

ABC, VED, and ABC-VED Matrix Analyses for Inventory Management in Community Pharmacies: A Case Study

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ABC, VED, and ABC-VED Matrix Analyses for Inventory Management in Community Pharmacies: A Case Study

Serbest Eczanelerde Stok Yönetimi için ABC, VED ve ABC-VED Matris Analizleri: Bir Olgu Çalışması

SUMMARY

Inventory control methods should be used effectively in community pharmacies to determine and obtain the needs for pharmaceuticals and non-pharmaceutical products at appropriate times and with proper procedures. An effective stock control provides positive outputs in the community pharmacy's economy, the quality of the service to be provided, and the pharmacy's image. In this context, within the scope of this study, it aims to evaluate ABC, VED, and ABC-VED matrix analyses in terms of community pharmacies.

In the study, ABC, VED, and ABC-VED matrix analyzes were applied using the inventory data of a community pharmacy serving in the city center of Van for the 2019-2020 financial year. For this purpose, firstly, annual consumption and expenditure data for each pharmacy item specified for the 2019-2020 financial year were collected. The data were then transferred to an MS Excel spreadsheet, and statistical analysis was performed using MS Excel statistical functions.

As a result of ABC-VED analysis, it was determined that the drugs in the first category were of great importance for effective stock control, the drugs in the second category were of medium importance, and the drugs in the third category were of low importance. They are because the pharmacy from which the research data is taken is close to the family health center and the socioeconomic structure of the pharmacy's environment. This categorization is thought to be appropriate.

Key Words: ABC analysis, ABC-VED matrix, Pharmacy, Inventory control, VED analysis

ÖZ

Toplum eczanelerinde ilaç ve ilaç dışı ürünlere olan gereksinimlerin uygun zamanlarda ve uygun yöntemler ile tespit edilip elde edilebilmesi için stok kontrol yöntemlerinin etkin bir şekilde kullanılması gerekmektedir. Etkin bir stok kontrolü gerek serbest eczane ekonomileri açısından gerekse sunulacak hizmetin kalitesi ve eczane imajı açısından olumlu çıktılar sağlamaktadır. Bu bağlamda bu çalışma kapsamında ABC, VED ve ABC-VED matrisi analizlerinin serbest eczaneler açısından değerlendirilmesi amaçlanmıştır.

Çalışmada Van ili merkezin hizmet sunmakta olan bir serbest eczane için 2019-2020 mali yılı için stok verisi kullanılarak ABC, VED ve ABC-VED matrisi analizlerinin uygulaması yapılmıştır. Bu doğrultuda, öncelikle 2019-2020 mali yılı için belirtilen eczane için her bir kalemine ait yıllık tüketim ve harcama verileri toplanmıştır. Veriler daha sonra bir MS Excel elektronik tablosuna aktarılmış ve MS Excel istatistiksel fonksiyonları kullanılarak istatistiksel analiz gerçekleştirilmiştir.

ABC-VED analizi sonucunda birinci kategoride yer alan ilaçların etkili bir stok kontrolü için büyük öneme, ikinci kategoride yer alan ilaçların orta derecede öneme ve üçüncü kategoride yer alan ilaçların düşük derecede öneme sahip olduğu saptanmıştır. Araştırma verilerinin alındığı eczane aile sağlık merkezi yakınında olması ve eczane bulunduğu çevrenin sosyoekonomik yapısı göz önüne alındığında elde edilen bu kategorizasyonun uygun olduğu düşünülmektedir.

Anahtar Kelimeler: ABC analizi, ABC-VED matrisi, Eczane, Stok kontrolü, VED analizi

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INTRODUCTION

Regardless of the size of the business, its field of activity, and the type of material used or needed, each company must keep different types and amounts of inventory to continue its activities. The amount of inventory held is a critical component that impacts the economies of organizations. While the amount of inventory is less than needed, it increases the cost of being out of stock or drug shortages. At the same time, its excess can reduce capital power and increase other expenses (Abromowitz, 1984; Tengilimoğlu and Yiğit, 2017). For this reason, it is essential to manage inventory correctly. When choosing the inventory control method, organizations should evaluate the business size, production and service type, financial possibilities, machinery, and equipment status, building and warehouse capacity, information flow system, communication, registration, and personnel (Abromowitz, 1984; Tengilimoğlu & Yiğit, 2017; Fri et al., 2020).

Inventory management is one of the most important activities that affect community pharmacies' economic development. It is also essential to maintain uninterrupted healthcare services throughout the pharmaceutical supply chain (Arslan et al., 2021). It is possible to follow up questions such as when and how much to order, what level the inventory amount should be, and the expiration date of a large number of various drugs and materials in pharmacies with inventory control. Performing inventory management with appropriate methods can minimize the adverse effects on pharmacy economies against unexpected situations such as price changes, seasonal demand fluctuations, also taking advantage of bulk discounts (Yüksel & Duman, 2017; Yılmaz, 2018; Fri et al., 2020; Fahriati et al., 2021). When the literature is examined, it is seen that the methods that provide the segmentation of the inventory items are more appropriate to ensure the effective management of the pharmaceutical supplies in the healthcare sector. Mani et al. (2014), Pirankar et al. (2014), Singh et al. (2015), Gupta et al. (2019), Dora et al. (2020), Bialas et al. (2020) revealed

that to reduce inventory costs in hospital pharmacies and to ensure pharmaceutical services without interruptions, inventories can be categorized according to their relative importance and can be followed more optimally. Inventory management techniques classifying items according to their relative importance are frequently used in the healthcare sector. Always, better and control (ABC), vital, essential, and desirable (VED), and ABC-VED matrix analyses are the most preferred among these methods. Nigah et al. (2010), Anand et al. (2013), Böker and Çetin (2020), Çil Koçyiğit and Doğan Çulha(2020), Gizaw and Jermal (2021) stated that the most suitable methods for inventory control in hospitals/health centers are ABC method, VED method, and ABC-VED matrix methods. Besides, the need for routine implementation of these methods is emphasized in these studies. Ceylan and Bulkan (2020) revealed that the classification of inventory items is also vital in community pharmacy. It is stated that these methods enable material resources and human resources to be used more efficiently by ensuring that the essential inventory items are checked more frequently.

This case study shows the applicability of these inventory item segmentation methods in community pharmacies and increases inventory management performance. In this context, the inventory data obtained from a community pharmacy was analyzed, and suggestions were presented in the study. It is thought that the information presented in this study will be a guide for inventory control, especially for community pharmacists and pharmacy faculty students.

MATERIAL AND METHODS

Within the scope of this study, ABC, VED, and ABC-VED matrix analyzes, which draw attention to inventory control methods, were applied in a community pharmacy serving in the city center of Van. The pharmacy is located near a Family Health Center (FHC). There are five family physicians have been operating in FHC. Also, there is no more pharmacy near the FHC.

The study collected annual consumption and expenditure data for each 1540 pharmacy items determined for the 2019-2020 financial year. Then transferred, the data to an Microsoft (MS) Excel spreadsheet, and statistical analysis was performed separately for each pharmacy item using MS Excel statistical functions.

Analysis of inventory items was carried out in three stages. After ABC analysis and VED analysis, respectively, the ABC-VED matrix was created. In ABC and VED analyzes, items were grouped by the authors and the pharmacist of the responsible manager of the concerning pharmacy.

While performing the ABC analysis, the annual expenditure of inventory items was firstly arranged in descending order. Then cumulative costs, the cumulative percentage of expenditure, and the cumulative percentage of the number of items were calculated. Then items with a cumulative percentage between 0-79.99 are assigned to group A, products between 80-94.99 are assigned to group B, and products between 95-100 are assigned to group C.

While performing VED analysis, 1540 inventory items were examined separately parallel to the literature and some other factors such as prescription rates of FHCs, consumer profile of the pharmacy, etc. Inventory classification was made by considering the studies using VED analysis for pharmacies in the literature (Ceylan & Bulkan, 2017; Fahriati et al., 2021), the general prescribing rates of FHCs in Turkey, and the situation regarding the relevant pharmacy. Yavuz et al. (2020) put forth nearly 28% of all prescription requests from FHCs around Turkey are for drugs prescribed for chronic illnesses, containing hypertension, dyspepsia, mood disorders, diabetes mellitus, etc. According to Güner et al. (2020), the general prescription rate of antibiotics was almost 29% in Turkey in 2017, and FHCs' rate of antibiotic prescribing in Istanbul was nearly 26%. Additionally, the Health Statistics Yearbook 2019, prepared by the Turkish Ministry of Health, states that the rate of antibiotics

prescribed by family physicians in Van is around 24%. The rate of analgesics is about 40%. In addition, the rate of prescriptions, including injectable drugs, is around 7%.

In the light of the information presented above, the allergy drugs, some antidiabetics and antibiotics, antiasthmatics, antihypertensives, and some others, and medicines and medical materials must be kept in the pharmacy according to the Turkish Medicines and Medical Devices Agency were evaluated under V (Vital) group. Medicines in many pharmacological groups, such as analgesics, antibiotics, antifungals, and antiemetics, which are of moderate importance for the patient, are in the E (Essential) group. Lastly, items and medicines that are not vital for the patient, such as cosmetics, supplements, and pruritus products, are handled under the D (Desirable) group.

In the last stage of the study, inventory items classified according to ABC and VED analyses in the ABC-VED matrix were divided into three categories. The inventory items that make up the first category are items in the AV, AE, AD, BV, and CV groups. The items in this category are the group of both vital and expensive drugs in terms of cost. The inventory items that make up the second category are the BE, CE, and BD groups. The drugs in this category are of medium importance in vitality and medium significance in cost. Finally, non-vital items that make up the third category are the items in the CD group. These are at the pharmacist's initiative according to the pharmacy's characteristics. They are not expensive in terms of cost.

RESULTS AND DISCUSSION

Inventory control is essential for community pharmacies, like many businesses. Several methods can be used in community pharmacies for inventory control. When the literature is examined, it is seen that the ABC-VED matrix method is one of the most suitable methods for pharmacies among them (Ceylan and Bulkan, 2017; Fahriati et al., 2021). Previous studies have evaluated ABC, VED, and ABC-VED inventory

control methods specifically for hospital pharmacies (Bialas et al., 2020; Dora et al., 2020; Singh et al., 2015). However, the number of studies dealing with community pharmacies is quite limited. To fill this gap, in the study, the expenditure of 1540 items, amounting to 365361,5121 Turkish Liras (TL), belonging to the year 2019-2020 of X Pharmacy, which provides service in the city center of Van (one of the biggest cities in the east part of Turkey), was analyzed using ABC, VED, and ABC-VED matrix.

Firstly, the number and percentage distribution of inventory items in ABC analysis, annual expenditure amount, and annual expenditure percentage are given in Table 1. The number of items in group A is 342, the number of items in group B is 491, and group C is 707. The annual expenditure amounts of group A are 292135.43 TL, the amount of items forming group B is 54944.77 TL, and the amount of items in group C is 18281,2321 TL. Annual expenditure percentages are 79.96% for A group items, 15.04% for B group items, and 5.004% for C group items.

Table 1. Number of Items and Expenditure Amounts According to ABC Analysis

ABC	Number of items	% of items	Total annual expenditure (TL)	% annual expenditure
A	342	22.21	292135.43	79.96
B	491	31.88	54944.77	15.04
C	707	45.91	18281.2321	5.004
TOTAL	1540	100.00	365361.4321	100

According to Table 1, 22.21% of 1540 items are in group A, 31.38% in group B and 45.91% in group C. Group A has the most negligible share in terms of expenditure amount. These values are also similar to Yüksel and Duman (2017), who evaluated the drug sales data of a community pharmacy in Turkey.

The categorization is not very significant when only depending on costs. In this regard, the critical

value of inventory items should also be considered to improve inventory management. Therefore, table 2 includes the inventory item information depending on the VED analysis result, which analyzes all items critically. Annual expenditure percentages are calculated as 3.64% for V group items, 90.23% for E group items, and 6.13% for D group items.

Table 2. Number of Items and Expenditure Amounts According to VED Analysis

VED	Number of items	% of items	Total annual expenditure (TL)	% annual expenditure
V	57	3.70	13306.88	3.64
E	1302	84.55	329666.7433	90.23
D	181	11.75	22387.80876	6.13
TOTAL	1540	100.00	365361.4321	100.00

The analysis findings made with the VED method were evaluated together with the total amount of items; 3.70% of the 1540 items are in the V group, 84.55% in the E group, and 11.75% in the D group. It can be said that these results show differences from the current literature in which approximately 50 percent of the products were evaluated under group E (Pund et al., 2016; Devnani et al., Gupta et al., 2007). It is

thought that this difference in classification is due to the fact that the existing studies were conducted specifically for hospital pharmacies. However, according to Güner et al. (2020) and the Health Statistics Yearbook 2019, especially antibiotics are seen as essential drugs for FHCs and pharmacies around them. Considering that the prescriptions received in the relevant pharmacy mainly include antibiotics, analgesics, anti-

allergics, and cold and gastrointestinal system diseases drugs which are categorized in the essential group, it is seen that the classification is appropriate.

After ABC and VED analyses were done separately, the ABC-VED matrix was created by cross-tabu-

lation Table 1 and Table2. Table 3, including the sub-groups that make up the ABC-VED matrix, shows the number of products in these groups and the annual expenditure amounts.

Table 3. Number of Products and Expenditure Amounts According to the ABC-VED Matrix Analysis

	ABC-VED Matrix	A	B	C
V	Category	AV	BV	CV
V	Number of Items	19	11	27
V	Annual Expenditure	11646.6	1015.98	644.16
E	Category	AE	BE	CE
E	Number of Items	309	428	565
E	Annual Expenditure	265858.98	48721.61	15091.67334
D	Category	AD	BD	CD
D	Number of Items	14	52	115
D	Annual Expenditure	14629.94	5207.17	2545.39876

After creating these groups, they were classified under three categories of their vital and material values (Table 4).

Table 4. Number of Category I-II-III Drugs and Annual Expenditure

CATEGORY	COMBINED CATEGORY	Number of items	% of items	Total annual expenditure (TL)	% annual expenditure
I	AV. AE. AD. BV. CV	380	24.68	293795.66	80.41
II	BE. CE. BD	1045	67.86	69020.45334	18.89
III	CD	115	7.47	2545.39876	0.70
TOTAL		1540	100.00	365361.5121	100.00

According to Table 4, 24.68% (380 items) are in Category I (AV, AE, AD, BV, CV). Considering the annual expenditure, this group constitutes the highest part with 80.41% (293795.66 TL). Category II (BE, CE, BD) is 67.86% (1045 products), and more than 50% of the annual items are in this group. The annual expenditure amount of the items in this group constitutes 18.89% (69020,45335 TL) of the total expenditure. The rate of items in Category III (CD) is 7.47% (115 products). The items in this group are at the lowest level, both in number and value. Considering the annual expenditure amount, it constitutes 0.7% (2545,39876 TL) of the expenditures.

When the ABC, VED, and ABC-VED matrix analyses were evaluated, some differences were seen

between studies conducted in different nations (Mani et al., 2014; Singh et al., 2015; Bialas et al., 2020). It should be noted that these differences can be about the nations' health systems, drug pricing and reimbursement systems, drug purchasing policies, the number of beds in the hospital, the status of the hospital, the health service profile provided, and the supply chain (Gizaw & Jemal, 2021; Yilmaz, 2018). From a different point of view, most of the studies in Turkey were carried out in hospital pharmacies, which is also why the results are different from national studies in general. After all, the results are similar to Ceylan and Bulkan's (2017) study conducted in a community pharmacy in Turkey. Therefore, the distributions of these categories in annual expenditure percentages have closer

values. In the study conducted by Ceylan and Bulkan (2017), the annual expenditure percentage of Category I was 75.25%, while in this study, it was 80.41%. In the study, the annual expenditure percentage of Category II is found as 22.18%, which Ceylan and Bulkan (2017) found as 18.89%. Lastly, while the annual expenditure percentage of Category III was 2.57%, it was calculated as 0.70% in this study. It is estimated that this situation resulting from the comparison is affected by factors such as the city where the pharmacy is located, location, patient profile, drug prices in the year of the study, and differences in drug purchase agreements from drug distribution channels of pharmacies.

In the light of the study findings, supplier performance evaluation should be made, especially for category I items. More sensitivity should be shown when estimating demand for items in groups A than B and C. For example, wrong planning and purchasing in group A will increase inventory costs. In this context, the correct planning of the pharmacy's needs and the consideration of equivalent products by making both pharmacological group-based and company-based evaluations during this planning will increase efficiency in inventory control. As Bialas et al. (2020) stated, significant deficiencies in applying such inventory control methods are frequently discussed theoretically in academic studies. In this context, increasing the practical application of such ways is crucial, reducing pharmacy expenses and saving money by effectively managing inventories. Therefore, the awareness and knowledge of pharmacists on this issue should be increased.

CONCLUSION

It is anticipated that inventory management performance in community pharmacies can be improved, and inventory tracking can be facilitated by using inventory control methods that target the segmentation of inventory types following the characteristics and conditions of each pharmacy. Thus, pharmacy and

country resources can be used more effectively and efficiently. To increase the knowledge and awareness of pharmacists about the importance of inventory control, these issues should be given more place in both undergraduate pharmacy education and in-service training programs. The correct and regular application of the inventory control methods discussed in this study will not only provide economic benefits to pharmacies. Still, it will also be effective in continuing service-oriented activities to increase efficiency and prevent being out of stock.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTION STATEMENT

ED: Data curation, Writing, Original draft preparation, Visualization, Investigation;

MA: Conceptualization, Methodology, Software, Writing-Reviewing and Editing, Supervision.

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