Inventory control techniques in medical stores of a tertiary care neuropsychiatry hospital in Delhi

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ABSTRACT

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. Objective: To identify the categories of drugs which need stringent management control. Material and Method: The ABC and VED analysis of the medical store of a Neuropsychiatry hospital at Delhi, India was conducted for the year 2008-2009 to identify the categories of items needing stringent management control. Results: The total number of the drugs at the medical store was 145 drugs. The total annual drug expenditure (ADE) on these drug items was Rs. 19219594.79. ABC analysis revealed 3.45%, 6.9% and 89.65% items as A, B and C category items, respectively, accounting for 70.5%, 19.68% and 9.83% of ADE of the medical store. VED analysis showed 32.41%, 61.38% and 6.2% items as V, E, and D category items, respectively, accounting for 70.9%, 28.72% and 0.38% of ADE of the medical store. On ABC-VED matrix analysis, 33.8%, 60% and 6.2% items were found to be Category I, II and III items, respectively, accounting for 92.33%, 7.29% and 0.38% of ADE of the medical store. Conclusion: It is suggested by the study that the management of Category I drugs should be done by the top management resulting in stringent control on the annual expenses. The Category II should be managed by the middle management level and Category III at lower managerial level.

Keywords: ABC; VED Analysis; Inventory Control; Inventory Management

1. INTRODUCTION

Approximately 35.0% of annual hospitals budget is spent on buying materials and supplies, including medicines [1]. This requires effective and efficient management of the medical stores. Efficient priority setting, decision making in purchase and distribution of specific drugs, close supervision on drugs belonging to important categories, and prevention of pilferage depend on the drug and inventory management.

Quality of care in tertiary care hospitals is also sensitive to the timely availability of facilities including drugs. Huge budget and key element in the provision of care make drugs as an important component of hospital care. The medical store is one of the most extensively used 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 medical stores in a manner that results in efficient clinical and administrative services [2]. The goal of the hospital supply system is to ensure that there is adequate stock of the required items so that an uninterrupted supply of all essential items is maintained. A study conducted by the Department of Personnel and Administrative Reforms in India has revealed that not only does the quantity of medicines received fall short of the requirement but also the supply is often erratic. Even common medicines are out of stock and remain so for a considerable period [3]. Of the various explanations for non-availability of even simple medicines in the third world countries, a large number are related to materials management. A study from a 1500-bedded state-funded hospital has claimed that review and control measures for expensive drugs brought about 20% savings [4].

Drug inventory management aims at cost containment and improved efficiency [5]. Inventory control is very essential in a developing country like India [6]. India is a country of scarce resources and it is the primary responsibility of each hospital to ensure optimum utilization of available resources to provide good service or quality patient care. Usually, the hospital management is faced with choosing the alternative of either lowering the qual-

ity of care or adopting ways and means to reduce the cost of inventories. Therefore, the need of the hour is that we follow the principles of rational drug use and inventory management techniques so that in the existing budget we can cater to more number of patients.

It is essential that health managers use scientific methods to maximize their returns from investment at a minimal cost [6-9]. Inventory analysis seeks to achieve maximal output with minimal investment input, based on the economic principle of stretching the limited means to meet unlimited ends. Each item may be considered critical and there is a perceived need to supply very high levels of service [10].

There is no denying that stocking hospital pharmaceuticals and supplies can be expensive and tie up a lot of capital, and bringing efficiencies to such important cost drivers—often 30% - 40% of a hospital's budget—can present meaningful savings [11]. Thus, a hospital materials manager must establish efficient inventory system policies for normal operating conditions that also ensure the hospital's ability to meet emergency demand conditions [12]. The study of use pattern helps in designing appropriate corrective measures. ABC analysis is an important tool used worldwide, identifying items that need greater attention for control [6-9,13]. The limitation of ABC analysis is that it is based only on monetary value and rate of consumption of the items. Sometimes, particularly in a hospital an item of low monetary value and consumption may be very vital or even life saving. Their importance cannot be overlooked simply because they do not appear in category A of inventory. Therefore, another parameter of the materials is their criticality. This could be in item of the therapeutic value of a drug or intrinsic value of the material in achieving the objectives of the hospital system.

We undertook this analysis of inventory control of drugs to identify areas for further improvement as well as to find corrective interventions to achieve this end result, we did the analysis of inventory control of drugs of the tertiary care Hospital providing the Neuropsychiatric care in Delhi, India for the last completed financial year, 2008-2009.

We attempted to narrow down the areas, where management supervision and control measures are needed for optimal utilization of the available resources.

2. AIMS & OBJECTIVES

General objective:
➢ To identify the categories of drugs which need stringent management control.
Specific objectives of this study were to:
➢ To analyze the annual consumption of items of medical store and expenditure incurred on them for the year 2008-2009;
➢ To evolve a priority system based on ABC and VED and ABC-VED matrix analysis;
➢ To identify the item categories requiring greater supervisory monitoring.

3. MATERIAL AND METHODS

The study was conducted at one of the largest super specialties tertiary care centers in Delhi, dedicated exclusively to neuropsychiatric and behavioral illnesses. It is an apex tertiary care institution of psychiatry, neurology and behavioral sciences utilizing a multidisciplinary approach. The data of annual consumption and expenditure incurred on each item of the medical store for the financial year 2008-2009 were collected and then transcribed and analyzed in MS Excel.

3.1. ABC Analysis

The annual consumption of all the drugs was calculated after multiplying unit cost by annual consumption and the resulting annual expenditure of individual items was arranged in descending order. Next step was to calculate the items cumulative cost of all the items, as well as the cumulative percentage of expenditure and the cumulative percentage of number of items. The drugs were then classified into three categories: A, B and C, based on the cumulative cost percentage of 70%, 20% and 10%, respectively.

3.2. VED Analysis

Criticality analysis of all the drugs in the medical store was conducted and then these drugs were classified based into three groups. Those drugs which are critically needed as the life saving drugs and those that must be available at all times were included in the **V** category. The items having lesser criticality needs as well as those that may be available in the hospital were included in the **E** group. The items with lowest criticality, or those whose shortage may not pose a threat to the health of the patients, were included in the **D** group.

3.3. ABC-VED Matrix Analysis

The data was coupled into an ABC-VED matrix by cross-tabulating the ABC and VED analysis. This resulted in categorization of drugs into (I, II and III). Category I comprised of items belonging to AV, AE, AD, BV and CV subcategories. The BE, CE and BD subcategories were included in category II, and the category III was represented by items in the CD subcategory. The first alphabet of these subcategories represent its position in the ABC analysis, whereas the second alphabet represents its place in the VED analysis.

The term stringent control is defined as the control by the top management of the hospital.

4. RESULTS

The present study was conducted at the medical store of IHBAS, Delhi (a 314 bed tertiary care health institute catering to the major portion of northern India), to identify the categories of drugs needing strict management control.

The drug formulary of the hospital comprises of 145 items. The total annual expenditure of the medicines in 2008-2009 was Rs.19219594.79.

4.1. ABC Analysis

ABC analysis revealed that, 3.45% (5), 6.9% (10) and 89.65% (130) items represented A, B and C category items, respectively, amounting for 70.5% (Rs. 13548757.56), 19.68% (Rs. 3782145.79) and 9.83% (Rs. 1888691.44) of annual drug expenditure of the medical stores **Table 1** and **Figure 1**.

Table 2 shows the cumulative annual expenditure in percentages (according to various classifications *i.e.* ABC, VED and Category I, II and III) vary with the cumulative percentage of items. Based on these findings cumulative curves were made to depict the relationship for all the three classifications used, *i.e.* ABC, VED and ABC-VED matrix outputs namely Category I, II and III.

4.2. VED Analysis

About 32.41% (47), 61.38% (89) and 6.2% (9) items were found to be V, E and D category items, respectively, amounting for 70.9% (Rs. 13626692.14), 28.72% (Rs. 5519867.40) and 0.38% (Rs. 73034.46) of annual drug expenditure of the medical store **Table 1** and **Figure 2**.

4.3. ABC-VED Matrix Analysis

ABC-VED matrix analysis is depicted in **Table 3**. This matrix yields nine 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.

$$AV + BV + CV + AE + AD = \textbf{CATEGORY} \quad (I)$$

$$BE + CE = \textbf{CATEGORY} \quad (II)$$

$$CD = \textbf{CATEGORY} \quad (III)$$

There were 49 (33.8%) items in category I, 87 (60%) items in category II and 9 (6.2%) items in category III, amounting for 92.33% (Rs. 17745451.14), 7.29% (Rs. 1401109.19) and 0.38% (Rs. 73034.46) of annual drug expenditure of the medical store, respectively **Table 1** and **Figure 3**.

5. DISCUSSION

In the healthcare delivery system the hospitals are dynamic institutions and spend their major portion of budget for material/logistics which rank second only to the employees' salaries. The entire system and sub-system of the hospital are dependent on the materials and without materials availability the patient care function of the hospital can come to stand still. Hence it is of great importance that materials of right quality are supplied to all users in right quantity at the right time and place. Inventory is one of the methods, which helps in achieving this goal. The inventory control is one of the important elements in materials management and an effective measure for containing cost of materials. Hence the control of the inventory is essential for efficient and effective supply management, which is vital to the patient care function [14].

The aim of the hospitals is to make medical services available timely and continuously. The regular availability of drugs is the topmost priority for any hospital. In case of drugs, we cannot achieve this aim by focusing only on one factor, whether cost or criticality. When we

Table 1. The ABC, VED analysis and ABC-VED matrix of the Medical store of IHBAS.

Category	No. of Items	% of Items	Annual drug expenditure	% Annual drug expenditure of the medical store
A	05	3.45%	13548757.56	70.5%
B	10	6.9%	3782145.79	19.68%
C	130	89.65%	1888691.44	9.83%
V	47	32.41%	13626692	70.9%
E	89	61.38%	5519867	28.72%
D	09	6.2%	73034	0.38%
Category I	49	33.8%	17745451.14	92.33%
Category II	87	60%	1401109.19	7.29%
Category III	09	6.2%	73034.46	0.38%

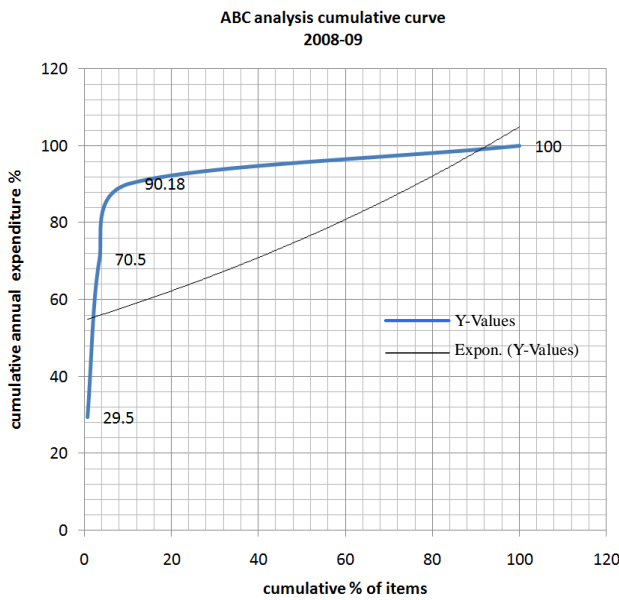**ABC analysis cumulative curve 2008-09**

Figure 1. ABC analysis cumulative curve.

Table 2. The cumulative % of items and cumulative annual expenditure % for various categories of the drugs of Medical store of IHBAS.

	Cumulative % of items	Cumulative expenditure %
A	3.45%	70.9%
B	10.35%	90.18%
C	100%	100%
V	32.41%	70.9%
E	93.79%	99.62%
D	100%	100%
I	33.1%	92.33%
II	93.8%	99.62%
III	100%	100%

VED analysis cumulative curve 2008-09
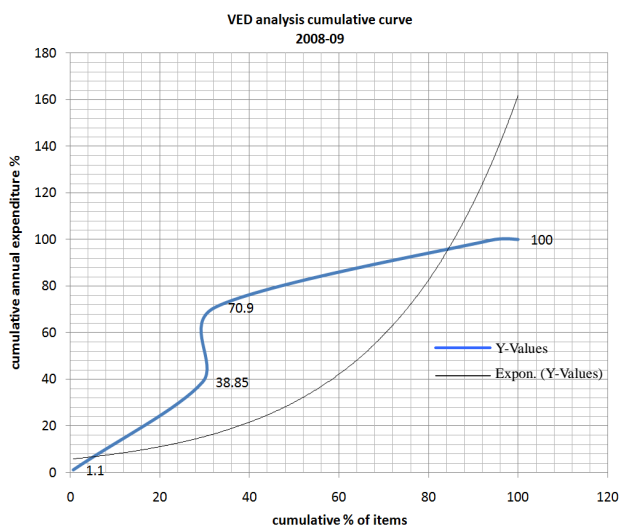
Figure 2. VED analysis cumulative curve.

Table 3. ABC-VED matrix analysis.

Category	V	E	D
A	03	02	0
B	09	01	0
C	35	86	09

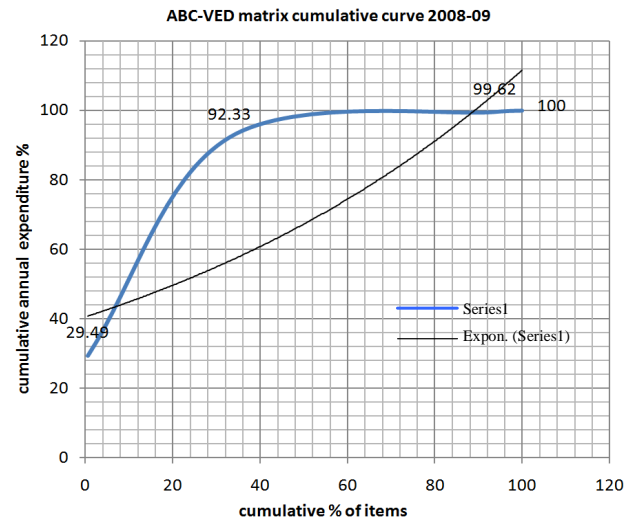**ABC-VED matrix cumulative curve 2008-09**

Figure 3. ABC-VED matrix cumulative curve.

focus on cost only, we might miss those which are less costly but vital. If we focus on both *i.e.* cost and criticality, we would be able to monitor the inventory better and avoid any situations of drug less periods. We have tried to substantiate this hypothesis by our study, where about 3.45% of the drugs consumed about 70% of ADE of the medical stores. This is the group requiring greater monitoring as it has fewer drugs consuming most of the money. But focusing on these drugs left us on missing the vital and essential drugs from B and C categories. On categorization of drugs by the ABC-VED matrix model, we were able to narrow down on drugs requiring stringent control.

5.1. ABC Analysis

The results of the present study showed that if we consider the ABC analysis alone for inventory management, it would help to effectively control 5 (3.45%) items in the A category, which represent almost 70% of annual drug expenditure of the medical store, but in our aim of focusing on these items we would compromise on the availability of items of vital nature from B and C categories (44 items, 30.3%). The results of the study are comparable with similar studies conducted in India [5,15-18].

5.2. VED Analysis

The results of the present study revealed that if we consider VED analysis alone then we can effectively

control the vital and/or essential items, accounting for 99.62% of annual drug expenditure of the medical store. Review of literature suggests that various other studies on the similar issue in our country show diverse results in the percentages of vital, essential and desirable items **Table 4** [5,15-18]. The reason of these varied results could be due to the different status of the hospitals agencies in terms of the specialties and super-specialties they cater to.

5.3. ABC-VED Matrix Analysis

It is quite evident from the results of the present study that the combination of ABC and VED analysis, in terms of the ABC matrix enhances the ability to narrow down our attention on 49 (33.8%) items belonging to category I for strict managerial control; these items are either costly or vital. The annual expenditure of category I items was 92.33% of annual drug expenditure of the medical store. This category if further divided into 2 subgroups—subgroup I comprises of AV, AE and BV and there are total 18 items (12.4%) that are expensive (91.1% of ADE). It is difficult to manage the medical services if these drugs are out of stock because they are either vital or essential. Further it is very important to prevent the locking up of capital due to these costly items, hence we need to maintain low buffer stock for these items as well as keep a strict vigil on the consumption level and the stock in hand. A two-bin method of ordering needs to be ensured for these as this will eliminate the risk of item shortage. The drugs belonging to CV (31%, 21.4%) are drugs of low cost but high criticality and take up 1.23% of ADE of the medical store. As they are representing very small percentage of the total expenditure hence they can be procured once a year and can be stocked as their carrying cost is low.

Category II items (87%, 60%) represent 7.29% of the ADE. These items can be ordered once or twice a year, thereby saving on ordering cost and reducing management hassles at a moderate carrying cost and without blocking substantial capital. Category III items (9%, 6.2%) consume 0.38% of the ADE. These items can also be ordered once a year and hence save on ordering cost. The result of the present study in comparison with similar studies in India is shown in **Table 4** [5,15-18].

Various studies done in our country are depicted in this table, and there are some salient observations: In contrast to various studies done on the similar topic in our country where the range of A class of drugs varies from 10.76% to 17.8%, in our study the group A drugs are only 3.45%, *i.e.* only 5 drugs. Similar are the findings for B and C group drugs in our study which are in markedly different percentages as compared to the earlier studies.

In our present study the percentage of vital drugs was 32.41%, and essential drugs were 61.38%. If we compare these findings with other studies the percentage of vital drugs range from 5.41% - 23.76% whereas the percentage of essential drugs range from 38.12% - 59.9%.The percentage of the desirable drugs is quite less in our study (only 6.2%) in comparison to the various other studies done in our country (range is 28.51% - 43.38%).

On developing the ABC-VED coupling matrix, the percentages of category I, II does not differ from existing studies too much, but category III shows marked differences from the other studies. These differences could be because of the nature of the inventory being quite different in our setup as compared to the general tertiary care hospitals. There is a paucity of studies in the super-specialty hospitals; therefore there is no way we could compare our results with the same.

6. CONCLUSIONS

During the year 2008-2009, the inventory expenditure of the medical store of a tertiary care neuropsychiatric hospital at Delhi was Rs. 19219594.79. There is a need of application of scientific inventory management tools for effective and efficient management of the medical stores and close supervision on items belonging to important categories. ABC-VED matrix analysis identifies the drugs requiring stringent control for optimal use of funds and avoid out-of-stock situations in the medical stores.

Table 4. Comparison of various Indian studies with the present study.

Category	Govt Hospital Nagpur study	AFMS study	CGHS study	GMCH, Goa study	PGI Chandigarh study	Present study
A	10.76	14.46	17.8	12.93	13.78	3.45
B	20.63	22.46	22.6	19.54	21.85	6.9
C	68.61	63.08	59.5	67.53	64.37	89.65
V	23.76	7.39	5.14	12.36	12.11	32.41
E	38.12	49.23	58.9	47.12	59.38	61.38
D	38.12	43.38	35.9	40.52	28.51	6.2
I	29.15	20.92	21.5	22.99	22.09	33.8
II	41.26	48.92	56.1	41.67	54.63	60
III	29.59	30.16	22.2	35.34	23.28	6.2

*All the values in this table are in percentages. The table has been adopted from Devnani *et al*, J Young Pharmacists 2010 with permission from the author and publisher.

Category 1: Needs close monitoring & stringent control by top management.

Category 2: Moderate control by the middle level management.

Category 3: Control at the lower managerial level.

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