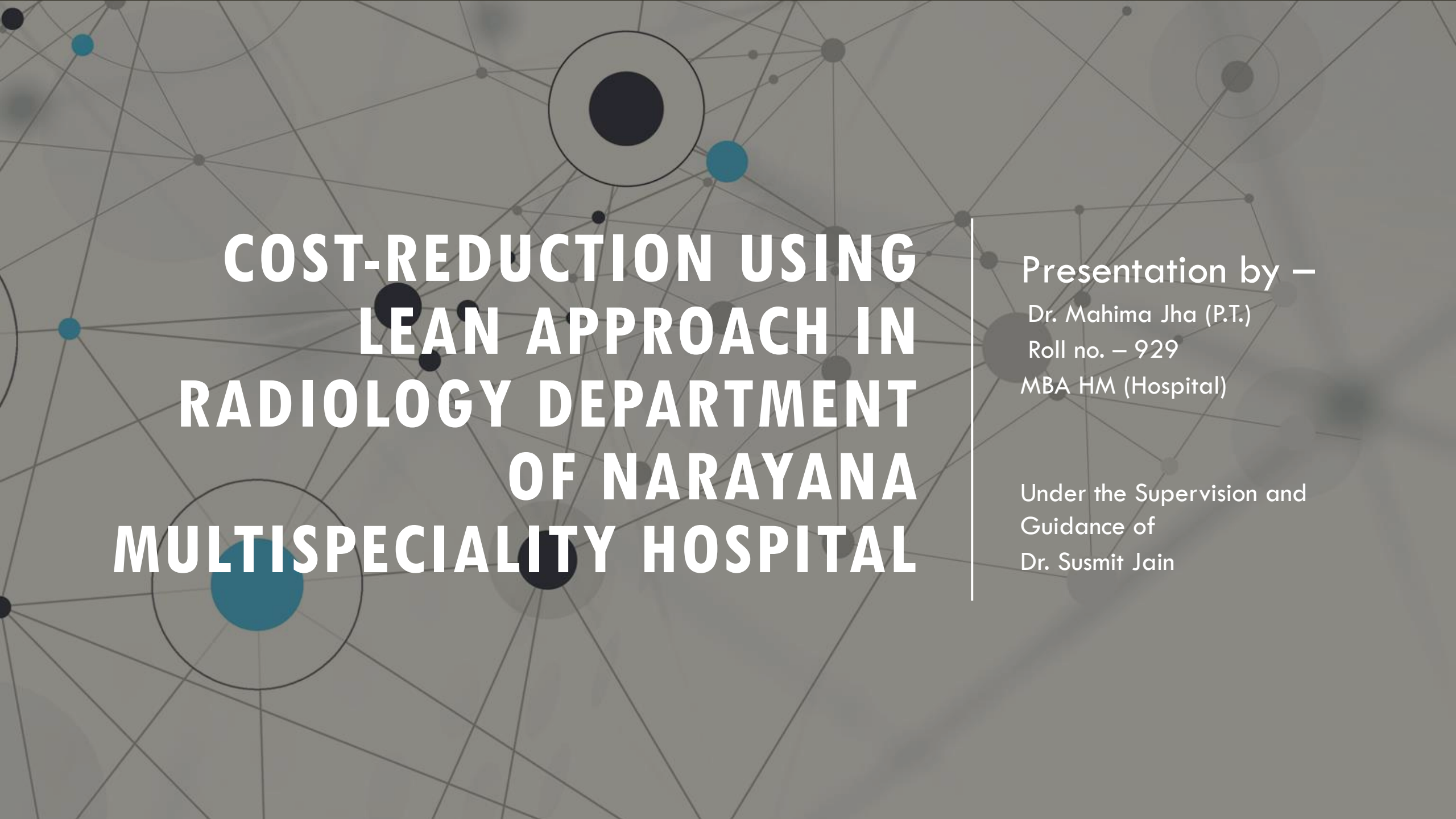




COST-REDUCTION USING LEAN APPROACH IN RADIOLOGY DEPARTMENT OF NARAYANA MULTISPECIALITY HOSPITAL

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INTRODUCTION

1. Hospital Administrators are continually looking for ways to reduce the cost and expenditure related to healthcare services.
2. The greater pressure on cost containment has an impact on hospital operations. The aim of the study is to contain the costs without compromising the quality of services and the challenge is to maintain the balance between the two.
3. The radiology department is an important revenue-generating department, but it also houses one of the costliest technologies to maintain and repair. For example, cost of an MRI Machine for GE Systems 1.5 Tesla ranges from 80 Lakhs to 8.5 crores, the CT Scan machine ranges from 80 lakhs to 3.8 crore and X Rays machine ranges from 1.5 lakhs to 75 lakhs (Indiamart).
4. With the rise of medical technology, the expenditure on medical materials is increasing disproportionately. For the utilization of the limited resources of the hospital, the health managers must use scientific inventory control methods. Cost reduction is essential for healthcare services due to rising material costs.
5. “Around 35-40% of the budget of healthcare organization budget is spent on procuring and purchasing the material and supplies” (YiĞİT, 2016).

WHY LEAN APPROACH?

Lean production is based on the philosophy of Toyota production systems.

Lean is a set of operating philosophies and methods that help create a maximum value for patients by reducing waste and waits. (Adegboyega K Lawal, 2014)

The main focus of the Toyota lean approach is on the efficiency of the resources being utilized and how the value is generated. It is also known as the Toyota model.

The lean approach has successfully demonstrated its applications in the health care industry.

Though lean started from the production industry, the research on its use in the health care industry is limited.

Lean has its application in almost all sectors of the health care system. It includes hospital, primary care, management, administrative staff, health care professionals, and support staff.

RESEARCH QUESTIONS

Q1. What are the various methods of cost-reduction, without compromising the quality in the radiology department of Narayana Multispeciality Hospital?

Q2. How is the cost analysis of material consumption of the radiology department conducted in Narayana Multispeciality Hospital?

OBJECTIVES



1. TO STUDY THE WORKFLOW
OF THE RADIOLOGY
DEPARTMENT OF NARAYANA
MULTISPECIALITY HOSPITAL.



2. TO DETERMINE THE
VARIOUS METHODS OF
COST-REDUCTION IN
RADIOLOGY DEPARTMENT
OF NARAYANA
MULTISPECIALITY HOSPITAL.



3. TO CONDUCT A COST
ANALYSIS OF THE MATERIAL
CONSUMPTION IN THE
RADIOLOGY DEPARTMENT OF
NARAYANA MULTISPECIALITY
HOSPITAL.

METHODS:

STUDY DESIGN: Descriptive, Quantitative, Cross-sectional study

SETTING: Narayana Multispeciality Hospital, Jaipur

SAMPLE SIZE COLLECTION: Data of cost analysis was obtained from the Hospital Information System. The cost related to radiology was determined for the consumables. Data recorded on RIS MOKSHA was also used. Weekly data for consumables was compiled for 3 months.

SAMPLING TECHNIQUE: Purposive Sampling

SAMPLE SIZE: 241 sampling units – cost of items indented during the study period

STATISTICAL METHODS: Data analysis was done through MS Excel. Value stream mapping was also included. TIMWOODS is incorporated in the study which is a lean tool that stands for 8 types of defects: Transportation, Inventory, Material, Waste, Over-processing, Overproduction, Defects, Staff. Value chain and Pareto analysis of the material was done.

LITERATURE REVIEW

Reference	Date	Design/Methods	Aim of the review	The main conclusion stated by the authors
Kadom N, Itri JN, Trofimova A, Otero HJ, Horný M	2018	Cost-effectiveness analysis	To review key features of cost-effectiveness analysis and its issues related to radiology	One of the critical aspects related to the technological advances of radiology is proving that values outweigh the cost. As the cost of the technologies is higher, not everyone in society can afford the diagnostic and screening procedures. One of the scientific methods to contain health technologies for better utilization of the resources is the cost-effectiveness analysis.
R. D. Geoffrey	2017	A descriptive study using time-driven activity-based costing	1.Describe how costs differ depending on the perspective of the stakeholder n 2.Explain why radiologists must understand costs and costing methods to articulate the value of their work 3.Describe the factors that influence indirect cost allocation n 4.Describe the advantages and disadvantages of various methods for measuring and reporting costs	Approximately 75 % of the hospital costs are fixed, direct, or overhead costs, and the allocation of these costs across the range of medical services is a huge challenge. ABC is a two-stage process that first assigns resource costs to discrete tasks or activities and the costs are assigned to a final product or service based on the use of the service. Identification and quantification of cost drivers are done for each activity that contributes to a final product or service.

Reference	Date	Design/Methods	Aim of the review	The main conclusion stated by the authors
Moodley I & Moodley S	2015	- Incremental cost analysis - Questionnaire-based survey	To conduct the cost analysis of PACS compared with conventional radiology	The advancement in radiology such as digital technologies leads to the elimination of the films and the paper-based reports used for the reports. It has also improved the workflows. PACS can control the various financial outcomes of the department but it also requires a financial investment at the beginning with a total cost that also includes RIS. Therefore, careful financial consideration should be applied. For the determination of the actual cost, true monetary and non-monetary aspects should be taken into consideration

Reference	Date	Design/Methods	Aim of the review	The main conclusion stated by the authors
Megan M Rose	2017	- Literature review - DMAIC model	To determine whether a lean six sigma approach in supply chain models would improve outcomes and financial savings	The author conducted a project in the cardiac catheterization and interventional radiology unit of an urban Midwestern hospital. There were many complications in the supply chain of the hospital. After data collection, the baseline data demonstrated many missing supplies, items that were expired, and overnight shipments. The lean six Sigma-based approaches were applied in the supply chain interventions and procedures. This resulted in improvement in outcomes, cost reductions leading to financial savings. all of the results are depicted by reducing waste and variation. The savings which the department achieved demonstrate lean six Sigma as a promising approach for improvements in the supply chain. The annual savings of \$5700 was noted as a result of a reduction in overnight shipments.

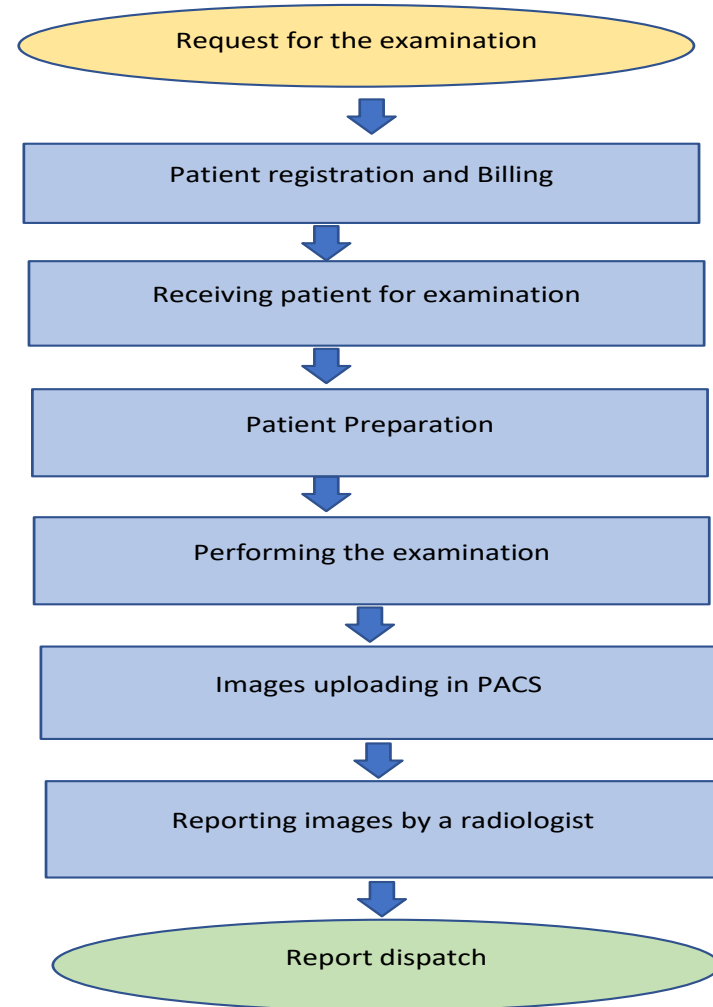
Reference	Date	Design/Methods	Aim of the review	The main conclusion stated by the authors
Ruben I Cohen	2018	To review lean methodology in healthcare	Review article	Lean is a method of quality improvement that originates from its success in Toyota production systems. the management of Toyota recognized that a high-value product should come at a competitive price. The main concept is based on the elimination of operations which are not adding any value from the point of view of customers. TPS was successful in reducing the inventories by using the concept of just in time. All the processes were streamlined in such a way that every step provided the required quantity with the required time. Lean is recognized as a means of transformation in a culture that changes the way a health care organization operates. The author explained the issues with lean. It sometimes can be focused on a single process rather than the whole system.

Reference	Date	Design/Methods	Aim of the review	The main conclusion stated by the authors
Vahit	2016	ABC, VED, and ABC VED Matrix analysis	To analyze the annual medical expenditure using the ABC VED matrix	The author used inventory control techniques such as ABC, VED, and ABC VED matrix.. He explained that 30-40% of the budget of the health care organizations is spent on the purchase of medical materials and supplies. an effective and efficient inventory control management is required for the medical materials. The ABC method is very important for the criteria of cost. It is based on the classification of drugs and materials as per their relative importance. the VED analysis is based on criticality. The author concluded that class 1 map vital medical items should be under the control of top management as it requires the greatest amount of attention. The consumption of the items and their stock level should be monitored continuously and the safety stock is to be kept low. The items lying in the category two and three should come under middle and lower Management.

Reference	Date	Design/Methods	Aim of the review	The main conclusion stated by the authors
Kruskal et al	2012	Literature review	Describe the lean approach to improving organizational performance and how it differs from other approaches ■ List the fundamental principles that must be consistently applied when implementing a lean transformation. ■ Provide an example from each of the four categories of tools that can be used to create and maintain	To implement a lean approach to improve organizational outcomes require to always keep in sight the goal, consumer needs. The journey of the lean transformation begins with a single step. The process requires organizational commitment. The involvement and contributions of every staff member are valued and appreciated

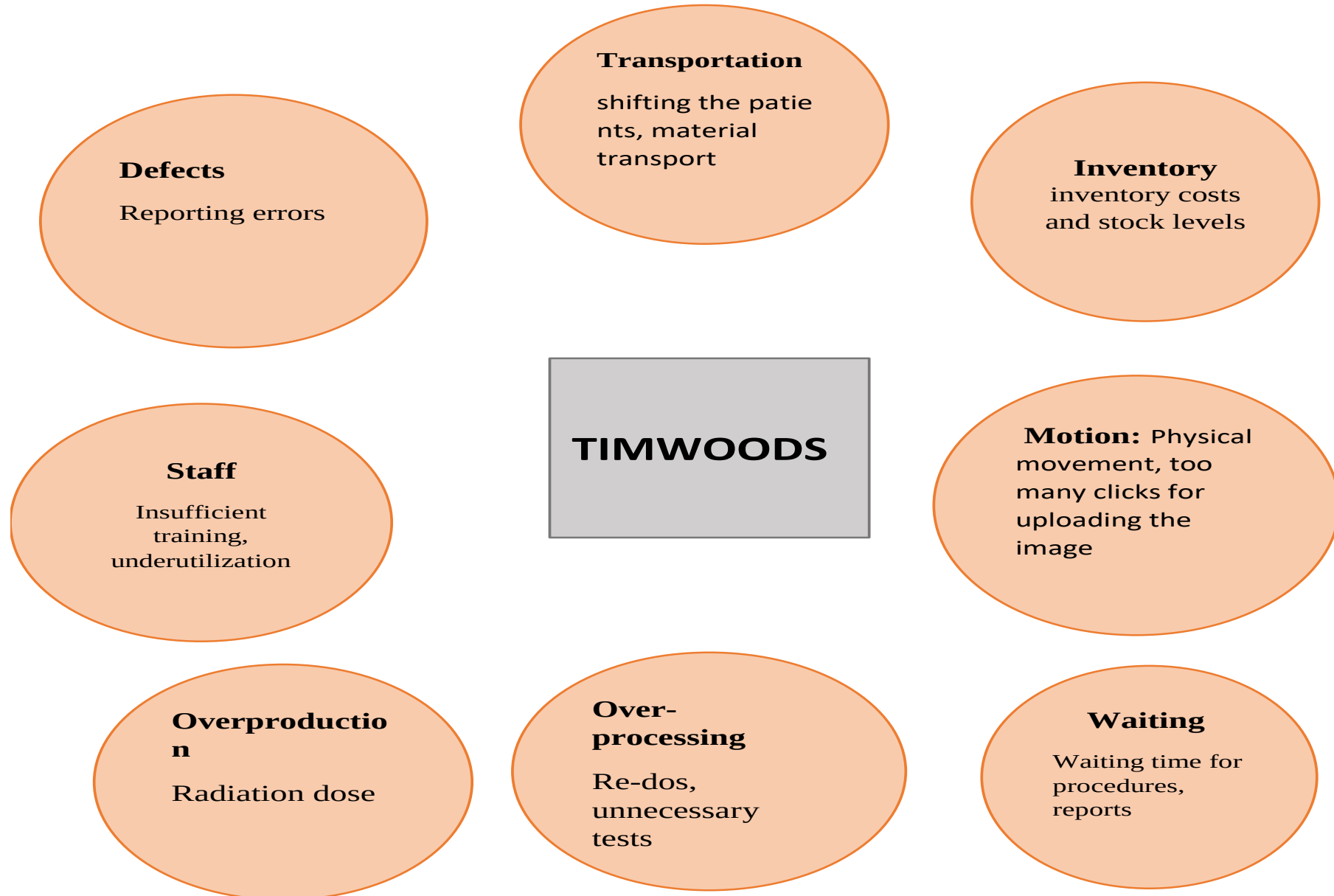
RESULTS

WORKFLOW OF THE RADIOLOGY DEPARTMENT



Lean tool: TIMWOODS

8 types of defects



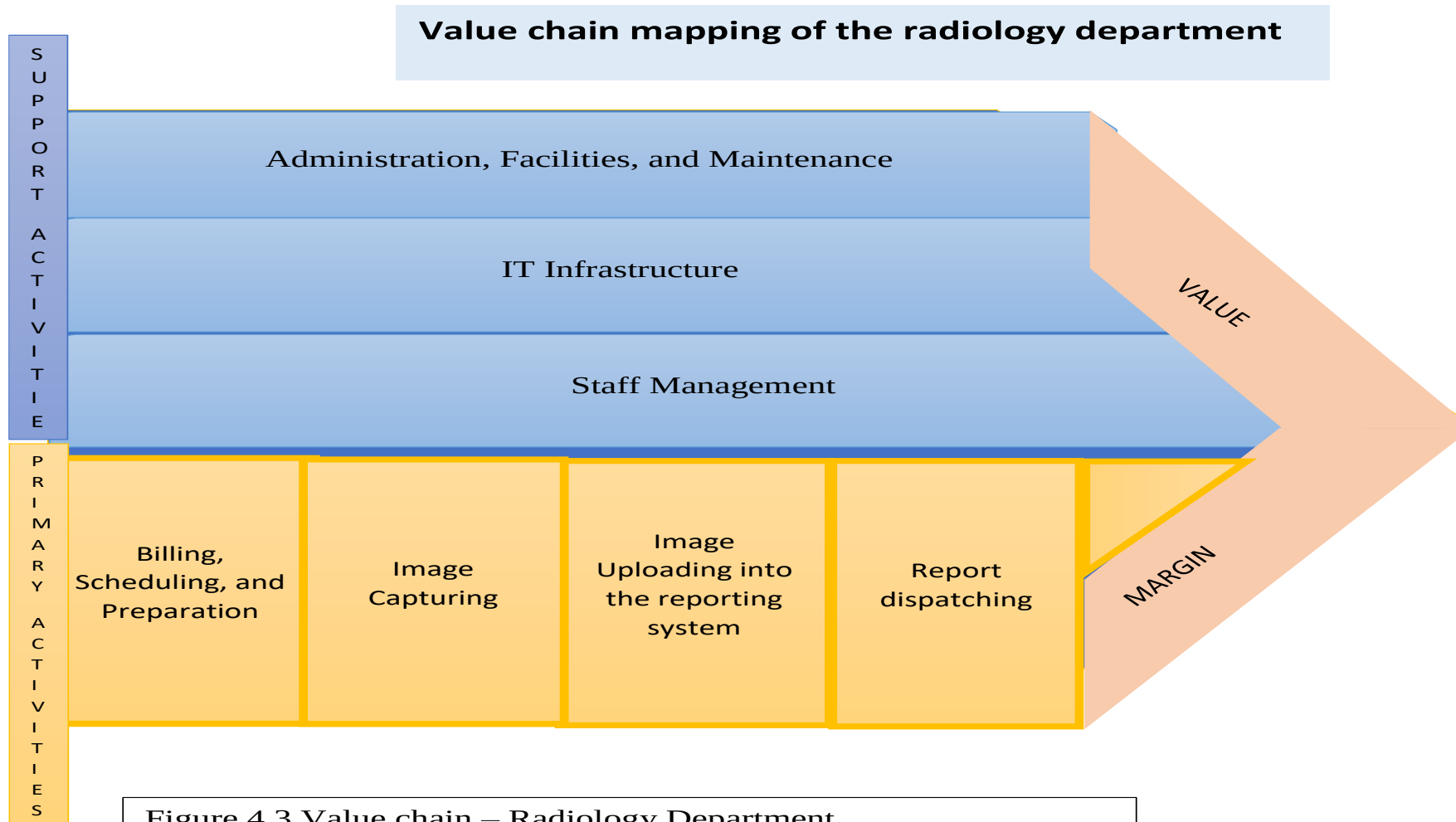
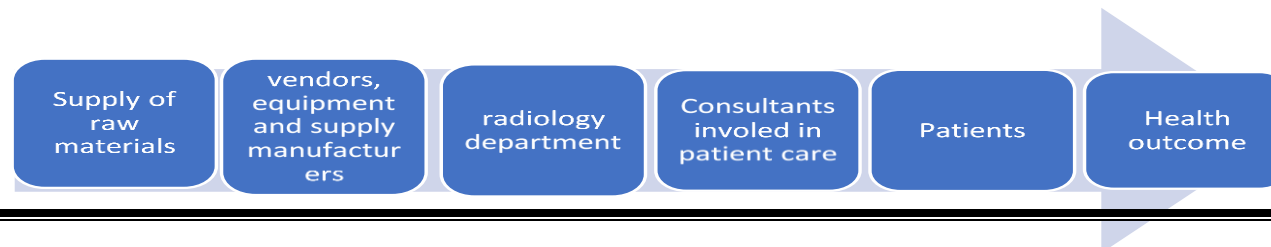


Figure 4.3 Value chain – Radiology Department



REVENUE GENERATION CYCLE OF RADIOLOGY DEPARTMENT



IPD Services

- MICU
- PICU
- PGW
- Semi Private Ward
- Private Ward
- HDU
- CCU
- MEDICAL WARD
- CTVS Ward
- Chemotherapy Ward
- ANC Ward

Emergency Department

- 24 * 7 services

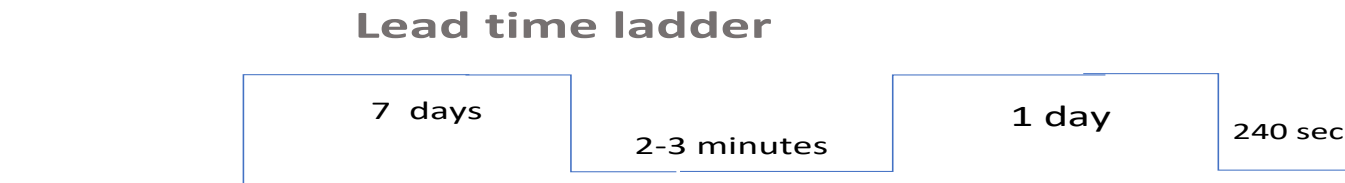
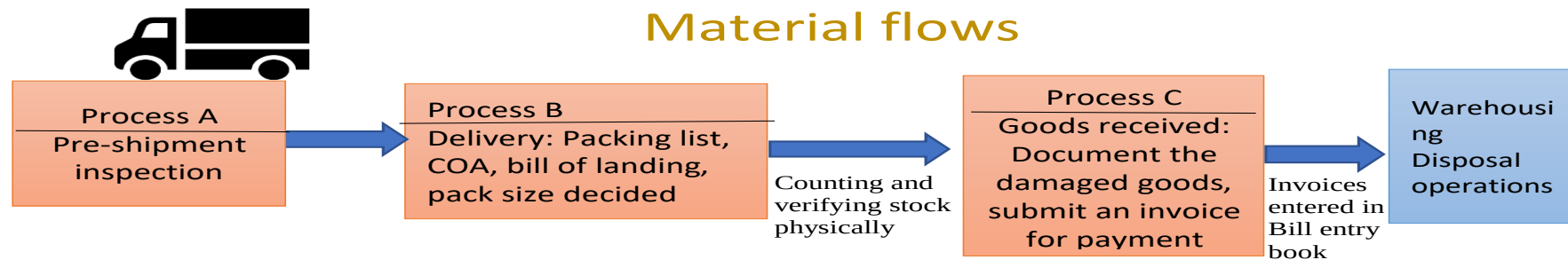
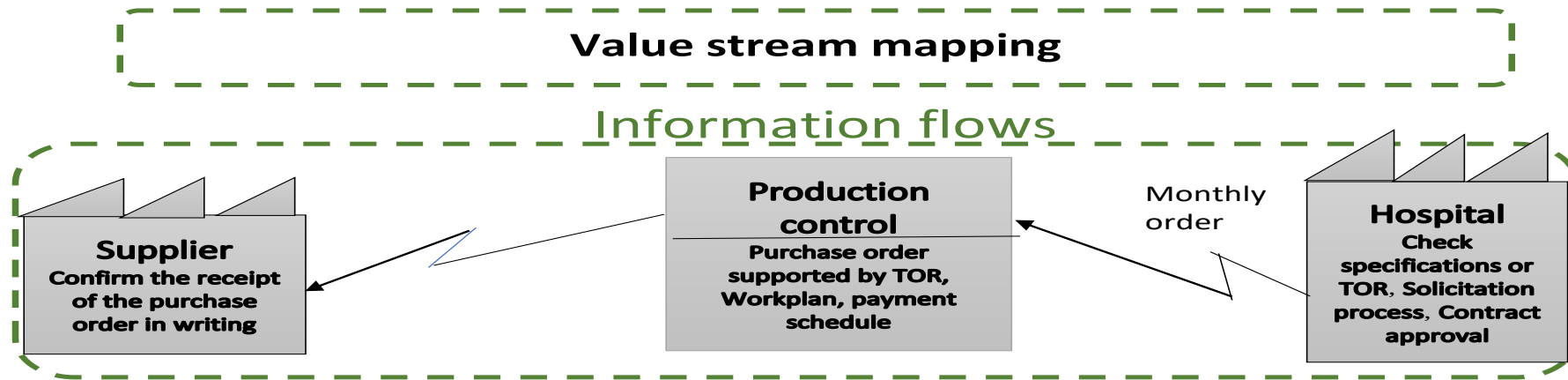
OPD

- OPD Consultations
- Preventive Health Checkups

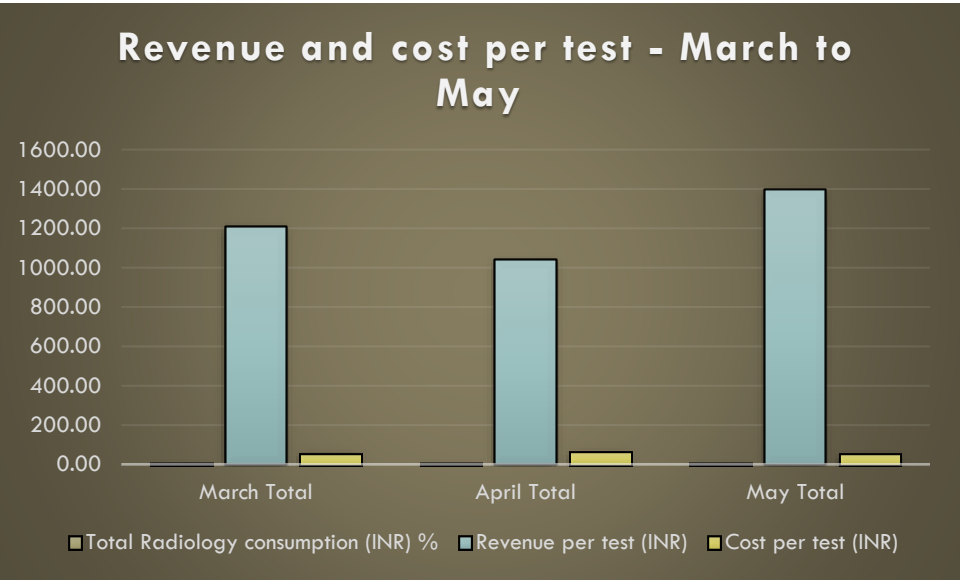
Insurance and TPA

- ECHS
- CGHS
- Railways
- Mediclaim
- Rajasthan Mediclaim
- Religare
- Apollo Munich
- Aditya Birla Health Insurance, etc.

VALUE STREAM MAPPING OF RADIOLOGY DEPARTMENT



DATA ANALYSIS AND INTERPRETATION



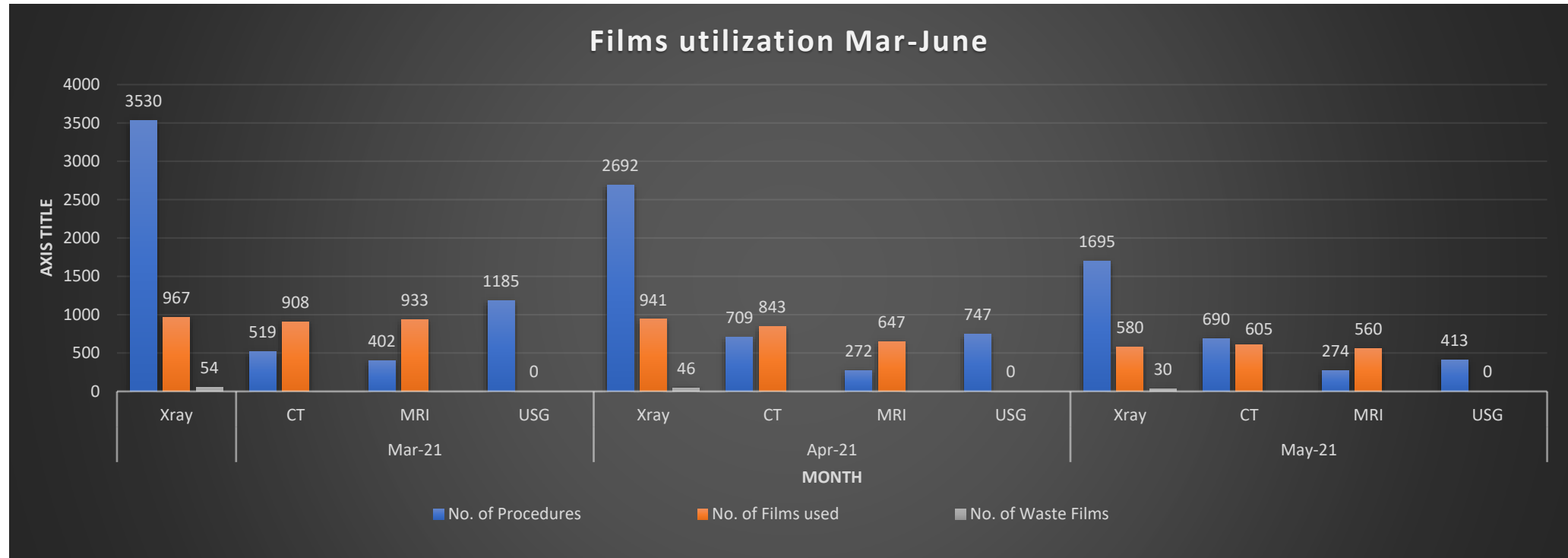
Revenue and cost per test – March to May. Radiology Department

	March Total	April Total	May Total
Total Radiology consumption (INR) %	4.37	5.79	3.61
Revenue per test (INR)	1,208	1,037	1,394
Cost per test (INR)	53	61	51

Radiology Consumption Analysis

- The revenue exceeds the consumption during the whole study period.
- During March, the total radiology consumption was 4.37 % of the total revenue and the cost per test was 53 as compared to the revenue per test i.e. 1 208.
- In April, the total consumption was 5.79 % of the total revenue. The cost per test was 61 and the revenue per test was 1037.
- The consumption was least in the month of March i.e. only 3.6 % with the revenue per test as 1 394 and the cost per test is 51. Thus the month of May was the most cost-effective. The consumption also varies depending on the number of tests done in the month as well as the type of studies.

FILM UTILIZATION



The film utilization is most effective in X-Ray studies. The number of films utilized is 967 for March for the total 3530 procedures i.e. 27.4 %. It is 941 for 2692 procedures in April i.e. 34.95 % and 580 for 1695 procedures in May i.e. 34.32 %.

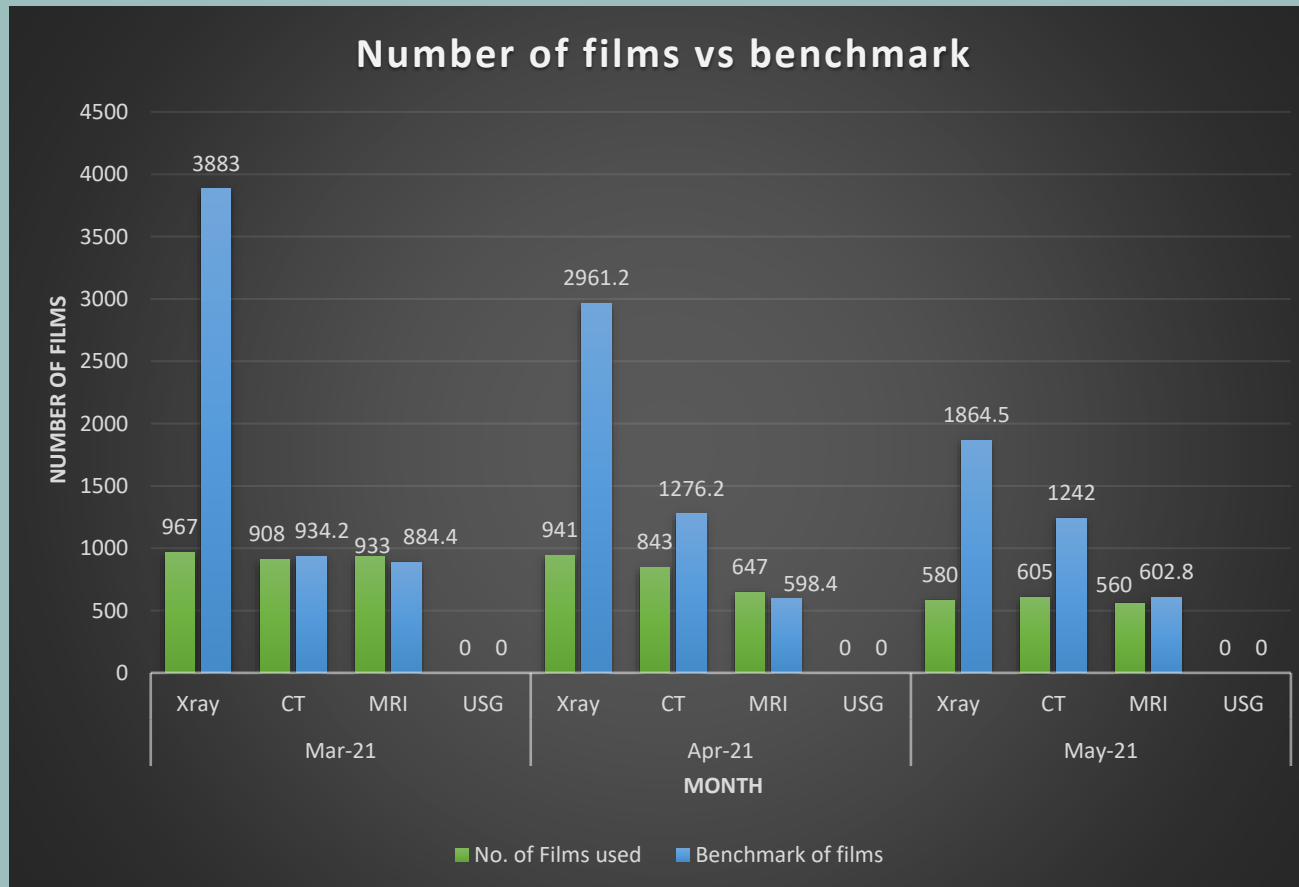
The greatest effectiveness of the cost reduction of the department is thus reflected in the X-ray procedures.

For CT, the films utilized are 908 for 519 procedures for March. It is 843 for 709 procedures in April and 605 for 690 procedures in May.

The least number of films are utilized in May which is also the most cost-effective month of the period.

For MRI, the film utilization is 933 for 402 i.e. average of 2.32 films per study in March; average of 2.37 per study in April and an average of 2.04 films per study In May .

BENCHMARKING

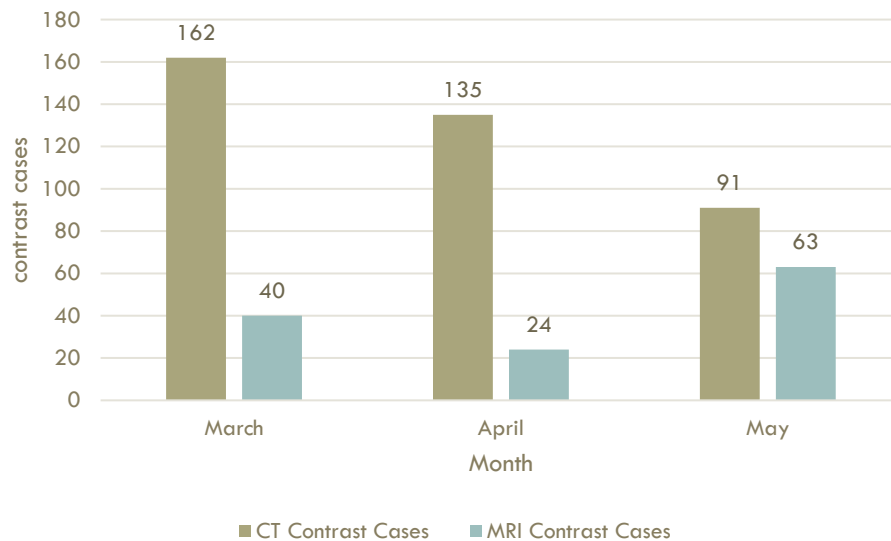


Benchmarking of films

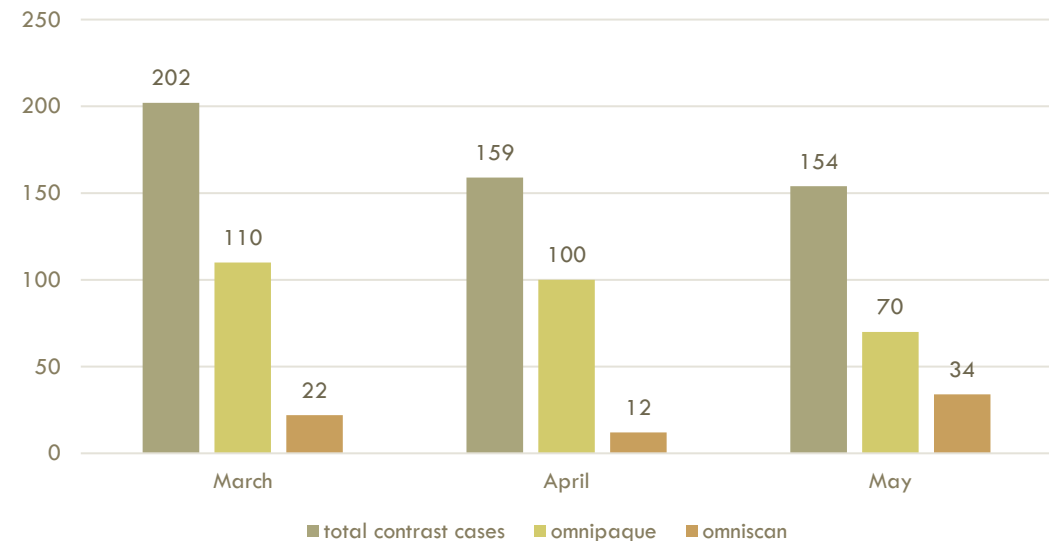
- The benchmarks of the department are monitored monthly. Benchmarking is used extensively in health services and identifies best practices to aspire in the organization.
- The number of films utilized in the X-ray procedures falls far below the benchmark. The benchmark for X-Ray films is 1.1 per study.
- The benchmark for CT films is 1.8 per study.
- For MRI studies, the number of films used exceeds the benchmark in March and April. In May, the films used are 560 against the benchmark of 602.8. The benchmark for MRI films is 2.2 per study.

CONTRAST UTILIZATION

Monthly contrast cases in CT Scan and MRI studies

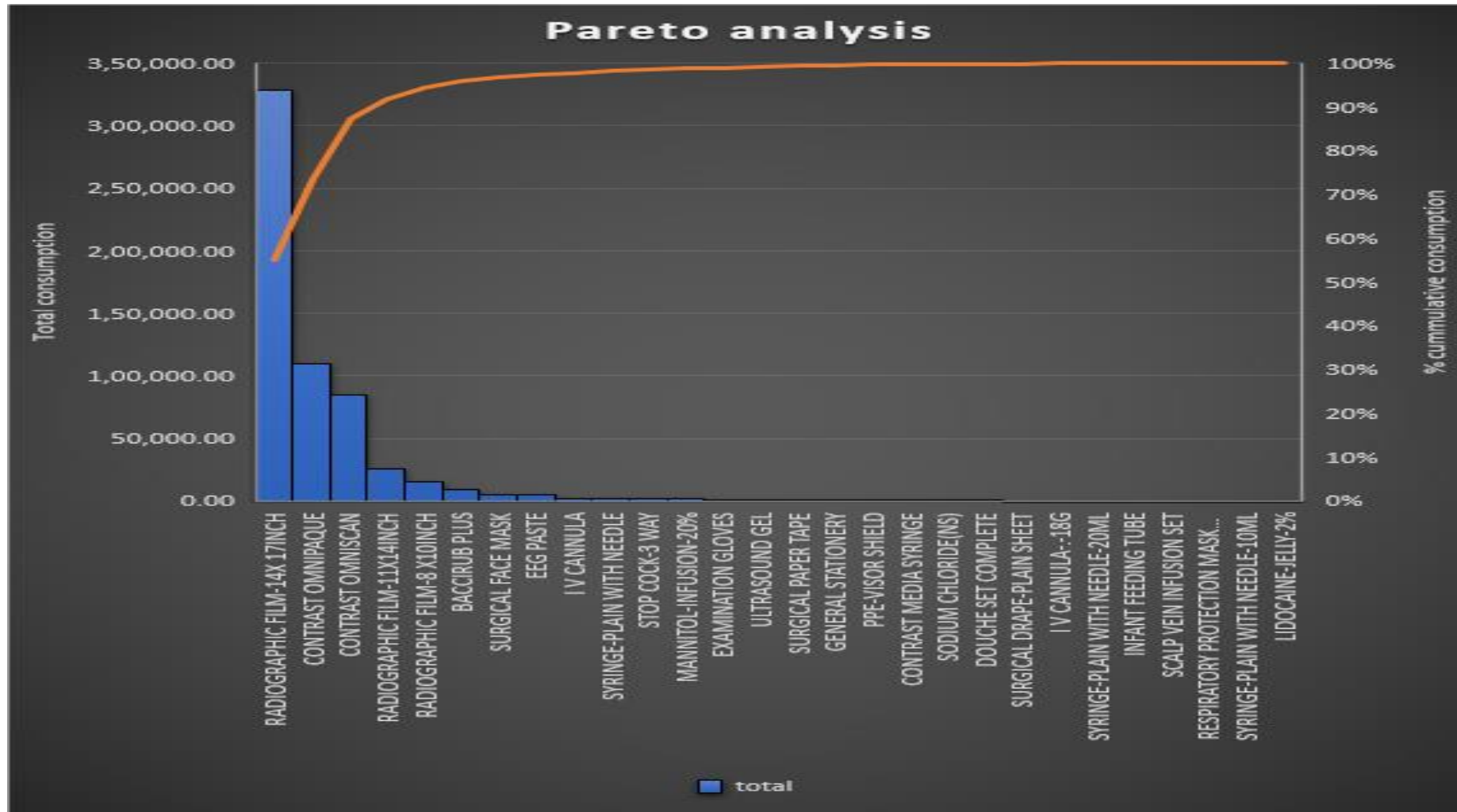


Contrast utilization March- May



- No wastage of contrast is reported during the study period.
- The contrast cases for CT scans are 162 which comprises 80.19% and the remaining 19.80% are for MRI studies in March. In April, the contrast CT cases are 84.90% and 15.09% are MRI contrast cases. The contrast cases differ in the month of May, with 59.09% of CT contrast cases and 40.90% MRI contrast cases.

PARETO ANALYSIS



Pareto diagrams are bar charts that are used to quantify data and depict the cost, frequency, or period. Here, the Pareto chart is used to depict the cost of various items consumed by the radiology department during 3 months.

MATERIALS COST AND CONSUMPTION %

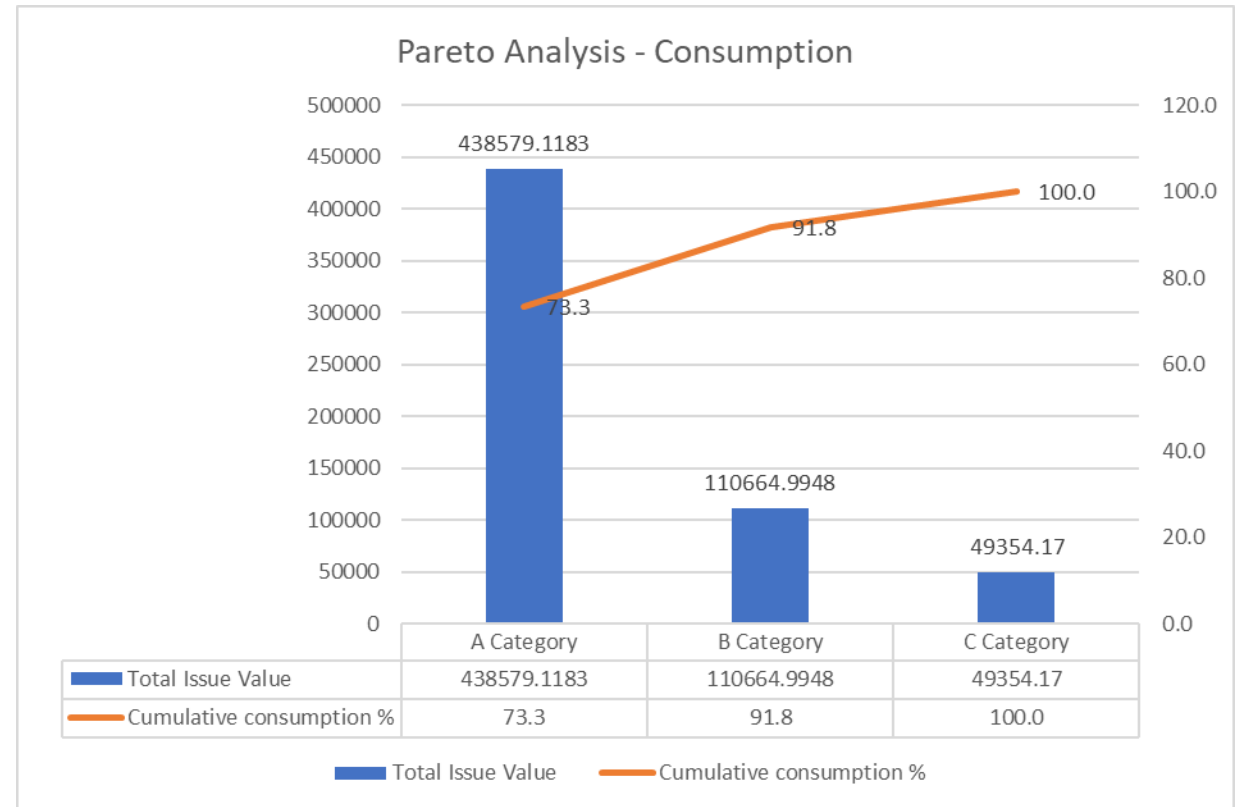
In the Pareto analysis, the materials are arranged in a descending manner with the highest value acquiring the top and lowest value at the bottom. The factors contributing the most to the particular effect ie the cost are displayed and visually analyzed.

Item name	Total cost	Cumulative consumption	% Consumption
RADIOGRAPHIC FILM-14X 17INCH	3,28,608.28	3,28,608.28	54.90
CONTRAST OMNIPAQUE	1,09,970.84	4,38,579.12	73.27
CONTRAST OMNISCAN	84,923.90	5,23,503.02	87.45
RADIOGRAPHIC FILM-11X14INCH	25,741.09	5,49,244.11	91.76
RADIOGRAPHIC FILM-8 X10INCH	15,325.48	5,64,569.59	94.32
BACCIRUB PLUS	9,374.28	5,73,943.87	95.88
SURGICAL FACE MASK	4,898.10	5,78,841.98	96.70
EEG PASTE	4,525.00	5,83,366.98	97.46
IV CANNULA	2,157.34	5,85,524.33	97.82
SYRINGE-PLAIN WITH NEEDLE	2,016.68	5,87,541.00	98.15
STOP COCK-3 WAY	1,959.91	5,89,500.91	98.48
MANNITOL-INFUSION-20%	1,890.00	5,91,390.91	98.80
EXAMINATION GLOVES	1,271.20	5,92,662.11	99.01
ULTRASOUND GEL	1,239.00	5,93,901.11	99.22
SURGICAL PAPER TAPE	1,138.24	5,95,039.36	99.41
GENERAL STATIONERY	826.70	5,95,866.06	99.54
PPE-VISOR SHIELD	551.39	5,96,417.45	99.64
CONTRAST MEDIA SYRINGE	532.00	5,96,949.45	99.72
SODIUM CHLORIDE(NS)	528.53	5,97,477.98	99.81
DOUCHE SET COMPLETE	268.80	5,97,746.78	99.86
SURGICAL DRAPE-PLAIN SHEET	212.80	5,97,959.58	99.89
IV CANNULA--18G	197.12	5,98,156.70	99.93
SYRINGE-PLAIN WITH NEEDLE-20ML	185.47	5,98,342.17	99.96
INFANT FEEDING TUBE	58.32	5,98,400.49	99.97
SCALP VEIN INFUSION SET	53.09	5,98,453.58	99.98
RESPIRATORY PROTECTION MASK N95	52.19	5,98,505.77	99.98
SYRINGE-PLAIN WITH NEEDLE-10ML	52.19	5,98,557.96	99.99
LIDOCAINE-JELLY-2%	40.32	5,98,598.28	100.00

PARETO ANALYSIS

80% of the cost is attributed to 20 % of items of consumption.

- ❑ In the hospital, the material consist of 73.3% of the cost is radiographic film-.-14inch x 17inch-x ray dry imaging and Contrast (iohexol)-350mg 100ml-omnipaque gel. These items are categorized in the A category.
- ❑ The material consisting of 16% of cost are contrast (gadodiamide)-0.5mmol/ml(20ml)-omniscan and Radiographic film- 11inch x 14inch-x-ray di hl dry imaging. These items are categorized in the B category.
- ❑ The remaining 24 items are classified into the C category. These items comprise 8 % of the total cost.
- ❑ Inventory control is essential for procuring the right materials, in the right quantity, at the right time, and the right cost.



Pareto Analysis - Consumption

Material Name	Total Issue Value	Consumption %	Cumulative consumption %
A Category	438579.118	73.2676875	73.267687
B Category	110664.995	18.4873559	91.755043
C Category	49354.17	8.24495684	100
	598598.282		

ABC Analysis

DISCUSSION:

The material consumption consists of 28 items indented for the radiology department during the study period i.e. from March to May.

The contrast cases are variable and the monthly cost associated with the contrast also fluctuates. The cost of the films is maximum for MRI studies. The film utilization is 2.32 films per study in March; 2.37 per study in April and 2.04 films per study in May. The benchmark for the films for the MRI studies is achieved in May.

The management of class A material is crucial to maintain an annual budget and their availability should be checked.

The management of class B material help in providing the essential items. They are at the level of less priority still their consumption must be watched with moderate control.

The management of class C material is at the least priority level.

The average consumption as part of the revenue is 4.59% for 3 months. The strict measures of control, monthly consumption analysis, and commitment of the staff members are contributory factors for the reduction in expenditure.



RECOMMENDATIONS:

- ❖ The maximum scope for cost reduction in the radiology department lies in the MRI Studies.
- ❖ The adoption of recent strategy of providing CDs for MRI studies, instead of films will reduce the film's utilization for MRI studies.
- ❖ To reduce the cost related to stationery and paper consumption, greater attention should be on linking the RIS with NH Care App. With the accessibility of all the reports online on NH Care App, the cost related to printing and stationery will be diminished.
- ❖ Eliminating paper records is another money-saving tactic.
- ❖ Negotiating rates with the suppliers and vendors for less rates for the items.
- ❖ The purchase department must be informed of the consumption pattern of contrast on a weekly basis.



CONCLUSION

It is an indispensable part of a hospital administrator to contain and reduce the cost and operating expenses.

The measures for cost reduction in the radiology department are optimum utilization of contrast and films, digitalization of services, achieving economies of scale, having a centralized buying unit for procurement, maintaining records of patients with insurance, and the use of IT.

The procurement strategy of the hospital and a strict watch on the consumption pattern of the department is commendable..

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THANK YOU

