

**STUDY ON INVENTORY OPTIMIZATION AT RAJIV GANDHI CANCER INSTITUTE
AND RESEARCH CENTRE, DELHI**

1

Dr. Akashi Gola

Roll no- 1059

2nd year student

IIHMR, JAIPUR

GUIDED BY – Dr. Seema Mehta

INTRODUCTION

2

- **INVENTORY-** The quantity of goods or the materials.
- **INVENTORY CONTROL** –Inventory control refers to the use of techniques to control inventory in warehouses to minimize stock in hand while fulfilling customer orders on time. Various techniques like two bin method, quality control, forecasting, etc., are used for controlling inventory.
- The objective is to make inventory decisions that minimize the total inventory cost and optimize quality through the use of scarce resources to meet the actual needs of consumers in an efficient manner at the right time and at low cost to strike balance between ‘too much and too little’
- About one-third of the hospital budget is spent on purchasing various materials and supplies, including medicines, and forty per cent of budget spent on the procurement and management of stores. This urges effective and efficient inventory management to bring significant improvement in medical store management.

INTRODUCTION

3

This accelerates the probability of stock out and overstocking of essential drugs resulted in wastage or blockade of financial resources, increase in out-of-pocket expenditure, and ultimately decline in the quality of healthcare services.

- Inventory management is one essential lever to use the resources efficiently. However, managing inventories in hospitals is a challenging task because of several issues: a high service level of medical supplies is required under the unpredictable demand, medical products constitute a significant portion of the overall costs, and the management of these supplies requires considerable effort to check the levels to track usage and to distribute them.
- Therefore, it is relevance to apply operations research tools to cope with the managerial issues of the hospital inventory system. Hospitals are searching for alternatives way to stay competitive by reducing the cost to the organization. Economic Order Quantity is the method to efficiently run the inventory. An Economic Order Quantity could assist what could be the best order quantity at the lowest price.
- Essentially, the main purpose of the study is to suggest an effective forecasting model which helps to reduce inventory stocks using Economic order quantity and ABC analysis. All the In-patient's pharmacy medicines, and surgical items from past 3 years will be analysed.

RESEARCH QUESTION

- To identify an effective forecasting model, which helps to reduce the inventory cost using Economic Order Quantity and ABC Analysis.

OBJECTIVES

- To identify and select A Category drugs, medical consumables, and surgical instruments used in the hospitals.
- To forecast the demand of identified items using Seasonal Index and Linear Regression.
- To calculate the EOQ for identified items.

METHODOLOGY

5

Type of study: Quantitative analytical study

- **Location of study:** The study was conducted at the Rajiv Gandhi Cancer Institute & Research Centre.
- **Duration of study:** A study was conducted from March 21 to June 21, 2022
- **Study subject:** Secondary Data
- **Sample size:** Total Items in Hospital stores: 2358

Category A- 400/2360

Category B- 710/ 2360

Category C- 1250/2360

➤ Sample for analysis – 11 Medicines

6

4 Medical Consumables

➤ **Sampling Technique:** The non-probability convenience sampling method was used in the research process.

➤ **Sampling Selection:**

Inclusive - In-patient medicines and consumables

Exclusive - out- patient medical items

➤ **Data Collection Method:** secondary Data was collected through review of the past records & from the hospital Management Information System and formulate to calculate forecasting using excel.

➤ **Statistical Method Employed:**

Seasonal index

Least Square Regression

Data Analysis –

- The data of medicines, medical consumables, holding cost, and ordering cost & per unit cost was provided by the hospital.
- The first step was to identify monthly indent items from inpatient pharmacy. To find which items needs more attention compared to others, categorizes them into ABC category. Sort out the 2358 items in A, B& C category, then selected the 11 items from A category with high cost & 4 items with regular demand.
- then insert their historical demands (last 3 years consumption) into an excel sheet to see the trend of particular items.
- Find out their future demand using seasonal index & least square regression method with formula. After calculated future demand of every quarters.
- Economic order quantity was calculated using its mentioned formula.

OPERATIONAL DEFINATION

ABC ANALYSIS- All items have been classified based on its consumption value in the hospital.

(Consumption value = (Unit price of an item) (No. of units consumed per annum)

- A- These items consume 70% of the total inventory cost and are only 10%of the total inventory by quantity.
- B- These items consume 20% of the total inventory cost and are 20%of the total inventory by quantity.
- C- These items consume only 10% of the total inventory cost and 70%of the total inventory by quantity.
- **FORECASTING INVENTORY** – Inventory forecasting is a method used to predict inventory levels for a future time period. It also helps keep track of sales and demand so you can better manage your purchase orders.

- **ECONOMIC ORDER QUANTITY-** The Economic order quantity (EOQ) refers to the ideal order quantity a company should purchase in order to minimize its inventory costs, such as holding costs, shortage costs, and order costs.

Economic Order Quantity

$$EOQ = \sqrt{\frac{2 \times D \times S}{H}}$$

Where:

- S=Setup costs (per order, generally including shipping and handling)
- D=Demand rate (quantity sold per year)
- H=Holding costs (per year, per unit)

Analysis & Result

SECTION A

- The following are the results and interpretation of the study carried, for which out of 2358 items I have taken 15 items which included 11 items are from A category with high cost & 4 items with regular demand in which the quarterly demand of these items were provided by the IPD pharmacy of the past 3 years were analyzed.
- Fig. 1 depicting the forecasting of 2022

Item Name	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	SI(Q1)	SI(Q2)	SI(Q3)	SI(Q4)	Q1(2022)	Q2(2022)	Q3(2022)	Q4(2022)
Herclone-440	40	30	34	38	34	28	24	32	42	30	40	32	1.1	0.9	1	1	38	29	32	33
Hervycta Plus -440	22	20	18	19	21	17	15	16	25	19	22	21	1.1	0.9	1	1	23	18	20	21
Perzeta 420 ml	12	9	12	15	13	6	9	12	15	7	9	13	1.2	0.7	0.9	1.2	13	7	9	12
Keytruda 100 ml/gm	21	12	6	7	12	9	3	6	27	6	21	24	1.6	0.7	0.8	0.9	21	12	17	23
Uniplatin 50 ml/gm	4500	2700	3,600	3,150	3780	2790	3,390	4,050	3870	2700	3,510	4,230	1.2	0.8	1	1.1	4310	2882	3613	3985
Kemocarb 450 ml/gm	400	300	340	380	330	270	210	320	420	300	380	310	1.2	0.9	0.9	1	368	277	308	319
Mitotax 30 ml/gm	2700	1800	2,160	1,890	2430	1080	1,530	2,340	1980	900	1,260	2,160	1.3	0.7	0.9	1.2	1819	921	1146	1405
Irinot 100 Mg	420	280	330	370	310	260	210	300	410	230	420	330	1.2	0.8	1	1	362	274	304	315
5-Flucel	13500	9000	11,250	10,800	12600	8100	11,700	12,150	10500	6300	9900	12,400	1.1	0.7	1	1.1	10804	6783	9557	10367
Asviia 3750 U	34	30	28	48	26	22	14	40	54	34	48	60	1	0.8	0.8	1.4	56	44	51	55
Examination Gloves Medium	20160	22500	20,500	20,900	18160	21100	18,000	20,400	21160	21300	21,500	21,400	1	1.1	1	1.1	20935	22876	21251	22148
Blood Glucose Strips (1*100)	30	22	25	23	26	21	24	25	26	22	25	27	1.1	0.9	1	1	27	21	24	25
Atracurium Inj (NEON)	1800	1000	1,200	1,150	1300	500	900	1,075	1150	650	990	1200	1.3	0.7	1	1.1	1080	555	755	789
Double Lumen CatheterR 16G (B.BRAUN)	1500	1000	1,200	1,100	1400	600	1,050	1,350	1225	550	990	1325	1.1	0.9	1	1	1175	576	940	1012
Infusable Pressure Bag 500ML	400	350	370	360	330	220	270	320	310	210	290	330	1.1	0.8	1	1.1	290	212	227	227

INTERPRETATION

12

- Seasonal index is the measure of the quarterly consumption compared to the annual average consumption. Here the seasonal index of 2022 is forecasted using least square regression method. The base is of 2019 consumption and then multiplied by seasonal index to find the average consumption in next years.
- There has been increase in demand for Hervycta plus-400 , Herclone -400, Asviia 3750 U , Examination Gloves Medium for the year 2021 when compared to 2019 & 2020.
- There has been increase in demand for Perjeta 420mg inj. , Kemocrab 450ml/mg , Mitotax 30ml/mg , Irinot 100 mg , 5 -Flucel , Atracurium Inj. (NEON) , Double Lumen Catheter 16g (B.BRAUN) , Infusible Pressure Bag 500 ml , for the year 2019 when compared to 2020 & 2021.
- There has been increase demand for Blood Glucose-strip for the year 2019 & 2021 when compared to 2020.
- There has been increase in demand for Uniplatin 50ml/mg , Keytruda 100ml/mg for the year 2021 when compared to 2019 & 2020.
- And the trend was captured & reflected in the forecasted value for the year 2022.

SECTION B

- Utilizing the seasonal index technique of predicting, demand was determined. whereas, the hospital provided ordering cost and holding cost . EOQ has calculated using

Economic Order Quantity

$$EOQ = \sqrt{\frac{2 \times D \times S}{H}}$$

- Fig No. 2 depicting Economic Order Quantity of 15 items.

ITEM	Q1					Holding	Cost	Ordering Cost (10				
	2022	Q2 2022	Q3 2022	Q4 2022	unit cost	(7% Of Cost)	Unit	% Of Unit Cost)	EOQ Q1	EOQ Q2	EOQ Q3	EOQ Q4
Herclone-440	38	29	32	33	50000		3500	5000	10	9	10	10
Hervycta Plus - 440	23	18	20	21	32000		2240	3200	8	7	8	8
Perzeta 420 ml	13	7	9	12	2,50,000		17500	25000	6	4	5	6
Keytruda 100 ml/gm	21	12	17	23	1,70,000		11900	17000	8	6	7	8
Uniplatin 50 ml/gm	4310	2882	3613	3985	350		25	35	111	91	102	107
Kemocarb 450 ml/gm	368	277	308	319	2000		140	200	32	28	30	30
Mitotax 30 ml/gm	1819	921	1146	1405	1148		80	115	72	51	57	63
Irinot 100 Mg	362	274	304	315	1148		80	115	32	28	29	30
5-Flucel	10804	6783	9557	10367	60		4	6	176	139	165	172
Asviia 3750 U	56	44	51	55	16000		1120	1600	13	11	12	13
Examination Gloves Medium	20935	22876	21251	22148	20		1.4	2	245	256	246	252
Blood Glucose Strips (1*100)	27	21	24	25	900		63	90	9	8	8	8
Atracurium Inj (NEON)	1080	555	755	789	38		2.7	3.8	56	40	46	47
Double Lumen CatheterR 16G (B.BRAUN)	1175	576	940	1012	1600		82	118	58	41	52	54
Infusable Pressure Bag 500ML	290	212	227	227	4500		315	4500	29	25	25	25

INTERPRETATION-

15

➤ The optimal quantity ordered to meet projected demand and minimize associated costs when holding and ordering costs are assumed to be 7 percent and 10 percent of unit cost for each quarter is following as

- Herclone plus-440 is 10, 9, 10, 10
- Hervytca-440 is 8, 7, 8, 8
- perjeta 420 ml is 6, 4, 5, 6
- Keytruda 100 ml/mg is 8, 6, 7, 8
- Uniplatin 50 ml/mg is 111, 91, 102, 107
- Kemocarb 450ml/mg is 32, 28, 30, 30
- Mitotax 30 ml/mg is 72,51, 57, 63
- Irinot 100 Mg is 32, 28, 29, 30
- 5-Flucel is 176, 139, 165, 172
- Asviia 3750 U is 13, 11, 12, 13
- Examination Gloves Medium is 245, 256, 246, 252
- Blood Glucose Strips (1*100) is 9,8, 8, 8
- Atracurium Inj (Neon) is 56, 40 ,46, 47
- Double Lumen Catheter 16g (B.Braun) is 58, 41, 52, 54
- Infusable Pressure Bag 500ml is 29, 25, 25, 25

Conclusion

- An economic order quantity and a forecasting model were given to them in order to aid in decreasing their stock outs. In order to minimise the problem of hospital product stock out, the economic order quantity optimises the order quantity for each product when an order is placed. The results have demonstrated improvements in forecasting through the provision and recommendation of the inventory control model. This method of forecasting will ensure the optimum items quantity in stock, which would increase profit & reduce inventory holding cost by forecasting according to the seasonal variations.

References

17

1. [Internet]. 2022 [cited 24 March 2022]. Available from: https://www.researchgate.net/publication/312023629_A_case_study_on_the_determination_of_EOQ_-_model_analysis_and_insights
- 2.[Internet]. Gijhsr.com. 2022 [cited 25 March 2022]. Available from: https://www.gijhsr.com/GIJHSR_Vol.2_Issue.1_March2017/3.pdf
3. [Internet]. 2022 [cited 25 March 2022]. Available from: https://www.researchgate.net/publication/332212917_A_PROBABILISTIC_ECONOMIC_ORDER_QUANTITY_EOQ_MODEL_FOR_INVENTORY_MANAGEMENT_OF_DRUGS_AND_HOSPITAL_CONSUMABLES
4. Organization S. Optimal Health Care Inventory Management Using Analytics [Internet]. Academia.edu. 2022 [cited 25 March 2022]. Available from: https://www.academia.edu/15572240/Optimal_Health_Care_Inventory_Management_Using_Analytics
- 5.Mohammed SA, Workneh BD. Critical Analysis of Pharmaceuticals Inventory Management Using the ABC-VEN Matrix in Dessie Referral Hospital, Ethiopia. Integr Pharm Res Pract. 2020; 9:113-125
<https://doi.org/10.2147/IPRP.S265438>
- 6.Ida Fitriana, Raden Gagak Donny Satria and Dwi Cahyo Budi Setiawan, 2018. Medicine Inventory Management by ABC-VED Analysis in the Pharmacy Store of Veterinary Hospital, Yogyakarta, Indonesia. Asian Journal of Animal and Veterinary Advances, 13: 85-90.
7. Gupta, R., Gupta, K. K., Jain, B. R., & Garg, R. K. (2007). ABC and VED Analysis in Medical Stores Inventory Control. Medical journal, Armed Forces India, 63(4), 325–327. [https://doi.org/10.1016/S0377-1237\(07\)80006-2](https://doi.org/10.1016/S0377-1237(07)80006-2)
8. Gupta, N., & Krishnappa, P. (2016). Inventory Analysis in a Private Dental Hospital in Bangalore, India. Journal of clinical and diagnostic research: JCDR, 10(11), IC10–IC12. <https://doi.org/10.7860/JCDR/2016/23273.8898>

Thank You