Research Article

PRIORITIZED ABC – FSN ANALYSIS OF INVENTORY MANAGEMENT IN PRIVATE AND HOSPITAL PHARMACY FOLLOWED BY QUESTIONNAIRE

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ABSTRACT

The aim of the study was to identify the pitfalls in the existing supply chain of private and hospital pharmacies, identify the variables that influencing more in the efficiency of the pharmacy, select the appropriate inventory analysis and suggest the prioritized inventory matrix to meet customer requirement in efficient manner. The qualitative and quantitative data has been collected through questionnaire and interview of the pharmacy personnel. Through SPSS, the normal distribution and correlation analysis to be carried out on sample data. The pitfalls were solved by the selection of appropriate inventory analysis and suggesting the prioritized inventory matrix to narrowed down the drugs for monitoring and control strategies of pharmacy drugs. The normal distribution and correlation analysis results shows that the variables collected through questionnaire are normally distributed and the variables that most influence the efficiency of the pharmacy supply chain. The implementation of Prioritized ABC – FSN matrix in pharmacy will helps to provide high-quality service to the customer and there will be an adequate supply of the items in the pharmacies. The future work also to be discussed. The prioritized ABC – FSN matrix to be adopted as a routine practice for optimal use of resources and elimination of out-of-stock and over stock situations in the hospital and private pharmacy.

Keywords: Pharmacy Supply Chain, Inventory Management System, Stock Outs, Overstock, IT Support in Pharmacy, correlation analysis, Inventory matrix analysis.

INTRODUCTION

At present, all the hospital and private pharmacies maintain their own inventory methods, but they are still experiencing problem in achieving effective inventory management. To attain the efficiency, the flow of medicines needs to be managed in all aspects to overcome the pitfalls like overstocking, expiry, etc. Pharmacy supply chain is the area in which alternative and compromise are not acceptable when unavailability arises. A health care cost is in an increasing phase, organizations are pressurized to give quality of care. Healthcare cost savings could be achieved by increasing the efficiency of the supply chain¹.

This study aims to present a case study of Coimbatore city based private and hospital pharmacies, their existing supply chain and its performance. A correlation analysis for the variables collected by the questionnaire which contributing more in stock out, overstocks and unavailability are provided. Finally derived is the ABC – FSN matrix to identify the categories of drugs needed more attention and future work.

This paper is organized as follows. A discussion on the methodologies used for data collection with literature reviews, followed by a data analysis and description about the major issues faced by the pharmacies. This descriptive cross sectional study is conducted to meet the patient demand in the right time at the right cost. To achieve that, the study is focused in Internal Supply Chain management in private and hospital pharmacies.

LITERATURE REVIEW

Supply chain in Pharmacy

The healthcare industry is facing many difficulties to meet the demand and expectation of people in all means. By comparing health care with other field, the costs incurred by drugs and the costs spend for health care technology hold major expenditure². Pharmacy is one of the most widely used therapeutic facilities at the hospital, and one of the very few areas where large amount of money is spent on buying items^{3,4}.

Inventory management always has a great impact on the overall performance of industries and commercial enterprises. So, it is highly mandatory to practice good inventory management for ensuring growth and profitability⁵. The inventory management involves all activities put in place to ensure that customer have the required product or service. It coordinates the purchasing, manufacturing and distribution functions to meet the marketing needs and organizational needs of availing the product to the customers. Inventory management is primarily involved in specifying the size and placement of stocked goods. Inventory management is required at different locations within a facility or within multiple locations of a supply network to protect the regular and planned course of production against the random disturbance of running out of materials.⁶

The research in Tanzania public hospital showed that drug requirements are not estimated according to actual hospital needs but, because of lack in proper logistics. In addition, there were improper stock recording practices in hospital pharmacy.⁷ The pharmacy in Delhi medical college having multiple issues related to pharmacy inventory such as frequent

stock-out, expiry of drugs, etc and the pharmacist are unaware of inventory control method.⁸ In hospital pharmacy the efficiencies and serviceability were affected in many ways, such as lack in the utilization of computer technology, improper inventory management, medicine shrinkage, unskilled labour, etc. These inefficiencies not only affect the sustainability of healthcare system, it also affect the patient and serviceability. These issues are overcome by incorporating information technologies in the function of pharmacy logistics, the existing business processes should be redesigned, and enhanced for the logistics skill of the pharmacy staff.⁹

The scope of inventory management also involves managing the replenishment lead time, replenishment of goods, returns and defective goods and demand forecasting, carrying costs of inventory, asset management, physical inventory, available physical space, demand forecasting, inventory valuation, inventory visibility, future inventory price forecasting and quality management. With a balance of these requirements, it is possible to reach an optimal inventory level, which is an ongoing process as the business needs shift and react to the wider environment.¹⁰ Many researchers stated that the major aims of hospital is to reduce the cost utilized in the healthcare without affecting the quality of service provided to the patient.

The research conducted in public health institutions in Kenya, stated that the performance of the hospital would be increased by adopting the inventory management practices by hospital pharmacy management teams. Along with performance, it will enhance the inventory record accuracy, investment and turnover in the pharmacy.¹¹ Pharmacy is one of the major components in the health care systems. But in India, the pharmacists have not been properly educated to overcome the barriers and attain the efficient pharmacy practice. The Health care education plays a significant role in the development of efficient health care system.¹² The current status of hospital pharmacy in south India were discussed and stated that the physicians and healthcare team are unaware of the inventory systems and drug list are not properly updated. These problems are rectified only when the pharmacists are familiar with the concept of “when, what and how much” to order. These three concepts enclose many parameters such as demand, lead time, review time, demand uncertainty, forecasting, safety stock, criticality of the item, etc. So, the ultimate goal of inventory is to have only the optimal materials.¹³

Inventory Analysis

Continuous quality management in medical store is capable of providing value-added services to the patients among various inventory analysis.¹⁴ The combination of ABC and VED analysis (ABC-VED matrix) that can be gainfully if employed to evolve a meaningful control over the material supplies. Category I include all vital and expensive items (AV, BV, CV, AE, AD). Category II includes the remaining items of the E and B groups (BE, CE, BD). Category III includes the desirable and cheaper group of items (CD).

The optimal lot size for purchasing is derived by EOQ by reducing the total operating cost. EOQ formula directs the inventory managers to determine how many optimum products to buy. However, the classical EOQ model assumes such as: constant demand, constant lead time, fixed order cost per order, instantaneous replenishment, no stocks out allowed, no demand uncertainty and quantity discount aren't available.¹⁵

In order the above assumptions does not reflect in all situations, the EOQ model must be modified in a real inventory system analysis. This survey clearly portrays the inventory problem faced by the hospital pharmacy and the assumptions made while deriving EOQ model. Certain parameters such as discounts by initial payment and ordering large quantity, etc. are also not considered in the inventory model. ABC and VED analysis identifies the drugs requiring stringent control for optimal use of funds and elimination of out-of-stock situations in the pharmacy.³ The combined FSN and VED analysis to find the non-moving items which are less critical. FSN analysis is used to find out the fast moving, slow moving, and non-moving items in a store department and VED analysis is applied to non-moving items. Thereby, avoiding or eliminating the ND class items which increases the space availability and reduce inventory holding cost, which in turn helps to attain the industry-wide standards.¹⁶

The efficiency in the utilization of resources and patient care to be improved by adopting the inventory management tools and that to be followed routinely by the management.¹⁷ The categorization of drugs and ABC – VED analysis leads to attain effective & efficient utilization of hospital funds and elimination of out-of-stock situations in the hospital pharmacy.¹⁸ ABC – VEN analysis are used to analyzing aggregate medicine data and discussed about the relatively small number of items holds most of the value of the supply fund (ABC analysis) and desirable items account for around quarter of the total fund by half of number of items (VEN analysis).¹⁹

The main difference of this paper from earlier work is the combination of ABC and FSN analysis (Inventory matrix) to identify the weight age of each pharmacy item in the matrix and suggest the appropriate EOQ model, with the influence of quantity discounts and price discount given by the supplier.

PROBLEM DESCRIPTION

Existing Supply Chain

As understanding new challenges pharmacies face today, how they cope with them, what they need in order to improve their situation and to realize successfully themselves in customer requirements. These are some of the major questions, this research project tries to find answers of. This was a retrospective study that was done in private pharmacies and multi-specialty hospital situated in Coimbatore and Erode region, Tamil nadu, India. The data related to the private pharmacy and hospital pharmacy supply chain was carried out through questionnaire. The questionnaire is a well-established tool within social science research for acquiring information. Adopting questionnaire, participant social characteristics, behaviour, attitudes and their beliefs and reasons for action with respect to the topic can be studied.²⁰

The questionnaire used for collecting data's is presented in the Appendix, and the data's used are shown in the Table I. Questionnaire analysis gives in-depth knowledge about the issues and analyses of matters relating to similar situations in other pharmacies. The data's collected through questionnaire clearly shows that the stock outs occurred due to the unawareness of inventory techniques by the pharmacy personnel and the efficiency of the existing method of inventory. To study the internal supply chain in pharmacies, the researcher interviewed the pharmacy personnel and consolidated the data and framed the existing internal supply chain. The existing supply chain in pharmacy and hospital to be framed are presented in section 3.1 and 3.2 respectively.

Private Pharmacy Supply Chain

In this competitive world, the efficiency of the pharmacy to be increased only when they were capable to meet the customer needs at the right time at the right cost right and private pharmacies are dealing with multitude of medicines to meet the customer requirements.

By keen observation of the present inventory management system and discussing with the executive personals of the pharmacies, a clear conception of the existing Inventory Management system has been gained. The Questionnaire revealed that most of the pharmacies arrange medicines in the alphabetical order and they mostly use Visual Method for checking the inventory. The reason cited for the preference of Visual method was that it is less time consuming and complicated compared to the other methods.

In that 53 pharmacies interviewed stated that they follow manual records as their inventory records and 8 pharmacies stated that they maintain inventory with the help of software. Despite of using software, only 4 pharmacies are aware about inventory management while remaining other pharmacies maintain the stock records without the knowledge of inventory management. 8 of the 53 pharmacies believed that the methods currently employed were satisfactory and the adopted system allowed for flexibility and adequate inventory control. The remaining was not satisfied believed that to incorporate the inventory management techniques with the software. Most of the pharmacies stated that there is no predetermined time for placing orders, they raised orders based on the dealers visit. The data related to the existing inventory system in private pharmacy has been collected through direct observation and framed in Figure. I.

Along with awareness, data collected about the response to the customers at the time of unavailability of drugs. The pharmacists suggested alternative drug to the customer and the number of customers accepted the alternative drugs suggested by the pharmacists. The major issues to be identified as stock outs and overstocking of non – moving items are not very clear, lack of logistical skills level of personnel working in pharmacy, the lack of IT support, knowledge about inventory techniques and demand forecasting.

Hospital Pharmacy Supply Chain

Many practitioners and academicians give some special importance for managing the pharmaceutical supply chain and believed that the measures taken for expenditure control reflects in the overall efficiency and serviceability of the organization. In hospital supply chain, pharmacies are responsibility for the supply of medicines to the patients and ensuring high standards of serviceability²¹. Hospitals are complex organization providing a large number of service to physicians, in and out patient, pharmacists and staff. These services include the tracking the records of patient both in and out, pharmacy, handling of drugs, laboratory, surgery, dietary, housekeeping, administration and others. Each area needs the supply of some specific and often unique material for fulfilling the serviceability¹⁴. The hospital supply chain holds all kinds of item such as high cost and low cost items, perishable and durable goods, large and small consumption, etc. Comparing the expenses utilized by the various department in hospital supply chain, the pharmaceutical supply chain holds large amount of hospital's operating expenses. Several researchers stated that 10% to 18% of total revenues accumulated as inventory costs in the healthcare sector²².

A cross-sectional and observational study was conducted at a hospital and hospital Pharmacy, Erode, India. The identified hospital in the study constituted about 550 bedded hospitals with various clinical departments such as General medicine, Gynecology, Diabetics, ENT, Orthopedics, Dental, Plastic surgery and Physiotherapy. Besides these, there are Intensive Care Unit, dialysis, inpatient and emergency services. On average about 280 patients visit the hospital for treatment every day. This is with one pharmacy located in the hospital building.

The study was carried out by the hospital pharmacy in-charge during the months of July and October 2015. Six dispensing staffs at three outlets of the pharmacy were observed for the difficulties faced and the errors made while dispensing medicines. The way of receiving stocks and their placement in the shelves was also executed and analyzed. Both qualitative and quantitative data's were collected from hospital pharmacies. Qualitative data were collected through Questionnaire and interviews.

The data related to the existing inventory system in hospital pharmacy has been collected through direct observation and framed in Figure 2. Face to face discussion was conducted with pharmacy and hospital staffs, such as pharmacy manager, pharmacist and other staff involved in the pharmacy supply chain. Through study the factors contributing to stock outs on one hand and over stocking on the other in ABC Medical Care and Hospital are not very clear. Lack of proper logistics and inventory management skills have been implicated as contributing factors.

This study therefore assessed inventory management and logistics skills level of personnel working at the pharmacy and gave clear view of the pitfalls in the private and hospital pharmacies and also discussed the remedies to the problems. An efficient inventory management system overcomes the issues of excess stock, out-of- stock, non-movable stocks, and also saves the time taken for collecting stock details by the pharmacists and increases the serviceability by fulfill the customer needs. Apart from this, inventory also be controlled in efficient manner and it will increase the hospital's profitability²³.

In most of the existing pharmacy inventory management, pharmacist can take their own decision for all purchasing without the involvement of purchasing department or top level management. But World Health Organization suggested that, pharmaceutical purchasing and procurement should be reviewed and approved by a designated purchasing committee and cannot be controlled by an individual.

RESEARCH METHODOLOGY

Concept of the Research

The goal of the research is to develop an EOQ model with the consideration of variables that influence the real time issues on one hand such as stock-out, overstock etc., and on the other hand like discounts, payment offer etc.

At the first stage, the concept of the questionnaire was defined with the pharmacists of private and hospital – Coimbatore and Erode region.

At the second stage, the retrospective study was done and framed the existing supply chain in private and hospital pharmacies in and around Erode and Coimbatore region. . With the help of SPSS, perform correlation analysis in the sample of data to check how each variable are correlated each other and influenced in the efficiency of the pharmacy operation. Sample

of data which has been collected through questionnaire and calculate measures of kurtosis and skewness for the sample variables.

At the third stage, the discussion about the inventory analysis and chosen the effective analysis of the inventory matrix formation and suggests the items which have to be reviewed regularly. Finally, we discussed about the future work of developing an inventory model.

Research methods and approaches

In order to attain the main objective, research methods can be put in the following steps

Questionnaire

Initially, the researcher has oriented to collecting qualitative and quantitative data through a questionnaire. During the survey, the pharmacist to be interviewed and framed the internal supply chain of the pharmacy. Later asked by pharmacy personnel to fill the questionnaire. Through questionnaire, the data like the method of inventory management followed by the pharmacy, way of categorization of the medicine, methods followed to

arrange medicines in shelves, additional quantities of the medications more than pharmacy needs, advise the customer to take the alternative if unavailability arises, how many of them will accept the alternative drugs, how often the purchase order to be raised, way of maintaining record of stock in and stock out to be collected.

Statistical Analysis using SPSS

Next, statistical analysis to be done by SPSS for the analysis of normal distribution, frequency, correlation analysis on sample data for relationship between the variables. By the result of SPSS analysis, identified the variables that most influence the efficiency of the pharmacy supply chain.

Inventory Matrix

The various inventory analysis to be studied and selected the appropriate analysis by considering the necessary variables for research work and formed the inventory matrix. Finally, suggested the pharmacy person to review the drugs regularly those to be identified in matrix and discussed about the future work of the research.

Table I. Data's collected through questionnaire

Questionnaire Parameter	Hospital Pharmacy Total - 12	Private Pharmacy Total - 65
Database Facility	12	14
Awareness of Inventory Management	07	21
Using Inventory Management	04	06
Stock –outs	Yes – 09, No – 03	81%
Fulfill Customer needs	80%	62%
Existing method is efficient one	Agree – 7 Disagree – 5	Agree – 12 Disagree - 53

Table II. Skewness and kurtosis result for normal distribution

Sample size of 25 questionnaires	Skewness			Kurtosis		
	Skew Value	Standard Error (SE _s)	Z _s	Excess Kurtosis	Standard Error (SE _k)	Z _k
Experience	0.203	0.464	0.43	-0.994	0.902	-1.01
Apply	0.511	0.464	1.01	-0.614	0.902	-0.68
Method	0.289	0.464	0.62	-0.853	0.902	-0.94
Meet	0.318	0.464	0.68	-0.686	0.902	-0.76
Efficient	0.467	0.464	1.00	-0.348	0.902	-0.38

Table III. Correlation analysis between the variables

Variables	Correlations			
		Apply	Meet	Efficient
Apply	Pearson Correlation	1	.585**	.498*
	Sig. (2-tailed)		0.002	0.011
	N	25	25	25
Meet	Pearson Correlation	.585**	1	.537**
	Sig. (2-tailed)	0.002		0.006
	N	25	25	25
Efficient	Pearson Correlation	.498*	.537**	1
	Sig. (2-tailed)	0.011	0.006	
	N	25	25	25

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table IV. Inventory analysis and their considerations

Sl. No	Title	Basis	Variables to be considered
1	ABC (Always Better Control)	Value of Consumption	To identify inventory hot spots
2	FSN (Fast Moving, Slow Moving, Non- Moving)	Consumption pattern of the drugs	To control Obsolescence
3	HML (High, Medium, Low)	Unit price of the drug	Mainly to control purchases
4	XYZ	value of drugs in storage	To review the inventories and their uses at scheduled intervals
5	VED (Vital, Essential, Desirable)	Criticality of the drugs	To determine the stocking levels of drugs
6	SDE (Scarce, Difficult, Easy to obtain)	Problems faced in procurement	Lead time analysis and purchasing strategies
7	GOLF (Government, Ordinary, Local, Foreign Sources)	Source of the drugs	Procurement strategies
8	SOS (Seasonal, Off - Seasonal)	Nature of supplies	Procurement / holding strategies for seasonal items like Cold, cough syrups

Table V. Detailed ABC-FSN matrix analysis of the drugs

ABC - FSN Matrix	A			B			C			Total		
	ADE	%	No of Drugs	ADE	%	No of Drugs	ADE	%	No of Drugs	ADE	%	No of Drugs
F	5574	6.30	4	4120	4.65	5	2840	3.21	7	12534	14.16	16
S	7934	8.96	9	13824	15.61	15	11253	12.71	26	33011	37.28	50
N	9432	10.65	17	15204	17.17	19	18357	20.73	24	42993	48.56	60
Total	22940	25.91	30	33148	37.44	39	32450	36.65	57	88538	100	126

Table VI. Detailed ABC-FSN matrix analysis of the drugs

Category	No. of Items	Percentage of items (%)	Percentage of Annual Expenditure (%)
I	42	33.33	33.77
II	60	47.62	45.50
III	24	19.05	20.73
Total	126	100.00	100

Table VII. Priority system based on ABC – FSN matrix analysis

Priority	No. of Items	Percentage of items (%)	Percentage of Annual Expenditure (%)
I	42	33.33	33.77
II	84	66.67	66.23
Total	126	100.00	100.00

Questionnaire

1.	Name of the Pharmacy?	1. Community	2. Institutional
2.	How many years of experience do you have in the Pharmacy Department?		
	1 – Not at all aware 2 – Slightly aware 3 – Somewhat aware 4 – Moderately aware 5 – Extremely aware		
3.	Do you think that items available in your pharmacy are enough to cover all consumer needs?		
	1 – Never 2 – Almost never 3 – Occasionally/Sometimes 4 – Almost every time 5 – Every time		
4.	Are you storing additional quantities of medications more than the pharmacy needs		
	1 – Never 2 – Rarely 3 – Occasionally 4 – A moderate amount 5 – A great deal		
5.	How often do you have inventory counts and when do you order?		
	1 – Never 2 – Rarely 3 – Sometimes 4 – Often 5 – Always		
6.	Are you aware of Inventory control method?		
	1 – Not at all aware 2 – Slightly aware 3 – Somewhat aware 4 – Moderately aware 5 – Extremely aware		
7.	When will you apply the inventory management?		
	1 – Never use 2 – Almost never 3 – Occasionally/Sometimes 4 – Almost every time 5 – Frequently use		
8.	If the medication is unavailable, do you advise the consumer to take the alternative?		
	1 – Would not consider 2 – Might or might not consider 3 – Definitely consider		
9.	How much percentage of consumer will accept the alternative drugs.		
	1 – Would not consider 2 – Might or might not consider 3 – Definitely consider		
10.	What is the source from which you buy your medications and goods?		
	1 – No, and not considered 2 – No, but considered 3 – Yes		
11.	Do you buy your medications through purchasing groups and also write the reason for group purchasing		
	1 – No, and not considered 2 – No, but considered 3 – Yes		
12.	Do you believe that existing system which you are following is an efficient one?		
	1 – Strongly disagree 2 – Disagree 3 – Neither agree or disagree 4 – Agree 5 – Strongly agree

Figure 1: Presents the overview of the internal supply chain in the pharmacies.

Figure 2: Presents the overview of the supply chain in the hospital pharmacy.

Chart 1: Scatter Plot between the variables Apply, Meet and Efficient

RESULT AND DISCUSSION

Normal distribution analysis by SPSS

Skewness and kurtosis are done for the sample of 25 questionnaires to find the asymmetry and peakedness of the distribution. The SPSS tool gives the value of skewness and kurtosis as well as their standard errors. The z-score for skewness are calculated by the ratio of the skew value to the standard error of the skewness and the z-score for kurtosis are calculated by the ratio of excess kurtosis to the standard error of the kurtosis.

The z-score test are calculated for the variables, which are influenced mostly in the efficiency of the pharmacy supply chain. Here the variables considered are experience of the pharmacists, awareness of the pharmacists in inventory management, how many pharmacies applying the inventory method in their inventory management, how many pharmacies meet their customer requirements and the overall efficiency of the pharmacies. The values of the selected variables are collected in Likert scale and normal distribution test to be conducted by SPSS.

The result of SPSS is listed in the Table II, the absolute z-scores for either skewness or kurtosis are lies within +1.96 to -1.96 is significant at $p > 0.05$. So, conclude that the data obtained from the questionnaire are approximately normally distributed.

Correlation analysis

The bivariate correlation analysis is used to determine the linear relationship between the variables. Before performing the correlation analysis, the vital first step of scatter plot is performed to check the relationship between the variables. Here the scatter plot is performed to find the relationship between the variables of how many pharmacies are applying the inventory method, how many pharmacies meet the customer requirements with the overall efficiency of the pharmacies.

The Table III shows the correlation between the variables of implementation of inventory method, how much it will help to meet the customer requirements and efficiency of the pharmacies. The Pearson correlation co-efficient (r) equals to 0.585** indicated the strong linear relationship between the variables apply and meet and the correlation co-efficient values (r) of 0.498* and 0.537** shows the correlation between the variables Apply and Efficient, meet and efficient respectively. The correlation analysis predicted that the variables Apply, Meet and efficient are linearly correlated to each other. So, we can conclude that the implementation of inventory method in pharmacy will helps to provide high-quality service to the

customer and there will be an adequate supply of the items in the pharmacies.

Formation of Inventory matrix

Inventory system holds set of policies and controls that monitor levels of inventory and the basic purpose of inventory analysis is, how much to be the safety stock and when the purchase orders should be placed. Inventory analysis suits for manufacturing, distribution, retail, or services. Without inventory control, it's unable to maintain sufficient safety stock and fails to meet the needs of the customers. Many inventory analysis is there to provide better control. In that, below classification shows how to choose the required inventory analysis based on the required criteria.

In the above inventory analysis classification, concentrated on ABC & FSN analysis. The reason for not choosing the remaining analysis are the High, Medium and Low (HML) classification follow the same procedure as is adopted in ABC classification. The only difference is that in HML, the classification unit value is the criterion and not the annual consumption value. The SDE analysis is based upon the availability of items with supplier and is very useful in the context of scarcity of supply. But in pharmacy, a lot of suppliers need to deliver the necessary item without delay.

In medicine, there is no chance for opting the medicine as vital, essential and desirable. In hospital pharmacy the doctors prescribed only the medicines available in their pharmacy. so, there is no option for storing desirable medicines. According to the current trend, we can get the required thing from any part of the world within a day. So a procurement difficulty (GOLF analysis) doesn't affect the pharmacy service. The matrix formation of ABC & FSN analysis are shown in the tables IV to VII.

ABC Analysis

By random sampling method, the sample of 126 drugs to be selected from 872 drugs, in that around 19.04% of the drugs were found to account for 65.37% of the annual drug expenditure at the Rural Health Centre (24 drugs) and were classified as A drugs. Another 27.7% of the drugs (35 drugs) consumed 23.62% of the budget (B category), while the remaining 53.17% of the drugs (67 drugs) accounted for only 11.01% of the annual drug expenditure (C category).

Class A items being the most valuable items, while class C items are relatively large in number, but constitute a relatively small amount of annual use value. This method aims to draw

managers' attention on the critical few (A-items) and not on the trivial many (C-items). B-items are the interclass items, with a medium consumption value. The steps in doing the ABC analysis are: determine annual quantity usage of each item, multiply the annual quantity usage by the cost of the item to get the total annual dollar usage, add the total dollar usage of all items to get aggregate annual dollar inventory expenditure, divide the total dollar usage of each item by the aggregate inventory expenditure to reach the percentage of total usage for any item, list the in rank order by percentage of aggregate usage, and review annual usage distribution and classify items as A, B, or C.

FSN Analysis

FSN Analysis to classify items based on their movement from Inventory. Here the items are classified as Fast, Slow and Nonmoving items considering both Average stays of the item in Inventory and Consumption rate of the item. This analysis can be done with the collected. Table III shows the FSN analysis based on average stay. The preliminary step is the calculation of the Average Stay for all the items involved in the analysis. The formula to find: Average stay of the material = Cumulative No of Inventory Holding Days/ (Total quantity received + Opening Balance). The higher the Average stay of an item in the pharmacy, the slower its movement from Inventory. On the contrary, a fast-moving item will have a shorter stay in the pharmacy.

FSN analysis based on a consumption rate. First step in this analysis is the calculation of the Consumption rates for all the items involved in the Analysis. The formula to find Consumption Rate is Total issue quantity/Total period duration. A very high Consumption rate implies that the item is a fast-moving and a slow-moving item will have a low Consumption rate. FSN Analysis in Inventory takes into account both these criteria in determining the final FSN status of an item.

FSN analysis reveals that 58 out of 126 drugs were classified as F class drugs and it holds 56.3% of annual expenditure. Around 42 drugs were considered as S class holds 24.25% of expenditure and the remaining 26 drugs were of N class accumulates 19.45% of annual expenditure.

ABC – FSN Analysis

Table V describes the ABC-FSN matrix analysis in detail. The table allows for detailed description of the various subcategories according to the expenditure and number of drug items. Such analysis helps to study the ABC, FSN and ABC-FSN matrix at the same time. The initial step of obtaining the efficient pharmacy management, every pharmacy must prepare a table of this nature. The Table V shows the ABC - FSN matrix, it was formulated by cross tabulating the ABC and FSN analysis.

From Table VI, the resultant combination three categories were classified (categories I, II and III). Category I was constituted by drugs belonging to AF, AS, AN, BF and CF sub-categories. The BS, CS and BN sub-categories constituted the category II and the remaining drugs in the CN sub category constituted the category III. In the above sub-categories the first alphabet denotes its place in the ABC analysis, while the second alphabet stands in its place in the FSN analysis.

The table reveals the inventory matrix analysis of the sample of 126 drugs and their corresponding drug expenditure. Category I holds 33.33% of drugs with 33.77% of annual expenditure, another 47.62% of drugs under Category II and holds 45.50% of

the total budget. The remaining 19.05% of drugs accounted 20.73% of total drug expenditure. This categorization of drugs based on ABC – FSN matrix analysis helps in identifying the group of drugs needed the strict monitoring and control.

Priority based ABC – FSN Analysis

From Table VII, the drugs accounting less than 10% of annual expenditure are under Priority I, it includes 42 drugs out of 126. This category includes AF, AS, BF and CF of ABC – FSN Analysis. The remaining drugs of 84 are Priority II consisted of drugs under AN, BS, BN, CS and CN of inventory analysis, it holds 66.23% of annual expenditure. The drugs are narrowed down by the priority based analysis are tabulated in Table VII and it's simplifying monitoring and control strategies of pharmaceutical drugs and leads the pharmacy to provide customer requirements in an efficient manner.

CONCLUSION

From this study, the pharmacy purchasing and the stock maintenance procedure has been observed through a questionnaire. Along with the questionnaire, discussion was conducted with the pharmacy personnel to identify the existing supply chain and major issues with the inventory management system. Through this, it can be concluded that, inventories were not managed in an efficient manner because of the personnel involved in medicine supply were lack in logistic skills level and aware about the inventory control techniques. It clearly states that the inventory parameters such as lead time, forecast and cost involved in inventory, etc. are not influenced at the time of order raising. Inventory parameters are strongly related to the lead time. The lead time in this competitive world was in hours to one day so, the pharmacy managers mainly concentrate on the discounts offered by the supplier.

The constraints and problems faced by the hospital inventory management to be overcome by implementing a new inventory model and attain serviceability in an effective and efficient way. The initial step of achieving the efficient inventory model, the inventory analysis to be selected based up on the present situation. Then formed the priority based ABC – FSN inventory matrix and narrowed down the drugs for monitoring and control strategies of pharmacy drugs. In future work, inventory policies with demand and discounts, supplier rating are to consider to build an appropriate inventory control model for the pharmacies. If all these are done with high-quality service to the customer can be provided and there will be an adequate supply of the items in the pharmacies.

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