Research Article

5-year inventory management of drug products using ABC-VEN analysis in the pharmacy store of a specialized public hospital in Vietnam

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Abstract

In developing economies, expenses of healthcare delivery have risen disproportionally to the monetary backing supplied by the federal government. However, issues relating to inventory control alongside regulating the pharmaceutical market have been recognized. We conducted a systematic categorization based on ABC and VEN analysis for available drugs at Can Tho Dermatological Hospital (CTDH) from 2016–2020, thereby making evidence-based recommendations for public authorities to attain rationality in monitoring the stock supply network. Results revealed that ratio of Category I with the highest cost and importance to the annual revenues was barely 88%. Meanwhile, fractions of Category II and III to the overall expenses were 5–10% and below 5%, respectively. Given scarce funds, it is crucial that Essential drugs be utilized effectively. Thanks to ABC-VEN integrated matrix, we uncovered medicines for which significant savings could be achieved. This method has proven to be a powerful tool in decision-making for importation and stockholding.

Keywords

Introduction

Materials and supplies (pharmaceutical and non-pharmaceutical products) account for a third of a hospital's budget, while 40% of that goes to the procurement and operation of hospital pharmacies (Mohammed and Workneh 2020; Dhodi et al. 2021). Since medicines constitute a noticeable portion of the hospital's spending, pharmacies can be regarded as a key functioning component in medical centers (Ahmed et al. 2019). In fact, approximately 10% of

the United States' healthcare budget fell into the pharmaceutical business in 2019 (Jobira et al. 2021). This figure was about fourfold higher in poorer nations (Kivoto et al. 2018). Chinese governmental allocation on medicines has also gone up, despite a downward tendency in economic growth (Yue et al. 2021). These indicate an apparent contradiction of healthcare cost escalation between wealthy countries and the third world (Ahmed et al. 2019). For certain developing countries, containing leaping medications expenses is one of many setbacks that remain unsett-

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led (Antonoglou et al. 2017; Yektadoost et al. 2018; Lestari et al. 2019). Besides, self-medication and antibiotic abuse are of alarming concern worldwide (Fox and McLaughlin 2018; Nguyen et al. 2021), with Vietnam no exception.

ABC-VEN has become a ubiquitous technique for medical specialists to gain a clear grasp of key traits of drug utilization in numerous countries for a certain time. The ABC is a concept to divide stocks into categories depending on their relative importance (Fathoni et al. 2019). It is also referred to as "separating the vital few from the trivial many" because according to the Pareto principle, for any group of things that contribute to a common effect, a relatively few contributors make up a majority of the outcomes (Devnani et al. 2010). VEN analysis, generally, is a technique designed to govern drugs and medicinal supplies. Unlike the aforementioned one, VEN characterizes stocks based on the basis of priority and necessity to patients' treatment (Devnani et al. 2010).

A combination of ABC and VEN analysis, or ABC-VEN matrix, can be gainfully employed to evolve a meaningful control over the material supplies (Mori et al. 2021). We can identify which drugs got credited for larger or smaller to the pharmaceutical inventory budget (Devnani et al. 2010). Consequently, managers could highlight classes of regimens that necessitated stringent operational control for judicious use of budget and elimination of out-of-stock situations (Akter et al. 2019). On top of that, this coupling table uncovered non-essential medications which were susceptible to expiry (Taddele et al. 2019).

In brief, ABC-VEN can:

- Show high-volume, low-cost alternatives that are either on the formulary or available commercially. Hospital administration takes advantage of this research to:
  - Opt for products that have an economical aggregate treatment cost, especially when supply funds are short (Mousnad et al. 2016). Indeed, no institution in LMIC societies normally has adequate means to purchase all recommended medications on the formulary list (Kivoto et al. 2018).
  - Seek alternate therapies if possible as the network chain of distributors has frequently been interrupted (Devnani et al. 2010).
  - Negotiate with pharma firms to obtain more reasonable prices. Such an approach is a leading trend in Europe as well (Garattini and Padula 2019).
- Perform cycle counting process (Fathoni et al. 2019).
- Indicate rates of different drugs' expenses and the healthcare consensus in the local community. Comparing medication consumption to disease patterns enables us to detect irrationalities.
- Interpret data from shorter-cycle (less than one year) investigations (Basha et al. 2020; Mohammed and Workneh 2020).
- Assign priorities for medicine selection, importation, and storage planning (Dudhgaonkar et al. 2017; Hazrati et al. 2018; Taddele et al. 2019).

Yet, a lot of healthcare providers in Vietnam are not familiar with it. Though there are some investigations using a similar method prior to our investigation, none of them took into account a Dermatologic Specialized Health Institution Drug Formulation.Skin diseases are prevalent in low-middle-income nations, particularly Vietnam, a tropical region with an excessive humidity level, is the key factor that triggers cutaneous infections and inflammations widespread. Unfortunately, insufficient stockpiling and degrading facilities are two major issues that medical personnel there struggle with on a regular basis. CTDH is a specialized public health unit. It is administered by the Can Tho Department of Health and is situated near the central district downtown. To establish an optimal list of drug-to-buy still has glaring difficulties. This study aimed to conduct a systematic categorization of available drugs at CTDH, thereby making evidence-based recommendations for public authorities to attain rationality in monitoring the stock supply network.

Since 1993, Australia has mandated all drug submissions for national formulary listing to include a cost-effectiveness inspection that gained extensive publicity and has proven to act as a catalyst in the provision of standard-related papers in countries such as Canada, New Zealand, and the UK (Langley and Sullivan 2020). In 2018, the Vietnamese Ministry of Health published Circular No. 19/2018/TT-BYT Introducing List of Essential Medicine. The drug formulary was formed after taking instructions in this legislative document and the hospital disease model into account.

Materials and methods

Drug and therapeutics committees are in charge of examining how clinicians dispense their medications (costs and utilization). To that end, the World Health Organization (WHO) and the Management Sciences for Health published a practical handbook in 2003 (Kastanioti et al. 2016; Kivoto et al. 2018). The number of materials and their actual cost can be simplified by categorizing them according to materiality, stock turnover, lead times, and seasonal consumed variations. Several inventory control techniques are discussed in medical literature for these settings (Hussain et al. 2019; Dhodi et al. 2021; Gizaw and Jemal. 2021). These:

- ABC: High, medium, and low-cost materials;
- VEN: Vital, Essential, Non-essential materials;
- FSN: Fast-moving, slow-moving, stationary materials;
- SDE: Limited in supply, difficult to supply, easy to supply;
- HML: Materials with high, medium, or low stock value;
- SOS: Classified as seasonal and non-seasonal materials.

ABC and VEN are two of the most preferred techniques in clinical settings in order to identify inefficient resource allocation, thereby optimizing the capacity and utilization of the healthcare system (Basha et al. 2020).

Study design and data collection

We conducted a retrospective cross-sectional record review. Annual consumption data and associated expenditures on individual regimens for each year between January 1st, 2016, and December 31st, 2020 were retrieved from the electronic health commodities information system (DHG Medicine Software and DHG Treatment) and manual records from CTDH's pharmacy. Invoices were recorded for every purchase and sale transaction of the pharmacy department.

Medical equipment was excluded. Pharmaceuticals were subsequently listed in a Microsoft Excel Spreadsheet. MS Excel 2016 statistical algorithms were used to carry out this analysis. Figures on pharmaceutical payments were extracted in the local currency, the Vietnamese Dong (VND), and then converted to USD at the rate of 1 USD = 22,720 VND; 22,665 VND; 23,155 VND; 23,080 VND; 23,005 VND in 2016 2017, 2018, 2019, 2020, respectively (registered on December 31st each year). Selected drugs were described by variables as pharmacological classes. The entire procedure of formulary evaluation was undertaken within 31 days of August 2021.

ABC (Always-Better-Control) method

the estimated sum of funds was calculated by multiplying quantities by their currency unit before sorting in descending order (Singh et al. 2015; Mousnad et al. 2016). The next step was computing cumulative fractions of costs allotted to each item. ABC analysis separates inventory items into three groups, as below: (Kastanioti et al. 2016; Kheder et al. 2020; Langley and Sullivan 2020).

- Class A represents items having the highest annual usage (70–80% of inventory spending).
- Class B is made of pharmaceuticals with a moderate utilization rate (15–20% of pharmacy capacity).
- Class C consists of medications with the lowest consumed frequency (5–10% of overall investment). The limitation of ABC analysis is that it is based only on the budget range and the rate of consumption of the item (Antonoglou et al. 2017). In a health institution, an item of low monetary value and volume of use may be very vital or even lifesaving. Their importance cannot be underestimated merely because they do not appear in category A (Taddele et al. 2019; Dhodi et al. 2021). Hence, another parameter of the materials was their criticality.

VEN (Vital-Essential-Non-Essential) method

VEN status was established succeeding discussions with a multidisciplinary group of health professionals at the hospital, which included senior pharmacists and experienced physicians. They used the list of the top ten ailments, the

Standard Treatment Guidelines, and the institutional formulary to determine if a drug was classified as V, E, or N.

In the VEN analysis, medications are classified into three specific categories: (Akter et al. 2019; Taddele et al. 2019; Langley and Sullivan 2020).

V (Vital medicines) – are potentially lifesaving and should always be stocked, or is crucial to providing basic healthcare services.

- E (Essential medicines) - are effective against less severe conditions. Still, this group was pertinent to the hospital morbidity pattern.
- N (Non-essential medicines) - are used to treat minor, self-limited disorders. They include those that neither show clear efficacy over risks nor whose market prices were incompatible with clinical advantages.

Patients may suffer permanent harm and loss as a result of mistakes and incomplete operations undertaken during the provision of healthcare services in medical facilities. Deficit or lack of cost-effective materials might therefore have a significant impact on hospital service delivery (Yilmaz 2019; Basha et al. 2020).

ABC-VEN matrix analysis

A combination of ABC and VEN analysis (ABC-VEN matrix) can be gainfully employed to evolve a meaningful control over the material supplies (Mori et al. 2021). It was formulated by cross-tabulating the ABC and VEN analysis, three new groups were listed (I, II, and III) afterward. The first alphabet in these subcategories denotes its position in the ABC analysis, while the second alphabet stands for its place in the VEN analysis (Migbaru et al. 2016; Jobira et al. 2021).

- Category I comprised all vital and expensive commodities (AV, BV, CV, AE, AN). These materials are necessary for hospitals, both financially and in terms of care delivery. Products in this category require tight supervision and a high degree of vigilance.
- Category II included the remaining items of the E and B groups (BE, CE, BN), which are essential and less costly than those of Category I. Stock controls of the materials in this category should be performed periodically.
- Category III was constituted the Non-essential and the cheapest group of items (CN) (Pauwels et al. 2015; Garattini and Padula 2019; Phuong et al. 2019; Kheder et al. 2020).

Data quality assurance

The obtained data were verified for validity and consistency and cleaned by cross-checking every day. We discarded incomplete data and redirected data collectors. Pharmacy specialists were recruited to gather information under the direct supervision of leading investigators.

Ethical consideration

Ethical approval was sought from the Institutional Review Board at CTDH. The letter of permission and ethical clearance was sent to the district authorities and Head of the institute and in charge medical store. Considering the objectives of the study, the ethical clearance was waived off. Data gathering was done after getting official authority.

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-Middle-Income Country(ies); **MS Excel**, Microsoft Excel; **the UK**, the United Kingdom; **the US**, the United States; **VEN**, Vital, Essential, Non-essential; **VND**, Vietnamese Dong; **WHO**, World Health Organization.

Results

ABC analysis

A five-year-period ABC examination of CTDH on 231, 220, 261, 241, and 325 medicines across the research course discovered that the peak procurement of the medical store happened in 2020. Out of these items, in 2016, 11.69%, 12.12%, and 76.19% of dispending stocks belonged to class A, B, or C, compensating 62.09%, 21.21%, and 16.70% of annual drug expenditures (ADE) in the U.S dollars (USD), respectively (Table 1). The cut-offs were not precisely 70/20/10%, but differed marginally, which was allowable.

The successive four years witnessed an upward turn in ADE contribution with respect to class A in parallel with a progressive decline of class C. To be more explicit, group A's share of the economy is expected to go up from 17.5% to 79.58% by 2020. At the same time, the registered number of class C in 2020 almost halved (8.37%) compared to the first year. Both quantity and value ratio of class B products, nonetheless, have risen, albeit not consistently (they decreased over the periods of 2016–2017 and 2018–2019). There was, on aggregate, just 15% of the entire expenditure devoted to these Class B drugs.

VEN analysis

As presented in Table 1 Class V made up a bulk of the ADE despite being compromised of less than half of the items. Class N, by contrast, had about a quarter of the commodities and represented minor baseline costs. Approximately one-third of the total money was allocated to products in Class E, which constituted 5.70%–42.50% of the monetary sum.

In terms of fluctuation, in 2016, of the 231 materials, 34.20% were in the V group, whereas 44.16% corresponded to the E group, and 21.65% fell into the N group. When referring to capital spending, respective figures for three groups were V (48.72%), E (42.50%), and N (8.79%). There were dramatic shifts in the predominance of Class V pharmaceuticals over this period, with both the quantity and value ratio. Interestingly, monetary occupation in the Vital class nearly doubled (91.46% in 2020 48.72% in 2016) though differences in the volume of items were just 10.11% throughout the investigating timeframe.

Through the dominance of category V in the ADE portion, the Essential class along with the Non-essential class surged. The data demonstrated that stocks in group E experienced a steep downfall in the two considered factors. When referring to the N category, quantitative records showed an opposite tendency to financial ones (increased from 6.97% to 28.62% in 2020). Still, changes in this category appeared to be unstable in the analysis timeline.

ABC-VEN coupling matrix

The ABC-VEN matrix was displayed in Table 2 below. Nine separate subcategories were accessed, which were further clustered into three primary categories as outlined in Table 1.

Table 2 indicated that the most expensive drugs, as expected, belonged to the Vital (AV, CV) and Essential category (AE), occupying a huge chunk of money spent on purchasing pharmaceuticals. Inventory purchases of meds in the AV subcategory occupied the largest part of the institution's ADE each year, and AV's fragment of procurement up-surged over five years, reaching its peak in 2020.

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

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.

It began at 31.66%, then rose remarkably in 2017, 2018, 2019 to 51.22%, 55.06%, and 73.33%, respectively, ending at 77.64%. Surprisingly, AV only was responsible for barely 10% of gross items. We recorded the largest figures were 10.45% (23 items) in 2018 and the smallest ones were 5.54% (18 items) in 2020. Concerning AE and CV classes, while the attribution of AE to ADE dropped substantially from 27.68% to 1.95%, this of CV fell minimally, eventually finishing at 0.61% lower than 4.62% in 2016, let alone a sudden jump in 2017 to 7.74%.

Besides, an unignorable amount of the inventory budget (6.09%–12.44%) was expended on life-saving items, such as those in the BV subgroup. Pharmaceuticals in this group in 2016–2020 were 16 (6.93%), 11 (5.00%), 15 (5.75%), 13 (5.39%), and 25 (7.69%), respectively. Less pricey and non-essential groups of medicines (CN), contributed under 5%, ranging from 0.93% to 4.81% of yearly expenses. In a broad view, CN subclass expenditure contribution did shrink, yet its percentage of products grew gradually. Once compared to 2016, the exact reduction in 2020 was 8.52%. The CN, as a whole, had the second-highest quantities of commodities among nine classes following the CV. The percentage deviation between the two was negligible (less than 9%). It was the year 2019 saw the numeral ratio of CN (26.97%) had surpassed that of CV (26.14%). Chronological ADE consumption (2016–2020) of the CN group were 4.15%, 4.81%, 4.36%, 2.95%, and 1.93%, respectively.
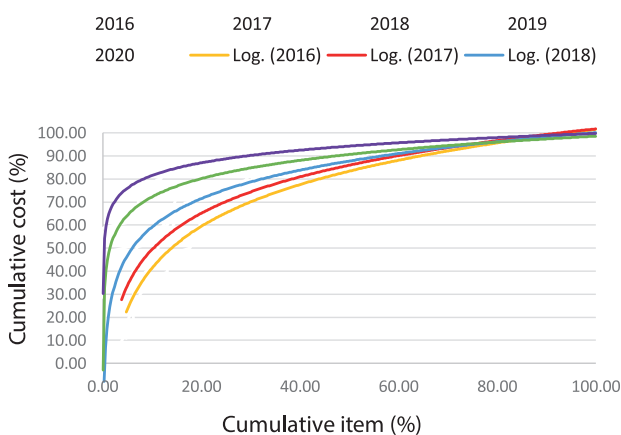
Figure 1. ABC-VEN Analysis Cumulative Pareto Curve (2016–2020).

According to the calculations in 2016, it constituted 79.14% (90) of category I materials, 16.71% (96) of the materials were category II and the remaining 4.15% (45) was category III. There was a progressive climb in financial value of the first group. Notably, category I consumed 84.73%, 85.40%, 88.85%, and 93.74% in the next four years (2017–2020). On the other hand, the registers of annual items fluctuated violently, with respective numbers from 2017 to 2020 being 175 (50.91%), 134 (51.34%), 105 (43.57%), and 145 (44.62%).

57–96 drugs worth 4.66%–16.71% of the average medicine funding in category II (BE, BN, and CE) could theoretically serve as a replacement for the same therapeutic action in category I in numeral settings. Healthcare commodities' climax of the second class (41.56%) the second class was witnessed in 2016 while the bottom (25.91%) was in 2017. Last but not least, Category III, regardless of the hiking in quantity ratio (19.48%–28.00%), its attributive expenditure in pharmaceutical sum sank more than two-fold in the final year (4.15% vs. 1.93%).

Therapeutic category and morbidity pattern analysis

After finishing the ABC analysis, we then grouped the drugs into therapeutic categories in order to build a morbidity pattern associated with drug utilization. The morbidity data were extracted and entered onto a pre-designed data collection form as per the WHO-ICD-10 system, whereas utilization, was based on each drug name (ATC code: Anatomical Therapeutic Chemical code) and its unit of issue. It was WHO Collaborating Center for Drug Statistics Methodology that reviewed and approved the ATC code in 2003 (as we introduced earlier), prior to being obtained by Drug Administration of Vietnam. MS Excel spreadsheets were, again used to quantitatively interpret morbidity data over the period 2016–2020 transmitted from CTDH's public health database. For the most part, cases reported of each disease were on the rise, with females and people from 15–59 years old making up the largest portions regarding gender and age.

As shown in Fig. 2, Herpes Zoster (B01) and chickenpox (B02) were two leading causes of morbidity in CTDH, with 2030 and 1940 cases recorded, respectively. Coming

after these two were anogenital warts (1537 cases) and benign neoplasm (1527 cases). Atopic dermatitis and secondary syphilis of skin and mucous membranes ranked fifth and sixth among them, which consequence in 790 and 741 hospitalized cases on aggregate, respectively. Lastly, allergic urticarial was the rarest disease compared to the remaining 9 ones. Reviews revealed gross 5-year cases was just 206.
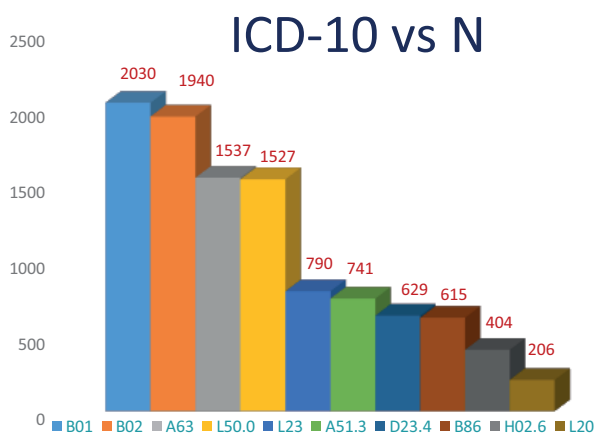
Figure 2. Total cases of top ten most common diseases given in ICD-10 code (2016–2020) in CTDH. B01: Herpes Zoster; B02: Varicella (chickenpox); A63: Anogenital (venereal) warts; L50.O: Benign neoplasm; L23: Atopic dermatitis; A51.3: Secondary syphilis of skin and mucous membranes; D23.4: Allergic contracting dermatitis; B86: Scabies; H02.6: Xanthelasma of eyelid; L23: Allergic urticaria.

Table 3 outlined the entire 12 pharmacological major groups of molecular entities procured in group A among hundred generics names of different active substances. As revealed in Table 3, topical dermatological preparations were of pivotal importance in the pharmaceutical formulary structure in the first 3 years of our assessment. Their constitution in ADEs A's group topped in 2016–2018 with respective registers of 24.0%, 33.7%, and 50.7% (excepted for 2016 when they somewhat shared the first position with pharmaceutics alternative preparations-22.4%). In the next 2 years, biological preparations came into place and immediately dominated the rest therapeutic groups (46.0% in 2019 and 64.6% in 2020), topical ones, conversely, shrank to just 15.0% at the end. Simultaneously, anti-infective and antibacterial sustained consumption percentage (22.4%, 22.1%, 19.0%, 16.4%, and 14.9%) relatively unchanged throughout 5 years. As opposed to that, the 3 last groups (Vitamins, minerals; Anticonvulsants, antiepileptic drugs; Gastrointestinal tract medicines) listed in Table 3 were responsible for a tiny minority (0.8–1%) to total ADE(s).

Discussion

The present research has proven the significance of practicing ABC-VEN measures to cluster medications depending on their contributive segments to ADE(s) and their relevance in the function of a regional healthcare center in Vietnam (CTDH). The assessment helps us gain deeper

Table 3. Expenditure Medicines in Category A in CTDH Formulary Therapeutic Categories for 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 medicines. antibacterials	22.4	22.1	19.0	16.4	14.9
3	Biological preparations	–	–	–	46.0	64.6
4	Antifungals	11.6	9.0	15.1	4.2	2.3
5	Pharmaceutics alternative preparations	24.7	20.7	1.8	–	–
6	Analgesics. anti-inflammatory drugs	10.4	3.7	5.4	–	–
7	Anesthetic and theater agents	2.0	3.5	–	–	–
8	Antivirals	2.6	2.4	3.1	2.0	–
9	Hormonal preparations. other synthetic substitutes	2.3	4.9	3.0	–	3.2
10	Vitamins and minerals	–	–	1.0	–	–
11	Anticonsulvants. antiepileptic drugs	–	–	0.9	–	–
12	Gastrointestinal tract medicines	–	–	–	0.8	–

ADE: Annual Drug Expenditures.

insights into medical consumption, which was accomplished by segmenting pharmaceuticals according to utilization volume and effects on health.

Summaries of outcomes

The findings report that the majority of pharmaceuticals were either vital or pricey that require stringent governance (Table 2). ABC analysis is a well-established technique for cost estimation in the supply chain network (Mousnad et al. 2016; Ahmed et al. 2019). We found that class A and B medications amounted to relatively similar just around 11–12% of all pharmaceutical types acquired on average throughout the five-year research period. Category A made up approximately three-quarters of ADEs whilst B was corresponded to as little as one-fifth (13.9%) of class A. C class items occupied the vast majority (78.6%), but they were responsible for no more than one-fifth of gross pharmacy expenses. With VEN analysis, CTDH invested 71.2%, 19.7%, and 9.1% of inventory revenues, respectively, to procure 42.3%, 30.8%, and 9.1% of items of category V, E, and N, respectively. Pharmaceuticals belonging to groups A and V necessitate rigorous examination, precise demand forecasts based on data, stringent financial vigilance, proper buffer stock, staggered purchase orders, optimal logistics, and a prudent procurement, warehousing, issue, and inspection strategy (Yilmaz 2019; Dhodi et al. 2021). Category B and E drugs required moderate monitoring, whereas the two remaining classes (C and N) can be maintained with looser practices and with a high safety stock level (for order and supply) (Mousnad et al. 2016; Mohammed and Workneh 2020). Once performed the ABC-VEN reconciliation analysis (Table 1), we enabled to implementation of intense inventory control on 50.7% of overall products (Category I), which occupied 86.3% of the ADE. A two-bin ordering procedure should be used to avoid deficiency of AV, AE, and BV subgroups of category I medicines (Devnani et al. 2010; Dudhgaonkar et al. 2017). AN items (just 1–2) consumed 2.8% of drugs incurred costs. These commodities may be excluded from the buying list if it delivers significant cost savings without impairing the service (Hazrati et al. 2018; Akter et al. 2019). Fortunately, in 2020, CTDH reported no

Table 4. Comparison of ABC-VEN Matrix Analysis of Different Studies by Various Authors.

Group	Present study		Jobira et al. (2021) (Ethiopia)		Mori al el. (2021) (Tanzania)		Mousnad et al. (2016) (Sudan)		Mohammed and Woekneh (2020) (Ethiopia)		Kivoto et al. (2018) (Kenya)	
	% 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.

ordered medicines fell into the AN subclass. Category II medications can be regulated by middle governance, and Category III ones can be handled by lower regulatory levels. Relevant categorization strategies should be used for the specific components (Dudhgaonkar et al. 2017).

There were significant variances in the proportion of products purchased between present research and similar studies around the world (Table 4). Those mismatches might be explained by the hospital settings where investigations were done. The observations were also within the same range indicated by the economist Pareto in comparison with studies conducted in Kenyatta Nationals Hospital (Kivoto et al. 2018); selected health facilities in Ethiopia (Jobira et al. 2021; Mori et al. 2021); Sudan National Health Insurance Fund (Mousnad et al. 2016); and Dessie Referral Hospital (Mohammed and Workneh 2020).

Typically, reports indicated an upsurge in the number of cases per year, yet, individual diseases showed a wide range of patterns. While varicella plummeted from the most prevalent hospitalized reason in 2016 to the fourth position; anogenital warts, benign neoplasm, and atopic dermatitis all saw dramatic growth (two-fold to three-fold increase) during the analyzed timeframe. Besides, it is noteworthy that topical dermatological, and biological preparations alongside pharmaceutical alternatives were the 3 most consuming attributive pharmacological groups in class A.

Policy recommendations

As in many impoverished regions, the disparity between health resources and patient load is profound in Can Tho City. Given a resource-constrained health care system in addition to ever-growing demands for drugs, optimizing existing resources is decisive. This again highlights the need of utilizing a variety of scientific instruments to mitigate previously stated difficulties (Deb et al. 2017). Moreover, drug shortages, which are portrayed as a complex phenomenon even in Europe, also put more strain on workload and affect clinical decision-making (Phuong et al. 2019). An online questionnaire was done among subscribers of Hospital Pharmacy European in 2013 indicated that life-sustaining drugs (e.g oncology drugs) were most suffered from drug shortages (45% of respondents). Similarly, we perceive that an insightful investigation on pharmaceutical shortages should be conducted in CTDH to reexamine the characteristics and impacts of this issue.

Legislators, hospital administrators, and pharmacists must work together to make sure that insufficient resources are used wisely to supply medications with the utmost capacity for societal benefits (Migbaru et al. 2016; Mori et al. 2021). Therefore, the ABC-VEN is a straightforward approach that should be adopted and implemented regularly in both the public and private sectors, particularly in the pandemic era (Fathoni et al. 2019; Lestari et al. 2019; Basha et al. 2020).

It is recommended that tenders and contracts should be designed in such a manner that the external lead time is minimized to the most tolerable duration (Hussain et al. 2019).

Strengths and limitations

To the best of our knowledge, this is the first time detailed aggregate data from CTDH electronic healthcare system have been combined to evaluate medicine incurred expenses adopting such analyzing method. Furthermore, we applied a renowned analyzing technique to track on a continuous five-year period pharmaceutical formulary in combination with the morbidity model of CTDH. To some extent, outcomes displayed in this research could bring value, both financially and academically.

Nevertheless, we are well aware that our data has a couple of limitations, such as incomplete and partial data, as well as price transparency. Additionally, there were inaccurate inputs and data loss in electronic health records for morbidity data. Apart from these, we assessed solely the acquisition cost of pharmaceuticals without considering their possible influence on lowering hospital length of stay, for example. Finally, we conducted our study in a single specialized hospital, although a renowned one nearby (Can Tho Central General Hospital) that typically treats patients with diverse diseases across the local community and acts as a referral center for patients with infectious disorders. In other words, certain discoveries are not representative of the entire area or country.

Conclusion

The study findings suggested that CTDH contained a large number of medications that require extensive monitoring and oversight, namely, pharmaceuticals in Class

A, V, and Category I. Since these corresponded to nearly 4/5 of inventory revenues together with their life-saving significance; authorities and professionals must incorporate to regulate the whole drug supply chain, and ensure uninterrupted accessibility of essential quality approved, safe pharmaceuticals with affordable prices, even to the lowest level of medical institutions (Ahmed et al. 2019).

Again, ABC and VEN analysis can be utilized to pinpoint the pharmaceuticals necessitating more stringent managerial control in order to maximize hospital funds and eradicate stock-outs that damage pharmacy's credibility (Singh et al. 2015). The personnel in drug supply departments should acquire intensive formal training and regular workshops or seminars related to the subject (Ahmed et al. 2019). Consequently, more investigations into the rationale for variability in purchases and morbidity should be the main focus of research initiatives. Matter of fact, we recognized that disease classification is not always comprehensive.

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References

Ahmed HA, Kheder SI, Awad MM (2019) Pharmaceutical inventory control in Sudan central and hospital stores using ABC-VEN analysis. Global Drugs and Therapeutics 4(2): 1–6. https://doi.org/10.15761/gdt.1000172

Akter R, Uddin MJ, Biswas RS (2019) Disease Pattern at Medicine Outpatient Department of A Tertiary Care Hospital. Chattagram Maa-O-Shishu Hospital Medical College Journal 18(1): 27–30. https://doi.org/10.3329/cmoshmcj.v18i1.42129

Antonoglou D, Kastanioti C, Niakas D (2017) ABC and VEN Analysis of Medical Materials of a General Military Hospital in Greece. Journal of Health Management 19(1): 170–179. https://doi.org/10.1177/0972063416682643

Basha MM, Navya VS, Wani ST, Gogi PV (2020) Study of Inventory Management in Pharmaceuticals: A Review of COVID-19 Situation. International Journal of Innovative Science and Research Technology 5(8): 366–371. https://doi.org/10.38124/ijisrt20aug257

Deb P, Mohanty IR, Slathia I, Verma V (2017) Drug utilisation and self medication pattern of anti-fungal drugs in dermatology outpatient department of a tertiary care hospital. International Journal of Basic and Clinical Pharmacology 6(9): 2189–2192. https://doi.org/10.18203/2319-2003.ijbcp20173742

Devnani M, Gupta A, Nigah RK (2010) ABC and VEN Analysis of the Pharmacy Store of a Tertiary Care Teaching, Research and Referral Healthcare Institute of India. Journal of Young Pharmacists 2(2): 201–205. https://doi.org/10.4103/0975-1483.63170

Dhodi DK, Sinha SR, Desai S, Vable M (2021) Always, better, and control-vital essential and Non-essential analysis of pharmacy store of tertiary care teaching hospital, Mumbai. National Journal of Physiology, Pharmacy and Pharmacology 11(10): 1164–1167. https://doi.org/10.5455/njppp.2021.11.03072202131052021

Dudhgaonkar S, Choudhari SR, Bachewar NP (2017) The ABC and VEN analysis of the medical store of the tertiary care teaching hospital in Maharashtra, India. International journal of basic and clinical pharmacology 6(9): 2183–2188. https://doi.org/10.18203/2319-2003.ijbcp20173741

Fathoni FA, Ridwan AY, Santosa B (2019) Development of Inventory Control Application for Pharmaceutical Product Using ABC-VEN Cycle Counting Method to Increase Inventory Record Accuracy. In: Proceedings of the 2018 International Conference on Industrial Enterprise and System Engineering (IcoIESE 2018). Atlantis Press. https://doi.org/10.2991/icoiese-18.2019.47

Fox ER, McLaughlin MM (2018) ASHP guidelines on managing drug product shortages. American Journal of Health-System Pharmacy 75(21): 1742–1750. https://doi.org/10.2146/ajhp180441

Garattini L, Padula A (2019) Pharmaceutical expenditure control in Europe: time to move from pricing to budgeting? Journal of the Royal Society of Medicine 113(3): 93–97. https://doi.org/10.1177/0141076819894681

Gizaw T, Jemal A (2021) How is Information from ABC–VEN–FNS Matrix Analysis Used to Improve Operational Efficiency of Pharmaceuticals Inventory Management? A Cross-Sectional Case Analysis. Integrated Pharmacy Research Practice 2021(10): 65–73. https://doi.org/10.2147/iprp.s310716

Hazrati E, Paknejad B, Azarashk A, Taheri MS (2018) ABC and VEN Analysis of Imam Reza Educational Hospital Pharmacy. Annals of Military and Health Sciences Research 16(3): e86183. https://doi.org/10.5812/amh.86183

Hussain M, Siddharth V, Arya S (2019) ABC, VEN and lead time analysis in the surgical store of a public sector tertiary care hospital in Delhi. Indian Journal of Public Health 63(3): 194–198. https://doi.org/10.4103/ijph.ijph_282_18

Jobira T, Abuye H, Jemal A, Gudeta T (2021) Evaluation of Pharmaceuticals Inventory Management in Selected Health Facilities of West Arsi Zone, Oromia, Ethiopia. Integrated Pharmacy Research Practice 10: 1–11. https://doi.org/10.2147/iprp.s298660

Kastanioti CK, Mavridoglou G, Karanikas H, Polyzos N (2016) ABC analysis: a tool of effectively controlling pharmaceutical expenditure in Greek NHS hospitals. Journal of Pharmaceutical Health Services Research 7(3): 173–179. https://doi.org/10.1111/jphs.12137

Kheder SI, Awad MM, Hamid KA (2020) Prioritization of Medicine Importation by the Private Sector in Sudan: Evidence from a Data Analysis, 2012–2015. Value in health regional issues 22: 27–34. https://doi.org/10.1016/j.vhri.2019.11.007

Kivoto PM, Mulaku M, Ouma C, Ferrario A, Kurdi A, Godman BB, Oluka, MN (2018) Clinical and Financial Implications of Medicine Consumption Patterns at a Leading Referral Hospital in Kenya to Guide Future Planning of Care. Frontiers in Pharmacology 9: 1348. https://doi.org/10.3389/fphar.2018.01348

Langley PC, Sullivan SD (2020) Pharmacoeconomic Evaluations: Guidelines for Drug Purchasers. Journal of managed care specialty pharmacy 26(6): 689–695. https://doi.org/10.18553/jmcp.2020.26.6.689

Lestari F, Ulfah A, Suherman, Azwar B, Fithri P (2019) Combining ABC and VEN Analysis for Managing Medicine Inventory (Case Study at Community Development Elderly in Indonesia). International Journal on Advanced Science, Engineering and Information Technology 6(3): 952–959. https://doi.org/10.18517/ijaseit.9.3.7153

Migbaru S (2016) ABC-VEN matrix analysis of pharmaceutical inventory management in tikur anbessa specialized hospital for the years 2009 to 2013, Addis Ababa, Ethiopia. Indian Journal of Basic and Applied Medical Research 5(2): 734–743. https://doi.org/10.4172/2167-7689.C1.021

Mohammed SA, Workneh BD (2020) Critical Analysis of Pharmaceuticals Inventory Management Using the ABC-VEN Matrix in Dessie Referral Hospital, Ethiopia. Integrated Pharmacy Research Practice 9: 113–125. https://doi.org/10.2147/IPRP.S265438

Mori AT, Mnandi PE, Kagashe GA, Håvard R, Haavik S (2021) ABC-VEN Analysis of Medicine Expenditure at Mwananyamala Regional Hospital in Tanzania. Modern Economy 12(10): 1449–1462. https://doi.org/10.4236/me.2021.1210074

Mousnad MA, Ibrahim MI, Palaian S, Shafie AA (2016) Medicine expenditures in Sudan National Health Insurance Fund: an ABC-VEN analysis of 5-year medicine consumption. Journal of Pharmaceutical Health Services Research 7(3): 165–171. https://doi.org/10.1111/jphs.12136

Nguyen PH, Tran VD, Pham DT, Dao TN, Dewey RS (2021) Use of and attitudes towards herbal medicine during the COVID-19 pandemic: A cross-sectional study in Vietnam. European Journal of Integrative Medicine 44: e101328. https://doi.org/10.1016/j.eujim.2021.101328

Pauwels K, Simoens S, Casteels M, Huys I (2015) Insights into European drug shortages: a survey of hospital pharmacists. PLoS ONE 10(3): e0119322. https://doi.org/10.1371/journal.pone.0119322

Phuong JM, Penm J, Chaar BB, Oldfield LD, Moles R (2019) The impacts of medication shortages on patient outcomes: A scoping review. PLoS ONE 14(5): e0215837. https://doi.org/10.1371/journal.pone.0215837

Singh S, Gupta AK, Latika, Devnani M (2015) ABC and VEN Analysis of the Pharmacy Store of a Tertiary Care, Academic Institute of the Northern India to Identify the Categories of Drugs Needing Strict Management Control. Journal of Young Pharmacists 7(2): 76–80. https://doi.org/10.5530/jyp.2015.2.4

Taddele BW, Wondimagegn AA, Asaro MA, Sorato M, Gedayi BG, Hailesilase AA (2019) ABC-VEN Matrix Analysis of the Pharmacy Store in a Secondary Level Health Care Facility in Arbaminch Town, Southern Ethiopia. Journal of Young Pharmacists 11(2): 182–185. https://doi.org/10.5530/jyp.2019.11.38

Yılmaz F (2019) The drug inventories evaluation of healthcare facilities using ABC and VEN analyzes. Istanbul Journal of Pharmacy 48(2): 43–48. https://doi.org/10.5152/IstanbulJPharm.2018.398141

Yektadoost A, Ebrahimi F, Mashouf M, Hadidi N, Koopaei NN, Kebriaeezadeh A (2018) Trend Analysis of Medicine Consumption Based on Therapeutic Categories in Iran: 2000–2016. Journal of Research in Pharmacy Practice 7(2): 95–103. https://doi.org/10.4103/jrpp.jrpp_17_96

Yue X, Li Y, Wu J, Guo JJ (2020) Current Development and Practice of Pharmacoeconomic Evaluation Guidelines for Universal Health Coverage in China. Value in health regional issues 24: 1–5. https://doi.org/10.1016/j.vhri.2020.07.580