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Strategic Inventory Control in Hospital Pharmacies: An ABC-VED Approach in a Hospital of Developing Country, Nepal

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ABSTRACT

Background: Drug inventories management is crucial for maximizing resource use and minimizing hospital pharmacy related expenses.

Method: This research sought to evaluate the medication inventory at hospital pharmacies with 50 beded capacity using the Always Better Control (ABC), Vital, Essential and Desirable (VED), and ABC-VED matrix analyses for the April 1, 2023, to March 30, 2024. The pharmacy maintained a stock of 1672 distinct medications, with a total yearly expenditure of NPR. 38,177,997.92/-.

Result: According to the ABC analysis, drugs were divided into three groups based on their annual consumption value: Category A comprised 304 drugs (18.18%), accounting for 71.5% of the costs; Category B included 443 drugs (26.49%), consuming 19.48%; and Category C consisted of 925 drugs (55.32%), utilizing 9.02%. As per the VED analysis, medications were categorized as vital (16%), essential (36%), or desirable (48%) according to their criticality. The ABC-VED matrix identified 30.20% of the drugs as Category I, necessitating strict control; 41.8% as Category II, requiring moderate control; and 28% as Category III, allowing for relaxed control.

Conclusion: This study underscores the importance of prioritizing high-value and critical medications for effective inventory management. Employing ABC-VED matrix analysis can substantially enhance patient care, optimize financial resources, and avert drug shortages in hospital pharmacies, especially in developing nations such as Nepal.

Key words: ABC; VED; ABC-VED matrix; Annual Drug Expenditure (ADE); inventory management; cost reduction.

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INTRODUCTION

Approximately one-third of a hospital's yearly budget is allocated to acquiring supplies and commodities, including medications, among which hospital pharmacies are one of the most extensively used therapeutic services and a significant area of continuous expenditure. This underscores the critical need for strategic planning, development, and organization of pharmacies to ensure the delivery of effective clinical and administrative services.[1] The primary objective of the hospital supply system is to ensure an ample inventory of essential goods, thereby guaranteeing the constant availability of necessary items. Research conducted by India's Department of Personnel and Administrative Reforms, one of the neighboring giants of Nepal, revealed that pharmaceutical distribution is not only inconsistent but also inadequate in volume.[2] Similarly, it is crucial to understand that deficiencies in fundamental medications exist and are expected to persist.[1] This unavailability of basic pharmaceuticals in developing nations can be attributed to issues in material management, further underscoring the need for a coordinated approach in inventory management and strategic planning.[2] A study at a government-

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supported 100-bed hospital demonstrated that the facility achieved nearly a 20% cost reduction by implementing control and monitoring systems for expensive drugs.[3] In a Nation like Nepal, which is still developing, the efficient management of hospital drug inventories is essential. Considering the scarcity of resources, maximizing their use is crucial. The current medical budget can be extended to serve more patients.[4] Healthcare facilities must utilize evidence-based approaches to optimize their investment returns while reducing expenses.[5] The American Society of Health-System Pharmacists (ASHP) Guidelines on Medication Cost Management Strategies for Hospitals and Health Systems highlight the significant financial burden of medication costs in hospitals and the need for effective budgeting and inventory management strategies such as Drug Expenditures, Annual Budgeting for Medication Costs, Inventory Management Strategies, Cost-Containment Strategies in Procurement and Waste Reduction.[1] One of the inventory management techniques widely used for identifying issues that require more attention for effective management is Always Better Control (ABC) analysis.[6] This method involves categorizing items or processes according to their perceived significance. It is also referred to as "distinguishing the crucial few from the trivial many" because a small number of contributors typically account for the majority of effects in any group of elements contributing to a common outcome.[7] The analysis divides items into three groups: Category A occupies around 10-15% of goods constituting approximately 70% of the total value (cost); the next 20-25% are classified as category B items, representing an additional 20% of the total value; and the remaining 65-70% fall into category C, accounting for around 10% of the overall worth.[8]

However, the ABC classification method has limitations, as it only considers an item's financial value and usage rate. In a hospital setting, low-cost items can be essential or potentially lifesaving. The significance of these items should not be disregarded simply because they were not classified as category A.[9] Therefore, it is necessary to consider the criticality of these components as an additional factor. On the other hand, Vital, Essential and Desirable (VED) analysis is grounded in the item's importance level and the cost associated with its scarcity.[10] These items can be categorized into three groups based on their criticality: vital, essential, and desirable. When crucial medications are unavailable, even for brief periods, they can lead to substantial disruptions in hospital patient care services.[11] A hospital's operational capacity may be compromised if essential supplies are inaccessible for more than a few days or a week.[12] However, a prolonged shortage of desirable items does not negatively impact hospital operations or healthcare delivery.[13]

METHODS

For the fiscal years 2023–2024, information on yearly usage of medicinal goods and cost for each pharmaceutical items were collected with the help of Midas pharmacy management software. Midas pharmacy management software is the IRD registered software, which is a digital solution designed to streamline and automate the operations of pharmacy or drug store. Midas features consist of inventory management, billing and sales, customer management, purchase and suppliers' management, report and analytics, user access and role of compilation. The information generated from Midas was transfer into Microsoft excel with the help of Drug and Therapeutic Committee, several specialized doctors and clinics pharmacists and other related medical professionals the medicinal goods was categorized based on its value that is Vital (V), Essential (E) and Desirable (D). The ABC categorization was based on its consumption and annual expenditure according to standard parameter. This information was entered into a Microsoft Excel spreadsheet. Statistical evaluation was performed using built-in statistical functions in Microsoft Excel. [1, 2] All research presented in this manuscript adheres to the ethical principles. No animal and human participants were involved, since ethical statement is not required for this study. The data collection and publication approval were taken from the concerned institutions.

The yearly costs for each product are listed from

highest to lowest. The total expenditure for all items was computed. Cumulative percentages of products and expenses were calculated.[7] Subsequently, inventory was categorized into three groups, A, B, and C, based on their respective cumulative cost percentages of 70%, 20%, and 10%.[4, 5] This ABC analysis method aids in classifying items according to their monetary impact, distinguishing between high-cost, high-priority medications, and those of lower financial importance.[14]

VED analysis classifies pharmaceutical products based on their importance in patient treatment.[5] Items were ranked in descending order based on yearly expenditure, and the total cost for all products was determined.[15] The cumulative percentages of both items and expenditures were calculated. Subsequently, the inventory was separated into three categories: vital (V), essential (E), and desirable (D), with crucial medications given priority, regardless of expense.[6, 16]

The integration of ABC and VED analyses resulted in the creation of the ABC-VED matrix, which established three primary categories (I, II, and III) to enhance inventory management.[7] Category I included high-priority and costly medications, comprising the subcategories AV, AE, AD, BV, and CV. Moderately essential medications were grouped into Category II, which included the subcategories BE, CE, and BD. The remaining CD subcategories form Category III, representing less critical and inexpensive items.[8, 9] In this classification system, the initial letter denotes ABC analysis, whereas the second letter indicates VED classification, ensuring a comprehensive approach to inventory control.[10, 11]

RESULTS

In fiscal year 2023-2024, the pharmacy operated by 50 beded hospital of Kathmandu, Nepal stocked 1672 different drugs, with a total annual expenditure of 38,177,997.92/-. The inventory is divided into three categories. Category A consisted of 304 drugs (18.18% of the total), accounting for 27,297,268.51/- (71.5%) yearly drug expenses. Category B included 443 drugs (26.49%), with an expenditure of 7,437,073.99/− (19.48%). The remaining 925 drugs (55.32%) fell under Category C, consuming 3,443,655.41/− (9.02%) of the total annual drug budget.

In the vital/V category, 268 drugs (16%) were identified, accounting for 27% of the annual drug expenditure, totaling 10308059.43/-. The essential/E category comprised 603 drugs (36%), with a procurement cost of 20463406.88/- (53.6%). The remaining 801 drugs (48%) amounted to 7406531.59/-, representing 19.4% of the total annual drug expenditure. The distribution of drugs across categories I, II, and III comprised 505 (30.20%), 699 (41.8%), and 468 (28%) medications, respectively. Expenditures for acquiring drugs in categories I, II, and III amounted to 30656932.31/- (80.29% of yearly drug spending), 6635336.02/- (17.37% of yearly drug spending), and 885729.55/- (2.32% of yearly drug spending).

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

Category	No. of items	Items (%)	ADE (Rs.)	ADE of the pharmacy (%)
A	304	18.18%	27297268.51	71.50%
B	443	26.49%	7437073.99	19.48%
C	925	55.32%	3443655.41	9.02%
Total (A+B+C)	1672	100.00%	38177997.9	100.00%
V	268	16.00%	10308059.43	27.00%
E	603	36.00%	20463406.88	53.60%
D	801	48.00%	7406531.59	19.40%
Total (V+E+D)	1672	100.00%	38177997.9	100.00%
I	505	30.20%	30656932.31	80.29%
II	699	41.80%	6635336.02	17.37%
III	468	28%	885729.55	2.32%
Total (I+II+III)	1672	100.00%	38177997.9	100.00%

Table 2 provides a comprehensive breakdown of the drugs classified into categories I, II, and III. Within category I, the AV, AE, AD, BV, and CV subcategories comprised 4%, 8%, 6.16%, 3%, and 8.97% of the drugs, respectively. These subcategories accounted for 18.2%, 39.6%, 13.7%, 6.2%, and 2.6% of the annual procurement drug budget, respectively. In category II, the BE, CE, and BD subcategories encompassed 9.68%, 18.36%, and 13.75% of the drugs, respectively, and consumed 9.9%, 4.1%, and 3.38% of the annual drug expenditure, respectively. Category III, specifically the CD subcategory, included 27.99% of all drugs, with procurement costs amounting to 2.32% of the annual drug budget. Table 3 presents a comparison between the findings of the current study and similar studies conducted across various regions of the country.

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

Category	A			
	ADE	ADE (%)	No. of Items	Items (%)
V	6948395.62	18.20%	67	4%
E	15118487.2	39.60%	134	8%
D	5230385.71	13.70%	103	6.16%
Total	27297268.5	71.50%	304	18.18%
Category	**B**			
	ADE	**ADE (%)**	**No. of Items**	**Items (%)**
V	2367035.87	6.20%	51	3%
E	3779621.8	9.90%	162	9.68%
D	1290416.32	3.38%	230	13.75%
Total	7437073.99	19.48%	443	26.50%
Category	**C**			
	ADE	**ADE (%)**	**No. of Items**	**Items (%)**
V	992627.94	2.60%	150	8.97%
E	1565297.9	4.10%	307	18.36%
D	885729.55	2.32%	468	27.99%
Total	3443655.41	9.02%	925	55.32%
Category	**Total (A+B+C)**			
	ADE	**ADE (%)**	**No. of Items**	**Items (%)**
V	10308059.4	27%	268	16%
E	20463406.9	53.60%	603	36%
D	7406531.59	19.40%	801	48%
Total	38177997.9	100%	1672	100%

DISCUSSION

Examining the pharmacy inventory using ABC-VED matrix analysis offers crucial information about the distribution of costs and ranking of pharmaceutical items. This section examines the information presented in Table 1 to explore its relevance in managing inventory and controlling expenses.

Category A encompasses 304 items (18.18%) but is responsible for 71.50% of the pharmacy's Annual Drug Expenditure (ADE), totaling Rs. 27,297,268.51. This indicates that a minor portion of the items contribute to a substantial portion of the overall costs, requiring close monitoring and management. Category B includes 443 items (26.49%) and utilizes 19.48% of the total budget, amounting to Rs. 7,437,073.99. These items are of moderate importance and need periodic evaluation, although not as crucial as those in Category A. Category C contains 925 items (55.32%), but only

Table 3. Comparison of ABC VED Analysis findings between the present study and other published studies term of % of items.

Category	Present study	Khurana (6)	Devnani (8)	Vaz fs (13)	Anaand (10)	Shaikh Teli (19)	Amer HY (20)	Damayanti (21)
A	18.18%	16.80%	13.78%	19%	18.60%	15%	9.90%	12.21%
B	26.49%	21.80%	21.85%	23.80%	24%	26%	20.10%	12.21%
C	55.32%	61.40%	64.37%	56.80%	57.40%	59%	70%	75%
V	16%	35.30%	12.11%	10.60%	13.20%	12%	47.60%	12.21%
E	36%	50.40%	59.38%	38.90%	38.80%	38%	24.60%	52.67%
D	48%	14.30%	28.51%	50.40%	48%	50%	27.80%	35.11%
I	30.20%	47.90%	22.09%	30.10%	28.70%	25%	54.11%	13.74%
II	41.80%	43.70%	54.63%	42.50%	41.10%	44%	26.91%	51.91%
III	28%	8.40%	23.28%	27.40%	30.20%	29%	18.98%	34.35%

accounts for 9.02% of the ADE, equaling NPR. 3,443,655.41. Despite the large number of items in this category, their financial impact is minimal, allowing for more relaxed inventory controls. The 80/20 rule, also known as the Pareto principle, is apparent in this scenario. A small number of items classified as Category A represent the bulk of expenditure. As a result, rigorous monitoring should be implemented for Category A, whereas Categories B and C can be overseen with fewer frequent checks. This approach allows for a more efficient use of resources. Other studies have supported the results of this investigation. According to published studies, the range of medications categorized in categories A, B, and C is 9.9%-19%, 12.21%-26%, and 56.8%-75%, respectively.

The inventory consists of three categories: vital (V), essential (E), and desirable (D). V items, comprising 268 units (16%), represent 27% of the total Annual Drug Expenditure (ADE) at Rs. 10,308,059.43. These crucial life-saving medications must be available continuously. E items, numbering 603 (36%), account for 53.60% of the total ADE (Rs. 20,463,406.88) and are integral to effective treatment, requiring stringent inventory management. D items, totaling 801 (48%), constitute only 19.40% of the ADE (Rs. 7,406,531.59) and can be stocked with lower urgency, as they are non-essential. This analysis underscores the importance of prioritizing drugs V and E in procurement strategies to ensure their constant availability, whereas D items allow for more flexible management approaches. According to published studies, the range of medications categorized in categories V, E, and D is 10.6%–47.6%, 24.6%–59.38%, and 14.3%–50.4%, respectively. The varying positions of hospitals regarding the specialties and super-specialties they serve may be the cause of the discrepancies in the results. The highest priority group, Category I, comprised 505 items (30.20%) that accounted for 80.29% of the total Annual Drug Expenditure (ADE), amounting to Rs. 30,656,932.31. This category encompasses expensive and crucial items (AV, AE, AD, BV, and CV) that demand the most rigorous oversight owing to their cost and significance in patient treatment. Within this category, the A-Vital (AV) subgroup consists of 67 items (4%) that make up 18.20% of the ADE, totaling Rs. 6,948,395.62. These medications are both costly and essential for saving lives, necessitating the highest level of management and control, and can be divided into four categories. Category A-Essential (AE) comprises 134 items (8%), accounting for 39.60% of the ADE (Rs. 15,118,487). This requires rigorous monitoring using automated systems. Category A-Desirable (AD) includes 103 items (6.16%), using 13.70% of the ADE (Rs. 5,230,385.71). They should be procured in restricted quantities. Category B-Vital (BV) consisted of 51 items (3%), utilizing 6.20% of the ADE (Rs. 2367035.87). Therefore, intermediate-level monitoring is required. Finally, Category C-Vital (CV) contained 150 items (8.97%), consuming 2.60% of the ADE (Rs. 992627.94). These demand minimal but steady inventory levels.

The moderate priority group, Category II, comprised 699 items (41.80%) that accounted for 17.37% of the Annual Drug Expenditure (ADE), totaling Rs. 6,635,336.02. This category includes important but moderately expensive items (BE, CE, BD) that require regular evaluation, although not as stringent as Category I. Within this group, Category B-Essential (BE) consists of 162 items (9.68%), utilizing 9.90% of the ADE (Rs. 3779621.8) and should have inventory policies based on demand. Category B-Desirable (BD) encompasses 230 items (13.75%), using 3.38% of the ADE (Rs. 1290416.32), and can be kept in minimal stock. Finally, Category C-Essential (CE) contains 307 items (18.36%), consuming 4.10% of the ADE (Rs. 1565297.9), and should undergo periodic monitoring. The lowest priority group, Category III, comprised 468 items (27.99%) that contributed approximately 2.32% of the ADE (Rs. 885729.55). These items consisted of non-essential and inexpensive medications (CD). Inventory management strategies may be more lenient in this regard. This published research indicates that the range of drugs in categories I, II, and III

are 13.74%-54.11%, 26.91%-54.63%, and 8.4%-34.35%, respectively.

Drugs with high volumes and costs are prioritized because interventions with these medications are expected to have the most significant therapeutic and economic effects. Given that the most expensive pharmaceutical products consume most of the budget, it is crucial to begin by examining and identifying their usage patterns before developing a comprehensive strategy.[15] Analyzing these consumption trends will facilitate the development of suitable corrective actions.[16]

The literature shows that integrating ABC and VED analyses (ABC-VED matrix) may prove beneficial in establishing effective control over material resources.[17] Category I encompasses all costly and essential items (CV, AE, AD, BV, and AV). The remaining items from groups E and B (BE, CE, BD) fall under Category II. Category III consisted of items that were both affordable and desirable (CD).[18, 19] Drug inventory management primarily aims to enhance efficiency and minimize costs. While every item may be considered crucial, necessitating high service standards, maintaining hospital medication, and supply stocks are both expensive and time-consuming. Significant savings can be realized by improving these major cost drivers, which account for 30–40% of a hospital's budget.[14, 20, 21] Consequently, a hospital materials manager must establish effective inventory system protocols to ensure that the facility meets both routine operational requirements and emergency situations.[5, 22] Nevertheless, it is neither feasible nor necessary to track all medications used in the healthcare system. Only one hospital's coverage and not including other strategic inventory management techniques is the major limitation of this study.

CONCLUSIONS

Effective inventory management in healthcare settings requires a multifaceted approach tailored to different drug categories. By implementing strict controls for high-cost, high-priority drugs, maintaining moderate oversight of Category II items, and adopting flexible stockings for low-impact drugs, hospitals can optimize their inventory processes. The integration of automated tracking systems and improved procurement strategies based on ABC-VED analysis will further enhance efficiency, reduce costs, and ensure the availability of critical medications. These measures collectively contribute to a more streamlined and responsive inventory management system, ultimately supporting better patient care and financial sustainability in healthcare institutions. The implementation of inventory management strategies, such as ABC, VED, and the ABC-VED Matrix, is expected to significantly improve patient care. These approaches would not only optimize the use of limited financial resources but also help prevent drug shortages and stockouts.

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Author Contribution

D.B.P conceived and designed the study and developed the questionnaire. The synthesis of results was carried out by S.D, B.G, A.S, P.D. S.D, S.K, K.R.B and B.P discussed ways of analyzing and analyzed the data. The drafts and final version of the manuscript were written by D.B.P, S.D, S.K. and D.B.P, S.K, P.D, B.P were involved in every version of the manuscript and read and approved the final version.

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