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Analysis of pharmaceutical inventory management in a state hospital in Myanmar

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ABSTRACT

Inventory management analysis for a state-level hospital pharmacy of Myanmar was conducted using ABC-VEN matrix analysis to identify the drug categories that require stringent management control. The annual expenditure of all drug items managed by pharmacy department for the years 2016 and 2017 was analyzed and application of ABC, VEN, and ABC-VEN matrix analysis was performed. The study showed that the average annual expenditure was 288,414 USD. Of the total 297 items of medicines, 7.7% (23), 16.8% (50), and 75.4% (224) were classified as A, B, and C category items, respectively, accounting for 70.4%, 19.7%, and 9.9% of drug expenditure. The VEN analysis revealed that 35.3% (105), 44.8% (133), and 19.9% (59) of items classified as Vital, Essential, and Non-essential category items, respectively, accounting for 65%, 32%, and 3% of drug expenditure. On ABC-VEN matrix analysis, drugs were grouped into Category I (38.0%), Category II (43.1%), and Category III (18.9%) accounting for 82.9%, 15.5%, and 1.5% of drug expenditure. Category I medicines are needed to be controlled strictly whereas Category II and Category III medicines need middle and low level of management, respectively. The ABC-VEN technique was recommended to be used for efficient resource utilization and elimination of wastage and stock-out situations in hospital pharmacies.

Keywords: Inventory management, hospital pharmacy, ABC-VEN matrix

INTRODUCTION

Inventory management (IM) is the supervision and regulation of the purchasing, storage, distribution, and use of products that an organization would apply in the production of these products. It would manage the supervision and control of quantities of finished goods for distribution or sale.[1] Hospital materials management (HMM) is the important part of the clinical sphere of health facilities service performance.[2] The intention of supply system in hospitals is to ensure that there is sufficient amount of required materials, so that continuous distribution of all essential materials is attained.[3] This needs the effective and efficient pharmacy management with a continuous and precise supervision on use of medicines, prevention of damage, procurement, and distribution of first prioritized medicines. Poor inventory management in health-care industry, especially the public health setting, contributed to the wastage of resources, insufficient availability of essential drugs, stock outs, and stock losses.

Procurement of materials and supplies such as drugs and chemicals use 30–35% of total operating costs of hospital inventory.[4] The medical stores department combined with the dispensing unit where distribution of medicines takes place, is one of the most highly used services of the hospital and spends extensive amount of money for procurement and maintenance activities.[5] A study in a 1500-bedded government hospital found that using inventory control techniques was able to save 20% of the hospital inventory budget.[6] Certainly, IM can produce profound improvement not only in patient care but also in the appropriate use of financial resources.[7] The fact is that effective inventory management can certainly make significant savings in the hospital budget.[8] IM is thus a key measurement in a continuous and consistent pharmaceutical supply in a hospital setting. It is important to classify medicines into categories in a pharmaceutical set-up to maintain and ensure the availability of the essential category of medicines to avoid all types of wastage such as, under stocking, overstocking, and expires.

Among the inventory management techniques, ABC and VEN matrix is the most appropriate for the hospital pharmacy.[9] The study conducted by Thawani *et al*. showed that improvements such as drug availability, budget management, demand reduction, and emergency purchase were noticed after introduction of ABC-VEN inventory control methods to the study place.[10] According to the findings from the study by Chungsiwapornpong and friends, ABC and VEN analysis systems are effective and powerful techniques for hospital pharmacies.[11] The ABC analysis (Always, Better, Control) is the method of classification based on the annual usage value of items.[5] The category A items consists of 10% of items, accounted for 70% of cumulative cost and category B is 20% of the items accounted for 20% of cumulative cost. The remaining 70% of items are category C, accounted for 10% of total cost.[9] The VEN analysis is based on the criticality of the items. The V (vital) items are critical for life and patient care, criticality of the E (essential) items is less than V items and alternative are acceptable and the N (Non-essential) items have the least critical value.[5]

Hospital utilization in Myanmar is increasing; 1.21 million admission cases in 2009 and 2.97 million in 2018, outpatient visits of 3.38 million in 2009 and 11.48 million in 2018. For the past 5 years, Ministry of Health and Sports of Myanmar has increased budget to public hospitals to purchase medicines under the supervision of the director of each hospital to increase drugs availability for patients. Of 3.2 million population of Rakhine State, 111,097 admissions and 230,391 outpatient visits were found in 62 hospitals in this state.[12] With spiral increase of hospital utilization in Myanmar, the hospital pharmacy is facing supply shortage of medicines. The knowledge on IM implementation for public hospitals in Myanmar including Rakhine State hospital is thus needed for more efficient operation to prevent stock out problems in hospital pharmacy. The medical supplies of hospitals need inventory management tools to spend budget appropriately, to reduce wastage, and to increase drugs availability for patient healthcare. The objective of this study was to analyze the current situation of medicine inventory management system of a state hospital in Myanmar using ABC-VEN matrix analysis.

METHODOLOGY

This descriptive study presented the current situation of inventory management of a state hospital. The hospital pharmacy of the Sittwe general hospital, Rakhine state, Myanmar was purposively selected as a site for our study.

The data on the inventory monthly movement from the pharmacy department of the Sittwe general hospital during 2 fiscal years, Apr 2016–Mar 2017 and Apr 2017–Mar 2018, were collected from stock record. The data on inventory movement of each medicine item were coded or categorized into designed variables and transcribed onto Microsoft Office Excel spreadsheet. The data of two fiscal years were used because with limited budget, the drug procurement and inventory would require 2-year data to complete the calculation cycle and the average drug consumption using 2-year data would be more reliable and better reflect the actual situation than using 1-year consumption data.

ABC-VEN Matrix Inventory Analysis

For ABC-VEN matrix analysis of procurement and consumption of all medicines, the collected data included annual consumption of each medicine dispensed from the medical store, procurement amount and procurement price of each medicine item.

The annual total expenditure of drugs was computed using the average of 2 financial years, 2016 and 2017. The sum of expenditure of all drug items of each fiscal year was calculated, and then expenditure of 2 years was averaged to derive the average annual drug expenditure. Whereas the ABC classification was based on expenditure data, the VEN was based on expert opinion. The item expenditure was arranged in descending order and the calculation of the cumulative percent of medicines expenditure and the cumulative percent of items were conducted. This arrangement was then classified all drug items into three categories as Class A, Class B, and Class C according to the cumulative expenditure at cost of approximately 70%, 20%, and 10%, respectively.

The medical superintendent of the hospital, two pharmacists, and one former pharmacist of hospital served as experts to classify all medicines into VEN status. The medicines that were critically required for the survival, and non-availability of them would have negative impact on both the patients and the impression of the health care institution were included in the Group V. The medicines used with less severe cases compared to Group V items, and their shortage could be allowed for a short period, were included in the E category. The medicines with minimum therapeutic advantage were included in the N group.

For the purpose of the ABC-VEN matrix analysis, a cross table of the ABC and VEN analysis was constructed. The combination of ABC and VEN cross tabulation derived nine subcategories which were grouped into Category I (Cat I), Category II (Cat II), and Category III (Cat III). Subcategories AV, AE, AN, BV, and CV belonged to category I. Category II was combined with the BE, BN, and CE subgroups and the subgroup CN was included in the Category III. In these subgroups, the first alphabet refers its position in the ABC analysis, whereas the second one denotes its position in the VEN analysis.

Data Quality of the Study

The data were collected from the stock record of the hospital medical store which reflected the inventory of this hospital. The ABC analysis was based on calculation while the decision for the VEN analysis was made by physicians and pharmacists who were the most knowledgeable about drug use. They also worked as manager and middle manager ranks. During data collection, the data were collected from the stock books, and missing data were rechecked. Data entry was performed in Microsoft Office Excel and double checked all entries with the stock record for typing error. Although the timeline of data was current year, they were only a few years back and they could still represent the current situation. The price of the drugs was first collected as Myanmar kyats and converted to US dollars (USD) using the current exchange rate at 1778 kyats per 1 USD.

RESULTS

The 500-bed general hospital was purposively selected for this study. The pharmacy department carried 297 drug items including 52% or 153 items being oral dosage form, 32% or 96 items for injection and 16% or 48 items for topical use. The data revealed that total drug expenditure of the 2016 fiscal year was 275,771 USD and that of 2017 was 258,198 USD averaging 266,984 USD per year.

ABC Analysis

Using ABC analysis to group 297 items, 70.43% of cumulative drug expenditure or 188,027 USD was classified as Class A occupying 7.74% of all medicines or 23 items. The 19.66% of consumed value or 52,493 USD of Class B consisted of 50 items or 16.84% of all items. While Class C included most items of the inventory at 75.42% or 224 drugs, its expenditure represented the least consumption at 26,464 USD or 9.91% of total drug expenditure as shown in Table 1.

VEN Analysis

According to VEN analysis, there were 105 of vital items (V) followed by 133 items of essential drug group (E) and 59 items of non-essential group (N). The Vital Group (V) was accounted for 173,856 USD or 65.12% of total drug expenditure which was the largest expenditure among three categories. The expenditure of the E group was 84,608 USD at 31.69% and the N group accounted for the least expenditure of 8521 USD or 3.19% (Table 2).

ABC-VEN Matrix Inventory Analysis

The matrix of ABC and VEN analysis in Table 3 showed that, 15 items were in AV subgroup, seven items in AE, 1 item in AN, 24 in BV and 66 in CV totaling of 113 items in Cat I. Cat II counted 128 items including 24 in BE, 2 in BN and 102 in CE.

Table 1: Average total drug expenditure for respective ABC groups

Drug class	Number of items	% Of total items	Average total consumption (USD)	% Of total consumption
A	23	7.74%	188,027	70.43
B	50	16.84%	52,493	19.66
C	224	75.42%	26,464	9.91
Total	297	100	266,984	100

A=Items with highest consumption value and require strict monitor,
B=Items with moderate consumption and require moderate monitor,
C=Items with least consumption value and require least monitor

Table 2: Average drug expenditure for VEN groups

Drug category	Number of drug items	% of total drug items	Average total consumption (USD)	% Of total consumption
V	105	35.35	173,856	65.12
E	133	44.78	84,608	31.69
N	59	19.87	8,521	3.19
Total	297	100	266,984	100

V: Vital items, E: Essential items, N: Non-essential items

The rest of 56 items in CN was classified as Cat III. The average consumption values of Cat I were 225,547 USD accounted for 84.48% of total expenditure and those of Cat II and Cat III were 37,689 USD or 14.12% and 3749 USD or 1.40%, respectively.

In the matrix analysis of ABC and VEN techniques, 113 items (38%) of cat I consumed 84.48 % of average consumption value. In the case of the three subgroups of Cat I (AV, AE, and BV), AV consisted of 15 medicines (5.1% of all medicines) that consumed 51.07% of average drug expenditure, 7 AE items (2.4%) occupied 18.12% expenditure and 24 BV items (8.1%) was 10.23 % consumption. The subgroup CV consist 22.2% of all items which was the highest numbers of items within Cat I; however, their cost was 3.82% of total expenditure. The AN subgroup contained only one medicine which consumed 1.24% of all drug expenditure. Cat II and Cat II occupied 128 items (43.10%) and 56 items (18.90%) and correspondingly consumed 14.2% and 1.4% of drug expenditure.

DISCUSSION

Our study is the first study of inventory analysis at a state hospital in Myanmar. ABC analysis of medical stores of the hospital showed that out of total 297 medicines, 7.74% of all medicines consumed 70.43%, 16.84% consumed 19.66%, and 75.42% utilized 9.91% of total drug expenditure. The proportion of items and monetary value of inventory in this state hospital was consistent with the ABC principle as in other studies. Class A represented least items with highest expenditure reflecting that they were high price items consuming most resources in term of budget and monitoring. The ABC and VEN analysis of the medical store of tertiary care teaching hospital in India by Dudhgaonkar *et al*. showed that 14.51% of items accounted for 69.75%, 16.94% consumed 20.24% and 68.55% accounted for 10.01% of annual drug expenditure.[2] Another similar study in Government Medical College, Aurangabad drug store observed by Pund *et al*. and friends revealed that Classes A, B, and C belonged 16.8%, 21.8%, and 61.4% of items respectively consumed 70%, 20.1%, and 9.9% of expenditure.[3]

With the least items, Class A drugs required very strictly control process, stock safety situation, accurate forecasting for purchasing and monitoring policy. Middle level of management and control was needed for B Class items whereas Class C required minimum management by other authorized personnel in limited human resources situation. Our study pointed that ABC analysis tool alone was applicable for medicine inventory management. However, Classes B and C included 24 of BV and 66 of CV vital medicines which were lifesaving items and the hospital needed to have on hand all the time even they were rarely used. Therefore, it would be inappropriate to place them in less controlled groups on Classes B and C, particularly in the situation that the drug procurement required long and time-consuming process as in the state hospital. The ABC-VEN matrix combined concepts between drug expenditure and criticality for more effective pharmaceutical inventory management to better serve patient care.

The VEN analysis in this study found out that 35.35%, 44.78%, and 19.87% of all medicine items were classified as vital, essential, and non-essential. It could be noticed that the state hospital carried most of V group and the E group items

Table 3: Average drug expenditure for ABC-VEN sub-categories

Category	Subcategory	Number of drugs	% of total drugs	Average total consumption (USD)	% of total consumption
Cat I	AV	15	5.05	136,337	51.07
	AE	7	2.40	48,384	18.12
	AN	1	0.30	3,307	1.24
	BV	24	8.10	27,317	10.23
	CV	66	22.20	10,202	3.82
	Total Cat I	113	38.05	225,547	84.48
Cat II	BE	24	8.10	23,712	8.88
	BN	2	0.70	1,465	0.55
	CE	102	34.30	12,512	4.69
	Total Cat II	128	43.10	37,689	14.12
Cat III	CN	56	18.86	3,749	1.40
Total items		297	100	266,984	100

Cat I: Category I, Cat II: Category II, Cat III: Category III. In each subgroup, the first alphabet refers its position in the ABC analysis, the second alphabet denotes its position in the VEN analysis

with minimum number of items on N group. Similarly, the study by Pund *et al*. in the government medical college, Aurangabad drug store showed that 35.3%, 50.4%, and 14.3% were vital, essential, and desirable category.[3] The VEN analysis of the study by Dudhgaonkar *et al*. in the medical store of the tertiary care teaching hospital also revealed that 54.03%, 30.65%, and 15.32% were belong to category V, E, and N, respectively.[2] With the limited budget situation, even in different countries and different environment, still most of the public hospitals would maintain only few items of non-essential or N group. All studied showed less than 20% of all items belonged to N group.

The ABC and VEN matrix analysis focused on 113 items or 38% of Cat I items which required strict management control because these medicines were either vital or expensive. The finding from the study conducted by Pund *et al*. were similar to the result of our study, 49.9%, 43.7%, and 8.4% items were Cat I, Cat II, and Cat III which consumed 82.3%, 16.5%, and 1.2% of expenditure, respectively.[3] As subcategories of AV, AE, and BV under Cat I were vital or essential, their unavailability was unacceptable. Their small buffer should be maintained before purchasing with strict monitoring of their consumption and stock levels. As 3.82% of total expenditure consumed by the subgroup CV in Cat I, these CV items should be closely monitored but purchase less than twice a year with adjusted order amount and stocked was suggested as their holding cost was low. Although only one medicine located in AN subgroup, its expenditure was high. It was the non-essential and expensive item. The medicine from this group could be removed according to rational medicines use without significant effect on healthcare. If still listed, appropriate inspection of its need should be conducted before purchase would be allowed and only needed demand should be procured. Since Cat II items consumed 14.12% of average drug expenditure, these medicines could be procured once a year hence reducing ordering costs and administrative overhead leading to saving of hospital spending. Drugs from Cat III used only 1.4% of average drug consumption and their ordering amount and frequency could be reduced thereby reducing their carrying cost without affecting patient care.

The application of inventory control tools was needed to perform effective pharmaceutical logistic management, procurement, and distribution of prioritized medicines in a state hospital. Our study described the benefit of using ABC-VEN analysis in pharmaceutical inventory management. For beneficial budget utilization, ABC-VEN analysis prioritized drug items which required close monitoring approach. The advantage of this analysis was that the efficient management of drugs inventory in hospital medical store could be enhanced by attention on 113 Cat I drug items or 38% of total 297 drugs.

This study has investigated the scientific inventory tools that group medicine items according to consumption value and criticality. The expected benefits of implementing this ABC and VEN matrix analysis were improvement in management efficiency of medical stores, better medicines, and supplies procurement decision which could lead to budget saving, less shortage of medicine, efficient drug storage, distribution, and utilization for advanced patient care. Therefore, the ABC and VEN matrix analysis was recommended to be implemented in hospitals for better supply chain management of medicines and medical supplies.

The limitation of the study was that only one hospital was purposively selected and only 2-year data of inventory and procurement could be collected. However, since this study was conducted in the state level hospital and the result from this study to a certain extent had similar flow with the other state and division level hospitals in Myanmar. The scale of expenditure might be different according to the size and capacity of hospitals, but the type of problems faced by the pharmacy department was comparable among hospitals. While the service and management system between now and then has not been changed, similar challenges were expected. The benefit of applying the ABC-VEN matrix analysis should be able to generalize to other hospitals. The inventory management of public hospitals could thus be optimized by applying the appropriate inventory management tools and

the ABC-VEN matrix was a good example presented in this study. This study only described the consumption of medicines in the main medical store of a hospital with ABC-VEN matrix analysis, the inventory management and stock flow of each ward in the hospital was still needed for future studies.

CONCLUSION

Our analysis showed average annual drug expenditure during 2016 and 2017 by Sittwe General Hospital was 266,984 USD for total 297 drugs. The use of scientific inventory management tools was needed for effective and efficient pharmacy stock management, effective prioritization, decision making in the purchase and distribution of specific items, and close monitoring of items belonging to important categories. The ABC-VEN matrix analysis helped prioritizing drugs that required close monitoring for effective and efficient utilization of budget. The analysis also recommended efficient procurement of drugs for each category for the state general hospitals in Myanmar.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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