

“Inventory Management in the Cardiothoracic and Vascular Surgery (CTVS) Specialty Sub Stores in the Operation Theatre (OT) Complex of a Multispecialty Tertiary Care Hospital”

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Why this topic?

- Inventory management is a challenge that exists worldwide in all hospital settings.
- Its management reaps benefits like ensuring smooth work flow, reducing wastage, lowering cost and most importantly saving lives
- The OT complex is a huge profit centre in a hospital
- The hospital had 23 functional OTs with a plan to expand its capacity to further add 17 more OTs.
- This problem existed across the specialties in the OT complex
- Maximum cases were operated in CTVS specialty

Introduction

Objective of inventory management

- Uninterrupted and timely supply of items to patients/ hospital departments
- At lowest cost
- Without compromising the quality
- To improve the profitability of the hospital/s' supply chain.

Study Setting

- The study has been carried out in **Medanta- the Medicity hospital** which is a tertiary care multispecialty hospital in Gurgaon
- This study is limited to the CTVS specialty sub stores in OT complex.
- There is a main OT store and specialty- wise sub stores within the OT complex itself
- There are 23 OTs currently and the volume of cases in total ranges between 80-100 per day. It plans to expand to 45 OTs in next three months.
- 7 OTs are specifically allotted to CTVS specialty and the cases operated per day ranges between 5-20.

Consumables under consideration for this study

For the purpose of this study they can be classified as follows:

i) On the basis of functionality:

- Perfusion sub store: includes consumables used during perfusion.
- Surgical sub store: consumables used during surgery and narcotics.
- Anaesthesia sub store: consumables used for anaesthesia induction.

ii) On the basis of number of uses:

- Single use: consumables which can be used only once.
- Multiple use: consumables which can be used more than once.

iii) On the basis of category of charges' in the patient's bill:

- Charged under consumables used
- Charged under OT charges

Problem Statements

Problem 1 :

The buffer stock maintained by the three cardiac sub-stores is not based on any scientific method. It is rather arbitrary and was fixed five years ago.

Problem 2:

There seemed to be a lot of stock left in the CTVS sub stores at the end of each day. So the question arises, is there overstocking of single use consumables in these stores?

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Problem 3:

It is difficult to determine the actual number of times the multiple use consumables have been used (since it is person dependant and there are chances of it being either underused or overused)and hence its consumption so how do we determine if there is overstocking of the same?

Objectives

- To determine the buffer stock of single use items to be kept by the three cardiac sub stores.
- To find out whether there is overstocking of single use consumables single use in the three cardiac OT sub stores and enumerate the consumables (single use) that are overstocked.
- To find out whether there is overstocking of multiple use consumables and provide suggestion on ways to ensure compliance to the hospital policy in reference to the number of times a multiple use item is to be used.

Methodology

Duration of the study: 2 months.

Type of Study: descriptive and cross-sectional study.

Data collection:

- Primary data was collected by direct observation of processes.
- Secondary data was collected from the information technology (IT) department.

The data for three months only (which includes December 2014, January 2015 and February 2015) was taken keeping in mind the given time constraints for the study.

Method: Writing notes while observing and getting data from hospital information system (HIS) and systems, applications, products (SAP) through the IT department.

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Data includes:

- i) Details on surgeries performed each day in the cardiac specialty for the three months (to understand the volume and average number of cases per day).
- ii) An audit report of stock (which would show the baseline of stock for each consumable to be maintained by each of the three cardiac OT sub stores).
- iii) Item movement of single use and multiple use consumables for the three months (to find out consumption of the same). This includes patient wise consumption of each consumable for the mentioned time period.

Problem 1 : The buffer stock maintained by the three cardiac sub-stores is not based on any scientific method. It is arbitrary.

Buffer Stock= (Maximum (Max.) Consumption- Average (Avg.) Consumption) * Lead Time (in days)

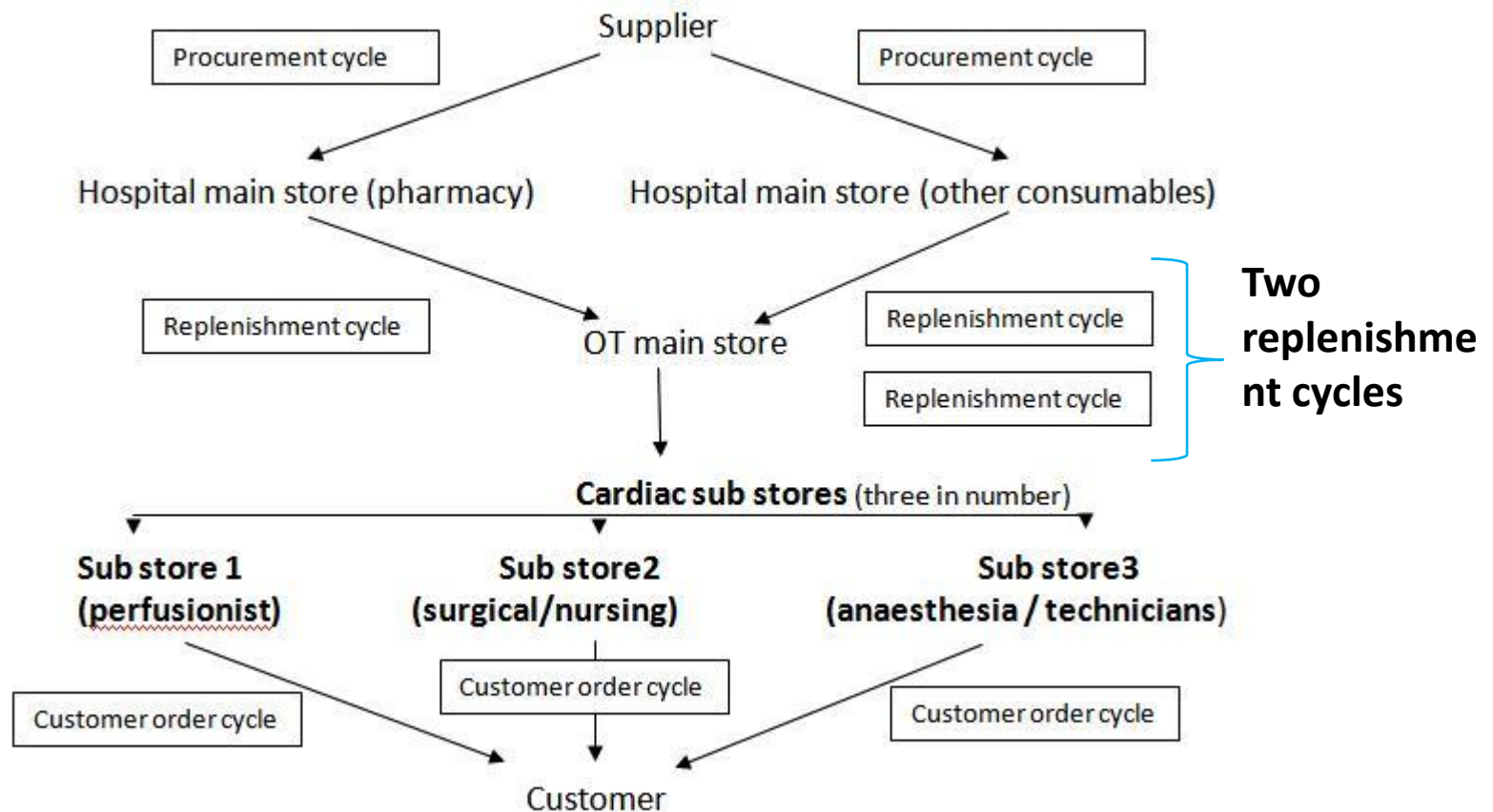
Key concepts:

Buffer Stock: The quantity of stock set apart as a safeguard against variation in demand and shortage or delay in supplies.

Lead Time: The average duration of time in days between placing of an order & receipt of material.

Stockout: A customer order arrives when product is not available.

Findings: Various supply chain stages in this hospital



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Various factors that influence the required level of buffer stock:

- Demand uncertainty
- Replenishment lead times
- Lead time variability
- Desired product availability
- Continuous review policies vs. Periodic review policies

Formula used

Therefore in this case,

Buffer Stock= (Maximum (Max.) Consumption- Average (Avg.) Consumption)

wherein,

- **Avg. Consumption** is avg. consumption of each item per day (avg. in mentioned three months)
= [Avg. consumption (Dec, 14) + Avg. consumption (Jan, 15) + Avg. consumption (Feb, 15)]/ 3
- **Avg. consumption for x month**= Avg. consumption per day in x month/number of working days
- **Avg. consumption per day** (each consumable) = Total consumption per day / total number of cases in that day
- **Max. Consumption**= consumption in case of max. number of cases per day.

Month wise distribution of cases operated in the CTVS speciality

December,14		January,15		February,15	
Total no. of cases	317	Total no. of cases	272	Total no. of cases	285
Total no. of working days	24	Total no. of working days	23	Total no. of working days	20
Average	13	Average	12	Average	14
Max. no of cases/day	18	Max. no of cases/day	18	Max. no of cases/day	20
Min. no of cases/day	6	Min. no of cases/day	2	Min. no of cases/day	4

The average number of cases operated per day for this period is 13

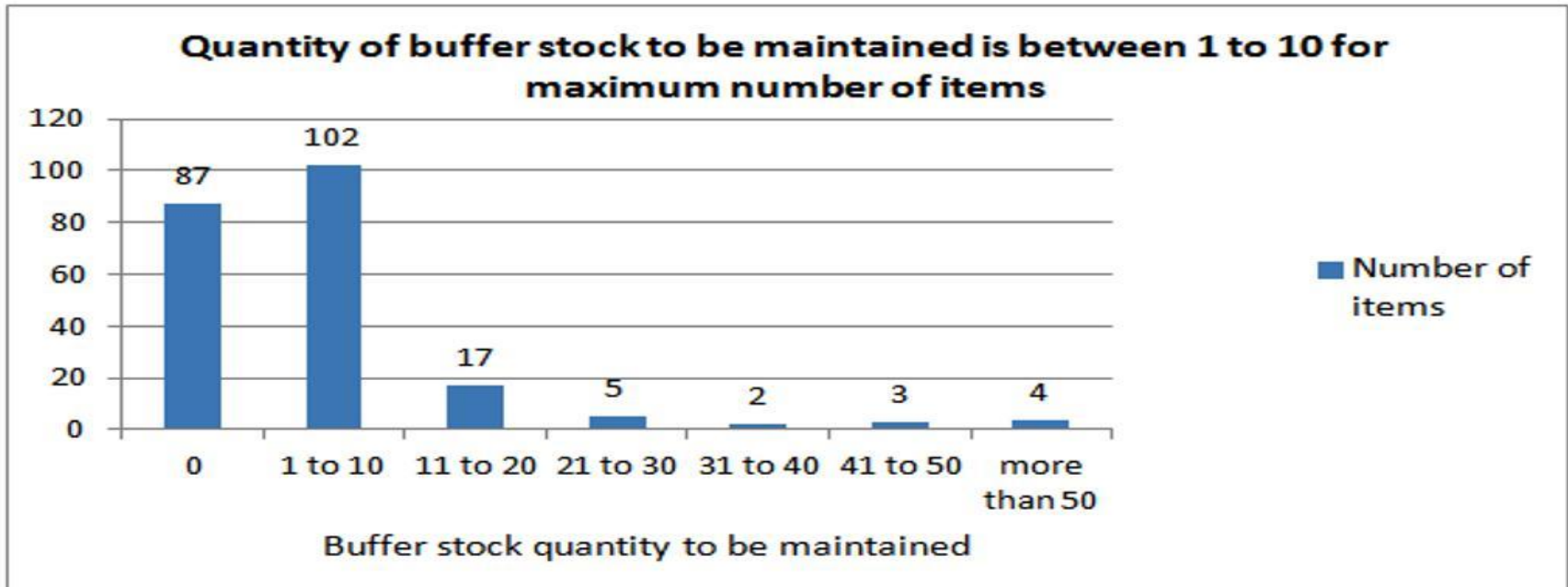
The maximum number of cases that had been operated in a day during this period is 20

Item wise quantity of buffer stock to be maintained (sample)

ITEM CODE	ITEM NAME	AVERAGE CONSUMPTION QTY				IF CASES 20 (Max.)	BUFFER STOCK
		DEC	JAN	FEB	OVERALL Avg.		
12M021020049	IABP CATHETER 7.5FR 40CC-DATASCOPE	1.12	1.04	0.58	1	1	0
12M021020114	OXYGENATOR CAPIOX ADULT SX-18-TERUMO	3.27	2.42	3.23	3	5	2
12M021020086	TUBING PACK ADULT 2050-MEDTRONIC	1.31	1.46	1.65	1	2	1
12M021020142	OXYGENATOR AFFINITY ADULT 95214-MEDT	0.50	0.15	0.42	0	1	0
12M021020116	OXYGENATOR CAPIOX PAED SX-10-TERUMO	0.69	0.35	0.65	1	1	0
12M021020085	BLOOD CARDIOPLEGIA DEL SYS MYOTHERM-MEDT	1.81	1.81	2.27	2	3	1

Overall average consumption is the average of three months' consumption per day

Number of items for which buffer stock is to be maintained- range wise



Source: Analysis of data received from IT department

Quantity of buffer stock to be maintained is between 1 to 10 for (102 out of total 220 items) 46% of the items. No buffer stock is to be maintained for (87 out of the total 220 items) 39.5% of the total items. Only for 20% of the items buffer stock of more than 10 is required.

Problem 2: There seemed to be a lot of stock left in the cardiac sub stores at the end of each day. So the question arises, is there overstocking of single use consumables in these stores?

Overstock= [Existing stock – (Avg. Consumption + Buffer Stock)]

(For each consumable) (For each consumable)

Wherein,

- Existing stock of each consumable was taken from the audit reports of finance department
- Avg. consumption for each and buffer stock for each as calculated by the above mentioned method.

Activities in the daily replenishment cycle of the cardiac OT sub stores by the OT main store – (Single use consumables)

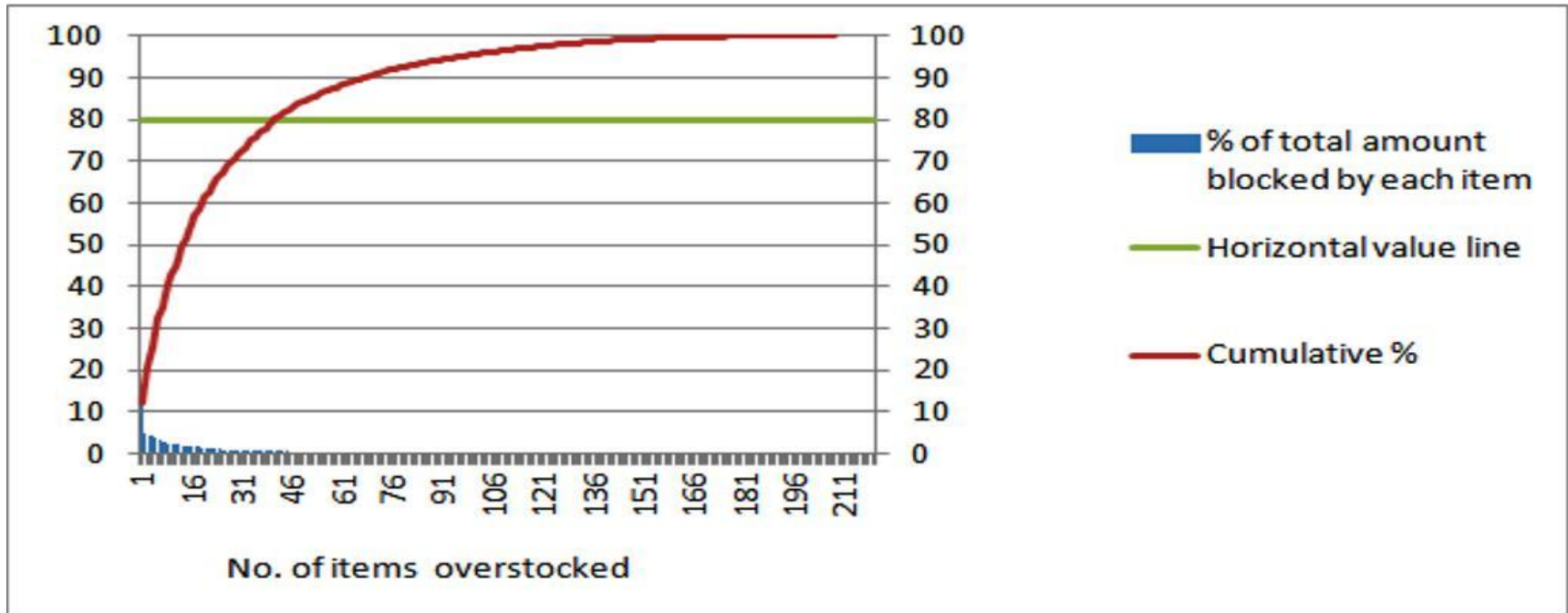
- Total consumption for each consumable is prepared by the respective sub stores
- This list is taken to the OT main store
- OT main store verifies the consumption with the consumables charged by them to each patient.
- The consumables used are replenished by the OT main store to the respective sub stores.
- **For consumables** which are charged **under** the category of **OT charges** in the patient's bill, replenishment is done by the OT main store, twice a week based on the consumption.

Overstocked quantity of single use consumable (sample)

ITEM CODE	ITEM NAME	AVERAGE CONSUMPTION QTY					STOCK	OVERSTOCKED QTY	UNIT COST	OPPORTUNITY COST	% OF TOTAL OPPORTUNITY COST	CUMULATIVE FREQUENCY %
		DEC	JAN	FEB	OVERALL	IF CASES 20 (MAX.)						
12M021020049	IABP CATHETER 7.5FR 40CC-DATASCOPE	1.12	1.04	0.58	1	1	7	6	30975.00	173374	12	12
12M021020114	OXYGENATOR CAPIOX ADULT SX-18-TERUMO	3.27	2.42	3.23	3	5	10	5	12547.50	68083	5	17
12M021020086	TUBING PACK ADULT 2050-MEDTRONIC	1.31	1.46	1.65	1	2	20	18	3612.00	64057	4	21
12M021020142	OXYGENATOR AFFINITY ADULT 95214-MEDT	0.50	0.15	0.42	0	1	7	6	9922.50	64013	4	25

Another important finding was that morphine (15 mg injection) which is a narcotic drug and has high chances of abuse was stocked in huge quantities. Its average consumption for the mentioned three months was approximately 1 and a stock of 34 of its units was maintained.

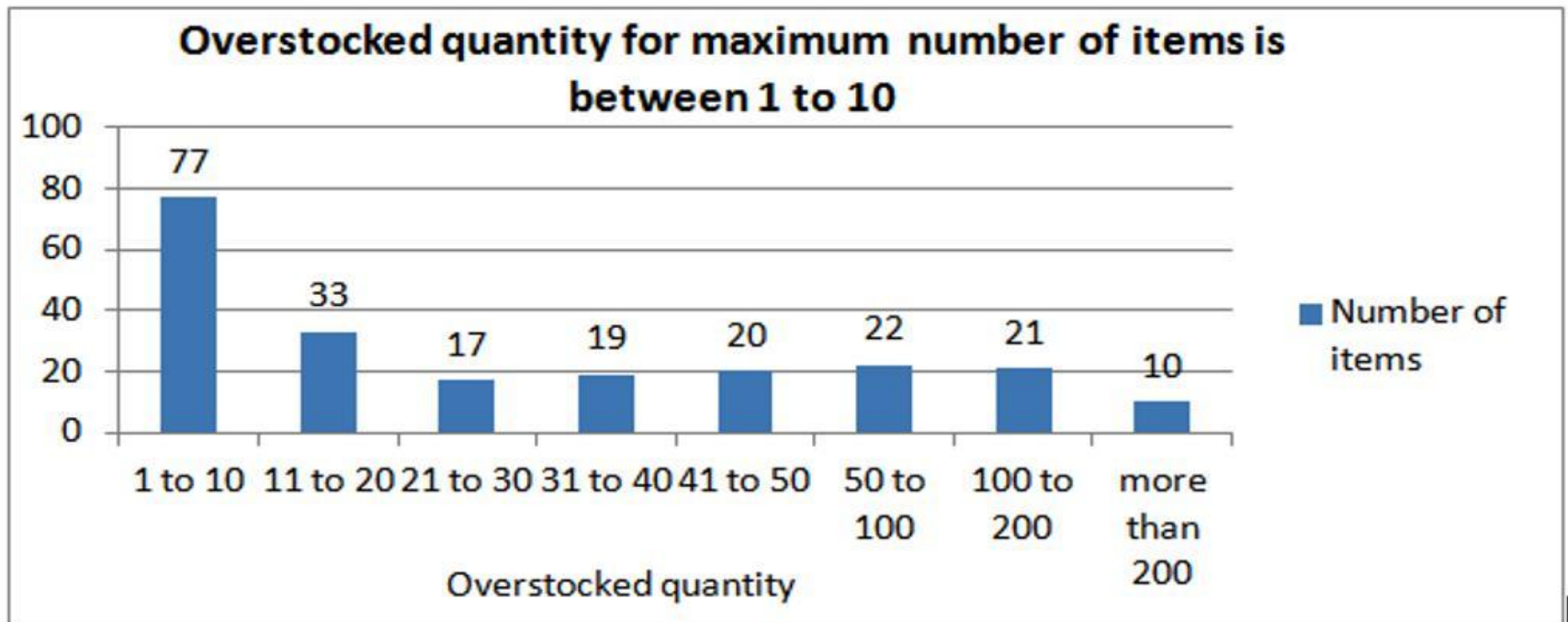
Pareto's chart showing 80% of amount being blocked by approx. 19% items



Source: Analysis of data received from IT department

Out of 656 single use items 220 were overstocked. These items contributed to an amount of Rs. 14, 58,022/- being blocked. Out of these 220 items, 41 items which is approximately 19% (18.63%) of total items overstocked contribute to 80% of the amount being blocked which is Rs. 11,66,809/-

Number of items having overstock quantity in different ranges



Source: Analysis of data received from IT department

77 out of 220 items i.e, 35% of items have overstock between 1 to 10 and 15% of the items (33 out of 220) have overstock items in range of 11 to 20, making it 50% of the items. However, it is overwhelming to see that 25% of the items have overstock quantity of more than 50.

Problem 3: It is difficult to determine the actual number of times the **multiple use consumables** have been used so how do we determine if there is overstocking of the same?

- Each consumable is used as per its pre defined number of uses
- After each usage it is checked for defect and sent for sterilisation to the central sterile supply department (CSSD)
- *Before sterilisation the CSSD puts a dot with a marker pen on the multiple use consumable*

The whole process continues, till the consumable completes its number of pre defined uses

- *It is then discarded* (discard register maintained)

The nursing supervisor takes this register to the hospital main store for other consumables

- *Based on this discard register a new multiple use item was replenished.*

Note: Italics indicate problem areas/points.

List of multiple use items with their stock status (sample)

ITEM CODE	ITEM NAME	DEC		JAN		FEB		3 MONTHS			OVERSTOCKED QTY
		AVERAGE CONSUMPTION	CLOSING BALANCE	AVERAGE CONSUMPTION	CLOSING BALANCE	AVERAGE CONSUMPTION	CLOSING BALANCE	AVERAGE CONSUMPTION	AVERAGE CONSUMPTION (IF 20 CASES)	CLOSING BALANCE (FEB)	
12M011010038	SHUNTINTRACOR CLEARVIEW 2.5MM-MEDTRONIC	19	5	5	0	0	0	8	12	0	
12M011010034	SHUNTINTRACOR CLEARVIEW 1.25MM-MEDT	0	10	10	10	10	0	7	10	0	
12M011010036	SHUNTINTRACOR CLEARVIEW 1.75MM-MEDT	4	0	0	10	16	4	7	10	4	
12M011010037	SHUNTINTRACOR CLEARVIEW 2.0MM-MEDTRONIC	0	10	5	0	15	5	7	10	5	
12M011010023	OCTOPUS TISSUE STAB.SYSTEM 4.3-MEDTRONIC	6	2	5	3	5	2	5	8	2	
12M011010033	FELT TEFLON 6X6 007837-BARD	0	5	5	7	7	7	4	6	7	1

Consumptions vary drastically between months. This gives a feel of their unregulated use. Although this could not be verified due to the limitation of access to such data.

List of reusable items not used even once in mentioned three months

ITEM CODE	ITEM NAME	QUANTITY	PRICE	OPPURTUNITY COST (in Rs.)
12M011010001	SURGILOOP YELLOW MAXI 1001-80-SCANLAN	8	150	1200
12M011010026	CAROTID SHUNT JAVID-007714-BARD	2	1200	2400
12M241240075	RESONO FORCEPS-420181-06-PER USE	14	15730	220220
12M241240079	VALVE HOOK-420192-PER USE	30	9240	277200
12M241240082	CURVED SCISSORS-420178-PER USE	13	14300	185900
12M241240084	LONG TIP FORCEPS-420048-PER USE	15	18182	272730
12M241240085	MEGA NEEDLE DRIVER-420194-PER USE	11	16577	182347
12M241240089	SNAP FIT INSTRUMENT-420157-PER USE	26	5775	150150
12M241240093	420182 ENDOWRIST STABILIZER INSTRUMENT	3	66087	198261
12M241240095	420171 MICRO BIPOLAR FORCEPS	1	23172	23172
TOTAL AMOUNT BLOCKED				1513580

These items are of worth Rs. **1513580/-** It was found that (the items in bold are the ones used in robotic surgery) these surgeries have not been done in the CTVS specialty since past six months.

- The amount blocked by overstocking single use consumables is 14, 58,022/- and for re-usable consumables is 1513580/- **summing up to a total of Rs. 29,71,602/-**
- **This is a huge opportunity cost for the organization as this amount can be used in better ways.**

Note: This amount excludes the cost for 12 items with varying quantities of overstock as the cost data for the same is not available.

Limitations

- The baseline for consumables (single use) to be considered as overstocked has been determined based on the data of the mentioned three months.
- The data to determine the actual number of times the multiple use consumables have been used is not been made available.

This problem has been identified based on process understanding by direct observation and interviewing relevant staff. Therefore, my approach to this has been to find out the consumption as per the transactions of these items and determine the stock of the same to be maintained.

Suggestions

- Over stocked items to be removed from the sub stores to enable better inventory control over only the stock required there.
- Buffer stock of each item to be maintained as per the defined criteria in the study, which therefore requires re -ascertaining the demand and consumption patterns on a regular basis and maintaining stock accordingly.
- The multiple use items that have not been used in the mentioned three months to be handed over to the urology department for their use as they are doing those surgeries.
- An automated system of determining the number of uses and discard of a multiple use item to be formed.

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THANK YOU