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## Research Article

# Medicine Inventory Management by ABC-VED Analysis in the Pharmacy Store of Veterinary Hospital, Yogyakarta, Indonesia

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## Abstract

**Background and Objective:** A good inventory control will support and accelerate the availability of drug services provided. The always, better and control (ABC) analysis, vital, essential and desirable (VED) analysis and the combination of ABC-VED analysis or ABC-VED matrix can be used for drug supply control. This study aimed to analyze the annual medical materials expenditure and consumption using inventory control techniques. **Methodology:** To prove that usefulness, a qualitative descriptive research was used in this study. The primary data were obtained through interviews and secondary data were obtained from pharmacy store and division of finance. The sample was a drug used by the pharmacy store of Veterinary Hospital Prof. Soeparwi, Faculty of Veterinary Medicine, Universitas Gadjah Mada, during January-December, 2016. Data were analyzed with Microsoft Excel and grouped by ABC-VED analysis category. **Results:** The total annual drug expenditure (ADE) incurred on 191 drug items issued in 2016 was Rp. 209,342,860.58. The ABC analysis showed that 14.14, 20.42 and 65.45% items drugs were found as always, better and control category items, respectively, amounting for 69.87, 20.42 and 9.71% of ADE of the pharmacy store. The VED analysis revealed that 14.14, 69.63 and 16.23% drug items were found to be Vital, Essential and Desirable category items, respectively, accounting for 26.10, 57.65 and 16.25% of ADE of the pharmacy store. On the ABC-VED matrix analysis, 25.13, 67.02 and 7.85% of drug items were found to be category I, II and III items, accounting for 74.17, 24.57 and 1.26% of ADE of the pharmacy store, respectively. **Conclusion:** The ABC-VED analysis can be adopted in drug inventory of hospital drug management so that it can plan the availability of drugs efficiently the quality of patient care.

**Key words:** ABC analysis, VED analysis, ABC-VED matrix, drug management, inventory control

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**Competing Interest:** The authors have declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

Regulations in Indonesia concerning veterinary medical services mention that the animal hospital is a veterinary medical service business that provides inpatient, outpatient and emergency services. Animal hospitals as an institution entrusted to perform services of medical veterinary course must provide quality services. To achieve quality services, support of health services in the hospital such as pharmaceutical supplies, food supplies, general logistics supplies and techniques<sup>1,2</sup>.

In general, hospitals have the largest routine fees on procurement of pharmaceutical supplies<sup>3</sup>. Various surveys showed that the drug costs about 40-50% of the total operational health services<sup>4-7</sup>. Nevertheless, the pharmaceutical service as a support service is the main revenue center. This is the fact that over 90% of hospital health services use pharmaceutical supplies, such as medicines, chemicals, radiological materials, consumables, medical devices and medical gases. Fifty percent of all hospital income comes from the management of pharmaceutical supplies<sup>2</sup>.

Good pharmaceutical supply control is the most important factor for the hospital. Careful, efficient, effective, responsible and sustainable management of the drug will have a positive impact and will serve to increase the income of the hospital. Poor management can impact hospital revenue decline<sup>2,4</sup>. For example, an excess supply of medication causes requiring many capital and incurring the high costs. Conversely, there is a shortage of inventory impact on impaired hospital services.

The present study was conducted in the pharmacy store of Veterinary Hospital Prof. Soeparwi, Faculty of Veterinary Medicine, Universitas Gadjah Mada (VHS). Veterinary Hospital Prof. Soeparwi, Faculty of Veterinary Medicine, Universitas Gadjah Mada is a non-profit institution, veterinary hospital education for prospective veterinarians and also expected to provide the best quality of service for animal patients. During the observation, drug procurement was performed based on monthly average drug usage data, so there was often unexpected purchase of drugs to be hastened (*cito*) and purchases to outside pharmacies. The calculation of drug stock is also problematic, namely the discrepancy of ending stock figures between physical stocks with recording done manually or with computer system. Meanwhile, there are still veterinarians who make prescription drugs that are not available in the veterinary hospital. This became one of the causes of drug purchases to outside pharmacies. Other causes are they do not serve recipes especially for cash patients due

to drug unavailability. Additionally, for example, at the end of December, 2014, the availability of drugs and disposable medical devices was expired. Therefore, the control of pharmaceutical supplies especially drugs is very important.

There are various techniques for drugs inventory management, commonly used are: always, better and control (ABC) analysis, vital, essential and desirable (VED) analysis and stock card<sup>8-11</sup>. ABC analysis is a method of classifying items according to their cost. It is also known as the Pareto principle<sup>10,11</sup>. The analysis classifies the items into three categories: 10-15% of the items account for approximately 70% of cumulative value (category A), 20-25% are category B items that account for further 20% of cumulative value and the remaining 65-70% are category C items amounting for a mere 10% of the total value<sup>10-13</sup>. The limitation of ABC analysis is that it is based only on monetary value and cost of consumption of items. Some items of low monetary value are vital or life saving. Their importance cannot be overlooked simply because they are not in category A. Therefore, an additional parameter of assessment is their criticality by VED analysis. Vital pharmaceuticals items can be given values based on their potential on live saving, crucial for health services and if it is impossible without them to safely alive and prevent death or disability of the patient. Essential pharmaceuticals are effective against less severe but significant illness. Desirable pharmaceuticals are effective for minor illness and low therapeutic advantage, unavailability of which will not interfere with functioning<sup>10-12</sup>. ABC-VED matrix analysis takes both the above analysis in consideration and gives result based on economic as well as critical value of drugs simultaneously. It also classifies drugs into categories according to the priority of their control<sup>14</sup>. The drug inventory management can bring out significant improvement in patient care and the optimal use of resources<sup>15</sup>.

The objectives of this study were (1) To analyze the consumption of drug items and drug procurement expenditures in January-December, 2016, (2) To prioritize drug procurement systems based on ABC, VED and ABC-VED methods and (3) To identify drug items that require greater monitoring or supervision.

## MATERIALS AND METHODS

**Data collection:** The research is descriptive qualitative research. The study was conducted at the pharmacy store of the VHS. The primary data were obtained from observations and interviews. The secondary data were obtained from the pharmacy store and finance division. The data of annual drug consumption and expenditure incurred on each drug items of the pharmacy store, for the financial year 2016 were collected.

**ABC analysis:** The investment value is calculated by following the steps below: (1) Annual drug expenditure (ADE) was calculated for the financial year 2016 by adding the expenditure incurred on each drug items, (2) The ABC analysis of all the drugs in the inventory was done. For this, the annual expenditure of individual drug items was arranged in descending order. The cumulative cost of all the drug items was calculated. As well, the cumulative percentage of expenditure and the cumulative percentage of number of drug items were calculated. Based on the cumulative cost percentage of 70, 20 and 10% from this list, they were then respectively subdivided into A, B and C categories<sup>9,11</sup>.

**VED analysis:** The VED criticality analysis of all the listed drug items was conducted by classifying the drug items into vital (V), essential (E) and desirable (D) categories. The VED status of each drug items was discussed with justification by veterinarians. Since the inventory of drugs was for the field practice area, the classification of drugs into VED was carried out keeping in mind the role and functions of a primary health center. The drug items critically needed the survival, that must be available all the times as their non-availability can seriously affect for the patient and the image of the VHS were included in the vital (V) category. The drug items with a lower criticality need and those, whose shortage can be tolerated for a short period at the VHS, were included in the essential (E) group. The remaining drug items with lowest criticality, the shortage of which would not be detrimental to the health of the patients, were included in the desirable (D) group<sup>9,11</sup>.

**ABC-VED matrix analysis:** A matrix was formulated by cross-tabulating the ABC and VED analysis to evolve a management system, which can be used for prioritization. From the resultant combination, 3 categories were classified. Category I was constituted by drug items belonging to AV, AE, AD, BV and CV subcategories. Category II was constituted by drug items belonging to BE, CE and BD subcategories. The remaining drug items in the CD subcategory constituted

category III. In these subcategories, the 1st alphabet denoted its place in the ABC analysis, while the second alphabet stood for its place in the VED analysis<sup>9,11</sup>.

**Statistical analysis:** The data were transcribed in a Windows Excel spreadsheet<sup>6,11,16</sup>. The statistical analysis was carried out using the MS Excel statistical functions (Microsoft Corporation, United State).

## RESULTS AND DISCUSSION

The total ADE of the pharmacy store VHS on drug items issued in January-December, 2016 was 209,342,860.58 rupiah. The drug used for the hospital consisted of 191 drug items.

**ABC analysis:** The result of ABC analysis showed that 14.14% (27), 20.42% (39) and 65.45% (125) drug items were found to be A, B and C category items, respectively, amounting for 69.87% (Rp. 146,276,108.82), 20.42% (Rp. 42,739,690.16) and 9.71% (Rp. 20,327,061.60) of ADE of the pharmacy store (Table 1). The cut-offs were not exactly at 70, 20, 10% and differed marginally, which is permissible<sup>9,11,17</sup>.

**VED analysis:** About 14.14% (27), 69.63% (133) and 16.23% (31) drug items were found to be V, E and D category items, respectively, accounting for 26.10% (Rp. 54,641,652.28), 57.65% (Rp. 120,676,150.89) and 16.25% (Rp. 34,025,057.41) of ADE of the pharmacy store. The VED analysis of the present study are shown in Table 1 and Fig. 1.

**ABC-VED matrix analysis:** The ABC-VED matrix analysis can be seen in Fig. 2. Nine different subcategories (AV, AE, AD, BV, BE, BD, CV, CE and CD) were observed by using this analysis. These nine subcategories were further grouped into three main categories, categories I, II and III (Table 2). Category I = AV+BV+CV+AE+AD = 48 drug items. Category II = 128 drug items and category III = 15 drug items. There were 48 (25.13%)

Table 1: ABC analysis, VED analysis, and ABC-VED matrix analysis of the pharmacy store, Veterinary Hospital Prof. Soeparwi FVM UGM

Category	Number of Drugs	Drugs of (%)	ADE (Rp)	ADE of (%)
A	27	14.14	146,276,108.82	69.87
B	39	20.42	42,739,690.16	20.42
C	125	65.45	20,327,061.60	9.71
V	27	14.14	54,641,652.28	26.10
E	133	69.63	120,676,150.89	57.65
D	31	16.23	34,025,057.41	16.25
I	48	25.13	155,279,485.10	74.17
II	128	67.02	51,425,727.68	24.57
III	15	7.85	2,637,647.80	1.26

Table 2: ABC-VED matrix analysis of the pharmacy store, Veterinary Hospital Prof. Soeparwi FVM UGM

Drug category	Number	(%)	Annual expenditure (Rp.)	(%)
<b>Vital (V) Category</b>				
Always (A)	6	3.14	45,638,276.00	21.80
Better (B)	7	3.66	6,516,915.98	3.11
Control (C)	14	7.33	2,486,460.30	1.19
Total	27	14.14	54,641,652.28	26.10
<b>Essential (E) Category</b>				
Always (A)	15	7.85	79,629,929.10	38.04
Better (B)	22	11.52	25,843,268.29	12.34
Control (C)	96	50.26	15,202,953.50	7.26
Total	133	69.63	120,676,150.89	57.65
<b>Desirable (D) Category</b>				
Always (A)	6	3.14	21,007,903.72	10.04
Better (B)	10	5.24	10,379,505.89	4.96
Control (C)	15	7.85	2,637,647.80	1.26
Total	31	16.23	34,025,057.41	16.25

% indicates percentage of total drug items in drugs list or percentage of total annual drugs expenditure of the pharmacy store

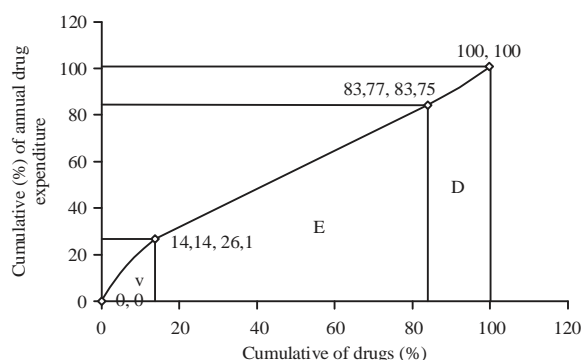


Fig. 1: Vital, essential and desirable (VED) analysis cumulative curve

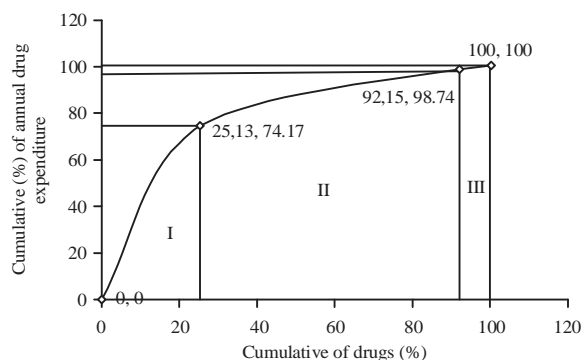


Fig. 2: ABC-VED analysis cumulative curve

drug items in category I, 128 (67.02%) drug items in category II and 15 (7.85%) drug items in category III, amounting for 74.17% (Rp. 155,279,485.10), 24.57% (Rp. 51,425,727.68) and 1.26% (Rp. 2,637,647.80) of ADE of the pharmacy store Table 2 and Fig. 2.

Medicine inventory control in Veterinary Hospital pharmacy is very essential<sup>8</sup>. Particularly in the pharmacy store

VHS as a limited resources, it is essential that the existing resources be appropriately utilized. Provision of care is sensitive to the timely availability of facilities, including drugs. In case of drugs, besides the cost factor, the criticality factor must also be taken into consideration, as it can be seen from our study, where about 15% of the drugs consumed about 70% of ADE of the pharmacy store. This is the group, requiring greater monitoring as it has fewer drug items consuming most of the money. It is also noted that not all the drugs in this group were vital or essential. It also had drugs from the desirable category. Categorization of drugs by the ABC-VED matrix analysis helps to narrow down on fewer drugs requiring stringent control.

**ABC analysis:** The results showed that if ABC analysis is carried out alone for drug inventory, it would help effectively control the recommended 27 (14.14%) drug items in the always (A) category, with almost 70% of ADE of the pharmacy store but it would compromise on the availability of drug items of vital categories from B and C categories (21 drug items, 10.99%). The results of the study are comparable with previous research<sup>9,11,17,18</sup> (Table 3).

**VED analysis:** The VED analysis was a need considered for ideal control which can be exercised on the identified vital and/or essential items, accounting for 83.75% of ADE of the pharmacy store. However, it is not possible to ignore the desirable group completely because category A contained six drug items were desirable with 10.04% of ADE of the pharmacy. The comparison of this current study with the previous study shown in Table 3. It showed high variation in the percentage of vital, essential and desirable drug items<sup>9,11,17,18</sup>. This could be because different institutes have

Table 3: Comparison of ABC analysis, VED analysis, and ABC-VED matrix analysis of previous study

Drug category	Present study (%)	DCM study, 2013 <sup>6</sup> (%)	PGIMER study, 2010 <sup>5</sup> (%)	GMCH study, 2008 <sup>7</sup> (%)	GMCH study, 2004 <sup>9</sup> (%)
A	14.14	18.6	13.78	12.93	10.76
B	20.42	24.0	21.85	19.54	20.63
C	65.45	57.4	64.37	67.53	68.61
V	14.14	13.2	12.11	12.36	23.76
E	69.63	38.8	59.38	47.12	38.12
D	16.23	48.0	28.51	40.52	38.12
I	25.13	28.7	22.09	22.99	29.15
II	67.02	41.1	54.63	41.67	41.26
III	7.85	30.2	23.28	35.34	29.59

ABC: Always, better, control, VED: Vital, essential, desirable, DCM: Department of Community Medicine, PGIMER: Postgraduate Institute of Medical Education and Research, GMCH: Government Medical College and Hospital

different service profiles, depending on the specialty services available. The present analysis of medicine inventory control was carried out in the pharmacy store which is providing animal health care services, particularly small animal. Whereas, the other studies have been carried out in human hospital with difference in level of care.

**ABC-VED matrix analysis:** The result of matrix from combination of the ABC and VED analysis make it possible to focus on category I consisting 48 (25.13%) drug items belonging to for strict managerial control as these drug items are either expensive or vital. The annual expenditure of these drug items was 74.17% of ADE of the pharmacy store. The drug items of AV, AE and BV in subcategory I consist of 28 (14.65%) drug items that are expensive because they take up 62.95% of ADE of the pharmacy store and their being out of stock is unacceptable as they are either vital or essential. To prevent locking up of capital due to these drug items, low buffer stock needs to be maintained while keeping a strict vigil on the consumption level and the stock in hand. Appropriate ordering method needs to be followed for these as this will eliminate the risk of drug items shortage.

The drug items of CV in subcategory I consist of 14 (7.33%) drug items that are drugs of low cost but high criticality or vital and take up 1.19% of ADE of the pharmacy store. This amount is negligible. These items can be procured once a year and stocked as their carrying cost is low. The drug items of AD subcategory I consist of only six drug items (3.14%) consuming 10.04% of the ADE. These drug items should be monitored for economic order quality (EOQ) and their order placement must be made after careful study of the need. Rational use of drug items in this subgroup, including their removal from the list if possible, can bring about substantial savings without affecting patient care. Thus, standards of drug and therapeutic are urgently needed in veterinary hospitals because they are important aspects of drug planning and become veterinary reference in providing therapy.

The drug items of BE, BD, EC in subcategory II consist of 128 (67.02%) consuming 24.57% of the ADE of pharmacy store. These drug items can be ordered once or twice a year, thereby saving on ordering cost and reducing management hassles at a moderate carrying cost and without blocking substantial capital. The drug items of CD in subcategory III consist of 15 drug items (7.85%) consuming 1.26% of the ADE. These drug items can also be ordered once or twice a year, thereby saving on ordering cost at a moderate carrying cost and without blocking substantial capital.

## CONCLUSION

The result of this study showed that during the year 2016, Rp. 209,342,860.58 were issued by the pharmacy store of VHS. This necessitates application of scientific inventory management tools for effective and efficient management of the pharmacy stores, efficient priority setting, decision making in purchase and distribution of specific drug items and close supervision on items belonging to important categories. Based on the ABC, VED and ABC-VED matrix analysis the drugs require stringent control for optimal use of funds and elimination of out-of-stock situations in the pharmacy. In addition, the need for standard therapies and medications to assist in drug planning and procurement is demanded.

## SIGNIFICANCE STATEMENT

This study discovers the basic principle of inventory control used ABC analysis based on cost criteria and VED analysis on critically, that can be beneficial for strategic drug supply, inventory control, improvement not only in patient care but also in the optimal use of resources. This study will help the researchers to uncover the critical areas of drug inventory management in Veterinary Hospital that many researchers were not able to explore. Thus a new theory on the ABC analysis, VED analysis, or ABC-VED matrix analysis may be arrived at.



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