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ORIGINAL RESEARCH

Abc-Ven Analysis of Drug Use and Cost in Outpatien Cardiology Under Indonesia's National Health Insurance: Study at a Single Center

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ABSTRACT

Introduction: Pharmaceutical procurement represents a significant proportion of hospital expenditure, with drug inventory accounting for approximately 10-20% of of total hospital costs. The ABC-VEN analysis has been widely used to improve pharmaceutical inventory management, but evidence regarding its application in outpatient cardiology services within Indonesia's National Health Insurance (JKN) system remains limited. This study aims to evaluate drug use patterns, pharmaceutical expenditure, and inventory priorities using ABC–VEN analysis in outpatient cardiology services under Indonesia's National Health Insurance (JKN) system.

Methods: A retrospective observational study was conducted using all outpatient prescriptions under the national health insurance program in the cardiology clinic from January to March 2020. The ABC method carried out the analysis of drug use patterns and cost. ABC-VEN matrix was formulated by combining the results of ABC and VEN analysis.

Results: A total of 4,443 prescriptions contained 482,457 items from 125 types of drugs. Based on usage value, Classes A, B, and C accounted for 68%, 21%, and 11%, respectively, while based on invesment value, they accounted for 68%, 27%, and 5%. Class A drug usage and cost represent only 6% and 2% of total drug types. VEN analysis identified no Vital drugs, whereas Essential medicines accounted for 94% of total drug utilization and 98% of total pharmaceutical expenditure The ABC-VEN matrix showed drug usage in Categories I, II, and III at 34%, 60%, and 6%, with the corresponding drug costs for 68%, 30%, and 2%. Category I drugs represented 34% of total drug use but consumed 68% of total pharmaceutical expenditure, indicating substantial budget concentration in a limited number of essential high-cost medicines.

Conclusion: The ABC analysis based on usage value and invesment value and VEN analysis shows differing patterns. Pharmaceutical expenditure in outpatient cardiology services was highly concentrated among a limited number of essential medicines. ABC–VEN analysis provides a practical framework for procurement prioritization, budget optimization, and strategic inventory control, thereby supporting more efficient pharmaceutical management and sustainable medication availability.

Keywords: ABC-VEN Analysis, Outpatient Cardiology, Procurement; Usage; Cost

INTRODUCTION

Medicines are essential components of healthcare services. Drug logistics management is a critical element of the healthcare system, as it directly ensures the availability, affordability, quality, and safety of medicines for patients (1). Hospitals allocate a substantial proportion of their budgets to materials and logistics, with pharmaceutical inventory accounting for approxi mately 10–20% of total hospital expenditure (2). However, budget allocations do not always meet the demand, necessitating the minimization of procurement expenses for medications. Therefore, efficient and cost-effective budgeting is essential to balance pharmaceutical supply expenditures. Inefficient pharmaceutical inventory management can negatively impact hospitals both clinically and economically by increasing costs, causing stockouts, and disrupting patient care. Therefore, effective drug procurement planning and inventory control are essential to ensure continuous medication availability and sustainable healthcare services (3). Effective and proper management of hospital drug inventory is crucial to ensuring the accessibility and sustainable availability of medications (4).

Previous studies on outpatient cardiology services under Indonesia's National Health Insurance (JKN) system have demonstrated that cardiovascular pharmaceutical expenditure represents a substantial component of overall healthcare costs, underscoring the importance of efficient drug utilization, procurement planning, and inventory management (5). Nevertheless, evidence regarding the specific application of ABC–VEN analysis for pharmaceutical prioritization in outpatient cardiology settings within the JKN framework remains limited.

ABC analysis is an effective method in inventory management. It is applied to drug consumption data over a period of one year or shorter, based on monetary value and consumption levels. Items with low monetary value may play a critical role and their usage can be life-saving. Therefore, the importance of such drugs cannot be overlooked simply because they are not categorized as Class A (6).

VEN analysis is based on the necessity of items in a hospital. Items are classified into three categories: Vital (V), Essential (E), and Non-essential (N). Vital drugs are life-saving, and without them, hospital services and patient care would be severely disrupted. Essential items include those without which hospital services can continue for more than a week, although patient care would be adversely affected. Non-essential drugs are used for mild ailments with low therapeutic benefits, and their absence would not significantly impact patient care (7).

ABC analysis is a widely utilized inventory management method for classifying pharmaceuticals based on consumption value and expenditure, thereby supporting cost prioritization and budget control. This approach primarily emphasizes economic value and may overlook low-cost medications with substantial clinical importance. VEN analysis complements this limitation by categorizing medicines according to their therapeutic significance into vital, essential, and non-essential groups. This approach enables healthcare facilities to prioritize pharmaceutical procurement based on clinical necessity and service continuity (8).

The independent application of either ABC or VEN analysis remains insufficient due to their respective limitations. ABC analysis does not adequately account for therapeutic importance, whereas VEN analysis may overlook economic implications. Therefore, integrating ABC–VEN analysis offers a more comprehensive framework by combining economic and clinical considerations, thereby enhancing pharmaceutical procurement planning, inventory control, and resource optimization (8).

Cardiovascular disease (CVD) represents a significant health burden in Indonesia due to its high prevalence. Categorized as a catastrophic disease, CVD necessitates substantial financial resources and long-term therapeutic interventions (9). According to 2020 data from the Social Security Administrator for Health (BPJS Kesehatan), healthcare financing for catastrophic diseases accounted for nearly half of the total national health expenditure. Among these, CVDs imposed the highest financial burden at IDR 8.2 trillion, followed by stroke (IDR 2.13 trillion) and renal failure (IDR 1.92 trillion) (10).

Given that cardiovascular diseases require prolonged treatment, the continuity of therapeutic services must be optimally maintained. Consequently, healthcare facilities—particularly hospitals—must ensure an adequate and sustainable supply of medications to support therapeutic adherence and guarantee the seamless delivery of healthcare services. Data from Universitas Airlangga Hospital indicate that the three highest volumes of outpatient visits are recorded in the internal medicine, cardiology, and neurology clinics. This high patient volume in cardiology directly contributes to the complexity of pharmaceutical stock management, necessitating efficient logistical strategies, such as the implementation of ABC–VEN analysis.

Despite the recognized value of ABC–VEN analysis in pharmaceutical inventory management, evidence regarding its application in outpatient cardiology services under Indonesia's National Health Insurance (JKN) system remains limited. This study provides context-specific evidence on drug use patterns, cost concentration, and pharmacy priorities in outpatient cardiology services within the JKN framework, thereby supporting more targeted and efficient inventory management strategies.

Universitas Airlangga Hospital, a tertiary referral center in East Java, has experienced a continuous increase in outpatient cardiology service demand. Given the rising burden of cardiovascular disease and its projected escalation in healthcare costs, effective pharmaceutical inventory control is essential to ensure medication availability and prevent disruptions in critical drug supply. Therefore, this study aims to analyze drug utilization and cost using ABC–VEN analysis in outpatient cardiology services under the JKN system at Universitas Airlangga Hospital.

METHODS

Study Design and Setting

This study was an observational study using a retrospective data approach and was conducted as a single-center study at the Pharmacy Department of Universitas Airlangga Hospital. The study utilized all outpatient cardiology prescriptions for patients covered by the National Health Insurance (*Jaminan Kesehatan Nasional/JKN*) from January to March 2020 as the study sample. No exclusion criteria were applied. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Airlangga Hospital (Ethical Clearance No. 002/KEP/2022.

Data Collection

Data were collected from pharmacist-verified prescriptions, including drug type, quantity, and unit price. Drug utilization (usage value) and drug cost value were subsequently calculated. Usage value was defined as the total quantity of each drug used during the study period, while investment value is the cost of using a number of drugs (usage cost). Usage cost was calculated by multiplying the unit price of each drug by its total quantity used. These utilization and cost data were then analyzed using ABC analysis, VEN analysis, and the combined ABC–VEN matrix method.

Data Analysis

ABC analysis classified drugs into three categories based on cumulative expenditure value: Group A comprised drugs contributing to 70% of total expenditure, Group B accounted for 20%, and Group C represented the remaining 10%. VEN analysis categorized medicines into Vital (V), Essential (E), and Non-essential (N) groups based on the National Essential Medicines List, National Formulary, Hospital Formulary, and expert judgement with cardiologists and pharmacists to ensure alignment with clinical needs and healthcare policies. Group V included life-saving medicines that are critical for patient survival, Group E consisted of essential medicines required for the effective management of major diseases, and Group N comprised medicines intended for minor conditions, supportive care, or non-critical therapeutic purposes.

Finally, the results of ABC and VEN analyses were cross-tabulated to develop the ABC–VEN matrix. This matrix was further divided into three priority categories: Group I as high priority (EA), Group II as medium priority (EB, EC), and Group III as low priority (NC). This classification supported more strategic pharmaceutical inventory management based on both economic value and therapeutic importance.

RESULTS

During the study period from January to March 2020, 4,443 outpatient cardiology prescriptions under the JKN system were analyzed, comprising 125 drug types with a total drug use of 482,457 items, reflecting substantial pharmaceutical demand in this clinical setting.

ABC Analysis

The results of ABC analysis are presented in Table 1. Based on drug usage value, Class A consisted of 8 types of drugs, representing 6% of the total drug types, with a total usage of 326,392 items accounting for 68% of total drug use. This indicates that a limited proportion of medications dominated overall pharmaceutical consumption in outpatient cardiology services. Major drugs in this category included include bisoprolol 2.5 mg tablets, nifedipine 30 mg extended-release tablets, candesartan 16 mg and 8 mg tablets, and simvastatin 2 0 mg tablets. Class B included 9 types of drugs (7%) with a total usage of 104,271 items (21%) of total drug use, reflecting moderate utilization. Medications in this class included acetylsalicylic acid capsules (100 mg and 80 mg), isosorbide dinitrate 5 mg tablets, allopurinol 100 mg tablets, and ticagrelor 90 mg tablets. Meanwhile, Class C comprised the majority of drug types, with 108 drug types (87%), but accounted for only 51,794 items (11%) of total drug use, indicating a large number of low-consumption medications such as lisinopril 5 mg, clopidogrel 75 mg, amlodipine 10 mg and 5 mg, and vitamins.

Based on usage cost, Class A consisted only 3 drug types (2% of total drug types) with a total usage of 162,323 items (34% of total drug use), yet accounted for 68% of the pharmaceutical cost. This demonstrates that a very limited subset of medications consumed the majority of the pharmaceutical budget. High-investment drugs in this category included nifedipine 30 mg extended-release tablets, bisoprolol 2.5 mg tablets, and ticagrelor 90 mg tablets. Class B included 6 types of drugs (5%) with a total usage of 116,475 items (24%) contributing for 27% of the drug cost. Drugs in this class included nitroglycerin 2.5 mg tablets, candesartan 16 mg and 8 mg tablets, atorvastatin 20 mg tablets, and clopidogrel 75 mg tablets. In contrast, Class C contained 116 types of drugs (93%) with a total usage of 203,659 items (42%), but accounted only for only 5% of the total cost. Examples of drugs in Class C include simvastatin 20 mg tablets, warfarin 2 mg tablets, spironolactone 25 mg tablets, beraprost 20 µg tablets, and acetylsalicylic acid 100 mg tablets. These findings highlight substantial cost concentration within a small number of high-investment drugs, emphasizing the strategic importance of strict procurement planning and inventory control for Class A medications.

Table 1. The ABC analysis result based on usage and investment value

Class	Usage Value			Investment Value			
	Drug Type (%)	Top 5 Pharmaceutical	Drug Item (%)	Drug Type (%)	Top 5 Pharmaceutical	Drug Item (%)	Usage Cost in %
A	8 (6)	Bisoprolol 2,5 mg Nifedipine 30 mg Candesartan 16 mg Candesartan 8 mg Simvastatin 20 mg	326,392 (68)	3 (2)	Nifedipine 30 mg Ticagrelor 90 mg Bisoprolol 2.5 mg	162,323 (34)	68
B	9 (7)	Acetylsalicylic acid 100 mg Isosorbide dinitrate 5 mg Acetylsalicylic acid 80 mg Allopurinol 100 mg Ticagrelor 90 mg	104,271 (21)	6 (5)	Nitroglycerin 2.5 mg Candesartan 16 mg Candesartan 8 mg Atorvastatin 20 mg Clopidogrel 75 mg	116,475 (24)	27
C	108 (87)	Lisinopril 5 mg Clopidogrel 75 mg Amlodipine 10 mg Vitamin B Complex Amlodipine 5 mg	51,794 (11)	116 (93)	Simvastatin 20mg Warfarine 2 mg Spironolakton 25 mg Beraprost 20 ug Acetylsalicylic acid 100 mg	203,659 (42)	5
Total	125 (100)		482,457 (100)	125 (100)		482,457 (100)	100

Figure 1. Pie chart of the comparative distribution of drug types based on usage value and investment value. The chart reaffirms that category A, with both high usage value and high costs, accounting for up to 68%, is filled by only a few drugs, 6% versus 2%. Likewise for category B. Category C, the amount of use or small usage cost is filled by many drugs, respectively 87 vs 93% of the types of drugs used. This comparison provides important insights into drug usage patterns and budget absorption, which are needed to support more strategic decision-making in inventory management and cost control in pharmaceutical services

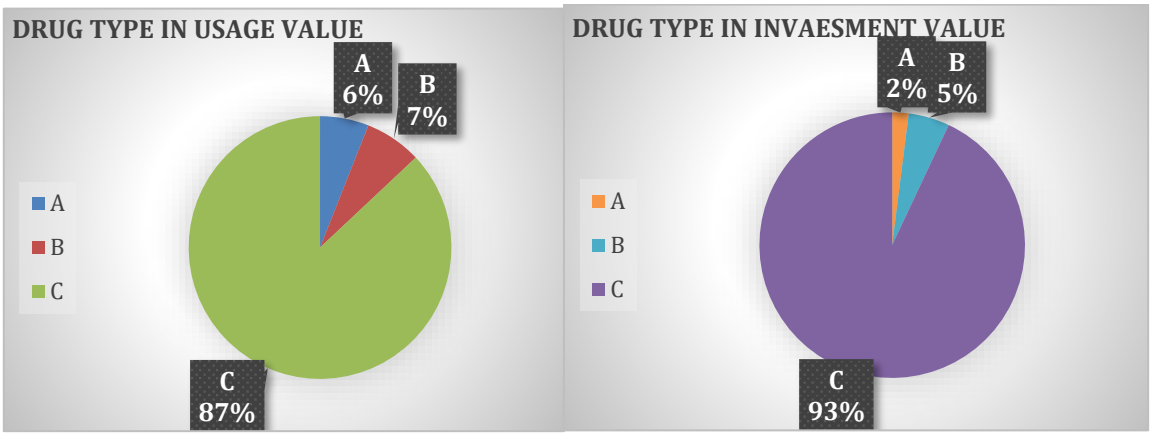

Figure 1. ABC analysis of drug types based on usage value and investment value.

VEN Analysis

VEN analysis demonstrated that no medications were classified under the Vital (V) category, reflecting the outpatient nature of cardiology services in which emergency life-saving drugs are not routinely prescribed. Essential (E) drugs predominantly accounted for pharmaceutical use, comprising 56 drug types (45%) with 453,945 drug items (94%) and contributing 98% of total pharmaceutical expenditure. This finding indicates that outpatient cardiology pharmaceutical demand was highly concentrated on essential long-term therapeutic agents necessary for continuous cardiovascular disease management. Major essential medications included bisoprolol 2.5 mg tablets, nifedipine 30 mg extended-release tablets, candesartan 16 mg and 8 mg tablets, simvastatin 20 mg tablets, and other primary cardiovascular therapies.

Non-Essential (N) drugs comprised 69 drug types (55%) but accounted for only 28,512 drug items (6%) and 2% of total pharmaceutical expenditure (Table 2), indicating relatively low clinical, operational, and financial priority. Examples of non-essential drugs in this study included allopurinol 100 mg tablets, vitamin B complex tablets, lansoprazole 30 mg capsules, metformin 500 mg tablets, and analgesic combination tablets. These findings suggest that although non-essential medications constituted a larger proportion of total drug types, their overall contribution to pharmaceutical expenditure and service continuity remained minimal.

Table 2. Drug grouping with VEN analysis

Class	Drugs Type (%)	Drug Item (%)	Usage Cost in %
V	0 (0)	0 (0)	0
E	56 (45)	453,945 (94)	98
N	69 (55)	28,512 (6)	2
Total	125 (100)	482,457 (100)	100

ABC-VEN Combination Analysis

The results of the ABC–VEN matrix analysis are presented in Table 3. Category I consisted of 162.323 drug items (34%) and accounted for 68% of total pharmaceutical expenditure, indicating that a limited number of essential high-investment drugs consumed the majority of the pharmaceutical budget. Category II represented the largest proportion of drug use, with 291,622 drug items (60%) and contributed 30% of total pharmaceutical expenditure. Meanwhile, Category III accounted for 28,512 drug items (6%) and only 2% of total pharmaceutical expenditure, reflecting the lowest clinical and financial priority. Overall, the ABC–VEN matrix demonstrated that pharmaceutical expenditure was primarily concentrated in Category I drugs, while the majority of drug items were distributed within Category II.

Table 3. Distribution of drugs based on categories I, II, and III

Category	Class	Drug Item (%)	Usage Cost in %
I	EA	162,323 (34)	68
II	EB, EC	291,622 (60)	30
III	NC	28,512 (6)	2
Total		482,457 (100)	100

DISCUSSION

Based on drug data processing results, a total of 125 types of medications were prescribed at the Cardiology and Vascular Outpatient Clinic from January to March 2020. Based on usage value, Class A represents drugs with the highest consumption value (fast-moving), accounting for 68% of the total drug usage in Cardiology Clinic, including antihypertensive and antihyperlipidemic drugs i.e., bisoprolol 2.5 mg, nifedipine 30 mg, candesartan 16 mg, candesartan 8 mg dan simvastatin 20 mg. Class B represents drugs with moderate consumption value, accounting for 21% of the total drug usage, including including acetylsalisilic acid 100 mg, isosorbide dinitrate 5 mg, acetylsalicylic acid 80 mg, allopurinol 100 mg and ticagrelor 90 mg. Class C accounts for 11% of the total drug usage, including lisinopril 5 mg, clopidogrel 75 mg, amlodipine 10 mg, vitamin B complex and amlodipine 5 mg. The ABC analysis based on usage value showed that bisoprolol 2.5 mg tablets had the highest consumption among antihypertensive drugs, with a usage volume of 92,319 units, and were classified as Class A. For this category, budget optimization and strict control are necessary to prevent stock shortages. Antihypertensive medications represent the most frequently utilized category, aligning with diagnostic data showing that hypertension was the most common diagnosis during the study period. In the diagnosis of hypertension, many patients receive more than 1 antihypertensive drug. Using medications from various drug classes in combination may produce additive or synergistic effects, resulting in a more significant reduction in blood pressure compared to simply increasing the dose of a single medication (11). Meanwhile, medication in Class B with moderate usage can be adequately monitored using stock cards without the need for stringent oversight as in Class A. Medications in Class C do not require tight monitoring. Pharmacists only need to review Class C drugs periodically. Reducing the quantity of slow-moving drugs in Class C is a practical approach often used to minimize inventory volume and investment (12).

Previous studies showed that ABC analysis based on investment value yielded different results. In Neurology Outpatient Clinic of a hospital in Indonesia, usage cost in Class A, B, and C accounted for 69.56%, 19.87%, and 10.58%, respectively (4). Class A includes drugs with a small number of items but high monetary value. In the provision of medications at the Cardiology Clinic, the availability of three types of drugs classified under Class A needs to be ensured. Class A accounts for 68% of the budget. Class B represents items with a moderate number and monetary value. For this class, six types of drugs are prioritized, consuming 27% of the budget. Items with a large number but small monetary value fall under Class C, which uses only 5% of the budget. These differences in patterns may be attributed to the disease characteristics and treatment regimens of each department, where cardiology services are primarily focused on managing chronic conditions with high prevalence, such as hypertension, dyslipidemia, and ischemic heart disease, which involve high-volume drug use but are predominantly low-cost. This results in a “high-volume, low-cost” phenomenon, where drugs are used very frequently but contribute relatively little to overall costs. Conversely, some medications, such as ticagrelor, have moderate usage volumes but high unit prices, thereby qualifying for Class A investment value. Based on this analysis, inventory procurement activities can be controlled by determining the order frequency. Class A items should be ordered more cautiously, more frequently, and in smaller quantities to minimize procurement costs and maintain low buffer stock. Class B items are controlled with optimal procurement frequency and volume, while Class C requires minimal control efforts (13,14).

The ABC analysis based on usage value and investment value demonstrates different patterns. Based on usage value, there are 8 drugs in Class A, while based on investment value, there are 3 drugs, accounting for 68% of the total cost. Only two

drugs are common between Class A by usage value and Class A by investment value: nifedipine 30 mg sustained-release and bisoprolol 2.5 mg. Nifedipine 30 mg sustained-release is a drug with both high usage and high cost, while bisoprolol 2.5 mg has high usage and relatively high cost. Additionally, ticagrelor is classified as Class B based on usage value but Class A based on investment value due to its moderate usage but high cost. Simvastatin, on the other hand, is categorized as Class A based on usage value and Class C based on investment value because it has high usage but a low cost.

The VEN classification refers to the National List of Essential Medicines, National Formulary, Hospital Formulary, and expert consultation with cardiologists and pharmacists to ensure alignment with clinical needs and healthcare policiest. This is as with the research conducted by Nguyen et al. that the VEN classification was established after discussions with a group of multidisciplinary health professionals in the hospital, which includes senior pharmacists and experienced doctors. They use a list of the top ten diseases, the Standard Care Guidelines, and an institutional formulary to determine whether a drug is classified as V, E, or N (15).

The VEN analysis was conducted on 125 types of drugs prescribed at cardiology clinic. Class V comprises life-saving drugs that must never run out of stock. If there is a deficiency when the drug is needed, it may result in patient death; therefore, it is classified as first-aid drugs in emergency situations (16). According to the VEN analysis results in Table 2, there were no Class V drugs identified because this study used data on outpatients who were prescribed oral and topical medications by a doctor such as Acetylsalicylic Acid 100 mg, ticagrelor 90 mg and betamethasone valerate cream 0,1%. This differs from a study conducted at the Cardiovascular Center in Mongolia in 2016, 2017, and 2018, which found that most cardiovascular drugs were classified as class V drugs, accounting for 64.52%, 71.88%, and 70% of the total cardiovascular drugs. These drugs consumed 51.03%, 69.86%, and 57.6% of the budget, respectively. This difference is attributed to the use of inpatient data, which included several vital cardiovascular drugs such as dobutamine injections, dopamine injections, amiodarone injections, and isosorbide dinitrate tablets (17). Class E includes drugs that target the root cause of diseases and are critical to healthcare services, with a stockout tolerance of less than 48 hours. In this study, the top five drugs in Class E include nifedipine 20 mg extended-release tablets, nifedipine 30 mg extended-release tablets, alprazolam 1 mg tablets, amlodipine 10 mg tablets, and amlodipine 5 mg tablets. Drugs categorized under Class E include those for antihypertensive, antiplatelet, antianginal, antihyperlipidemic, diuretic therapies, as well as drugs affecting coagulation, non-narcotic analgesics, antiarrhythmics, heart failure medications, and some anxiolytics. Class N comprises drugs with mild effects, procured mainly to complement the formulary. The top five drug in class N in this study include acarbose 100 mg tablets, acarbose 50 mg tablets, allopurinol 100 mg tablets, gabapentin 100 mg tablets and ambroxol 15 mg/5ml syrups. Drugs in Class N include therapies for antacids and anti-ulcer, antigout, vitamins and minerals, antitussives, drugs for prostatic hypertrophy, antiparkinsonian agents, antidiabetics, cathartics, expectorants, mucolytics, electrolytes, antibacterial, antiallergics, neuropathic pain management, hepatoprotections, anti-inflammatory and antipruritic agents, anti-anemics, antivertigo, antiasthmatics, antithyroid, antiemetics, antidiarrheals, some anxiolytics, and disposable medical materials.

ABC analysis is a method that focuses on the effect of a drug item on budget allocation, without considering clinical importance of the use of the drug item in the hospital. ABC analysis emphasizes on financial value, and may overlook low-cost items that are crucial for operational continuity or patient satisfaction. VEN analysis, on the other hand, categorizes drugs based on their level of importance without considering overall cost and usage volume, potentially leading to inefficiencies in budget allocation (18). When the ABC and VEN analyses are used independently, the results often do not lead to effective and efficient inventory control. Combining the ABC-VEN analyses enhances and sustains the quality of healthcare services provided to patients while optimizing hospital drug inventory costs (19). Integrating both methods is essential to achieve better outcomes in pharmaceutical inventory management.

Based on usage costs, this study found that Category I accounted for the highest expenditure at 68% of the total drug costs. This finding aligns with a study by Ceylan & Bulkan in 2017, and Mfizi (2023), which found that Category I accounted for the largest share of costs at 75.25% and 87.88%, respectively (20,21). The majority of the pharmaceutical budget at the cardiology outpatient clinic is allocated to Category I medications, which are essential medications with high investment value, particularly the EA group. The EA group consists of essential medicines with high usage volumes, accounting for 68% of total usage cost and 34% of total usage. The operational stability of cardiology services is highly dependent on the continuous availability of essential medications that have high utilization rates and economic value. Category I drugs not only account for the majority of the budget but also serve as the primary therapy for preventing major complications such as stroke, heart failure, or myocardial infarction. Therefore, the risk of stockouts in this group not only impacts financial efficiency but can also increase clinical risks, rehospitalization rates, and the overall financial burden on the hospital. This indicates that the management of Category I drugs must be prioritized in hospital pharmaceutical logistics management. Maintaining a consistent supply of Category I drugs throughout the year is crucial for smooth hospital operations, as their unavailability is unacceptable. Maintaining low-cost buffer stocks can prevent shortages while monitoring consumption and available inventory.

From the ABC-VEN combination analysis, Category II consists of EB and EC classes, representing essential drugs with medium and low investment values, accounting for 30% of total usage cost and 60% of total usage. In terms of usage volume, Category II medications had the highest usage at 60%. This aligns with the study by Deressa et al. (2022), conducted in hospitals and health centers, which found that Category II medications accounted for the highest usage volume at 54.69%. Meanwhile, a study by Mfizi (2023) showed that the use of Category II drugs was moderate at 40.70%. This is because the study by Mfizi et al. was conducted at a district-level pharmaceutical distribution center, where vital items were found in large quantities (44.20% of products) and fell into the high-priority category (21). From the perspective of usage cost, these findings align with studies by Mfizi (2023) and Deressa (2019), which indicate that Category II includes a portion of medications with moderate cost levels (8,21). This category represents a group of medications that remain essential for healthcare services

but do not impose the same cost burden as Category I. Proper management of Category II drugs is critical to ensuring the availability of essential medications, which directly impacts the quality of pharmaceutical services provided (22). Category III consists of NC drugs, which are non-essential with low investment values, consuming only 2% of the annual budget. Due to the low cost of this category, procurement can be done once or twice a year to save ordering costs while maintaining reasonable storage expenses (23). Hospitals can save costs in this category and allocate the savings toward purchasing vital or essential drugs. Drugs in Category III include non-cardiovascular medications such as vitamins, minerals, and others.

A study utilizing community pharmacy inventory data from downtown Van, Turkey, during 2019–2020, revealed that 24.68% of items fell into Category I (AV, AE, AD, BV, CV), accounting for the highest annual expenditure at 80.41%. Category II (BE, CE, BD) comprised over 50% of annual items, with expenditures amounting to 18.89% of the total. Category III included 7.47% of items, representing the lowest proportion both in quantity and value, with annual expenditures of only 0.70% of the total (24). The ABC-VEN analysis results across studies conducted in various countries (8,12,20,21,24,25) exhibit significant variation in the percentages of Categories I, II, and III. These differences can be attributed to factors such as the healthcare system of the country, drug pricing and reimbursement policies, procurement policies, hospital bed capacity, healthcare service profiles, and supply chain mechanisms (26,27). To ensure service sustainability, an ABC–VEN analysis specific to each service unit is required, as it contributes to inventory control. From this study, category I of the ABC-VEN matrix is dominated by essential drugs, with a few types of drugs that require strict planning and procurement control.

CONCLUSION

The ABC analysis based on usage value and cost value, and VEN analysis show differing patterns. Pharmaceutical expenditure in outpatient cardiology services was highly concentrated among a limited number of essential medicines. ABC–VEN analysis provides a practical framework for procurement prioritization, budget optimization, and strategic inventory control, thereby supporting more efficient pharmaceutical management and sustainable medication availability.

DECLARATIONS

Author contributions: The first author developed the research concept, conducted the study, collected and analyzed the data, and contributed to the interpretation of the results. The second and fourth authors provided supervision and academic mentorship in the fields of clinical pharmacy and hospital-based pharmaceutical management. The third author acted as both academic advisor and clinical consultant, contributing specialized expertise in cardiology and vascular medicine. The fifth and sixth were responsible for drafting, revising, and finalizing the manuscript for publication.

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REFERENCES

1. Wasni W, Shadiqi MA, Rahman F, Adhani R, Isa M. Literature Review: Evaluation of Drug Logistics Management Implementation. Indonesian Journal of Global Health Research. 2025 Dec 30;7(6):1197–206. https://doi.org/10.37287/ijghr.v7i6.1248
2. Taşer M, Ozban M. Improvement of Drug Stock Management Using ABC-VED Analysis in a University Hospital. Clinical and Experimental Health Sciences. 2024 Sep 30;14(3):618–24. https://doi.org/10.33808/clinexphealthsci.1204223
3. Erowati TI, Herowati R, Purwidyaningrum I, Widodo GP, Oetari RA, Atmadani RN, et al. Planning and procurement evaluation in 2019-2020 at pharmaceutical installation of X Private Hospital, Sidoarjo, Indonesia. Journal of Advanced Pharmacy Education and Research. 2024;14(2):42–9. https://doi.org/10.51847/eETvRwI7NV
4. Damayanti D, Suprapti B, Andarsari MR, Machin A, Hakim LN. ABC-VEN analysis of drug use in outpatients at a neurology department in Indonesia. Pharmacy Education. 2024 May 1;24(3):63–8. https://doi.org/10.46542/pe.2024.243.6368
5. Nur AB, Suprapti B, Yulistiani Y, Yusuf M, Kurniawati N. Drug cost analysis of outpatients with cardiovascular disease under the national health insurance scheme. Pharmacy Education. 2023 Jan 21;23(4):1–4. https://doi.org/10.46542/pe.2023.234.14
6. Sharma S. Tools for Assessing and Monitoring Medicine Use. In: Pharmaceutical Medicine and Translational Clinical Research. Elsevier Inc.; 2018. p. 445–63. https://doi.org/10.1016/B978-0-12-802103-3.00033-X
7. Abate SM, Gebremariam MY, Migbaru S, Yigeremu M, Woldegerima B, Shibeshi W. ABC-VEN matrix analysis of pharmaceutical inventory management in Tikur Anbessa ABC-VEN matrix analysis of pharmaceutical inventory management in Tikur Anbessa, Addis Ababa, Ethiopia. Indian Journal of Basic and Applied Medical Research. 2016;(5):734–43.
8. Deressa MB, Beressa TB, Jemal A. Analysis of Pharmaceuticals Inventory Management Using ABC-VEN Matrix Analysis in Selected Health Facilities of West Shewa Zone, Oromia Regional State, Ethiopia. Integr Pharm Res Pract. 2022 Feb; Volume 11:47–59. https://doi.org/10.2147/iprp.s354810
9. Kemenkes RI. Menangkal Penyakit Berat [Internet]. Kemenkes RI; 2024. Available from: https://link.kemkes.go.id/mediakom
10. Margarini E. Kemenkes RI [Internet]. 2021 [cited 2026 May 9]. Peringatan Hari Jantung Sedunia 2021: Jaga Jantungmu untuk Hidup Lebih Sehat. Available from: https://ayosehat.kemkes.go.id/peringatan-hari-jantung-sedunia-2021-jaga-jantungmu-untuk-hidup-lebih-sehat
11. Wald DS, Law M, Morris JK, Bestwick JP, Wald NJ. Combination Therapy Versus Monotherapy in Reducing Blood Pressure: Meta-analysis on 11,000 Participants from 42 Trials. American Journal of Medicine. 2009 Mar;122(3):290–300. https://doi.org/10.1016/j.amjmed.2008.09.038
12. Rizkya I, Sari RM, Erwin, Sari RF. Determination of Inventory Policy based on ABC Classification. In: IOP Conference Series: Materials Science and Engineering. Institute of Physics Publishing; 2020. https://doi.org/10.1088/1757-899X/851/1/012014
13. Silaen BR, Nasution M, Muti'ah R. Implementation of the ABC Analysis to the Inventory Management. International Journal of Science [Internet]. Available from: http://ijstm.inarah.co.id816
14. Kamarul M, Rahim IA, Hassan Q, Santhirasegaran #2, Nadarajah SR, Radzuan K. A Case Study of Inventory Analysis in a Healthcare Product Manufacturing Company. Int. J Sup. Chain. Mgt [Internet]. 2018. Available from: http://excelingtech.co.uk/

15. Nguyen PH, Dang TVK, Nguyen PT, Vo TMH, Nguyen TTM. 5-year inventory management of drug products using ABC-VEN analysis in the pharmacy store of a specialized public hospital in Vietnam. Pharmacia. 2022;69(2):517–25. https://doi.org/10.3897/pharmacia.69.e84348
16. Almahdy I, Kholil M, Haekal J, Widodo T. Control Analysis of Medicine Inventories Using ABC, Ven, and EOQ Approach in Pharmaceutical Companies. International Journal of Scientific Advances. 2021;2(5). https://doi.org/10.51542/ijscia.v2i5.6
17. Lkhagvasuren D, Mukhtar Y, Dorjbal E. ABC-VEN Matrix Analysis on the Cardiovascular Medicines Used at the Cardiovascular Center in Mongolia. Sapporo Medical Journal. 2020.
18. Yulistiani Y, Hamidi NF, Utomo FN, Hamidah KF. Shifts in drugs use after the COVID-19 pandemic based on the analysis of ABC, VEN and ABC-VEN matrix. Pharmacia. 2023;70(4):1315–22. https://doi.org/10.3897/pharmacia.70.e113558
19. Al-Najjar SM, Jawad MK, Saber OA. Application of ABC-VED Matrix Analysis to Control the Inventory of a Central Pharmacy in a Public Hospital: A Case Study. International Journal of Science and Research. 2018 Jan;9(1):1328–36. https://doi.org/10.21275/ART20204180
20. Ceylan Z, Bulkan S. Drug Inventory Management of a Pharmacy using ABC and VED Analysis. Eurasian Journal of Health Technology Assessment. 2017;2(1):13–8.
21. Mfizi E, Niragire F, Bizimana T, Mukanyangezi MF. Analysis of pharmaceutical inventory management based on ABC-VEN analysis in Rwanda: a case study of Nyamagabe district. J Pharm Policy Pract. 2023 Dec 1;16(1). https://doi.org/10.1186/s40545-023-00540-5
22. Abdelmonim Ahmed H, I. Kheder S, Mohamed Awad M. Pharmaceutical inventory control in Sudan central and hospital stores using ABC-VEN analysis. Glob Drugs Ther. 2019;4(2). https://doi.org/10.15761/gdt.1000172
23. Mohammed SA, Workneh BD. Critical Analysis of Pharmaceuticals Inventory Management Using the ABC-VEN Matrix in Dessie Referral Hospital, Ethiopia. Integr Pharm Res Pract. 2020 Sep;Volume 9:113–25. https://doi.org/10.2147/iprp.s265438
24. Dursa E, Arslan M. ABC, VED, and ABC-VED Matrix Analyses for Inventory Management in Community Pharmacies: A Case Study. Fabad Journal of Pharmaceutical Sciences. 2022;47(3):293–300. https://doi.org/10.55262/fabadeczacilik.1134573
25. Dudhgaonkar S, Choudhari SR, Bachewar NP. The ABC and VED analysis of the medical store of the tertiary care teaching hospital in Maharashtra, India. Int J Basic Clin Pharmacol. 2017 Aug 22;6(9):2183. https://doi.org/10.18203/2319-2003.ijbcp20173741
26. Gizaw T, Jemal A. How is Information from ABC–VED–FNS Matrix Analysis Used to Improve Operational Efficiency of Pharmaceuticals Inventory Management? A Cross-Sectional Case Analysis. Integr Pharm Res Pract. 2021 Jun;Volume 10:65–73. https://doi.org/10.2147/iprp.s310716
27. Yilmaz F. The drug inventories evaluation of healthcare facilities using ABC and VED analyzes. Istanbul Journal of Pharmacy. 2019 Oct 9;48(2):43–8. https://doi.org/10.5152/IstanbulJPharm.2018.398141