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Five-Year Approach to Managing Drug Inventories through ABC-VEN Analysis in the Pharmacy Unit of a Specialized Public Hospital in Vietnam

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ABSTRACT

In developing countries, healthcare expenditures have increased disproportionately compared to the financial resources provided by the government. Challenges related to inventory management and pharmaceutical market regulation have also been identified. To address these issues, we performed an ABC-VEN classification of the medicines stocked at Can Tho Dermatological Hospital (CTDH) between 2016 and 2020, aiming to provide evidence-based insights to help policymakers improve the efficiency of the drug supply system. The findings indicated that Category I drugs, which accounted for the highest cost and importance, represented approximately 88% of the hospital's annual expenditure. In contrast, Category II and III drugs contributed around 5–10% and less than 5% of total costs, respectively. With limited financial resources, it is essential to ensure the judicious use of Essential medicines. The integrated ABC-VEN matrix enabled the identification of drugs where substantial cost reductions could be achieved, demonstrating its effectiveness as a strategic tool for procurement and inventory control decisions.

Keywords: ABC-VEN matrix, Expenditures, Can Tho city, Drug utilization, Dermatology hospital

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Introduction

Materials and supplies, encompassing both pharmaceutical and non-pharmaceutical products, make up nearly one-third of a hospital's total expenditures, with about 40% of that amount devoted to the purchase and operation of hospital pharmacies [1, 2] Given that medicines represent a significant portion of overall healthcare costs, pharmacies play a pivotal role in the efficient functioning of healthcare institutions [3]. In 2019, the pharmaceutical sector accounted for around 10% of the healthcare expenditure in the United States [4], while this share was approximately four times higher in lower-income countries [5]. Similarly, government spending on medicines in China has continued to rise despite a slowdown in economic growth [6]. These trends highlight a distinct imbalance in healthcare spending patterns between developed and developing nations [3]. For many low- and middle-income countries (LMICs), controlling the rapid escalation of medicine costs remains a persistent challenge [7-9]. Moreover, global issues such as self-medication and antibiotic misuse have raised significant concern [10, 11], and Vietnam is no exception to this problem.

The ABC-VEN method has become a widely adopted analytical framework for healthcare professionals to evaluate drug utilization patterns within specific time frames and settings. The ABC approach classifies inventory items based on their financial importance [12] and follows the Pareto principle, which states that a small proportion of items often account for the majority of the total consumption value—hence the notion of distinguishing "the vital few" from "the trivial many" [13]. On the other hand, the VEN analysis organizes medicines according to their therapeutic significance—Vital, Essential, or Non-essential—depending on their necessity in patient care [13].

When these two analytical techniques are combined into an ABC-VEN matrix, the resulting framework provides valuable insights into drug inventory control and prioritization [14]. This integrated analysis helps identify which drugs contribute most to the overall pharmaceutical budget [13] and enables administrators to determine which medicine categories require tighter control to optimize resource allocation and prevent shortages [15]. Additionally, the method assists in recognizing redundant or non-essential medications that may be prone to expiration [16].

In essence, ABC-VEN analysis can:

- Identify high-volume, low-cost therapeutic alternatives available on the formulary or in the market.
- Assist hospital management in selecting medications with cost-effective overall treatment expenses, particularly when financial resources are constrained [17]. As noted by Kivoto et al. (2018) [5], hospitals in LMICs rarely possess sufficient budgets to procure every recommended drug on their formulary.
- Encourage substitution with alternative treatments when the distribution chain faces interruptions [13].
- Support negotiations with pharmaceutical companies for more favorable pricing, a practice increasingly adopted across Europe [18].
- Facilitate the implementation of cycle counting processes [12].
- Provide insights into local healthcare consumption trends by correlating medication usage with disease prevalence, thus identifying irrational prescription behaviors.
- Enable short-term (less than one year) evaluations of drug usage [1, 19].
- Guide decision-making in the prioritization, importation, and storage of pharmaceuticals [16, 20, 21].

Despite these advantages, many healthcare facilities in Vietnam remain unfamiliar with this analytical framework. Although prior studies have utilized similar approaches, none have specifically targeted a Dermatologic Specialized Health Institution's Drug Formulation. Skin disorders are notably prevalent in tropical, humid climates such as Vietnam's, where excessive moisture fosters bacterial and fungal skin infections. Nonetheless, challenges such as insufficient inventory reserves and deteriorating storage conditions frequently disrupt medical operations. The Can Tho Dermatology Hospital (CTDH), a specialized public healthcare institution under the Can Tho Department of Health and located in the city's central district, continues to face difficulties in developing an optimal and cost-effective drug procurement list. Hence, this study sought to systematically categorize the available medications at CTDH and provide evidence-based recommendations to improve pharmaceutical inventory management and ensure rational utilization of resources.

Since 1993, Australia has required that all submissions for inclusion in the national formulary be accompanied by a cost-effectiveness evaluation, a policy that has since influenced similar practices in Canada, New Zealand, and the United Kingdom [22]. In alignment with this global trend, Vietnam's Ministry of Health released Circular No. 19/2018/TT-BYT in 2018, which introduced the List of Essential Medicines. The hospital's formulary used in this study was developed based on the guidance provided in this regulation and tailored to reflect the institution's specific disease profile.

Materials and Methods

Drug and Therapeutics Committees (DTCs) are responsible for overseeing how physicians prescribe and utilize medications, including their associated costs. To facilitate this, the World Health Organization (WHO) and the Management Sciences for Health released a practical guide in 2003 outlining standardized procedures for evaluating drug utilization [5, 23]. By classifying supplies based on criteria such as cost significance, inventory turnover, procurement lead time, and seasonal demand fluctuations, healthcare facilities can better streamline inventory control. Various management techniques have been proposed in the literature to improve efficiency in such contexts [2, 24, 25]. These include:

- ABC analysis – categorizes materials as high, medium, or low cost;
- VEN analysis – classifies drugs as Vital, Essential, or Non-essential;
- FSN analysis – identifies fast-moving, slow-moving, and non-moving items;
- SDE analysis – ranks items as scarce, difficult, or easy to procure;
- HML analysis – separates materials according to high, medium, or low stock value;
- SOS analysis – differentiates seasonal from non-seasonal materials.

Among these, ABC and VEN analyses are the most widely adopted in hospital settings because they help detect inefficiencies in resource allocation and enhance the overall management and performance of healthcare systems [19].

Study design and data collection

This investigation employed a retrospective cross-sectional record review approach. Data on annual drug consumption and corresponding expenditures were collected for the five-year period from January 1, 2016, to December 31, 2020. Information was retrieved from the DHG Medicine Software, DHG Treatment System, and manual pharmacy records at Can Tho Dermatology Hospital (CTDH). Each pharmaceutical transaction—both purchases and sales—was documented through invoices recorded by the hospital pharmacy.

Medical devices and equipment were excluded from the analysis. All pharmaceutical data were compiled into a Microsoft Excel spreadsheet, and statistical computations were performed using MS Excel 2016. Financial figures were initially recorded in Vietnamese Dong (VND) and then converted to US Dollars (USD) based on the exchange rates on December 31 of each respective year:

2016 – 1 USD = 22,720 VND;
2017 – 1 USD = 22,665 VND;
2018 – 1 USD = 23,155 VND;
2019 – 1 USD = 23,080 VND;
2020 – 1 USD = 23,005 VND.

Drugs were categorized by pharmacological class, and the entire formulary review process was conducted over 31 days in August 2021.

ABC (always better control) analysis

The ABC approach evaluates the financial impact of each medicine by multiplying the quantity consumed by its unit price to obtain the total expenditure per item [17, 26]. These totals are arranged in descending order, after which cumulative cost percentages are calculated. Based on the Pareto principle, medicines are then classified into three categories [22, 23, 27]:

- Class A: High-cost, high-consumption drugs that account for roughly 70–80% of total expenditure.
- Class B: Moderately used medicines representing 15–20% of the pharmacy budget.
- Class C: Low-cost, infrequently used drugs making up the remaining 5–10% of the overall cost.

While the ABC technique provides valuable insight into expenditure concentration, it has a key limitation: it considers only cost and consumption volume [7]. In healthcare settings, some low-cost or rarely used drugs may be lifesaving or critically important. Hence, excluding them from priority lists based solely on financial metrics would be inappropriate [2, 16]. To address this, the criticality of each drug must also be evaluated.

VEN (vital–essential–non-essential) analysis

The VEN classification was established through consultation with a multidisciplinary committee of senior pharmacists and physicians at CTDH. The process involved reviewing the hospital's top ten disease profiles, Standard Treatment Guidelines (STGs), and the institutional formulary to determine the appropriate category for each medication. Drugs were grouped into three categories [15, 16, 22]. Vital (V): Medications that are indispensable, often lifesaving, and must be available at all times to ensure the continuity of essential healthcare services.

- Essential (E): Drugs effective for managing common but less critical diseases and are aligned with the institution's morbidity pattern.
- Non-Essential (N): Medicines used for minor, self-limiting conditions or those offering limited therapeutic benefit relative to their cost or safety profile.

Errors or inefficiencies in the supply and management of essential medicines can have serious consequences, including patient harm and service disruption. Inadequate access to affordable and necessary medical materials may significantly compromise hospital care delivery and patient outcomes [19, 28].

ABC–VEN matrix analysis

Integrating ABC and VEN analyses into a combined ABC–VEN matrix allows for more comprehensive and effective management of pharmaceutical inventory [14]. This approach was constructed by cross-tabulating the results of both analyses, thereby creating three consolidated categories—I, II, and III. In this classification, the first letter denotes the drug's position in the ABC analysis, while the second letter reflects its rank in the VEN classification [4, 29].

- Category I encompassed all drugs that were both vital and high-cost, including subgroups AV, BV, CV, AE, and AN. These items are crucial for both clinical services and hospital finances; hence, they demand rigorous oversight and strict monitoring to prevent shortages or misuse.
- Category II consisted of items from the E and B groups (BE, CE, BN)—these are essential drugs of moderate cost and importance. Regular stock evaluations are recommended to maintain balance and ensure adequate availability.
- Category III included the least critical and lowest-cost group, represented by CN items [18, 27, 30, 31].

Data quality assurance

Collected data were checked daily for completeness, accuracy, and consistency. Any incomplete records were excluded, and data collectors were reoriented when discrepancies were detected. Information gathering was conducted by qualified pharmacy professionals under the direct supervision of principal investigators to ensure reliability and validity.

Ethical considerations

Ethical clearance for this research was obtained from the Institutional Review Board of CTDH. Official permission letters were issued to relevant district authorities and institutional leaders, including the head of the medical store. Given the study's retrospective design and non-invasive nature, the ethical review committee granted a waiver for informed consent. Data collection proceeded only after formal authorization had been secured.

Abbreviations

ADE – Annual Drug Expenditures; ATC – Anatomical Therapeutic Chemical; CTDH – Can Tho Dermatology Hospital; ICD-10 – International Classification of Diseases, 10th Revision; LMIC(s) – Low- and Middle-Income Country(ies); MS Excel – Microsoft Excel; UK – United Kingdom; US – United States; VEN – Vital, Essential, Non-essential; VND – Vietnamese Dong; WHO – World Health Organization.

Results and Discussion

ABC analysis

The five-year ABC analysis conducted at CTDH evaluated 231, 220, 261, 241, and 325 pharmaceutical products, respectively, over the study period. Findings revealed that the hospital's highest procurement volume occurred in 2020. In 2016, 11.69% of the total stock belonged to Class A, 12.12% to Class B, and 76.19% to Class C, accounting for 62.09%, 21.21%, and 16.70% of the Annual Drug Expenditure (ADE) in U.S. dollars (USD), respectively **(Table 1)**. Although the proportional thresholds did not align exactly with the conventional 70/20/10% division, the slight variations were considered acceptable.

Table 1. ABC and VEN Analysis of Pharmaceuticals at CTDH (2016–2020).

2016				2017				2018				2019				2020			
No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE

A	27	11.69	17,931.7	62.09	32	14.55	25,379.3	70.54	45	17.24	29,817.3	72.69	29	12.03	57,907.2	78.43	19	5.85	94.671.1	79.58
B	28	12.12	6,125.3	21.21	18	8.18	3,754.8	10.44	34	13.03	5,928.8	14.45	26	10.79	8,258.4	11.18	31	9.54	14.327.5	12.04
C	176	76.19	4,824.1	16.70	170	77.27	6,844.4	19.02	182	69.73	5,272.8	12.85	186	77.18	7,669.5	10.39	275	84.62	9.957.7	8.37
V	79	34.20	14,069.8	48.72	103	46.82	23,532.8	65.41	116	44.45	27,797.1	67.77	99	41.08	61,836.0	83.75	144	44.31	108.799.2	91.46
E	102	44.16	12,273.3	42.50	62	28.18	9,374.7	26.06	68	26.05	5,984.3	14.59	69	28.63	7,029.1	9.52	88	27.08	6.782.8	5.70
N	50	21.65	2,538.0	8.79	55	25.00	3,071.0	8.54	77	29.50	7,237.5	17.64	73	30.29	4,970.0	6.73	93	28.62	3.374.3	2.84
1	90	38.96	22,858.5	79.14	175	50.91	31,676.4	84.73	134	51.34	35,029.2	85.40	105	43.57	65,603.3	88.85	145	44.62	111,115.3	93.41
2	96	41.56	4,824.3	16.71	57	25.91	2,572.5	10.46	71	27.20	4,202.2	10.24	71	29.46	6,051.2	8.20	89	27.38	5,547.0	4.66
3	45	19.48	1,198.3	4.15	51	23.18	1,729.6	4.81	56	21.46	1,787.5	4.36	65	26.97	2,180.6	2.95	91	28	2,294.0	1.93

ADE: Annual Drug Expenditures

Over the following four years, a noticeable rise was observed in the ADE share of Class A drugs, accompanied by a consistent reduction in the proportion of Class C items. Specifically, the financial contribution of Class A medicines increased sharply—from 17.5% in 2016 to 79.58% in 2020—while the share of Class C products nearly halved to 8.37% by the end of the same period. In contrast, Class B drugs exhibited fluctuations in both quantity and value; their contribution increased overall but showed temporary declines between 2016–2017 and 2018–2019. Altogether, Class B accounted for approximately 15% of the total expenditure during the five-year span.

VEN analysis

As illustrated in **Table 1**, Vital (V) drugs represented the largest portion of the Annual Drug Expenditure (ADE), despite comprising less than half of the total inventory. Conversely, Non-essential (N) drugs accounted for roughly one-quarter of all items but contributed minimally to the overall cost. Essential (E) drugs occupied an intermediate position, consuming about one-third of total spending and ranging between 5.70% and 42.50% of total monetary allocation.

In 2016, out of 231 listed medicines, 34.20% were categorized as Vital, 44.16% as Essential, and 21.65% as Non-essential. Corresponding expenditure shares for these groups were 48.72% (V), 42.50% (E), and 8.79% (N). Throughout the five-year study, there was a marked increase in both the number and cost proportion of Vital

drugs. By 2020, spending on this group had nearly doubled to 91.46%, compared to 48.72% in 2016, although the total number of items within this category increased by only 10.11%.

Despite the dominance of Vital medicines in expenditure, the Essential (E) and Non-essential (N) classes also experienced notable shifts. The E group saw a substantial decline in both the number of items and associated costs over time. The N category, on the other hand, showed contrasting trends—its item count rose from 6.97% to 28.62% in 2020, whereas its financial contribution fluctuated considerably, indicating inconsistent consumption patterns throughout the study period.

ABC–VEN coupling matrix

The results of the ABC–VEN matrix analysis are summarized in **Table 2**. This integration identified nine distinct subcategories, which were subsequently consolidated into three major groups, following the same structure presented in **Table 1**.

Table 2. Nine subcategories of pharmaceuticals at CTDH (2016–2020).

	2016				2017				2018				2019				2020			
	No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE	No. of Items	% of Items	ADE (USD)	% ADE
AV	16	6.93	9,143.6	31.66	23	10.45	18,426.9	51.22	27	10.34	22,585.2	55.06	23	9.54	54,139.9	55.06	18	5.54	92,355.1	77.64
AE	9	3.90	7,994.6	27.68	8	3.64	6,274.5	17.44	9	3.45	3,922.0	9.56	4	1.66	2,654.0	9.56	1	0.31	2,316.0	1.95
AN	2	0.87	793.5	2.75	1	0.45	677.9	1.88	9	3.45	3,310.1	8.07	2	0.83	1,104.9	8.07	0	0.00	0	0.00
BV	16	6.93	3,593.1	12.44	11	5.00	2,321.7	6.45	15	5.75	2,543.0	6.20	13	5.39	4,495.4	6.20	25	7.69	11,675.4	9.81
BE	9	3.90	1,986.1	6.88	4	1.82	769.5	2.14	7	2.68	1,245.9	3.04	7	2.90	2,078.4	3.04	4	1.23	1,571.8	1.32
BN	3	1.30	546.1	1.89	3	1.36	663.6	1.84	12	4.60	2,139.9	5.22	6	2.49	1,684.6	5.22	2	0.62	1,080.3	0.91
CV	47	20.35	1,333.2	4.62	69	31.36	2,784.1	7.74	74	28.35	2,688.9	6.51	63	26.14	3,200.7	6.51	101	31.08	4,768.8	4.01
CE	84	36.36	2,292.6	7.94	50	22.73	2,330.7	6.48	52	19.92	816.4	1.99	58	24.07	2,288.2	1.99	83	25.54	2,894.9	2.43
CN	45	19.48	1,198.3	4.15	51	23.18	1,729.6	4.81	56	21.46	1,787.5	4.36	65	26.97	2,180.6	4.36	91	28.00	2,294.0	1.93

ADE: Annual Drug Expenditures.

As shown in **Table 2**, the costliest pharmaceuticals, as anticipated, were primarily concentrated in the Vital (AV, CV) and Essential (AE) categories, which together consumed a substantial proportion of the total drug expenditure. Among these, medications classified under the AV subgroup accounted for the largest share of the hospital's ADE each year, with a consistent upward trajectory across the five-year span. The proportion of AV purchases began at 31.66% in 2016 and climbed significantly through 2017, 2018, and 2019 to 51.22%, 55.06%, and 73.33%, respectively, culminating at 77.64% in 2020. Despite this high monetary contribution, AV drugs represented only a small fraction of total items, never exceeding roughly 10%, with the maximum recorded at 10.45% (23 items) in 2018 and the lowest at 5.54% (18 items) in 2020.

Regarding the AE and CV categories, AE's proportion of total expenditure dropped sharply from 27.68% in 2016 to 1.95% in 2020, whereas CV's share decreased slightly, ending at 0.61%—a marginal decline from 4.62% in 2016—after a brief spike to 7.74% in 2017.

A notable portion of the budget (ranging between 6.09% and 12.44%) was also directed toward the BV subgroup, which includes critical, life-saving medications. The number of BV items fluctuated over the years, reported as 16 (6.93%) in 2016, 11 (5.00%) in 2017, 15 (5.75%) in 2018, 13 (5.39%) in 2019, and 25 (7.69%) in 2020.

In contrast, the least costly and non-essential drugs in the CN category accounted for less than 5% of the yearly pharmaceutical budget, varying between 0.93% and 4.81%. Although spending on CN items declined over time—with an 8.52% reduction by 2020 compared to 2016—the number of items in this group gradually increased. Overall, CN had the second-highest number of products among the nine subgroups, closely following CV, with their quantitative difference remaining under 9%. Interestingly, in 2019, CN items (26.97%) slightly outnumbered those in CV (26.14%). Over the five-year period (2016–2020), ADE expenditures for CN drugs were recorded as 4.15%, 4.81%, 4.36%, 2.95%, and 1.93%, respectively.

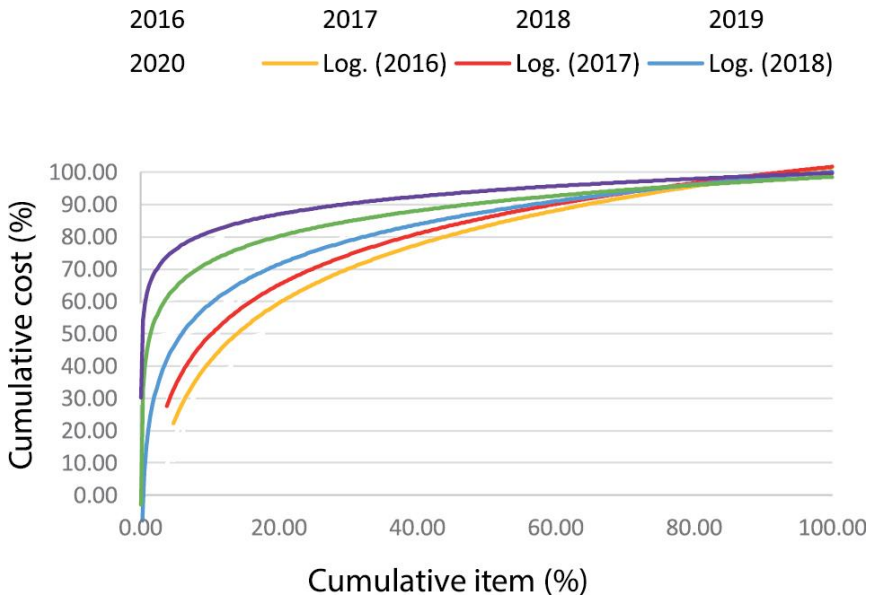

Figure 1. ABC-VEN Analysis Cumulative Pareto Curve (2016–2020).

In 2016, calculations showed that category I included 79.14% (90 items) of all materials, while category II comprised 16.71% (96 items), and category III accounted for the remaining 4.15% (45 items). Over the subsequent years, the financial share of category I displayed a steady upward trend, consuming 84.73%, 85.40%, 88.85%, and 93.74% of the total value in 2017, 2018, 2019, and 2020, respectively. In contrast, the number of items in this category varied considerably over time, recorded as 175 (50.91%), 134 (51.34%), 105 (43.57%), and 145 (44.62%) in the same order.

Category II, encompassing BE, BN, and CE subgroups, represented 57–96 drugs that collectively absorbed 4.66%–16.71% of total medicine expenditure. These drugs could, in many instances, act as alternatives for those in category I due to overlapping therapeutic purposes. The highest proportion of category II drugs (41.56%) occurred in 2016, whereas the lowest (25.91%) was observed in 2017.

Finally, category III demonstrated a notable increase in the proportion of items (from 19.48% to 28.00%), yet its expenditure share in total pharmaceutical costs declined by more than half, falling from 4.15% in 2016 to just 1.93% in 2020.

Therapeutic category and morbidity pattern analysis

Following the ABC analysis, drugs were organized into therapeutic categories to establish a morbidity pattern corresponding to their usage. Morbidity statistics were collected using a standardized form based on the WHO-ICD-10 classification, while drug utilization data were compiled according to each medication's name, ATC (Anatomical Therapeutic Chemical) code, and dosage unit. The ATC coding system, originally evaluated and validated by the WHO Collaborating Center for Drug Statistics Methodology in 2003, was subsequently adopted by Vietnam's Drug Administration. The morbidity data from CTDH's public health database for 2016–2020 were analyzed quantitatively using MS Excel spreadsheets.

Overall, disease incidence demonstrated an increasing trend during the study period, with the majority of cases occurring among females and individuals aged 15–59 years. As illustrated in **Figure 2**, Herpes Zoster (B01) and chickenpox (B02) were the two most prevalent conditions, recording 2,030 and 1,940 cases, respectively. These were followed by anogenital warts (1,537 cases) and benign neoplasms (1,527 cases). Atopic dermatitis and secondary syphilis of the skin and mucous membranes ranked fifth and sixth, with 790 and 741 total hospitalizations, respectively. Allergic urticaria was the least common among the twelve conditions, with only 206 cumulative cases reported over the five-year period.

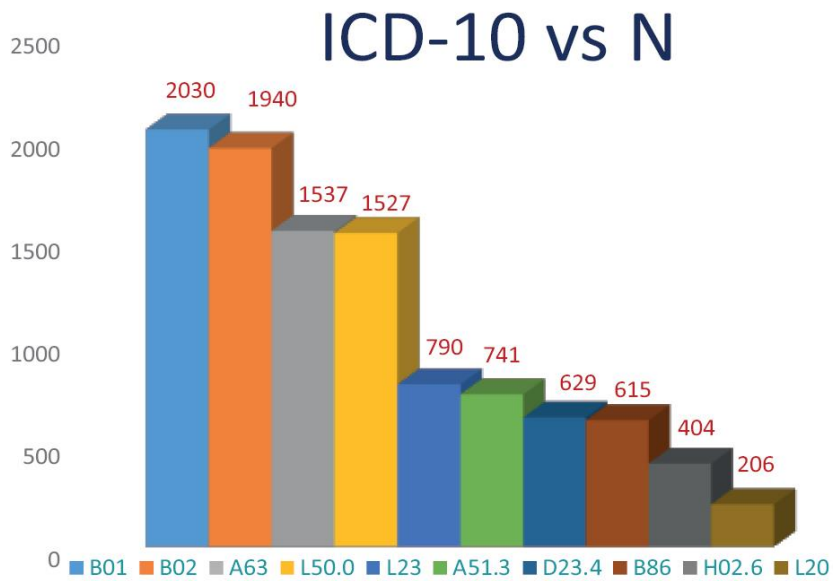

Figure 2. Total number of the ten most prevalent diseases based on ICD-10 classification (2016–2020) at CTDH. B01: Herpes Zoster; B02: Varicella (chickenpox); A63: Anogenital (venereal) warts; L50.O: Benign neoplasm; L23: Atopic dermatitis; A51.3: Secondary syphilis of the skin and mucous membranes; D23.4: Allergic contact dermatitis; B86: Scabies; H02.6: Xanthelasma of the eyelid; L23: Allergic urticaria.

Table 3 presents the twelve principal pharmacological categories of molecular entities included in group A, comprising a hundred generic names of diverse active compounds. As demonstrated in **Table 3**, topical dermatological agents played a predominant role in shaping the pharmaceutical formulary structure during the initial three years of the evaluation period. Their share within ADEs group A reached 24.0%, 33.7%, and 50.7% in 2016, 2017, and 2018, respectively, though in 2016 they shared the leading position with pharmaceutical alternative preparations (22.4%). In contrast, during the last two years, biological preparations became the dominant therapeutic category, accounting for 46.0% in 2019 and 64.6% in 2020, while topical agents notably declined to 15.0% by the study's end. Meanwhile, anti-infective and antibacterial agents maintained a relatively stable consumption rate across the five-year period (22.4%, 22.1%, 19.0%, 16.4%, and 14.9%). Conversely, the final three therapeutic categories—vitamins and minerals, anticonvulsant and antiepileptic medications, and gastrointestinal drugs—contributed only marginally to the total ADEs, representing between 0.8% and 1%.

Table 3. Expenditure on medicines in category A in CTDH formulary therapeutic categories (2016–2020)

No.	Therapeutic Category	% of ADE				
		2016	**2017**	**2018**	**2019**	**2020**
1	Topical dermatological preparations	24.0	33.7	50.7	30.6	15.0
2	Anti-infective and antibacterial agents	22.4	22.1	19.0	16.4	14.9
3	Biological preparations	–	–	–	46.0	64.6
4	Antifungal agents	11.6	9.0	15.1	4.2	2.3
5	Pharmaceutical alternative preparations	24.7	20.7	1.8	–	–
6	Analgesic and anti-inflammatory drugs	10.4	3.7	5.4	–	–
7	Anesthetic and operative agents	2.0	3.5	–	–	–
8	Antiviral medicines	2.6	2.4	3.1	2.0	–
9	Hormonal preparations and other synthetic substitutes	2.3	4.9	3.0	–	3.2
10	Vitamins and mineral supplements	–	–	1.0	–	–
11	Anticonvulsant and antiepileptic drugs	–	–	0.9	–	–
12	Gastrointestinal medications	–	–	–	0.8	–

ADE: Annual Drug Expenditures.

This study has demonstrated the critical importance of employing the ABC-VEN analytical approach to categorize pharmaceuticals based on their contribution to Annual Drug Expenditures (ADEs) and their clinical significance within the operational framework of a regional healthcare institution in Vietnam (CTDH). Through this evaluation, a clearer understanding of medicine utilization patterns was achieved by classifying drugs according to their consumption levels and therapeutic impact.

Summary of findings

The results indicate that most medicines were either essential or high-cost items that demanded strict management oversight **(Table 2)**. The ABC method remains a widely accepted approach for estimating costs and optimizing pharmaceutical supply chains [3, 17]. In the current analysis, Class A and B drugs collectively represented about 11–12% of the total pharmaceutical types procured annually throughout the five-year period. However, Category A accounted for roughly 75% of total ADEs, while Category B contributed only about one-fifth (13.9%) of Class A's expenditure. Conversely, Class C medicines, which formed the largest proportion (78.6%) of all items, generated less than 20% of the total drug expenditure.

In the VEN classification, CTDH's inventory spending was distributed as 71.2% for Vital, 19.7% for Essential, and 9.1% for Non-essential drugs, which corresponded to 42.3%, 30.8%, and 9.1% of the total number of pharmaceutical items, respectively. Medications grouped as A and V require close monitoring, accurate demand forecasting, financial discipline, sufficient buffer stock, staggered procurement, effective logistics, and a well-coordinated system for purchasing, storage, issuance, and inspection [2, 28]. In contrast, B and E category drugs necessitate moderate supervision, while those in C and N groups can be managed under more flexible conditions with higher stock safety levels for ordering and supply [1, 17].

The combined ABC-VEN matrix analysis **(Table 1)** facilitated the establishment of strict inventory regulation over 50.7% of total medicines (Category I), which represented 86.3% of overall ADEs. To prevent stock shortages, a two-bin replenishment method is recommended for AV, AE, and BV subgroup medicines within Category I [13, 20]. A minimal number of AN items (only 1–2) accounted for 2.8% of total drug costs, suggesting that excluding these from procurement could result in meaningful cost reductions without compromising healthcare services [15, 21]. Notably, CTDH reported that no medicines purchased in 2020 were classified as AN. Medicines in Category II should be subject to intermediate control, while those in Category III can be managed with less stringent oversight. Tailored control strategies are advisable depending on the characteristics of each category [20].

Considerable differences were observed in the distribution of medicine categories between this research and comparable international studies **(Table 4)**. Such disparities are likely attributed to variations in institutional settings and operational contexts where those studies were undertaken. Nonetheless, the outcomes remain consistent with Pareto's economic principle and align with findings from related studies conducted at Kenyatta

National Hospital [5], selected healthcare facilities in Ethiopia [4, 14], the Sudan National Health Insurance Fund [17], and Dessie Referral Hospital [1].

Table 4. Comparison of ABC-VEN matrix analysis of different studies by various authors.

Group	Present study		Jobira *et al.* (2021) (Ethiopia)[4]		Mori *al el.* (2021) (Tanzania)[14]		Mousnad *et al.* (2016) (Sudan)[17]		Mohammed and Woekneh (2020) (Ethiopia)[1]		Kivoto *et al.* (2018) (Kenya)[5]	
	% of Items	% of ADE	% of Items	% of ADE	% of Items	% of ADE	% of Items	% of ADE	% of Items	% of ADE	% of Items	% of ADE
A	12	75	12	80	17	70	17	70	17	76	14	80
B	11	13	10	11	26	20	22	20	20	16	17	15
C	77	12	78	9	57	10	61	10	63	8	69	5
V	43	70	17	35	15	18	2	6	34	52.6	22	34
E	30	14	68	61	78	72	53	68	64	46.9	53	58
D	27	7	15	4	7	10	45	26	2	0.5	25	8
1	51	90	27	85	29	62	73	71	44	84.5	32	85
2	30	8	49	13	70	26	51	24	55	15.3	48	14
3	19	2	24	2	1	2	32	5	1	0.2	20	11

Annual Drug Expenditures.

Overall, annual records revealed an upward trajectory in total disease cases, though the trends for individual conditions varied notably. Varicella, once the leading cause of hospital admissions in 2016, dropped to fourth place by the end of the study period, whereas anogenital warts, benign neoplasms, and atopic dermatitis exhibited remarkable two- to threefold increases during the same timeframe. Furthermore, within Class A drugs, the most heavily consumed pharmacological categories were topical dermatological preparations, biological agents, and pharmaceutical alternatives.

Policy recommendations

In Can Tho City, as in many low-income regions, there exists a substantial imbalance between healthcare resources and patient demand. Considering the limited budget and escalating need for medications, optimizing resource utilization is of paramount importance. This reinforces the necessity of employing analytical tools such as ABC-VEN to address these persistent challenges [32]. Additionally, the issue of drug shortages—recognized as a global problem even in high-income regions like Europe—further complicates healthcare delivery and decision-making [31]. A 2013 online survey conducted among members of Hospital Pharmacy Europe reported that nearly half of respondents (45%) identified life-saving drugs, such as oncology treatments, as the most affected by shortages. Likewise, a detailed study on drug shortages in CTDH is essential to better understand their causes and implications.

Collaboration among policymakers, hospital management, and pharmacists is crucial to ensure that limited resources are allocated efficiently to maximize public health benefits [14, 29]. Therefore, the ABC-VEN methodology represents a practical and efficient framework that should be routinely integrated into both public and private healthcare systems—particularly under pandemic conditions [9, 12, 19]. It is also advisable that procurement tenders and contracts be structured to minimize external lead times to the shortest feasible duration [24].

Strengths and limitations

To the best of our knowledge, this research marks the first attempt to systematically integrate comprehensive data from the CTDH electronic healthcare database to assess pharmaceutical expenditures using the ABC-VEN analytical framework. Moreover, the study applied this well-established model across a continuous five-year

period, incorporating CTDH's morbidity data to provide a more holistic evaluation. These findings are anticipated to hold both financial and academic relevance.

However, several limitations must be acknowledged. The dataset contained gaps, incomplete records, and limited transparency in pricing. Inaccuracies and missing entries in the morbidity data derived from electronic health records may have influenced the analysis. Furthermore, the study evaluated only acquisition costs, without accounting for potential downstream economic effects, such as reduced hospitalization durations. Another limitation lies in the study's scope, as it was conducted in a single specialized institution—CTDH—whereas the nearby Can Tho Central General Hospital serves as a referral center for a wider patient population with more diverse conditions. Consequently, some findings may not fully reflect regional or national trends.

Conclusion

This study revealed that CTDH's formulary includes a substantial proportion of medicines requiring high-level monitoring, specifically those classified as A, V, and Category I drugs. Since these account for nearly 80% of total pharmaceutical expenditures and include life-saving treatments, coordinated efforts among healthcare authorities and professionals are essential to maintain a secure, efficient, and affordable drug supply chain that guarantees continuous access to quality-assured essential medicines, even at lower healthcare levels [3].

The ABC and VEN methodologies remain valuable instruments for identifying pharmaceuticals that demand tighter control to enhance budget efficiency and prevent stock-outs that could undermine the pharmacy's operational credibility [26]. Personnel involved in pharmaceutical logistics should receive systematic training and participate in ongoing professional development programs, such as workshops and seminars, focusing on inventory management and drug utilization analysis [3]. Future studies should prioritize exploring the causes of purchasing fluctuations and morbidity trends, as current disease classification systems may not provide a complete representation of clinical realities.

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