RESEARCHARTICLE

MANAGEMENT OF DRUGS USING 3 D MUSIC INVENTORY CONTROL TECHNIQUE IN A TERTIARY CARE HOSPITAL

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ARTICLE INFO	ABSTRACT

Background: The medical store is one of the most extensively used facilities of the hospital. Approximately 35% of annual hospitals budget is spent on buying materials and supplies, including medicines and hence it is essential that health managers use scientific methods to achieve efficient management and patient satisfaction.
Aim and objectives: To apply Selective Inventory Control techniques for the drugs used in Intensive Care Unit of Tertiary care teaching hospital.
Materials and methods: The annual consumption and expenditure incurred on each item of controlled drugs in Medical ICU for the year 2013-14 was analyzed and inventory control techniques, i.e. ABC, VED and ABC-VED matrix analysis, were applied.
Results: It was observed that 14 medicines (43.33%) out of 30 were classified in the category1(AV+BV+CV+AE+AD) for stringent control.
Conclusion: Scientific inventory control management to be applied for efficient management of medical stores.

INTRODUCTION

Quality of care in tertiary care hospitals is also sensitive to the timely availability of facilities including drugs. The medical store is one of the most extensively used facilities of the hospital and one of the few areas where a large amount of money is spent on purchases on a recurring basis. This emphasizes the need for planning, designing and organizing the medical stores in a manner that results in efficient clinical and administrative services (Kunders *et al*., 2000). The goal of the hospital supply system is to ensure that there is adequate stock of the required items so that an uninterrupted supply of all essential items is maintained (Kidwai, 1992). A study from a 1500-bedded state-funded hospital has claimed that review and control measures for expensive drugs brought about 20% savings (Pillans *et al*., 1992). Approximately 35% of annual hospitals budget is spent on buying materials and supplies, including medicines. This requires effective and efficient management of the medical stores. Efficient priority setting, decision making in purchase and distribution of specific drugs, close supervision on drugs belonging to important categories, and prevention of pilferage depend on the drug and inventory management (Doshi *et al*., 2007).Drug inventory management aims at cost containment and improved efficiency (Thawani *et al*., 2004).

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Inventory control is very essential in a developing country like India. India is a country of scarce resources and it is the primary responsibility of each hospital to ensure optimum utilization of available resources to provide good service or quality patient care (Gupta and Kant, 2000). It is essential that health managers use scientific methods to maximize their returns from investment at a minimal cost (Ramanathan, 2006; Das, 2001 and Gopalakrishnan and Sundaresan, 1985). Inventory analysis seeks to achieve maximal output with minimal investment input, based on the economic principle of stretching the limited means to meet unlimited ends (Beier, 1995).

There is no denying that stocking hospital pharmaceuticals and supplies can be expensive and tie up a lot of capital, and bringing efficiencies to such important cost drivers—often 30% - 40% of a hospital's budget—can present meaningful savings(Anonymous, 2008).Inventory is a necessary part of doing business and provided by most organizations in any sector of economy (Tersine, 1994). Thus, a hospital materials manager must establish efficient inventory system policies for normal operating conditions that also ensure the hospital's ability to meet emergency demand conditions (Duclos, 1993).

Aim

Application of Selective Inventory Control techniques for the controlled drugs used in Intensive Care Unit of Tertiary care teaching hospital.

Objectives

1) To identify the categories of controlled drugs in Medical ICU which need stringent management control
2) To identify the item categories requiring greater supervisory monitoring
3) Application of collective inventory control techniques to analyze and effectively and efficiently manage medical stores in the ICU.

MATERIALS AND METHODS

The data of annual consumption and expenditure incurred on each controlled drugs in Medical ICU for the financial year 2013-14 were collected from the receipt - expense register. The data were then transcribed in an MS Excel spreadsheet. The statistical analysis was carried out using the MS Excel statistical functions. Annual expenditure for each controlled drug used in ICU were calculated for Jan 2014 – Dec 2014.

ABC analysis

ABC analysis of all the controlled drugs used in the ICU was done. For this, the annual expenditure of individual items was arranged in descending order. The cumulative cost of all the items was calculated. The cumulative percentage of expenditure and the cumulative percentage of number of items were calculated. This list was then subdivided into three categories: A, B and C based on the cumulative cost percentage of 70, 20 and 10% respectively.

VED analysis

The VED criticality analysis of all the listed items was performed by classifying the items into vital (V), essential (E) and desirable (D) categories.ICU(Med)panel of specialists were used to decide upon the criticality of items.VED value given as per consensus of more than 50% members of the specialist panel. The final list of drugs arranged on the basis of criticality by medical experts was analyzed for concurrence of opinion regarding classification.

ABC –VED matrix

The ABC-VED matrix was formulated by combining the ABC and VED analysis to evolve a management system, which can be used for prioritization. From the resultant combination, three categories were classified (I, II and III). Category I was constituted by items belonging to AV, AE, AD, BV and CV subcategories. The BE, CE and BD subcategories constituted category II, and the remaining items in the CD subcategory constituted category III. In these subcategories, the first alphabet denotes its place in the ABC analysis, while the second alphabet stands for its place in the VED analysis.

Music 3D

Drugs with High and low consumption were determined based on ABC analysis. A drugs with 70% of annual expenditure were considered to be high consumption value and those with 10% of annual expenditure to be Low consumption value. Both

high and low consumption items were further classified based on Criticality (VED analysis) to avoid any stock outs.

Limitations of Study

1) Study conducted for only controlled drugs in medical ICU.
2) Only medical specialist were discussed for VED analysis.

RESULTS AND DISCUSSION

ABC analysis of all the controlled drugs used in the ICU as shown in (Table 1)

Table 1.ABC analysis of all the controlled drugs used in ICU

S No	Drug analysis	Category			Total
		A	B	C	
1.	Total annual consumption (%)	71.8%	19.7%	8.5%	100%
2.	Value of annual consumption (Rs)	46,90,296	12,77,075	5,56,229	65,23,600
3.	No of items	5	6	19	30
4.	Percentage of items	17 %	20%	63%	100%

ABC Distribution Cost

Distribution of cost of drugs as per ABC Analysis is shown below in Figure 1
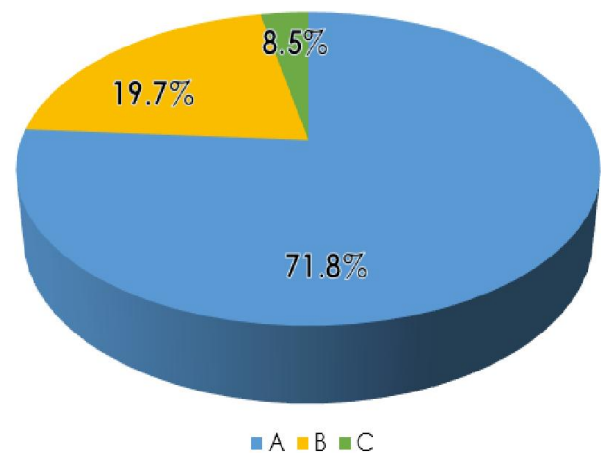

Fig. 1. Distribution of cost of drugs as per ABC analysis

VED analysis

VED analysis of all the controlled drugs used in Medical ICU.VED value given as per consensus of more than 50% members of the specialist panel as shown in (Table 2) below

Table 2. VED analysis of all the controlled drugs

Category	No of drugs	Percentage of Total
V	11	36.6 %
E	10	33.3 %
D	9	30 %
TOTAL	30	100 %

VED chart

No. of drugs and Percentage of expenditure incurred for the drugs shown in Figure 2 below:
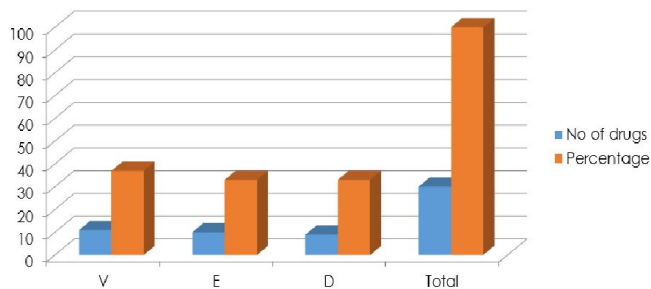

Fig. 2.No. of drugs and percentage of expenditure incurred for the drugs

ABC-VED Matrix

The ABC-VED matrix analysis classification of the inventory reveals the nine different subcategories (AV, AE, AD, BV, BE, BD, CV, CE and CD). These nine subcategories shown in (Table 2) were further grouped into three main categories, categories I, II and III. The total value of drugs in each category I, II & III were 82.40% (Rs.53, 72,070.00/-), 14.90% (Rs. 9, 73,800.00/-) and 2.70% (Rs. 1, 77,730.00/-) of total annual drug expenditure (ADE) of the medical stores respectively (Table 4).

CATEGORY WISE COST DISTRIBUTION

Graph showing Cost distribution for each category of the drugs below in (Graph 1 & 2)
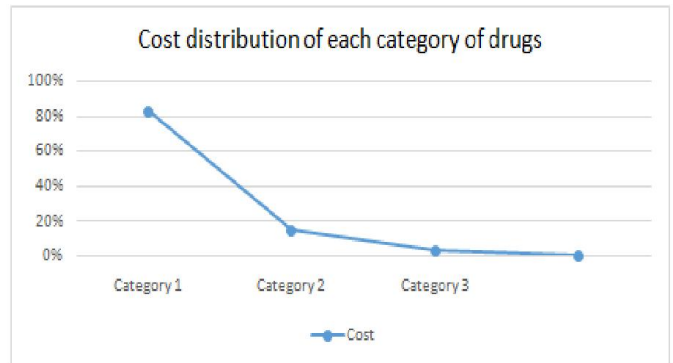
Graph 1. Cost distribution for each category of the drugs

DISCUSSION

ABC analysis of controlled drugsused in Intensive care Unit of 1000 bedded tertiary care hospitals revealed that out of 30 items in the drug list worth Rs 65,23,600 considered for the study, 17 % (5), 20% (6) and 63% (19) items were found to be A, B and C category items, respectively, amounting for 71.80% (Rs. 46,90,296.00/-), 19.70% (Rs. 12,77,075.00/-) and 8.5% (Rs. 5,56,229.00/-) of ADE of the medical stores.

Table 2. The ABC-VED matrix analysis

VED ABC	V	E	D	Total
A	AV(2 items) 6.7% Rs 22,02,600 (33.8%)	AE (2 items) 6.7% Rs21,00,120 (32.2%)	AD (1 items) 3.3% Rs 3,87,576 (5.9)%	(5 items)16.7% Rs 46,90,296/- (71.9%)
B	BV (2items) 6.7% Rs 5, 15, 900 (7.9%)	BE (3 items) 10% 5, 10,600 (7.8%)	BD (1 items) 3.3% Rs 2, 50,575 (3.8%)	(6 items) 20% Rs 12, 77,075/- (19.6%)
C	CV (7 items) 23.3% Rs 1, 65,874 (2.5%)	CE (5 items) 16.7% Rs 2, 12,625 (3.3%)	CD (7items) 23.3% Rs1, 77,730 (2.7%)	(19 items) 63.3% Rs 556229/- (8.5%)
Total	(11 items) 36.7% Rs 28,84,374/-	(10 items) 33.4% Rs 28,23,345/-	(9 items) 29.9 Rs 8,15,881	(30 items) 100% Rs 65,23,600/-
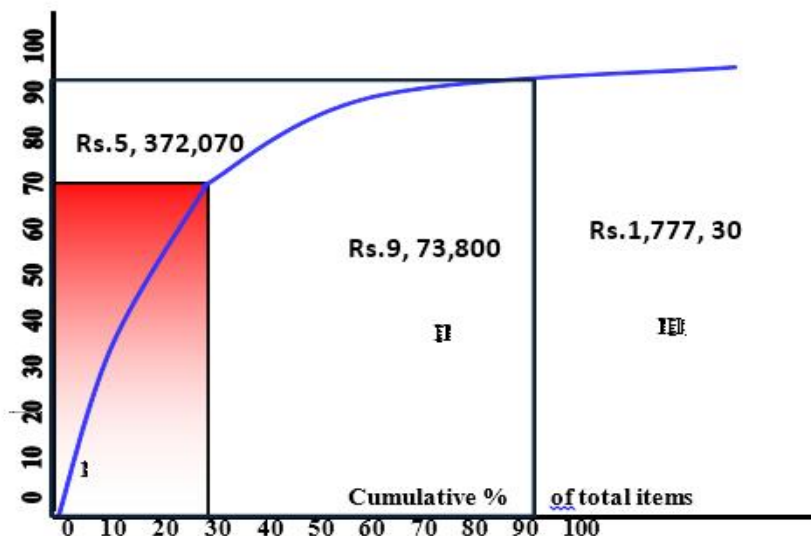
Graph 2. ABC - VED matrix analysis

VED analysis revealed that vital items (V) accounted for 36.60% (11), essential items (E) accounted for 33.60% (10) and desirable items accounted for 30% (9). The total value of drugs in each category I, II & III were 82.40% (Rs.53, 72,070.00/-), 14.90% (Rs. 9, 73,800.00/-) and 2.70% (Rs. 1, 77,730.00/-) of total annual drug expenditure (ADE) of the medical stores respectively. The result of the present study in comparison with similar studies (Khurana *et al*., 2013) is shown in (Table3) below

Table 3.Comparison of various Indian studies with present study

Category	Neuropsychiatry hospital, New Delhi	GMCH, Goa study	PGI, Chandigarh study	AFMS Study	Present study
A	3.45	12.93	13.78	14.46	17
B	6.9	19.54	21.85	22.46	20
C	89.65	67.53	64.37	63.08	63
V	32.41	12.36	12.11	7.39	36.6
E	61.38	47.12	59.33	49.23	33.3
D	6.2	40.52	28.51	43.38	30.0
I	33.8	22.99	22.09	20.92	82.4
II	60	41.67	54.63	48.92	14.9
III	6.2	35.34	23.28	30.16	2.7

If ABC analysis was alone considered for inventory control, it would have taken care of just 6.77% of the drugs pertaining to category A. This would have completely neglected the vital drugs from category B and C which comprises of 11.47 %. Similarly if only criticality factor VED analysis) was taken as a basis for inventory control, ideal control can be exercised only on the identified vital and/ or essential items accounting for 69.51% (1076). However this would have easily missed the category A items in the desirable group. Hence an inventory control method which takes into consideration both the cost factor and the criticality factor (Table 4) proves to be a better method for efficient control of inventory.

Table 4.Categorization of the drugs

Category	Comprise of	Drugs (no)	Percentage of Cost	Cost (Rs)
I	AV+AE+AD+BV+CV	14	82.4%	53,72,070
II	BE+CE+BD	09	14.9%	9,73,800
III	CD	7	2.7%	1,77,730

It is quite evident from the results of the present study that the combination of ABC and VED analysis, in terms of the ABC matrix enhances the ability to narrow down our attention on 14 items belonging to category I for strict managerial control; these items are either costly or vital. The annual expenditure of category I items was 82.40% of annual drug expenditure of the medical store. Category II items represent 14.90% of the ADE. Category III items consume 2.70 % of the ADE. Hence based on ABC and VED analysis various inventory management functions can be performed by managers at different levels as shown in (Table 5).In addition, application of Multi Unit Selective Inventory Control Analysis (MUSIC 3D) method of inventory control can also be applied in the same matrix which enables a better and more stringent management of the Inventory to prevent stock out (Table 6). The control criteria of 3 dimensions are finance, operations and material. Hence, this approach ensures a simple method of fixing ideal stock level of

each drugs taking into account of criticality, availability and consumption value (Table 7).

Table 5. Inventory management

Functions	Category I	Category II	Category III
Forecasting	Accurate	Accurate	Approximate
Budget control	Close check	Reasonable check	No check
Pre purchase functions	Maximum attention	Some attention	Least attention
Negotiations	Top management	Middle management	Lower management
Follow up	Regular	Infrequent	Rare
Inspection	Close control	Simple check	Visual check
Inventory control	Constant	Vigilant	Routine
Level of control	Top	Middle	Store keeper
Review	Monthly	3 monthly	Yearly
Safety stock	Minimum	Reasonable	Large
Order quantity	Fixed EOQ	Fixed EOQ	Fixed ROL
Stock Taking	Frequent	Less frequent	Least frequent

Table 6. Showing music 3D value

	High Consumption Value		Low Consumption Value	
Critical	LLT Critical LLT HCV	SLT Critical SLT HCV	LLT Critical LLT LCV	SLT Critical SLT LCV
	1234			
Non Critical	N critical LLT HCV	N Critical SLT HCV	N Critical LLT LCV	N Critical SLT LCV
	5678			

Note: LLT – Low Lead Time; SLT – Short Lead Time; HCV – High Consumption Value; LCV- Low Consumption Value.

Table 7. Inventory management by application of music 3D

S No	Category		Management
1.	1 & 2	a)	Service Level- 100% to be maintained
		b)	Cannot go for bulk Purchase
		c)	Inventory control –Top Management
		d)	Reorder level is to be maintained
		e)	Effort to bring down lead time
2.	3 & 4	a)	Stockless Purchasing
		b)	Safety stock can be maintained using long Lead time
		c)	Efforts to bring lead time
		d)	Can go for bulk discount during purchasing
3.	5	a)	Strict Inventory control
		b)	Frequent order
		c)	Consult reorder plan
4.	6	a)	Purchase order
5.	7	a)	Bulk Purchase
6.	8	a)	Purchase at regular interval
		b)	Bulk purchase
		c)	Avoid expiry

Conclusion

Sound inventory control method will facilitate the management in controlling the cost and also ensure the timely availability of vital and essential items in the hospital which will definitely go a long way in achieving patient satisfaction and even patient delight. This study analyzed the inventory control method taking into account the controlled drug list of a tertiary care service hospital. Sound inventory control method is of utmost

importance in efficient management of the scarce resource in the healthcare setting.

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