Drug Inventory Management Using ABC-VEN and EOQ Analysis for Improving Hospital Efficiency

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ARTICLE INFO

A B S T R A C T

Pharmaceutical Installation at Hospital is a service unit that has a very large influence on hospital services and income from hospitals because the source of income and expenses comes from pharmaceutical installation activities in procurement to distribution. This research is a study on inventory management for Pharmaceutical supplies at Santo Yusup Boro Kulon Progo Hospital, Yogyakarta, this study aims to find a suitable inventory management calculation method that can be applied in hospitals, researchers chose ABC-VEN analysis to be applied to hospital pharmacy supply planning, as well as calculating the optimum number of orders in pharmaceutical drug supply, using EOQ calculations (Economic Order Quantity), as well as calculating when the reorder time (ROP) for the type of supply in pharmacy. This research method is a type of analytical descriptive research, the subjects of this study are the head of the service, head of finance, Head of Pharmacy installation, Head of Pharmacy and Hospital Therapy Team, other TFT members, as well as secondary data in the form of pharmaceutical sales reports, pharmacy reports in the form of opnam stock reports, reports of expired drugs, etc., data processing based on analytical descriptive using Microsoft excel. Where the results of the study from the number of pharmaceutical supplies at Santo Yusup Boro Hospital were 465 Drug items after being classified based on ABC-VEN analysis, 18 drugs entered the AV group, 20 drugs in the BV group, and 57 drugs including the CV group, after grouping based on ABC-VEN analysis in calculating the Optimum value of ordering drugs respectively, drug items, after using calculations based on ABC-VEN and EOQ analysis there was the efficiency of Rp. 22,206,511.52 in one year or there was efficiency of 41.8%. The conclusion of this study shows that the ABC VEN and EOQ methods can increase efficiency in the supply of medicines in hospital pharmacy installations, so this method is suitable for application in hospitals to manage supplies in hospitals.

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A B S T R A K

Instalasi Farmasi di Rumah sakit merupakan, unit pelayanan yang memiliki pengaruh sangat besar terhadap pelayanan rumahsakit serta pendapatan dari rumahsakit, karena sumber pendapatan maupun pengeluaran bayak bersumber dari aktivitas instalasi farmasi dalam pengadaan sampai dengan pendistribusian.Penelitian ini merupakan penelitian tentang inventory manajemen untuk perbekalan Farmasi di RSU Santo Yusup Boro Kulon Progo, Yogyakarta, penelitian ini bertujuan untuk mencari suatu metode perhitungan inventory manajemen yang cocok yang dapat diterapkan di RS, peneliti memilih analisi ABC-VEN untuk dapat di terapkan pada perencanaan persedian farmasi RS, serta menghitung jumlah pemesanan Optimum pada persedian obat farmasi, dengan memakai perhitungan EOQ(Economik Order Quantiti), serta menghitung kapan waktu pemesanan kembali (ROP) untuk jenis persedian yang ada di farmasi. Metode penelitian ini merupakan jeneis penelitian deskriptik analitik, subyek penelitian ini adalah kepala bidang pelayanan, kepala bidang keuangan,

Kepala instalasi Farmasi, Ketua Tim Farmasi dan Terapi RS, anggota TFT lainya, serta data sekunder berupa laporan penjualan farmasi, laporan farmasi berupa laporan stok opnam, laporn obat kadaluarsa dsb, pengolahan data berdasarka deskriptik analitik mengunakan Microsof exel. Dimana hasil penelitian dari jumlah persedian farmasi RSU Santo Yusup Boro sebanyak, 465 Item obat setelah di golongkan berdasarkan analisi ABC-VEN terdapat 18 obat yang masuk golongan AV, 20 obat masuk golongan BV, serta 57 obat termasuk kelompok CV, setelah dilakukan pengelompokan berdasarkan analisi ABC-VEN di hitung nilai Optimum pemesanan obat masing- masing, item obat, setelah mengunakan perhitungan bedasarkan analisi ABC-VEN dan EOQ terjadi Efisiensi sebesar Rp 22.206.511,52 dalam satu tahun atau terjadi efisiensi sebesar 41,8 %. Konklusi dari penelitian ini menunjukan bahwa metode ABC VEN dan EOQ mampu meningkatkan efisiensi pada persediaan obat-obatan di instalasi farmasi rumah sakit, sehingga metoda ini cocok untuk diaplikasikan di rumah sakit untuk mengelola persediaan di rumah sakit.

INTRODUCTION

Hospital Pharmacy Installation (IFRS) is a supporting unit that provides quality health services. The IFRS is an inseparable part of a complete hospital health service system oriented to patient care, high-quality medicines, and affordable clinical pharmacy services for all levels of society (Aziz et al., 2017). It has been clarified in the Decree of the Minister of Health Number 58 of 2014.

Pharmacy services become the income generator for hospitals. It is because 90% of every health service requires pharmaceutical supplies such as drugs, BMHP, medical gas, and other medical devices. 50% of the hospital income is earned from the pharmacy. Therefore, the pharmaceutical inventory must be managed properly, carefully, and responsibly to prevent decreasing revenues (Irma Lusyana Manik, 2019).

Effective management of pharmaceutical inventory (Dehghani Mahmodabadi et al., 2019) can reduce supply costs without ignoring the stock of pharmaceutical inventory. The effective ways can be through proper logistics management in IFRS with planning, procurement, storage, distribution, and pharmaceutical supplies. (Lopes et al., 2021) Each stage should be well-coordinated and controlled to achieve efficient and effective drug management (Khuriyati, 2016a).

Previous research conducted by Doso, Sunarni, and Herdwini (2018) compared some methods in inventory management, namely the EOQ, JIT, and MMSL which got the best EOQ among the others. Suryodiningrat (2015) studied the EOQ method. He found that this method generated more efficient management than the others applied by the hospital (Suryoningrat, n.d.).

This research has found different findings from Suryoningrat, D. (2015) entitled "Analysis of Pareto-Based Drug Procurement and VEN with Economic Order Quantity Method on Cost Efficiency in Pharmacy Installations at PKU Muhammadiyah Hospital, Bantul". He set the category based on crisis value and determined the percentage value (25%) of the storage cost SITED of previous studies. In this research, the VEN grouping is based on a consensus involving TFT (pharmacy and therapy team) (Hasanah Hali et al., 2021) and related fields at the Santo Yusup Boro General Hospital. The grouping is also following the percentage of storage costs by calculating the total storage costs divided by the total inventory value multiplied by 100%. The storage costs are incurred and used in the framework of drug storage. Total inventory value is the total investment of all inventories in IFRS Santo Yusup Boro Hospital.

The drug ordering system at the Santo Yusup Boro General Hospital never applies any proper method. That is why there is a buildup of stock at risk of expired drugs. This problem will increase losses. In the last two years (2018-2019), there was about 17.5 kg of expired drugs. On the other hand, there is also a stock out of several drugs that may interfere with service providers and reduce pharmaceutical efficiency. Therefore, we try to identify the most appropriate calculation method at the Santo Yusup Boro General Hospital. We decide to use the ABC-VEN and EOQ methods. It is because the ABC method can classify types of pharmaceutical inventory based on infestation values, while the VEN can group them based on their properties so that both will produce a comprehensive picture of pharmaceutical inventory based on their properties and investment values. They can help the hospital to make the best decisions. The EOQ can reduce stock-out events that often occur in hospitals. This research is limited to pharmaceutical preparations, not BMHP.

Literature review

Hospital Pharmacy Installation (IFRS) is a work unit that consists of qualified pharmacist staff (Menkes RI, 2013). In a pharmacy installation, there is a process of planning, procurement, storage, distribution, and use (Khuriyati, L. I, 2016) where pharmaceutical planning functions to prevent shortages that can cause patient complaints (Rofiq et al., 2020a). Inventory management is the core of the system. The pharmaceutical inventory aims to minimize total inventory costs and optimize quality (Croke, 2019). balance stock out and over stock, and avoid financial losses as the ultimate goal (Jobira et al., 2021).

Many studies examined inventory management at hospitals, regional health systems, drug companies, and non-health industries. They try to check whether there has been efficiency in the selected methods to the total inventory cost. Some studies include such Magarsa Babyssa Deressa Tamirat Bekele Beressa, and Awol Jemal, in 2019. The study was conducted in the western zone of the Shewa region (Deressa et al., 2022)involving fifteen research health service facilities.

Gizaw and Jemal (2018) also conducted research in a drug supply agency in an area. The sample was 393(Gizaw and Jemal, 2021) drugs distributed by the company. These studies use a cross-sectional design to identify categories of items that require focused managerial control, priority, and replenishment intervals. The designs also would evaluate whether the ABC-VED-FNS matrix was suitable for effective and efficient inventory control. The results showed that it could provide optimal and substantial financial benefits, especially in group A which had the highest age average but in small quantities. Therefore, it must be a priority in its management.

However, in one hospital which served the needs of patients from various types of medical services, the drug inventory at the pharmacy installation must be well-maintained according to service needs and the efficiency of financing. That is why the grouping and management only focused on Group A which must be developed. The A, B, and C groups must be managed to maintain service quality.

The ABC – VEN and EOQ matrix have been used by many researchers to classify types of inventory based on investment value and the properties of a pharmaceutical preparation. The next step is identifying the efficiency of the total inventory costs after ABC-VEN and EOQ compared to the current financing method. Here are some studies that use the ABC-VEN and EOQ methods.

P. O. Agada and E. H. OgwucheA (2020) conducted a study using a crossectional case analysis method. They tried to find out the best management models (P. O, 2019). The results showed that the probabilistic EOQ model could determine the optimal economic order quantity and reorder level of each drug and hospital consumables needed at the Hospital Central Pharmacy. The orders decreased with increasing ordering costs. This finding is similar to Agnes Susanto, Erna Kristi, and Agastya (2015). They used an observational analytic and cross-sectional study. This research aimed to identify factors that affected total inventory cost in the class-A drug items management at private hospitals type B (Susanto et al., 2017). The results showed that order frequency and quantity affected the total inventory cost of class-A drug items. However, the unit price and hidden costs due to damaged expired, and misdelivered drugs could not influence the total inventory cost. They also found a positive relationship between order frequency and total inventory cost.

Therefore, increasing the order frequency will increase the total inventory cost. Nopiana and Atik Nurwahyuni (2021) did non-experimental comparative research for cardiovascular drugs with the highest usage costs in 2019e. They focused on inventory control(Pulungan and Nurwahyuni, 2020). The purpose was to minimize the total inventory cost by implementing the ABC-EOQ-ROP-SS method and maintain the service level. The result showed a cost efficiency of up to 17.91% of the actual order.

Some reviews prove that EOQ can support efficiency in total inventory costs. However, those studies are limited to certain types of prioritized drugs. Their findings should be further examined using the EOQ, ROP, and SS inventory methods by adding the types of drugs to generate the same results.

Abdul Rafiq, Oetari, and Gunawan Pamudji Widodo in 2021 conducted research entitled "Analysis of Drug Inventory Control Using ABC, VEN and EOQ Methods" at Bhayangkara Hospital of Kediri city. This is descriptive-analytic research. The research aims to analyze the control system and improve the efficiency of the drug management cycle for National Health Insurance (BPJS) patients of AE classification. The data are taken from January - December 2018. Next, the results are compared with parameters such as Reorder Point, Inventory Value, Inventory Turn over Ratio, Customer Service Level, Safety Stock, and Maximum inventory level. This comparison is to assess the efficiency of inventory control to obtain adequate and efficient drug inventory .(Rofiq et al., 2020a). The results show that the ABC and VEN methods could improve drug management to be more effective and efficient, especially in the drugs classified as AE category. The data on planning, procurement, and use of drugs for BPJS patients in 2018 are analyzed using the EOQ method. They are then compared to the parameter values used to reduce the Stock Out value, but the effectiveness and efficiency of drug control are not achieved.

Dewanto Suryoningrat, Dwi Pudjaningsih, and Firman Pribadi conducted a study in 2017. The research was a quantitative and analytical descriptive observational design. It aimed to analyze the procurement of drugs in the pharmacy installation of PKU Muhammadiyah Hospital of Bantul regency. The sample was all types of drugs in the pharmacy. The drugs were classified using the Pareto method, and 50 drug items(Suryoningrat, n.d.). were grouped as ABC VEN criteria. The results showed that the EOQ method was more efficient than the conventional calculation applied based on the IFRS policy of PKU Muhammadiyah Bantul.

Previous research related to the ABC VEN model based on the VEN method determined based on the criticality level of the drug as seen from the highest level of usage. On the other hand, the EOQ research model in hospitals determines the value or cost of Handling Costs based on assumptions. Assumptions are usually used with values ranging from 3% to 30%.

In our research, we determine the VEN model based on filling out forms and discussions, the form is a list of drugs from the ABC Classification which is then determined by the head of the Pharmacy and Therapy Team, specialist doctors, Head of Service, and Pharmacists in charge of pharmaceutical installations, determining the VEN category of all ABC groups based on from, Regulations in the form of Regulation of the Minister of Health of the Republic of Indonesia Number 47 of 2018 concerning Emergency Services, where pharmaceutical supplies that have meaningful properties are for Life-saving, The patient must be given the drug, to save the patient from death, the discussion discusses whether this type of drug should prevent the patient from dying, the risk of disability, the role of the drug in disease, the action of the drug and the efficacy of the drug on an evidence basis.

For the calculation of the holding cost value in this study, we determined based on the accounting calculation model as follows: HR, Utilities, Communication costs, Drug VAT, total investment risk costs, total depreciation of infrastructure plus and percentage of investment risk costs in the form of expired drugs, damaged drugs, and missing drugs, as well as administrative errors. From the description above, it can be seen that the research differs from previous studies.

METHOD

Research Design

This is descriptive-analytic research. The data are collected retrospectively. They consist of primary and secondary data. The primary data include direct interviews or through Google Form with relevant departments and/or predetermined respondents. The secondary ones are reports of pharmaceutical sales, stock taking, and expired drugs. The

data are taken from January 2021 to December 2021. The sample is 465 types taken from the monthly prescriptions and costs issued by the doctors in inpatient and outpatient rooms. This research provides an overview of the object under study through the data or samples that have been collected as they are.

The research subjects are the Heads of Service Section, Finance, IFRS, coordinator of nurses, and IFRS staff. The object is the drug supply planning and IFARS pharmacy reports at Santo Yusup Boro Hospital. The research instruments are interview guidelines, observation/checklist, recording forms for all IFRS drug items at RSU Santo Yusup Boro, worksheets, checklist forms, and periodic drug stock-taking reports. Quantitative and descriptive data are processed using Microsoft Excel. This research uses drug inventory data at the Santo Yusup Boro Hospital Kulonprogo from 1st January 2021 to 31st December 2021 with 465 types of drug items. The data will be grouped using the ABC-VEN analysis based on the use and investment values. The steps of ABC-VEN analysis are described in the following section:

1. Collecting the data in the form of a list of drugs and their prices
2. Classifying the amount of pharmaceutical inventory using the ABC method
3. Identifying drug groups based on the VEN method; the information on the drugs' VEN classification is obtained using a forum technique (consensus) involving other parties like the Head of Service Unit, TFT of Santo Yusup Boro Hospital, Representative TFT Members, Head of IFRS, and Representative Doctor.
4. The ABC-VEN analysis results will be calculated using the EOQ (Economic Order Quantity) method using the following equation:
5. Calculating the ROP (Reorder Point) to get efficient and optimal inventory results,

6. Comparing the results of the total inventory using the EOQ method with IFRS Policy to decide which one is the most efficient using the following equation:

RESULTS AND DISCUSSIONS

1. Implementation of ABC-VEN method at Santo Yusup Boro Hospital

The drug supply planning is set using the consumption method based on ABC-VEN analysis at Santo Yusup Boro General Hospital. The analysis is done by gathering information from respondents as the secondary data to be further processed. The interview data are obtained through a decoding process using Axial Coding, Sub-themes, and Themes. The interviews conclude that there has been no pharmacy planning at the Santo Yusup Boro General Hospital. The drug planning and order are assigned to the responsible pharmacists and one appointed pharmacy technician (TTK). The applied method remains unclear. Commonly, the amount and type of drugs follow the consumption pattern, but sometimes it also considers the assumption of increasing patients. The hospital orders drugs from PBF which has collaborated with other hospitals and also through E-Catalog. The drug procurement is done per month, with regular lead times of 3-5 days and e-catalog 10-12 days

The secondary data are taken from pharmaceutical inventory based on the investment/Pareto method. The data are displayed in the following chart.
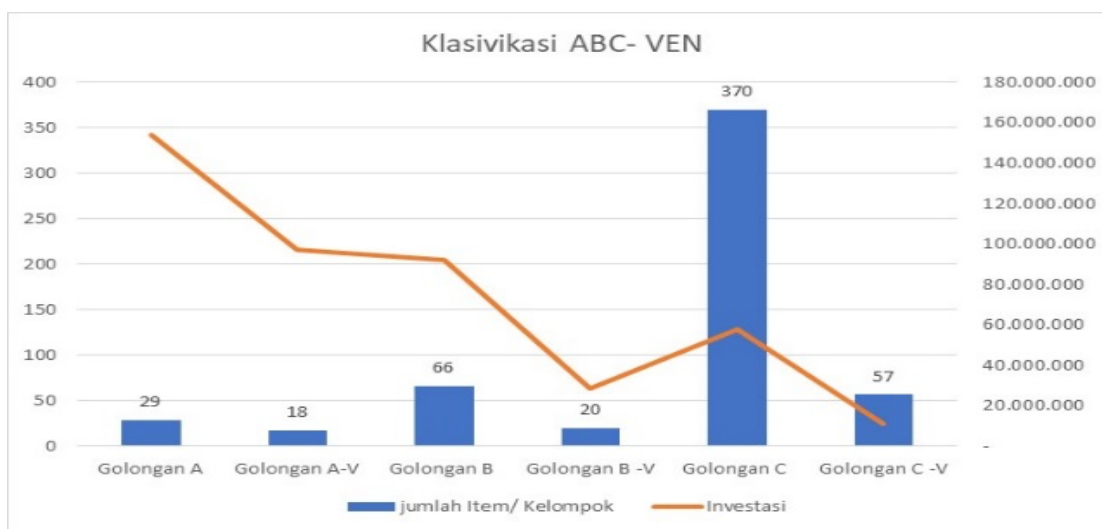

Diagram 1 ABC-VEN Classification

From January to December 2021, there are 456 drugs used for service, while there are 465 drug inventories in the pharmacy. The infestation is 418,512,278 of the 465 drug items included in group A (29 items). The total investment is Rp. 153,906,569 (50% of the total cost of drugs). Group B consists of 66 items with a total investment cost of Rp. 91,989,746. Group C has 370 items with a total investment of Rp. 57,803,943. 19% of the total investment shows which drugs as the vital group. Group A has 29 drug items. 18 drugs as the vital criteria (AV=18), and the investment value is Rp 97,272,497,-. Group B has 66 drug items, and the criteria for

vital drugs are 20 drug items (BV=20). The investment value is Rp. 28,572,388. Group C has 370 drug items, and 57 (CV=57) are vital with an investment value of Rp. 11,069, 579.

2. Calculation of EOQ (Economic Order Quantity) at Santo Yusup Boro Hospital

The EOQ is obtained based on the analysis of the drug needs. Based on the ABC-VEN analysis, the drugs calculated using EOQ are those classified as AV, BV, CV, and EOQ and determined using the following formula.

The cost per order is Rp. 1,981 after calculating the components included in the cost, such as administrative, telephone, forms, and others. There are also IFRS HR costs each time there is an order, while the storage costs are 23% of the total cost. This cost is calculated using the Accurate/Accounting technique, where the amount of inventory storage is the sum of the total storage costs including HR, Utilities, Communication costs, Drug VAT, total investment risk costs, total depreciation of infrastructure plus, and percentage of investment risk costs in the form of Expired drugs, damaged and lost drugs, as well as administrative errors.

The following are the results of the EOQ analysis depicted with the Diagram.
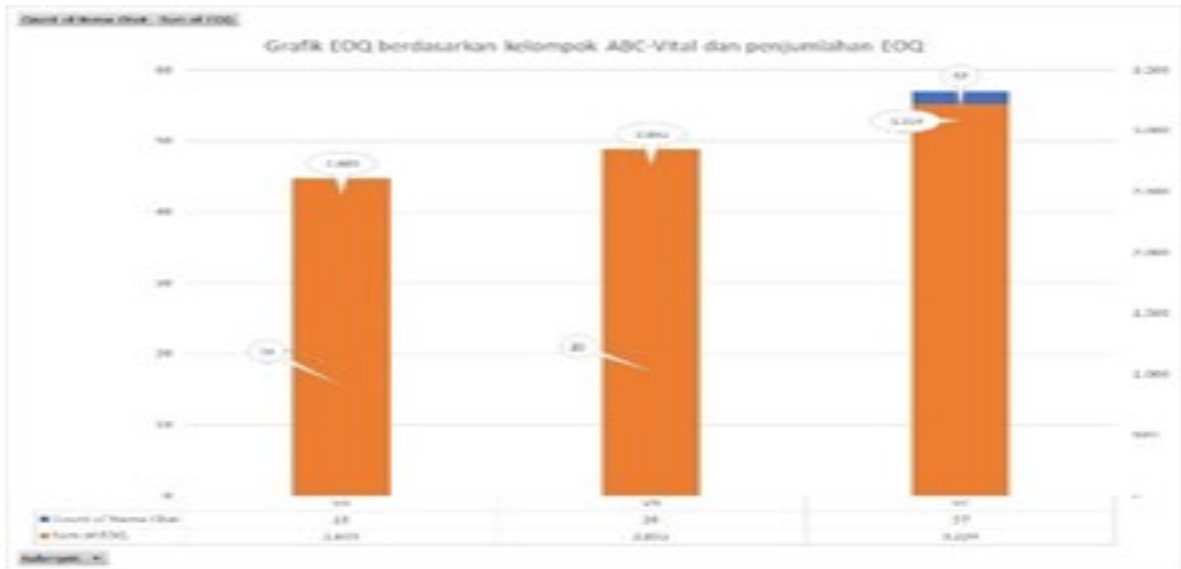
Graph 2. EOQ Analysis
Source: IFRS sales report at RSU Santo Yusup Boro which has been processed

The following is an EOQ analysis table taken from the ABC-VEN analysis of the AV, BV, and CV groups. It aims to summarize the samples from each drug group (the one with the highest EOQ value).

Tabel 4.7 Perhitungan analisis EOQ berdasarkan nilai tertinggi setiap kelompok

| Nama Obat	Kelompok	EOQ
Amlodipin 10 mg tab	VA	866
Amoxicilin 500 mg tab	VA	533
Aspilet tab 80mg	VA	516
Ambroxol 30mg tab	VB	837
metformin 500mg	VB	567
Amlodipin 5 mg tab	VB	454
Clonidine 0,15 mg	VC	479
diazepam	VC	396
ISDN 5 mg ---	VC	268

Source: IFRS sales report at Santo Yusup Boro General Hospital

The EOQ analysis reveals the optimal number of ordered items. In the VA group for the Amlodipine drug, the EOQ results in 866 tablets, while the 10 mg Amlodipine drug unit is 100 pcs per unit/box, so the EOQ for each Amlodipine drug order is 8 Box units/box. In the VB group for 500mg metformin, the EOQ results in 567 capsules, while the 500mg metformin drug unit is 100 capsules per unit/box, so the total order is 5 units/box. In the VC group for clonidine 0.15, there are 479 pcs drugs ordered, and Clonidine 0.15 units are 100 tablets units/box, so the optimal number is 5 boxes.

3. Calculation of ROP (reorder point)

The reorder point (ROP) is obtained from the amount of drug needed during the lead time plus the amount of safety stock. Lead time and the amount of safety stock are set using some statistical methods. The safety stock requires a standard deviation value obtained from the calculation of the standard deviation of the drug requirement per month in the previous year. The lead time is also equalized in units of months to $\frac{1}{6}$ months. The desired service level value is 95% with an error tolerance of 5%. Thus, based on the Z distribution table, the Z value is 1.645.

The following are the results of the calculation of ROP and safe stocks in the form of bar charts
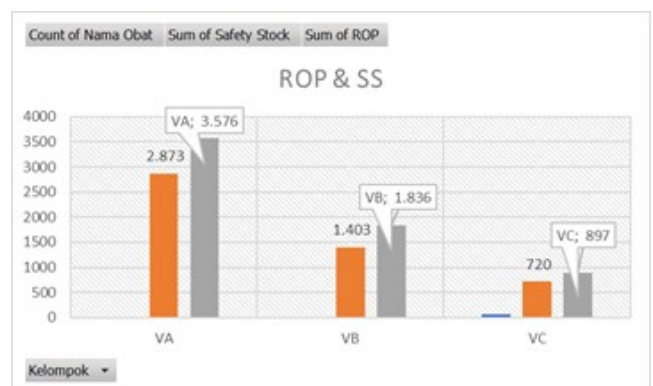
Graph 3. EOQ Analysis
Source: IFRS sales report at RSU Santo Yusup Boro which has been processed

The following is an ROP analysis table from the ABC-VEN analysis of the AV, BV, and CV groups to summarize the highest and lowest ROP values.

Tabel 3 Analisi ROP

Nama Obat	Kelompok	ROP
Amlodipin 10 mg tab	VA	1518
Aspilet tab 80mg	VA	581
Amoxicilin 500 mg tab	VA	559
Tetagam prefilled syringe	VA	4
Levofloxacin inf	VA	3
ABU serum inj (biosave) per ml	VA	2
metformin 500mg	VB	544
Amlodipin 5 mg tab	VB	333
Ambroxol 30mg tab	VB	255
NICARDEX INJ	VB	2
Aminofluid inj	VB	2
ATS inj (BIOSAT) 1500iu 1ml	VB	1
Clonidine 0,15 mg	VC	213
New Diatab	VC	97
diazepam	VC	85
Amiodarone inj	VC	1
Valisanbe (diazepam) inj	VC	1
PTU tab	VC	1

Sumber: Laporan penjualan IFRS RSU Santo Yusup Boro yang telah diolah

The results show that the highest reorder point in the AV group is 1518 tablets of Amlodipine 10 mg tab. It is important to order Amlodipine 10 mg tab when the stock has reached 1518 tablets or 15 boxes. Meanwhile, the lowest reorder point of the AV group contains 2 ABU serum drugs, so it is necessary to order ABU serum (anti-snake venom) when the stock is only 2 vials left. The number of safety stock is 1 to 1120 units for each type of drug, and the reorder point (reorder point) is 1 to 1,518 units for each drug.

4. Cost efficiency after inventory planning using ABC-VEN and EOQ methods

This research compares the total cost of drug inventory with the previously planned EOQ with the drug procurement model according to the traditional techniques implemented by IFRS Santo Yusup Boro Hospital.

The analysis of drug procurement shows that ordering drugs frequency is based on the purchasing history. Meanwhile, the average amount of inventory held by IFRS is assumed from the calculation of the average requirement per month divided by two.

Table 5 Cost of drug inventory in 2021

Tabel 4.9. Biaya penghematan persediaan obat tahun 2021

Keterangan	Total Biaya Pesan	Total Biaya Simpan	Total Biaya Persediaan
Penerapan EOQ	13,127,136	17,831,372	30,958,508
Kebijakan IFRS	37,419,900	15,745,160	53,165,059
Total penghematan			22,206,552
Persentase penghematan			42

Source: IFRS sales report at RSU Santo Yusup Boro General Hosptial

The table shows that the total cost of inventory using the EOQ is Rp. 30,958,508 and hospital policies of Rp. 53,165,059. There is a difference in the cost of the drug inventory value (Rp. 22,206,552 or 42.%). It means that drug planning with a combination of consumption methods with ROP will save costs of Rp. 22,206,552

DISCUSSION

1. Implementation of drug supply planning using the consumption method based on ABC-VEN analysis at Santo Yusup Hospital Boro Kulon Progo

There has been no pharmacy planning at the Santo Yusup Boro General Hospital. The planning and order of drugs will be carried out by the responsible pharmacist and one appointed pharmaceutical engineering staff (TTK). Meanwhile, the method remains unclear. The types of ordered drugs follow consumption patterns, plus the assumption of increasing patients. The drug inventory planning at the Santo Yusup Boro General Hospital has never been calculated using ABC-VEN analysis. The interviews reveal problems or issues in the availability of drugs at the Santo Yusup Boro General Hospital, including drug stock, ED drugs, and ordering depth like minimum order. Another problem is that the doctors do not want to use others of the same kind.

One hospital that also does not have a drug supply control system is the Pharmacy Installation at the Ende Hospital. Purchase Planning is done manually based on the history of drug use in the last three months and manual checking of which drugs will or have been used. The results show that the current drug inventory control system at the Pharmacy Installation of Ende Hospital is not good enough due to the relatively high purchase cost. Using the dynamic lot sizing method for AV category drugs, the cost can be saved up to 4.95% (Fahriati et al., 2021)

During the service period from January to December 2021, there are 456 drugs used for services. The total drug inventory in the pharmacy is 465 items. There are 29 items included in group A. Group B consists of 66 items, and Group C has 370 items. Based on the VEN analysis in group A, 18 drugs as the vital criteria (AV=18). Meanwhile, group B has 20 items (BV=20), and Group C has 57 items (CV=57) that fit the vital criteria.

The use of ABC analysis to manage the drug inventory system can help the pharmacy in planning the procurement of drugs registered in private health insurance effectively (Fahriati et al., 2021) (17). Ahmed et al, revealed that ABC/VEN analysis represents a simple and effective drug dispensing analysis method. It functions to identify priority drug groups. If their usages are scaled up, they may have clinical and economic impacts (Ahmed et al., 2019).

This research also proves that the procurement of the goods in other hospitals is only done by recapitulating and purchasing the products. The inventories are calculated manually based on average usage per month without any details regarding storage and inventory ordering costs for one item(Hutahaean and Mulyani, 2020). Poor inventory planning will negatively influence because many drugs are stagnant or rarely used so that they pass their expiration dates. Sub-optimal planning also affects storage costs, and a financial turnover will be disrupted.

Some efforts have been made by the Santo Yusup Boro General Hospital to overcome the issues of drug planning and procuring. One of them is conducting regular orders. Pharmacists will ask for cash from the finance department when ordering drugs. For the expired drugs, there should be necessary returns if possible. To control the costs, the pharmacy unit will search for generic drugs or those included in the National Health Insurance (JKN). However, the hospital must analyze the drug inventory through an appropriate calculation method.

Some literature reviews show various models of pharmaceutical inventory like systematic evaluation,

statistical methods, fuzzy logic, ABC-VED, EOQ, JIT, etc. Some case studies are based on annual expenditure with ABC classification in pharmacy. They try to identify and correct inventory management problems by proposing timely analysis. All the methods used in drug inventory management have been reviewed to get the best one. The result will be combined and applied in an automated environment to keep the inventories at optimal levels (Basha et al., 2020).

2. The optimum number of orders for drugs inventory through the EOQ (Economic Order Quantity) at Santo Yusup Boro General Hospital, Kulon Progo

The correctly-applied EOQ will reduce storage costs, and risk of damages, and reduce drug expiration rates. The EOQ calculation of each item can reduce storage costs and the risk of damage/cancellation. The ordering costs may be increased but it can save a lot of costs. Proper drug inventory management is crucial for IFRS because it will affect investment, storage, and hospital profits. Errors in setting the size of materials will affect the budget. It can spend large amounts of annual hospital funds and increase storage costs (Darmawan et al., 2021).

The EOQ analysis reveals an optimal number of ordered items. It is calculated based on the amount of expenditure in one year classified as ABC-VEN, and the calculated EOQ is the ABC-Vital group. In the VA group for the Amlodipine drug, the EOQ calculation result in 866 tablets, while the unit for Amlodipine is 100 pcs per unit/box. Therefore, the EOQ for every order of Amlodipine is 8 box units/box. In the VB group for 500mg metformin, the EOQ calculation shows 567 capsules, while the 500mg metformin drug unit is 100 capsules per unit/box, so the number of orders is 6 units/box. In the VC group, clonidine 0.15 drugs were 479 pcs, and Clonidine 0.15 units were 100 tablets units/box, so the optimal number of orders is 5 boxes.

Previous findings have found that EOQ is best for controlling stagnant and deficient drugs (Dewi et al., 2020). Optimal ordering planning is obtained based on the proper calculation of the EOQ. It can determine and set a probability that each drug will expire so that the losses caused by expired drugs can be prevented(Alfanda et al., 2018) (23). The EOQ method will respond faster if there is a sudden increase in demand(Rofiq et al., 2020b).

3. The ideal reorder period through the calculation of the ROP (Reorder Point) at the Santo Yusup Boro General Hospital

Reorder Point is when the company must order drugs again so to make sure the ordered drugs can be received on time. This is because drug orders cannot be delivered on the same day. Previous studies showed that the highest reorder point was found in 9 items of Unalium 10 mg, so it is necessary to order Unalium when the stock has reached 9 items (Almahdy et al., 2021).

The interview results with the Head of IFRS reveal that the procurement period is not conducted within a fixed time. Most of the procurement is done every month, but some drugs are done every three months. Related to the safety stock in the hospital, the Head of IFRS explained that not all types of drugs have safety stock. On the other hand, the lead time for regular drugs ranges from 3 to 5 days, while e-catalog ranges from 10 to 12 days.

The highest reorder point in the AV group is 1518 tablets of Amlodipine Tab 10 mg, so it is necessary to order 10 mg of Amlodipine tab when the stock is about 1518 tablets or 15 boxes. The lowest reorder point from the AV group contains 2 ABU serum drugs. The hospital must order ABU serum (anti-Snake venom) when there are only 2 vials left. The number of safety stock ranges from 1 to 1120 units for each type of drug, and the reorder point is 1 to 1,518 units.

Previous studies have shown that the number of safety stock is 1 unit for each drug item, meaning that the safety stock should not run out while waiting for the next order(Fatimah et al., 2022).

4. Cost efficiency after inventory planning using ABC-VEN and EOQ methods

The drug supplies are expected to be in sufficient quantities at the time required and at the least cost(Almahdy et al, 2021 . Establishing good inventory management practices is the key to improving patients' satisfaction and overall financial performance (Abdullahi et al., 2019).

The total cost of inventories using the EOQ is Rp. 30,958,508 and hospital policy of Rp 53,165,059. It means there is a difference in the cost of the drug inventory value (Rp. 22,206,552 or 41.8%). Drug planning using the EOQ method can save costs of Rp. 22,206,552 It shows that the inventory planning using ABC-VEN and EOQ methods provides cost efficiency.

Previous researchers explained that the EOQ and ROP methods increase the efficiency of BPJS drug management and decrease the inventory value by Rp. 71,943,426(Darmawan et al., 2021). Efficient investment in drug supply value can be realized through rational prescribing and replacement of high-cost and non-essential vital drugs with low-cost ones (Mori et al., 2021). Effective and efficient management of pharmacies requires efficient prioritization and proper decision-making in the purchase and distribution of drug items and close supervision of those classified as important categories (Fitriana et al., 2017).

The EOQ method intervention has been applied for three months. An effect analysis shows inventory control method can reduce the frequency of drug voids and types of vital consumables. If there is a shortage of drugs, other efforts are made to fulfill the procurement(Burhan et al., 2019). The EOQ method must be implemented regularly to make sure that it can significantly contribute to financial efficiency and positively influence the quality of hospital services.

RESEARCH IMPLICATIONS

1. This research applies the ABC-VEN analysis to help the hospitals to decide what types of drugs must be available, fulfill services, determine the drugs that can be listed in the hospital formulary, make policies at the installation of hospital pharmacy, control, reporting, storage, monitoring, and checking.
2. The EOQ and ROP calculations can help the hospital to set the costs that will be allocated for services in the next year. Thus, the hospital can make policies related to financing, monitoring, and evaluating drug procurement more clearly.
3. The efficiency generated by ABC-VEN and EOQ analysis approaches can increase the hospital income, so they should be applied in the hospital's information system continuously and correctly

LIMITATIONS

The EOQ and ROP methods on drug procurement are carried out retrospectively. Experimental observation is done based on annual data. The research does not describe the number of drugs in more detail. The raw data in the pharmacy unit is not complete enough, so the researchers must take more time to recap the findings to be analyzed using ABC-VEN.

CONCLUSIONS

ABC-VEN analysis can control the type and amount of drugs in the IFRS of Santo Yusup Boro Hospital. There is a total of 465 drug items. After the ABC-VEN analysis, there are 95 drug items classified as a priority in procurement because they are included in the ABC-Vital.

The total inventory cost without the drug method is Rp. 53,165,059/year. The total inventory cost using the EOQ method is Rp. Rp. 30,958,508 /year. The EOQ method can save the cost of Rp. 22,206,552/year (42%). Drug inventory planning based on the ABC-VEN and EOQ methods can provide better cost-efficiency.

RECOMMENDATIONS

Until now, Santo Yusup Boro General Hospital still does not have a specific method for drug inventory planning. It becomes the cause of decreasing IFRS performance. Another issue is inefficiency from IFRS which results in a decreasing hospital income. The hospital should prepare a systematic drug procurement plan. Consumption methods (ABC-VEN, EOQ, and ROP Combination Analysis) in drug procurement are practical and easy to apply.

The results of the ABC-VEN analysis show that EOQ can overview the overall pharmaceutical needs starting from the amount, type of drug, infestation value, and efficiency. The hospital needs to think about the best methods to be applied through training pharmaceutical staff; especially the responsible pharmacist and other staff appointed to use the ABC-VEN and EOQ combined analysis methods. There should be use of the RS MIS so that pharmaceutical planning and reporting can be easily monitored and evaluated.

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