

**A study on inventory control using ABC analysis,
Forecasting and Economic order quantity at CIMS
hospital, Ahmedabad**

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Introduction

- At present, all the hospital maintains their own inventory management techniques, but they are still facing problem in achieving effective management. To attain the effectiveness, the flow of medical items needs to be managed in all aspects to overcome overstocking, expiry, stock out, etc. Supply chain for hospital is the areas in which alternatives and compromise are not acceptable and organizations are pressurizing to give quality of care. The issue related stock out leads to profit loss as well as sales loss. With today's uncertain economy hospitals are searching for alternative ways to keep ahead of their competitors by effectively driving sales and by cost reduction.

Rational

The current forecasting method at CIMS hospital has problem due to ineffective forecasting that resulted in product stock outs, increase holding cost and loss of sales. The current forecasting method is simple average, by this method variability in not taken into consideration, that's leads to product stocks outs.

Objective

To suggest alternative ways to reduce inventory stock outs and loss of sales by providing more effective forecasting method using Economic order quantity and ABC analysis.

Research questions

What are the alternative ways to reduce hospital's stock outs and loss of sales?

Methodology

Study Setting

This study
took place at CIMS
hospital, Ahmedabad
from 15th February
2019 to 25th April 2019

Sample size calculation

Monthly indent Items IPP = 3194

Item category: A = $257/3194 = 8.04\%$

B = $565/3194 = 17.16\%$

C = $2372/3194 = 74.26\%$

Samples for analysis: Category A (257 items)

Items with regular demand = 12

Items with uncertain demand = 12

- **Sampling methods:** Purposive sampling
- **Study type:** Observational study
- **Research instruments:** Data was collected directly from Management Information System of CIMS hospital and Format to calculate forecasting using excel
- **Statistical methods employed:** Lest square regression
Seasonal index
- **Inclusion Criteria:** Inpatients medical and surgical items
- **Exclusion Criteria:** Outpatient Medical items

Forecasting method

Simple average

- This forecasting method was used in CIMS hospital. In this method they decide the demand quantity using last three months' consumption average of each item. They order the same quantity for the next month.

Seasonal Index

- This method is used to find the accurate demand when there is a seasonal fluctuation with the consumption pattern.
- To calculate seasonal index...
 - ✓ We take the yearly average or quarterly sales.
 - ✓ Divide each quarterly sales figure by its yearly average.
 - ✓ Take the average of these index of each quarter to get seasonal index values.

Least square regression

- $Y = a + bX$

Y – Dependent variable

a – y - intercept (value of Y when $X=0$)

b – Slope

X – independent variable

$$b = \frac{\sum xy - n \cdot \bar{x} \bar{y}}{\sum x^2 - n \cdot \bar{x}^2}$$

$$a = \bar{y} - b \cdot \bar{x}$$

EOQ

An EOQ is used to minimize stock outs and find the optimal order quantity while minimize total cost associated with each product. The holding cost and order cost are equal when the optimal order quantity is obtained. As mention in the literature review, all the variables needed in order to calculate the optimal order quantity.

Formula EOQ:

$$Q = \sqrt{\frac{2DS}{H}}$$

D= Demand

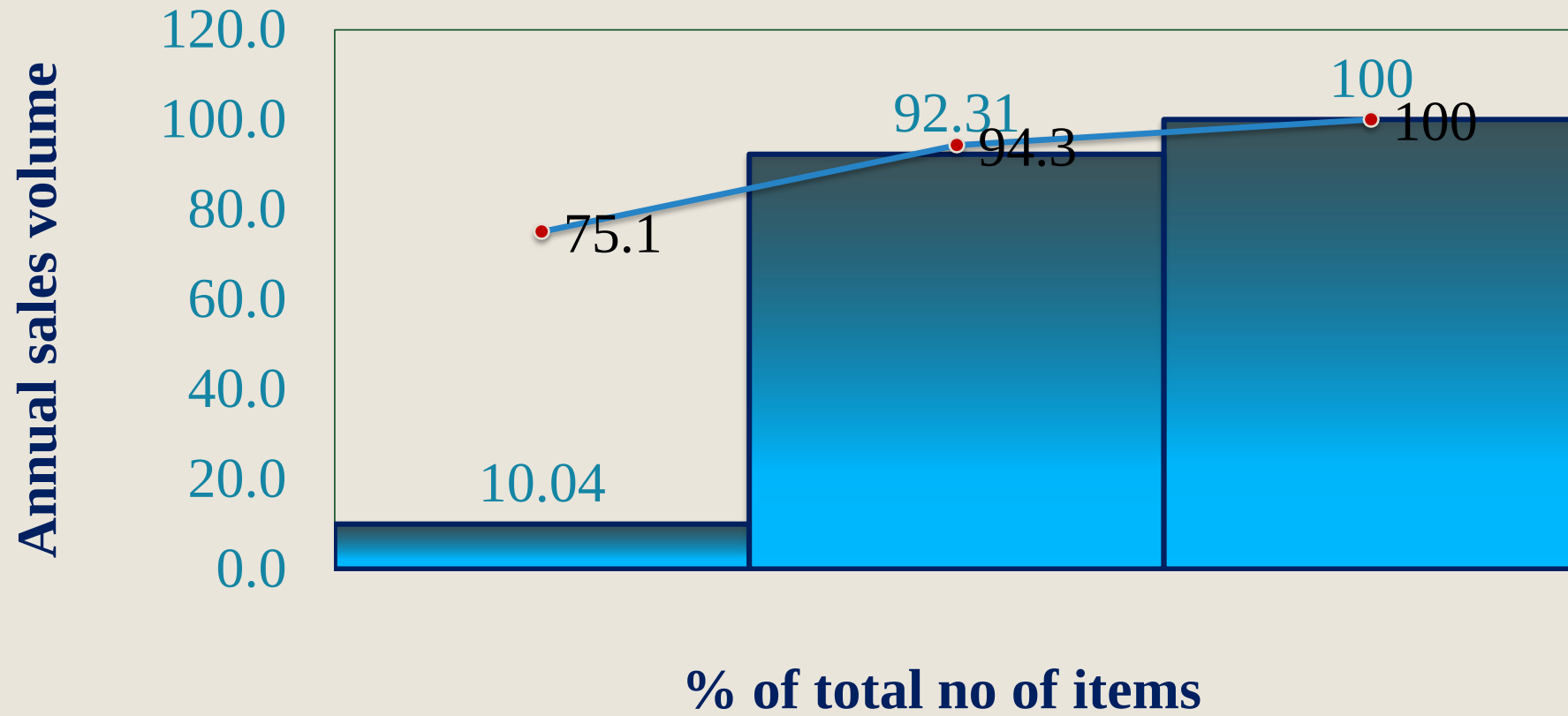
S= Ordering Cost

H= Holding Cost

Cost estimation

- Holding cost = $Q/2 * H$
- Ordering cost = $D/Q * s$
- $TC = Q/2 * H + D/Q * S$

ABC analysis

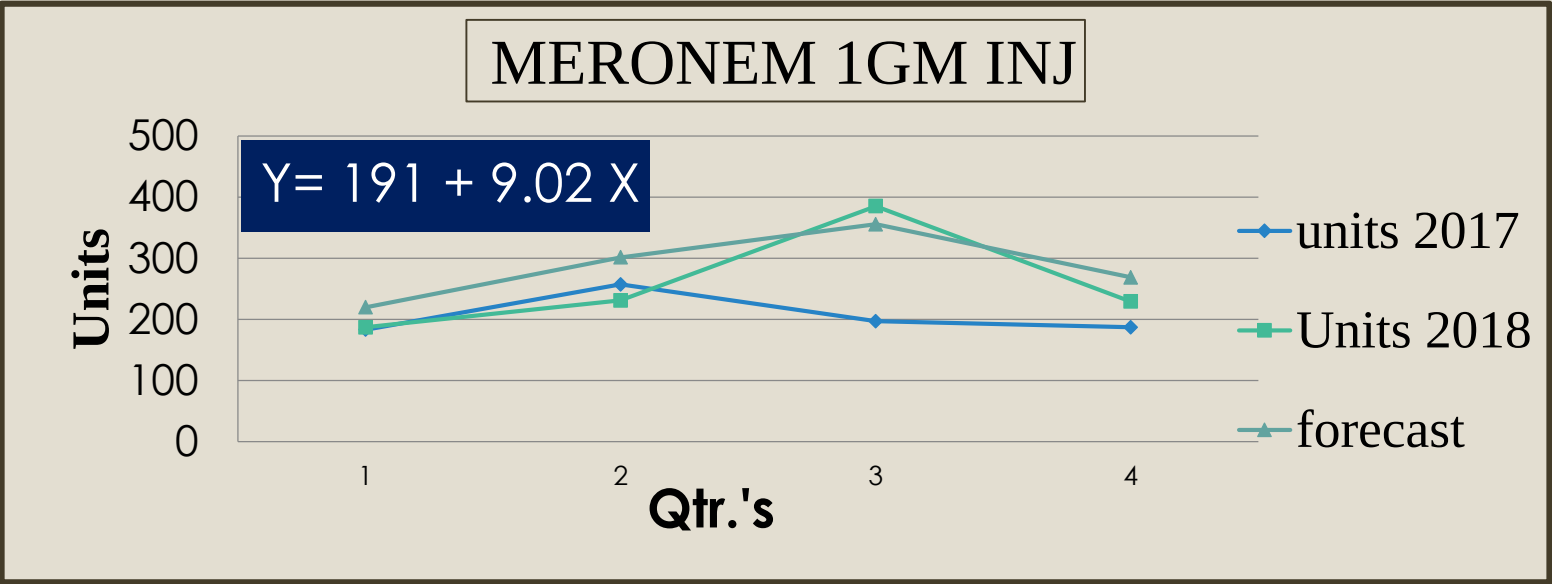


Results

MERONEM 1GM INJ				
Qtr.'s	Units 2017	Units 2018	Forecast	Seasonal index
1	183	187	220	0.81
2	257	231	301	1.07
3	197	385	355	1.22
4	187	229	269	0.90

MERONEM 1GM INJ	
1	88
2	110
3	31
Ave	76
EOQ = 25	

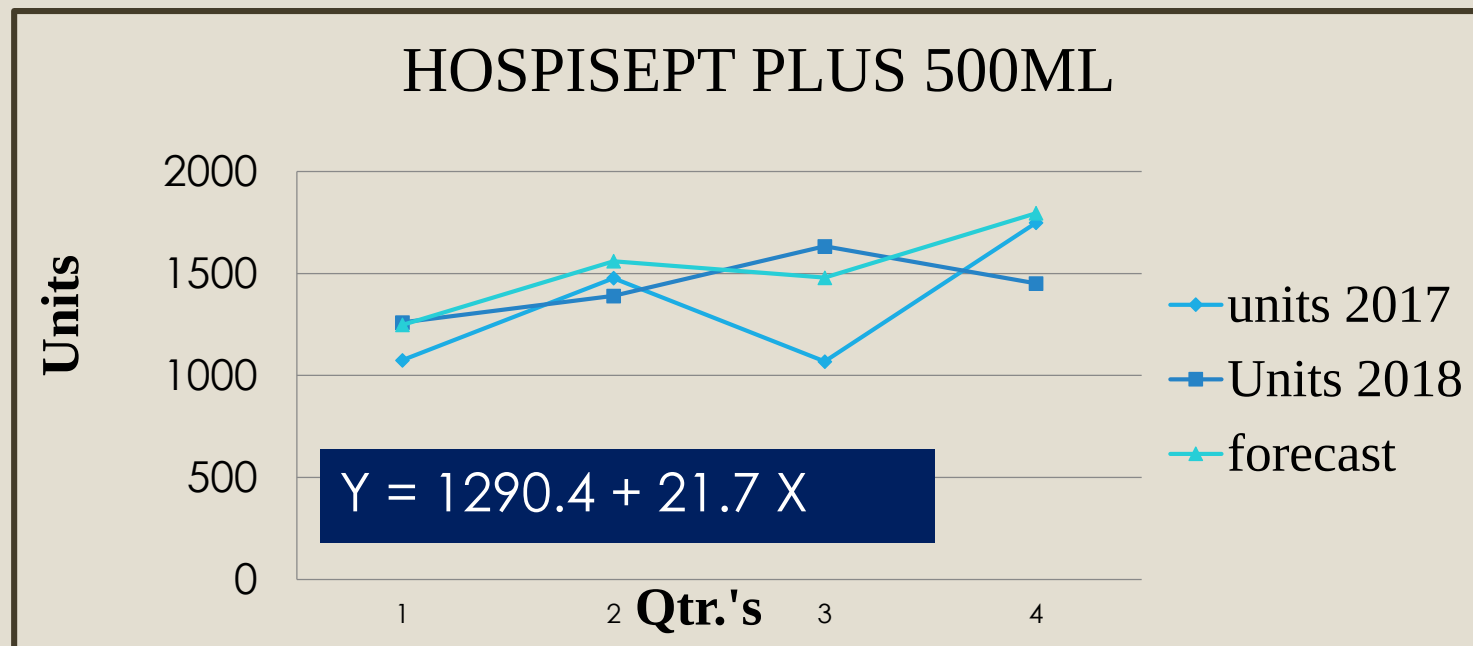
Forecast for 1 month = 73



HOSPISEPT PLUS 500ML				
Qtr.'s	Units 2017	Units 2018	Forecast	Seasonal index
1	1075	1260	1248	0.84
2	1477	1390	1561	1.04
3	1068	1633	1480	0.97
4	1749	1451	1796	1.16

HOSPISEPT PLUS 500ML	
1	514
2	447
3	490
Ave	484
EOQ = 68	

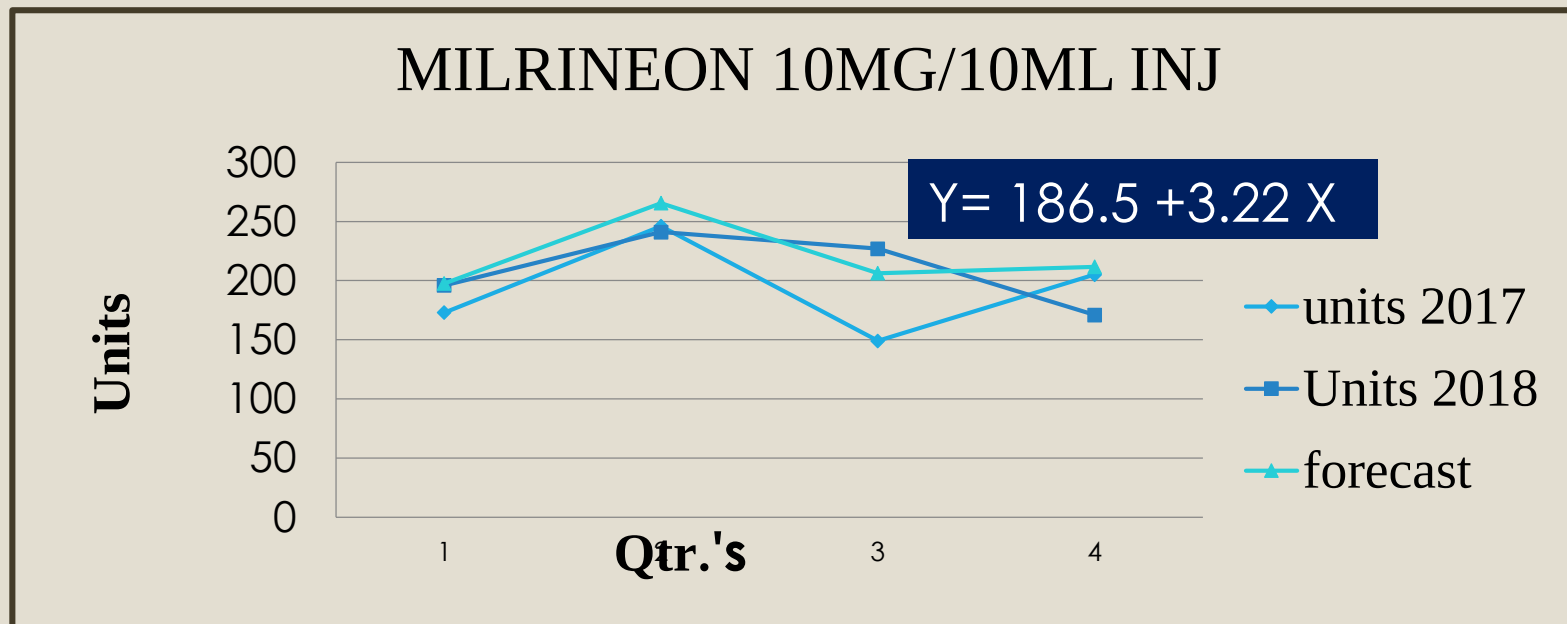
Forecast for 1 month : 416



MILRINEON 10MG/10ML INJ				
Qtr.'s	Units 2017	Units 2018	Forecast	Seasonal index
1	173	196	198	0.92
2	246	241	266	1.21
3	149	227	206	0.93
4	205	171	212	0.94

MILRINEON 10MG/10ML INJ	
1	60
2	66
3	45
Ave	57
EOQ = 24	

Forecast for 1 month = 66



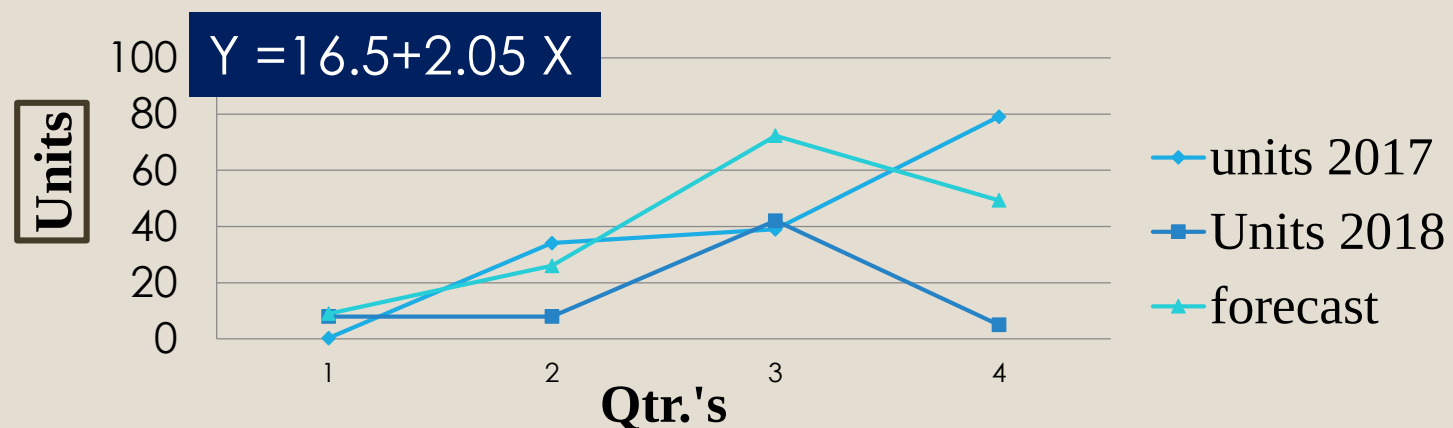
XYLISTIN FORTE PLUS 3MIU-IV				
Qtr.'s	Units 2017	Units 2018	Forecast	Seasonal index
1	0.3	8	9	0.26
2	34.1	8	26	0.70
3	39	42.1	72	1.85
4	79.1	5	49	1.20

XYLISTIN FORTE PLUS 3MIU-IV	
1	2
2	2
3	1
Ave	2

EOQ = 5

Forecast for 1 month = 3

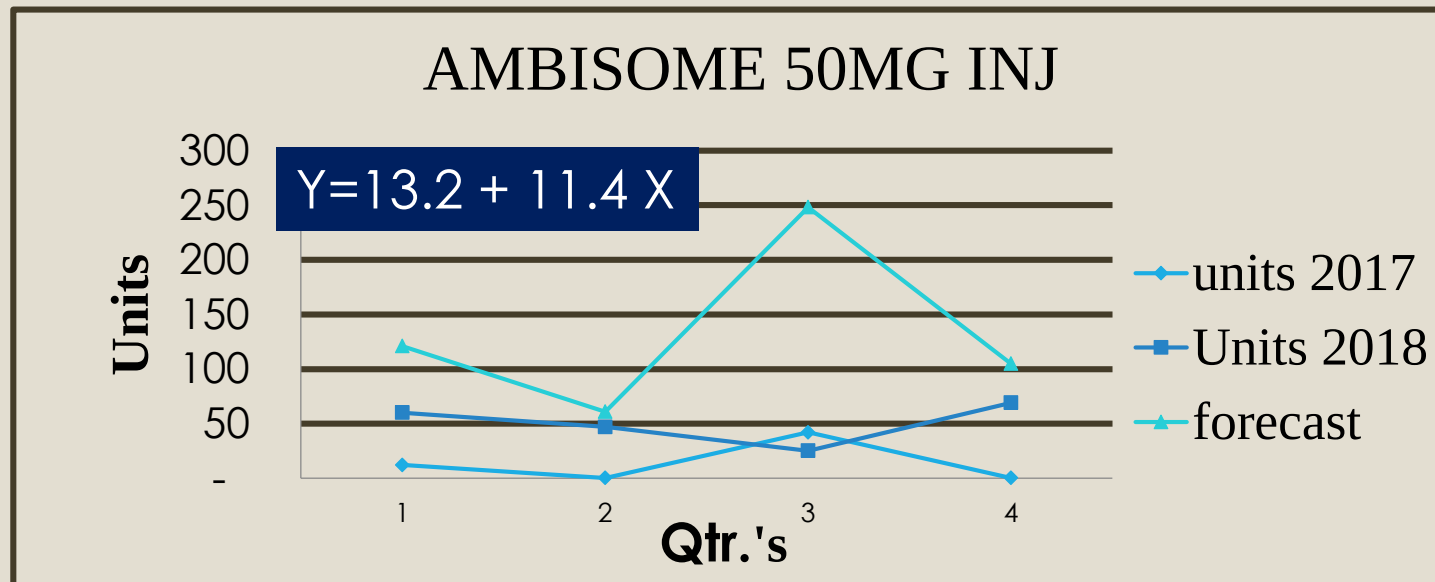
XYLISTIN FORTE PLUS 3MIU-IV



AMBISOME 50MG INJ				
Qtr.'s	units 2017	Units 2018	forecast	seasonal index
1	12	60	121	1.04
2	0	47	61	0.48
3	42	25	248	1.78
4	0	69	105	0.70

AMBISOME 50MG INJ	
1	3
2	66
3	0
Ave	23
EOQ = 18	

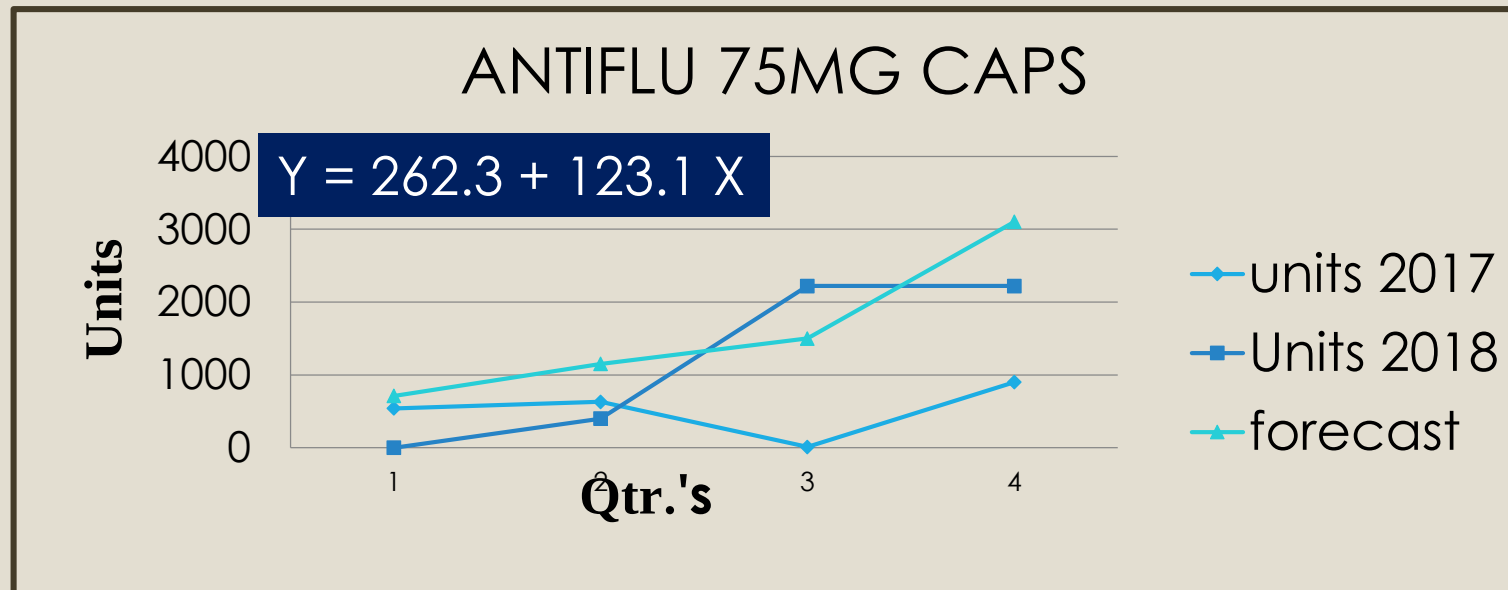
Forecast for 1 month = 40



ANTIFLU 75MG CAPS				
Qtr.'s	units 2017	Units 2018	forecast	seasonal index
1	540	0.3	712	0.52
2	630	400.2	1152	0.77
3	10.2	2220	1499	0.93
4	900.2	2220	3102	1.78

ANTIFLU 75MG CAPS	
1	670
2	1050
3	500
Ave	740
EOQ = 47	

Forecast for 1 month = 237



EOQ of current and Recommended method

	Current	Recommended
	EOQ	EOQ
I1	76	25
I2	484	68
I3	49627	646
I4	131	34
I5	263	48
I6	47	23
I7	57	24
I8	65	26
I9	1023	102
I10	151	33
I11	219	45
I12	110	34
I13	2	5
I14	23	18
I15	37	14
I16	146	31
I17	528	100
I18	9	9
I19	740	47
I20	823	78
I21	52	15
I22	153	21
I23	243	63
I24	57	29

Current method				Recommended method			
Qtr. HC	Qtr. OC	D.C	Total Cost	Qtr. HC	Qtr. OC	D.C	Total Cost
13007.20	1510.88	108393.3	122911	4340.97	4340.97	103934.9	112617
6218.41	144.00	51820.0	58182	877.67	877.67	44578.2	46334
7384.50	1.40	61537.5	68923	96.14	96.14	55012.7	55205
7291.20	488.25	60760.0	68539	1877.10	1877.10	60138.3	63892
4930.30	174.97	41085.9	46191	908.95	908.95	39349.5	41167
201.52	40.02	1679.3	1921	98.07	98.07	2002.6	2199
3365.28	498.75	28044.0	31908	1392.97	1392.97	32420.4	35206
1817.40	235.42	15145.0	17198	718.71	718.71	18284.3	19722
957.22	8.74	7976.8	8943	95.35	95.35	8669.1	8860
375.91	21.76	3132.6	3530	82.18	82.18	2586.3	2751
237.57	9.34	1979.8	2227	48.81	48.81	2125.7	2223
176.88	14.30	1474.0	1665	53.92	53.92	1694.2	1802
160.31	897.75	1335.9	2394	509.73	509.73	2411.8	3431
8618.40	3071.54	71820.0	83510	6765.22	6765.22	124172.7	137703
8437.44	2217.60	70312.0	80967	3092.47	3092.47	35937.3	42122
4826.23	309.23	40218.6	45354	1032.45	1032.45	28725.9	30791
1914.68	43.41	15955.7	17914	362.39	362.39	25211.0	25936
1195.38	1282.40	9961.5	12439	1288.58	1288.58	10789.8	13367
3258.96	41.14	27158.0	30458	207.36	207.36	8710.1	9125
5421.92	60.00	45182.7	50665	511.92	511.92	36397.6	37421
2077.05	372.80	17308.7	19759	593.65	593.65	7877.7	9065
1756.53	101.75	14637.8	16496	244.22	244.22	4884.8	5373
1784.12	68.58	14867.7	16720	465.47	465.47	26327.7	27259
1645.60	288.00	13713.3	15647	841.47	841.47	20488.1	22171
			824462				755742

Cost estimation

Cost estimation: Total cost					
Current method			Recommended method		
Holding cost	Order cost	cost of consumption	Holding cost	Order cost	cost of consumption
87060	11,902	7,25,500	26,505	26,505	7,02,730
Overall cost		824462	Overall cost		755740
Total savings			6,73,294		

Discussion

- After analysing the results, the current forecasting model showed that the hospital inventory holding cost was high due to excess storage of medical and surgical items as compared to proposed forecasting model and economic order quantity model shows reduction in overall total cost.
- For instance, the cost estimate table shows the total savings with each items. If the hospital proceeds in implementing the recommended forecasting model along with the economic order quantity, it would help them save approximately Rs. 6.73,294 per quarter.

- The recommended model aids the company in forecasting more accurately according to each product and their demand variations. Along with the forecasting model, the economic order quantity allows the company to optimize each order and reduce the inventory holding cost as well as total cost.
- As a result, the recommended method would ensure enough products are in stock to satisfy patient demand and save money.

Conclusion

- The current model for forecasting used by CIMS hospital has some problems due to unproductive forecasting that leads to lose of sales and stock outs. In order to deal with this problem, also reduce stock outs.
- The new proposed model of forecasting allows a more accurate results for different items according to there seasonal variations. The economic order quantity helps us to decide optimum quantity for each product during the placement of order.

- An effective forecasting have shown improvements in forecasting as well as in cost reduction. The seasonal index forecasting method helps to reduce inventory holding cost around Rs. 60555. So, if the CIMS hospital follows and implements the recommended forecasting, Economic order quantity model, they would be able to reduce the total cost by approximately Rs. 6,73,294 per quarter. The problem CIMS hospital faces would be reduced by implementing the proposed forecasting and Economic order quantity model. The model will ensure the optimum items quantity in stock, which would increase profit and reduce inventory holding cost.

