drugs (n=886)

Category	Cumulative percentage of items	Cumulative expenditure percentage
A	21.22	68.50
B	48.87	90.41
C	100	100
V	12.30	19.45
E	28.10	37.01
D	100	100
I	25.40	70.38
II	55.76	89.74
III	100	100

Table 4. : Comparison of ABC, VED and ABC VED matrix analysis of different studies in India

Category of drug	Thawani V R et al (2004)	Gupta R et al (2007)	Devanani M et al (2010)	Present study
A	10.76	14.46	13.78	21.22
B	20.63	22.46	21.85	27.65
C	68.61	63.08	64.37	51.13
V	23.76	7.3	12.11	12.30
E	38.12	49.23	59.38	15.80
D	38.12	43.38	28.51	71.90
I	29.15	20.92	22.09	25.40
II	41.26	48.92	54.63	30.36
III	29.59	30.16	23.28	44.24

another 38.1 percent (85) essential and the remaining 38.1 per cent (85) desirable[13].

Gupta et al (2007) in their study reported that 24 items (7.3%) were found to be vital, 160 items (49.3%) essential, and 141 items (43.4%) desirable.

Table 2 & figure 3 shows ABC-VED matrix analysis. Nine different sub categories were studied using this analysis. These nine were further grouped into three main categories (I, II & III).

Drugs in category I (25.40 per cent) are either vital or expensive, and should be managed with greatest attention. Category II (30.36 per cent) consists of drugs that are essential and of average cost. They can receive a little less priority, but their consumption must also be watched with moderate control. Category III (44.24 per cent) consists of drugs that are desirable and inexpensive, and are thus lowest in the hierarchy of priority. They should be purchased periodically. The buffer stocks of these inexpensive items can be high and these items can be accorded a lower level of management.If ABC analysis is considered alone for drug inventory, it would help effectively control the recommended 45 drugs in the A category, but it would compromise on the availability of drugs of vital nature from B and C categories (35 drugs).Similarly, if VED analysis alone is considered, ideal control can be exercised on the identified vital and essential drugs.

In a combination of ABC and VED analysis, the resultant matrix makes it possible to focus on 80 drugs belonging to category I (subcategories AV, AE, AD, BV and CV) for vigilance as these drugs are either expensive or vital. This classification is useful in preventing shortages as well as gaining financial control.

We recommended the use of ABC-VED combination matrix for drug management at our hospital with the following instructions that would hold true for any other hospital also. Customized monitoring of category I drugs has to be done for effective management. AV, AE and BV subgroups of category I consist of drugs that are expensive (25.40 per cent of ADE) and their being out of stock is unacceptable as they are either vital or essential. To prevent locking up of capital due to these drugs, low buffer stock needs to be maintained while keeping a strict vigil on the consumption level and the stock in hand.

AD drugs (87) consume 9.8 per cent of the budget. These drugs should be monitored for economic order quality (EOQ), and their order placement must be made after careful study of the need. Rational use of drugs in this subgroup, including their removal from the drug list if possible, can bring about substantial savings without affecting patient care.

CV drugs (10) take up only 1.13 per cent of the ADE. Since this amount is negligible, these drugs can be procured once a year and stocked as their carrying cost is low. Also, management efforts are reduced and stock-outs are prevented without any significant blocking of capital. Category II and III consume 74.60 per cent of the annual budget respectively. These drugs can be ordered once or twice a year, thereby saving on ordering cost and reducing management hassles at a moderate carrying cost.

CONCLUSION

Our study found that there is a need for conducting such analysis regularly, and applying the inventory management tools for effective and efficient management of the pharmacy, along with close supervision on items belonging to important categories. The inventory classification and results of the study have been communicated to the drug store officials, and are being incorporated in the decision making on purchases, storage and monitoring of the pharmacy items.

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REFERENCES

1. Kunders GD, Gopinath S, Katakam A. In: Hospitals: Planning, Design and Management. New Delhi: Tata McGraw-Hill Publishing Company Limited; 2000. Planning and designing supportive services-Pharmacy; pp. 27381.
2. Dwivedi S, Kumar A, Kothiyal P. Inventory Management: A Tool of Identifying items That Need Greater Attention for Control. PharmaInnovation. 2012; 1(7): 125 129.
3. Wiedenmayer K, Summers RS, Mackie CA, Gous AGS, Everard M, Tromp D. Developing Pharmacy Practice: A Focus on Patient Care. Working Draft for Field Testing and Revision. Geneva: World Health Organization &International Pharmaceutical Federation; 2006; 15.
4. West D. Purchasing and Inventory Management. In: Desselle SP, Zgarrick DP, editors. PharmacyManagement: Essentials for All Practice Settings, 2nd ed. New York: McGraw-Hill Co., Inc.; 2009; 383.
5. Ramanathan R. ABC inventory classification with multiple-criteria using weighted linear optimization. ComputOper Res 2006;33:695-700.
6. Das JK. Inventory Control. In: Kaushik M, Agarwal AK, Arora SB, editors. Essentials of Logistics and Equipment Management, Manual ofPost Graduate Diploma in Hospital and Health Management. New Delhi: Indira Gandhi National Open University, School of Health Sciences; 2001.
7. Gopalakrishnan P, Sundaresan M. Material management: An integrated approach. New Delhi: Prentice Hall; 1985.
8. Brown RB. Materials management systems. New York: John Wiley and Sons; 1977.
9. Vaz FS, Ferreira AM, Kulkarni MS, Motghare DD, Pereira-Antao I. A Study of Drug Expenditure at a Tertiary Care Hospital: An ABC-VED Analysis. J Health Manag. 2008;10:11927.
10. Fox ER, Tyler LS. One pharmacy's approach to managing drug shortages. Am J Health-Syst Pharm 2003; 60:27-31.
11. Ali AK. Inventory Management in Pharmacy Practice: A Review of Literature. Archives of Pharmacy Practice 2011; 2(4):151-156.
12. Ali M, Gupta J. Drug store and business management. 8th ed. New Delhi: CBS Publishers; 2008.
13. Thawani VR, Turankar AV. Sontakke SD, Pimpalkhute SV , Dakhale GN et al.Economic analysis of drug expenditurein government medical hospital,nagpur. Indian J Pharmacol 2004; 36(1):15-19.