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Application of ABC-VED analysis for inventory control in drug store of a tertiary care hospital of North Maharashtra

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ABSTRACT

Introduction: The hospital's pharmacy is one of the most heavily used therapeutic services and one of the few places where a significant amount of money is spent on recurrent purchases. This underlines the need of strategically planning, creating, and arranging the pharmacy to ensure effective clinical and administrative services. **Materials and Methods:**Inventory control techniques like ABC, VED and ABC-VED matrix analysis were used to evaluate the annual drug expenditure at drug store of Government Medical College & Hospital Jalgaon for the financial year 2019-20. **Results:**Total number of drugs in inventory in Government Medical College & Hospital Jalgaon in the year 2019-20 were 334 and the annual drug expenditure was 54040462/-. Category A comprised of 49 drugs (14.7%) for which annual drug expenditure was 37286500/- i.e. 69%. 87 drugs (26%) accounting to 11324859/- (20.96%) were classified as category B drugs. Category C drugs included 198 drugs comprising 59.3% of total inventory and consumed 5429103/- i.e. 10.05% of total annual drug expenditure. 39 drugs (11.7%) were classified into vital/V category which accounted for 15257089/- i.e. 28.23% of annual drug expenditure, while essential/E category included 127 (38%) drugs for which 30161684/- (55.81%) was incurred for their procurement. 168 (50.3%) drugs accounting to 8621689/- (15.95% of total annual drug expenditure). **Conclusion:**The application of inventory control strategies such as ABC, VED, and the ABC-VED Matrix will help in significant improvements in patient care.

KEYWORDS: ABC, VED, ABC-VED matrix, annual drug expenditure.

INTRODUCTION:

Purchasing materials and supplies, including pharmaceuticals, accounts for around a third of the yearly hospital budget. [1] The hospital's pharmacy is one of the most heavily used therapeutic services and one of the few places where a significant amount of money is spent on recurrent purchases. This underlines the need of strategically planning, creating, and arranging the pharmacy to ensure effective clinical and administrative services. [2] The purpose of the hospital supply system is to guarantee that there is enough stock of the needed commodities to ensure that all essential things are available at all times.According to a research done by India's Department of Personnel and Administrative Reforms, not only is the quantity of medications received insufficient, but the supply is also inconsistent. Even simple medications are in short supply and will be for some time. [3] A great majority of the reasons for the non-availability of even basic medications in third-world countries are connected to materials management. According to a research from a 1,500-bed state-funded hospital, review and control mechanisms for pricey pharmaceuticals saved the facility roughly 20%. [4]

In a growing country like India, inventory control in hospital pharmacies is critical. Because resources are limited, it is critical to make the best use of what is available. More patients can be served with the current medication budget if reasonable drug usage and improved drug management procedures are followed. It is critical that health managers employ scientific methodologies to optimize their investment returns at the lowest possible cost. [4]

Drug inventory management emphasizes cost reduction and increased efficiency. Each thing may be considered vital, and there is a presumed need to provide extremely high service standards. There's no doubting that stocking hospital drugs and supplies is costly and time-consuming, and introducing improvements to such significant cost drivers - which account for 30-40% of a hospital's budget - may result in significant savings. [5] As a result, a hospital

materials manager must design effective inventory system regulations that assure the hospital's capacity to satisfy emergency demand situations as well as routine operation requirements. [6] However, monitoring every medicine used throughout the health system is both impracticable and unnecessary.

Priority is given to high-cost, high-volume medications, whose intervention is most likely to have the largest therapeutic and economic impact. It's critical to start with the most expensive pharmaceutical items, which account for the majority of the budget, and then devise a plan to investigate and identify their usage patterns. The analysis of use patterns will aid in the development of suitable remedial actions. ABC analysis is a widely utilized approach for identifying issues that require more attention for control. [7–9]

The ABC approach of categorizing things or operations according to their perceived significance is called ABC analysis. It's also known as "separating the important few from the inconsequential many" since a small number of contributors account for the bulk of the impacts in any group of objects that participate to a common effect. The items are divided into three categories according to the analysis: the first 10-15 percent of the goods account for roughly 70% of the total value (cost), 20-25 percent are category B items accounting for another 20% of the total value, and the remainder 65-70 percent are category C items accounting for only 10% of the combined worth. [10]

The disadvantage of ABC classification is that it only considers the item's monetary worth and rate of consumption. In a hospital, a low-cost item that is consumed may be extremely important or even lifesaving. Because they are not in category A, their significance cannot be neglected. As a result, the criticality of the components is another aspect to consider. [11]

The VED analysis is based on the item's significance level and shortage cost. The things might be categorised into three groups based on their criticality: vital, essential, and desirable. When important pharmaceuticals are unavailable, even for a short time, there might be major functional disruptions in hospital patient care services. The hospital's ability to function can be harmed if vital products are unavailable for more than some few days or a week. Even if the lack of desirable commodities endures, it will have no negative impact on healthcare or hospital operations. [12]

To develop meaningful control over material sources, a mixture of ABC and VED analysis (ABC-VED matrix) might be beneficial. All essential and costly things fall within Category I. (AV, BV, CV, AE, AD). The remaining products from the E and B groupings fall under Category II (BE, CE, BD). The things in Category III are both attractive and affordable (CD). [4]

The current study used an ABC, VED, and ABC-VED matrix analysis of the pharmacy store at Government Medical College& hospital, Jalgaon a 456-bedded tertiary care teaching, research, and referral health center serving the Jalgaon district and surrounding areas of Maharashtra state to determine the medication categories that required more rigorous monitoring. The study's particular goals were to: (1) assess the yearly consumption of pharmaceutical products and expenditures for 2007-08, (2) develop a priority system that relies on ABC and VED and ABC-VED cross - tabulation, and (3) determine the item categories that required more supervisory oversight.

MATERIALS AND METHODS

For the financial year 2019-20, statistics on yearly consumption and expenditure for each pharmaceutical item were collected. The information was subsequently entered into an MS Excel spreadsheet. MS Excel statistical functions were used for the statistical analysis.

ABC analysis

Individual item yearly expenditures were ordered in descending order. The total cost of all the products was determined. We calculated the cumulative percentage of spending and the cumulative percentage of goods. Following that, the list was separated into three categories: A, B, and C, based on the cumulative cost percentages of 70%, 20%, and 10%, respectively. [4]

VED analysis

All of the given items were classified into vital (V), essential (E), and desired (D) categories for the VED criticality analysis. The V category featured goods that were absolutely necessary for the patients' lives and that had to be available at all times. The E group contained products with a lesser criticality demand and those that could be provided at the hospital. The remaining items in the D group were those with the lowest criticality and their absence would not be harmful to the patients' health. [4] A group of physicians, surgeons, paediatricians, and pharmacists discussed the VED status of each item and provided justifications.

ABC-VED matrix analysis

By combining the ABC and VED analyses, the ABC-VED matrix was created. Three categories emerged from the resulting combination (I, II and III). The entries in Category I came from the subcategories AV, AE, AD, BV, and CV. The BE, CE, and BD subcategories made up category II, while the rest of the CD subcategory made up category III. The first alphabet in these subcategories represents its position in the ABC analysis, whereas the second alphabet denotes its position in the VED analysis. [4]

The study was initiated after taking ethics committee approval from Institutional Ethics Committee, Government Medical College& Hospital, Jalgaon.

The flow of conduct of study is depicted in Figure 1

[Figure 1 about here.]

RESULTS:

Total number of drugs in inventory in Government Medical College & Hospital Jalgaon in the year 2019-20 were 334 and the annual drug expenditure was 54040462/-. Category A comprised of 49 drugs (14.7%) for which annual drug expenditure was 37286500/- i.e. 69%. 87 drugs (26%) accounting to 11324859/- (20.96%) were classified as category B drugs. Category C drugs included 198 drugs comprising 59.3% of total inventory and consumed 5429103/- i.e. 10.05% of total annual drug expenditure Table 1 .

39 drugs (11.7%) were classified into vital/V category which accounted for 15257089/- i.e. 28.23% of annual drug expenditure, while essential/E category included 127 (38%) drugs for which 30161684/- (55.81%) was incurred for their procurement. 168 (50.3%) drugs accounting to 8621689/- (15.95% of total annual drug expenditure)Table 1

Number of drugs in categories I, II and III included 83 (24.8%), 148 (44%) and 103 (29.3%) drugs, respectively. Cost incurred for procurement of drugs classified in categories I, II and III were 41497754/- (68.57% of annual drug expenditure), 10585044/- (19.59% of annual drug expenditure) and 1957664/- (3.62% of annual drug expenditure) .Table 1

Detailed classification of drugs in categories I, II and III is given in table 2. Category I i.e. AV, AE, AD, BV, CV categories included 1.5%, 8.4%, 4.8%, 2.7% and 7.4% drugs, respectively for which 20.5%, 40.3%, 8.2%, 5.9% and 1.9% of the annual drug expenditure was spent for procurement, respectively.Categories BE, CE, BD included 8.7%, 21% and 14.7% of drugs accounting for 11%, 4.5% and 4.1% of annual drug expenditure, respectively. Category III i.e. sub-category CD included 30.8% of the total number of drugs and the cost incurred for their procurement was 3.6% of annual drug expenditure .Table 2

Comparison of findings of the present study with other such studies conducted in various parts of the country is given below in Table 3

[Table 1 about here.]

[Table 2 about here.]

[Table 3 about here.]

DISCUSSION:

The prompt accessibility, including medications, is critical to the provision of treatment in a health centre. In the case of medications, in addition to the criticality element, the cost factor must also be considered, as evidenced by our study, which found that roughly 20% of the medicines consumed about 70% of the pharmacy's ADE. This is the category that requires more supervision since it contains fewer pharmaceuticals that use the majority of the funds. Not all of the medications in this group were V or E, as well. There were other medications in the desired category. The ABC–VED matrix paradigm helps to categorize medications and limit down the number of pharmaceuticals that require strict monitoring. [8]

When important medications are unavailable, even for a short time, there may be substantial functional disruptions in patient care. As a result, essential pharmaceuticals should constantly be kept in adequate quantities to assure continuous availability. This class of medications must be carefully regulated and monitored. [9]

According to the findings of the current study, if ABC analysis is used alone to control drug inventory, it will totally manage the suggested 49 (14.7%) drugs in category A, resulting in nearly 70% of ADE in the pharmacy, but it will compromise the availability of items of V category from the B and C categories (13 items, 10.1 percent). The findings of the present study were corroborated by other studies. [8, 9, 13, 14] However study done at a neuropsychiatry hospital, Delhi had differing results for number of drugs categorized in A,B and C. [4] The range of drugs classified in categories A, B, C in the above mentioned published studies are 3.5%-19.4%, 6.9%-24%, and 56.8% -89.7%, respectively. [4, 8, 9, 13–15]

If just VED analysis is taken into consideration, optimal control may be exerted on the detected V and/or E groups, which account for 84.04 percent of the central drug store's ADE. As a result, it was impossible to completely disregard the desired group. In the present study number of drugs in categories V, E and D were comparable to findings of other published studies. [13–15] However, studies done at PGIMERChandigarh [8], Service hospital Pune [9] and neuropsychiatry hospital, Delhi. [4] The range of drugs classified in categories A, B, C in the above mentioned published studies are 7.4%-32.4%, 38.9%-61.4%, and 6.2% -50.4%, respectively. [4, 8, 9, 13–15]The explanation for the disparities in results might be related to the hospitals' differing position in terms of the specialties and super-specialties they serve. [4]

For a limited time, a lack of essentials can be endured. If these critical medications are unavailable for a few days or a week, the hospital's ability to function may be jeopardized (Drugs like antibiotics). These medicines should also be carefully regulated and monitored. Even if the shortage of attractive pharmaceuticals persists, it will have no negative impact on patient care or hospital operations (Drugs like vitamins). [16]

The findings of this study clearly show that combining ABC and VED analysis in terms of the ABC matrix improves our capacity to focus our attention on 83 (24.8 percent) items in category I for stringent management control; these things are either expensive or critical. The yearly expenditure on category I goods accounted for 68.57 percent of the medical store's annual medication cost. This category is further split

into two subgroups: subgroup I includes AV, AE, and BV, with a total of 42 pricey goods (12.6 percent) (63.3 percent of ADE). Because these pharmaceuticals are either crucial or necessary, it is difficult to handle medical services if they are out of stock. [14]

Furthermore, it is critical to avoid capital lock-up as a result of these expensive things, thus we must maintain a minimal buffer stock for these items and keep a close eye on consumption and stock in hand. For these, a two-bin ordering procedure is required, since this will eliminate the chance of item scarcity. CV medicines (7.4 percent) are low-cost but high-criticality pharmaceuticals that account for 1.9 percent of the medical store's ADE. Because they account for such a small fraction of total spending, they can be purchased only once a year and stocked because their carrying costs are cheap. [12] Category I drugs needs close vigilance and tight control preferably managed by senior officials, whereas category II drugs need moderate level of monitoring which can be done by medium level officials and category III drugs need less stringent control. [4]

44 percent of the ADE is made up of Category II products. These things may be ordered once or twice a year, saving money on ordering and minimizing management headaches at a low carrying cost and without putting a significant amount of cash at risk. [4] Category III products utilize3.62 percent of the ADE. These things may also be bought once a year, saving money on transportation charges. Table 3 compares the findings of the present research study to those of previous studies conducted in India. [8, 9, 13, 14]

When it came to establishing the ABC-VED connection matrix, the proportions of category I and II did not change much from prior research, but category II did. These variances might be due to the fact that the structure of the stockpile in our setup differs significantly from that in normal tertiary care institutions since our institute provides super specialty healthcare as well. Since we couldn't find studies where mix of specialty and super specialty healthcare is provided, we were unable to compare our findings to those of others.

In a nutshell, such type of analysis allows you to look at the ABC, VED, and ABC-VED matrix all at once. Every drug store/pharmacy should set up a table like this, since it may be a useful aid in good medication management.

CONCLUSION: The total drug inventory in drug store of Government Medical College & Hospital Jalgaon for financial year 2019-20 was 334, for which annual drug expenditure incurred was 54040462/-. The application of inventory control strategies such as ABC, VED, and the ABC-VED Matrix will help in significant improvements in patient care.These strategies would not only aid in the efficient and effective use of limited financial resources, but they would also prevent the occurrence of medicine shortages including out of stock incidences.

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LIST OF FIGURES

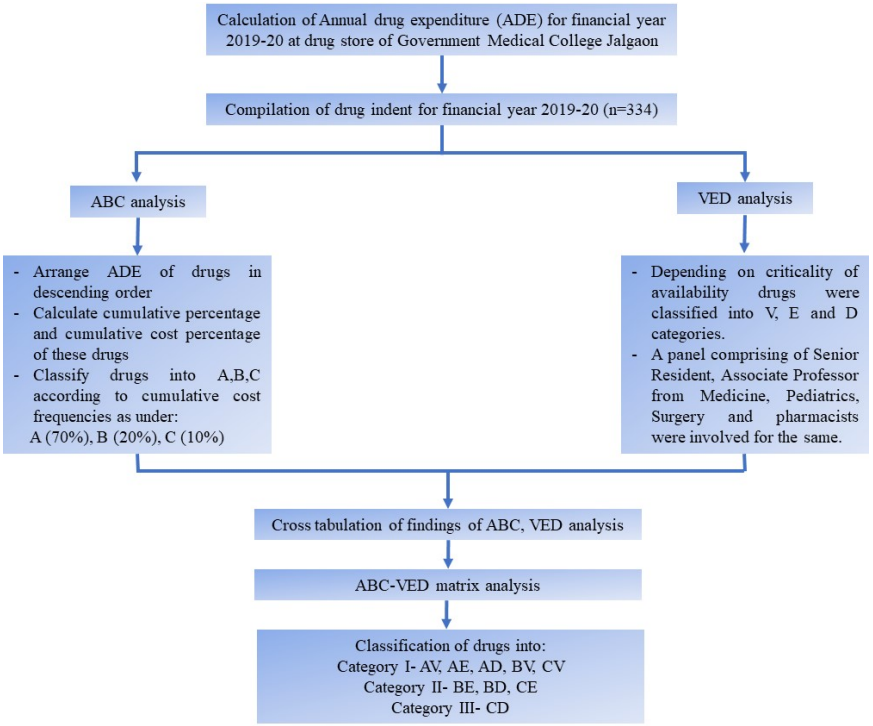

Figure 1: Flow of conduct of the present study.

LIST OF TABLES

Category	No. of items	% of items	ADE (Rs.)	% of ADE of the pharmacy
A	49	14.7%	37286500	69.00%
B	87	26.0%	11324859	20.96%
C	198	59.3%	5429103	10.05%
V	39	11.7%	15257089	28.23%
E	127	38%	30161684	55.81%
D	168	50.3%	8621689	15.95%
I	83	24.8%	41497754	68.57%
II	148	44.0%	10585044	19.59%
III	103	29.3%	1957664	3.62%

[ADE- Annual drug expenditure]

Table 1: Classification of drugs according to ABC, VED, categories I, II and III in the present study.

	A				B				C				Total			
	ADE	**% of ADE**	**No. of drugs**	**% of drugs**	**ADE**	**% of ADE**	**No. of drugs**	**% of drugs**	**ADE**	**% of ADE**	**No. of drugs**	**% of drugs**	**ADE**	**% of ADE**	**No. of drugs**	**% of drugs**
V	1104583	20%	5	1.5	3186895	5.9%	9	2.7	1024359	1.9%	25	7.4	15257089	28.2%	39	11.7
E	2179608	40.3%	28	8.4	5918519	11.0%	29	8.7	2447080	4.5%	70	21	30161684	55.8%	127	38
D	444458	0 8.2%	16	4.8	2219445	4.1%	49	14.7	1957664	3.6%	103	30.8	8621689	16.0%	168	50.3
Total	**3728650**	**69%**	**49**	**14.7**	**11324859**	**20.96%**	**87**	**26.1**	**5429103**	**10%**	**198**	**59.2**	**54040462**	**100%**	**334**	100

Table 2: Findings of ABC-VED matrix analysis in the present study.

Category	Present study	Vaz et al. [13]	Khurana et al. [4]	Thawani et al. [15]	Anand et al. [14]	Gupta et al. [9]	Devnani et al. [8]
A	15%	19.	3.5%	10.7%	18.6%	14.5%	13.8%
B	26%	23.8	6.9%	20.5%	24.0%	22.5%	21.8%
C	59%	56.8	89.7%	68.8%	57.4%	63.0%	64.4%
V	12%	10.6	32.4%	23.7%	13.2%	7.4%	12.1%
E	38%	38.9	61.4%	38.1%	38.8%	49.2%	59.4%
D	50%	50.4	6.2%	38.1%	48.0%	43.4%	28.5%
I	25%	30.1	33.8%	29.1%	28.7%	20.9%	22.1%
II	44%	42.5	60.0%	45.7%	41.1%	48.9%	54.6%
III	29%	27.4	6.2%	25.2%	30.2%	30.2%	23.3%

Table 3: Comparison of ABC, VED analysis findings of present study with other published studies.