

“IMPROVING MRI TURNAROUND TIME FOR ENHANCED PATIENT CARE: A QUALITY IMPROVEMENT INITIATIVE” IN KIMS HOSPITAL, SECUNDERABAD , TELANGANA- AN OBSERVATIONAL STUDY.



Dissertation Submitted to



The IIHMR University, Jaipur

For the partial fulfillment for the award of the degree

of Master of Business Administration (MBA)

in

Hospital and Health Management

by

Dr. Pallavi Agarwal

Under the Supervision and Guidance of

Dr. Mamta Chauhan

2023

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled “**Improving MRI Turnaround Time for Enhanced Patient Care: A Quality Improvement Initiative**” in KIMS Hospital, Secunderabad , Telangana-**An observational Study** is the bonafide record of my original researchwork. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished workof others has been duly acknowledged in the text.

A handwritten signature in black ink, appearing to read 'Pallavi', with a horizontal line underneath.

Dr. Pallavi Agarwal

Date: May 2023

COLLEGE CERTIFICATE

This is to certify that dissertation titled **“Improving MRI Turnaround Time for Enhanced Patient Care: A Quality Improvement Initiative”** in KIMS Hospital, Secunderabad, Telangana- **An observational Study** is a record of the research work undertaken by **Dr. Pallavi Agarwal** in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide: Dr. Mamta
Chauhan
IIHMR University, Jaipur
Date: May 2023

School Dean: Dr. (Col) Mahender
IIHMR University, Jaipur
Date: May 2023

ABSTRACT

TITLE:

“Improving MRI Scan Turnaround Time for Enhanced Patient Care: A Quality Improvement Initiative” in KIMS Hospital, Secunderabad, Telangana- An observational Study.

INTRODUCTION:

MRI^[1] is an important diagnostic tool in a world on medicine which assists the clinicians in providing accurate, timely, and detailed diagnosis thereby enabling the appropriate treatment. TAT (Turn Around Time) is a key performance indicator used by hospitals to monitor and enhance patient care quality and efficiency. Hospitals can improve patient outcomes, satisfaction, resource utilization, and financial success by striving for shorter TATs., TAT refers to the time interval between completing the MRI scan of one patient (patient A) and starting the next MRI scan for the next patient (patient B). TAT and patient waiting time are critical aspects in hospitals since they directly affect the patient's experience and satisfaction. Patient waiting time for MRI refers to the amount of time a patient must wait before receiving an MRI scan. Long waiting times can lead to the reduced footfall of patients in the hospital. As, radiology is the most frequently visited department and is considered to be revenue generating, it must be made sure that the waiting times must be reduced to achieve maximum patient satisfaction thereby improving the excellence of service quality.

OBJECTIVE:

To assess the patient waiting time and turnaround time for MRI scans in the radiology department, to find out the gaps leading to increased waiting times and increased scan times, & to provide relevant suggestions for improvements based on the study findings.

METHODOLOGY:

It is an Observational cross sectional descriptive study conducted at radiology department at KIMS Hospitals, Secunderabad, Telangana. A total of 260 observations were taken for KIMS Hospitals, Secunderabad and 100 observations for KIMS Hospitals, Paradise. Out of which, 100 samples are selected by random sampling for detailed analysis. The duration of the study was 3 months.

Inclusion Criteria: All the OP & IP patients visiting the radiology department for MRI during daytime. Exclusion Criteria: Anesthesia cases, Patients coming during night shifts, pregnant women, special or VIP Cases.

KEY FINDINGS:

The main causes of the delay of MRI scan and increased waiting times were later arrival of the patient, non-cooperative patient, anxiety and discomfort of patient due to machine noise, claustrophobic patients, delay in pre-scan preparation of patients and billing delays depending upon cash, corporate or package patients.

SUGGESTIONS:

All computers must be regularly updated to avoid any system error issues. Regular analysis of the blank slots must be done to provide it to the next patient. Some music system must be there to ensure the noise cancellation of machine.

KEY WORDS:

Radiology, Magnetic Resonance Imaging, Turn Around Time, Waiting time.

ACKNOWLEDGEMENT

I would like to convey my warm regards and gratitude to my mentor at KIMS Hospitals, Ms. Renuka Radhakrishnan, Manager of Corporate Projects for giving me this golden opportunity to do this wonderful project and without whose active guidance and kind co-operation I would have not made headway in my training period. It has been my privilege to work and learn from her.

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I would also like to present my heartily gratitude to my mentor at IIHMR University, Dr. Mamta Chauhan, Professor for constantly leading my way throughout this span of internship.

Dr. PALLAVI AGARWAL

Hospital & Healthcare Management 2021-2023

IIHMR University, JAIPUR

ABBREVIATIONS

OP	Out Patient
IP	In Patient
ER	Emergency
MRI	Magnetic Resonance Imaging
TAT	Turn Around Time
ENT	Ear Nose Throat
MRCP	Magnetic Resonance Cholangio Pancreatography
PACS	Picture Archiving and Communication Systems
QMS	Queue Management System
RIS	Radiology Information System
HMIS	Hospital Management Information System

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1.1 ORGANIZATION PROFILE



KIMS^[2] facilities is one of India's major corporate healthcare organizations, with facilities in Telangana, Andhra Pradesh, and Maharashtra offering multi-disciplinary integrated healthcare services with a focus on tertiary and quaternary healthcare at reasonable prices. Under the "KIMS Hospitals" brand, 12 multi-specialty hospitals with a total bed capacity of nearly 4,000 beds are managed. KIMS provide comprehensive healthcare services in over 25 disciplines and super specialties, including cardiac sciences, oncology, neurosciences, gastroenterology, orthopedics, organ transplantation, renal sciences, and mother and childcare.

Under the leadership of Dr. Bhaskar Rao Bollineni, founder and Managing Director, and Dr. Abhinaya Bollineni, Executive Director, and CEO, it has developed from a single hospital to a chain of multi-specialty hospitals through organic expansion and smart acquisitions. The first hospital in the network, Nellore, opened in 2000 and has a capacity of about 200 beds.

According to the CRISIL^[3] Report, KIMS Hospitals, Secunderabad is the flagship hospital and one of the largest private hospitals in India at a single location (excluding medical colleges), with a capacity of 1,000 beds. KIMS Hospitals believes that the price and quality of healthcare services given, as well as a track record of developing long-term partnerships with medical professionals, especially doctors, have facilitated and aided expansion.

Vision:

To be the most opted healthcare services brand by offering people with affordable treatment and the finest clinical outcomes. And to be the best environment for doctors and people to work.

Mission:

- Providing inexpensive quality care to our patients through patient-centric systems and processes.
- Enabling clinical outcome driven excellence through the use of current medical technology and providing a strong motivation for doctors to pursue academics and medical research.

Department of Radiology:

KIMS Department of Radiology and Medical Imaging is a highly specialised, round-the-clock full-service department that attempts to address all patient and clinician needs in Diagnostic Imaging and Image Guided Therapies. The department is known for providing the most modern radiology and medical imaging services to patients and physicians. Radiologists seek to give their colleagues with the tools and information they require to achieve diagnostic and therapeutic excellence. Since its founding, the department of Radiology at KIMS has established a reputation as a top centre for imaging and minimally invasive treatment services. It serves not only patients from the hospital but also patients from the surrounding community. Services and programs provided at the KIMS Department of Radiology include:

- | | |
|----------------------------|--------------------------|
| • 3D and Advanced Imaging | • Ultrasound |
| • Abdominal Imaging | • Cardiothoracic Imaging |
| • Body CT | • Cardiovascular Imaging |
| • Gastrointestinal Imaging | • Thoracic Imaging |
| • Genito-urinal Imaging | • Breast Imaging |
| • MRI | |

1.2 STUDY BACKGROUND

MRI^[4] is a non-invasive and painless diagnostic imaging procedure that creates clear images of the inside of the body using a powerful magnetic field and radio waves. MRIs are used to detect a wide range of medical disorders, including tumors, traumas, and brain and spine ailments. MRI is an important diagnostic tool in a world on medicine which assists the clinicians in providing accurate, timely, and detailed diagnosis thereby enabling the appropriate treatment. The salient features of MRI like accurate diagnosis, non-invasiveness, detailed & real time imaging is a boon for providing treatments for various ailments, diseases, and conditions.

Thus, MRI can be kept equivalent to quality of treatment and services provided. Quality can be explained as the ability and potential to deliver results in a fair amount of time while keeping a high level of accuracy and attention to detail. In order to ensure excellent service quality and improvisation of the ongoing services. TAT (Turn Around Time) is a key performance indicator used by hospitals to monitor and enhance patient care quality and efficiency. Hospitals can improve patient outcomes, satisfaction, resource utilization, and financial success by striving for shorter TATs.

Here, TAT refers to the time interval between completing the MRI scan of one patient (patient A) and starting the next MRI scan for the next patient (patient B). TAT and patient waiting time are critical aspects in hospitals since they directly affect the patient's experience and satisfaction. Patient waiting time for MRI refers to the amount of time a patient must wait before receiving an MRI scan. A long TAT & prolonged waiting times can lead to patient dissatisfaction, increased anxiety, and delays in diagnosis and treatment. Delayed MRI Scans lead to delayed diagnosis and treatment of certain medical conditions that require immediate & prompt attention leading to worsening of patient's health condition. This delayed diagnosis lead to more extensive treatment at later stages, thereby increasing the healthcare costs and decreasing the patient satisfaction.

TAT is a critical & useful metric^[5] in hospitals for a number of reasons:

- **Patient outcomes:** A shorter time to diagnosis and treatment can lead to speedier diagnosis and treatment, which can enhance patient outcomes. A physician, for example, can make a

more informed judgement regarding a patient's treatment plan if a laboratory test result is accessible more rapidly.

- **Patient satisfaction:** This is enhanced by reduced wait times and faster results. Hospitals that prioritize shorter TATs may see an increase in patient satisfaction. Shorter TAT can increase the efficient use of resources like MRI machines, laboratory equipment, and hospital staff. More patients can be handled in the same period of time by minimizing the length of time a resource is tied up for a single patient.
- **Financial Impact:** TAT may have a financial influence on a hospital's revenue, particularly when speedier test results or treatment are required.

Addressing TAT and patient waiting time issues in hospitals necessitates a multifaceted approach that considers both patients' and staff's concerns. Healthcare facilities can provide a better experience for patients and assure rapid and accurate diagnosis by optimizing processes, expanding resources, and improving communication.

This study ensures that the TAT is measured and the gap analysis has been done to identify the possible factors contributing in the delay of investigation. At last, it ensures that appropriate suggestions are given based on the study findings so as to improve the TAT and waiting times to bridge the void between dissatisfaction and satisfaction and to achieve the maximum possible output in terms of increase in growth of the organization via the means of maximizing the revenues.

1.3 RATIONALE OF STUDY: -

The rationale of this study is to assess the efficiency of the MRI scan process from the time a patient goes for an investigation till that patient comes out and next patient enters. The study's goal is to identify the elements and to find out the gaps leading to process delays and inefficiencies and to provide relevant solutions to improvise turnaround time. There are various reasons why MRI turnaround time studies are significant. First, MRI delays can have a detrimental influence on patient treatment, as lengthy wait times can cause anxiety, discomfort, and decreased patient satisfaction. Second, delays can have an influence on the overall efficiency of the healthcare system by increasing waiting times for other patients and increasing expenses owing to squandered resources. Finally, finding opportunities for improvement in the MRI process can assist healthcare professionals in optimizing resources, improving patient care, and lowering total costs. An MRI

turnaround time study can assist healthcare practitioners in identifying potential for process improvement, improving patient care, and optimizing resource efficiency.

1.4 RESEARCH QUESTION: -

- What is the Turn Around Time for MRI Scan at radiology department at KIMS Hospitals, Secunderabad?
- What are the factors associated with increased time duration of scans, increased waiting times and delays?
- How can the factors causing delay be optimized to improve the efficiency of MRI scanning process?

1.5 AIMS & OBJECTIVES: -

1. To evaluate the existing turnaround time for MRI scan and locate any workflow bottlenecks or inefficiencies in the imaging department elements that affect the turnaround time for MRIs.
2. To conduct a gap analysis and identify areas for process improvement to expedite MRI turnaround times, increase patient volume, and enhance patient satisfaction."
3. To assess the cost-effectiveness and ensuring the optimum and efficient utilization of resources- staff, machines and equipment by looking at the number of patients served per machine and comparing it with the scan time.
4. To provide recommendations based on the findings of study that can help KIMS Hospital to optimize its resources, reduce costs, and enhance patient satisfaction by improving MRI turnaround time.

1.6 PROCESS FLOW

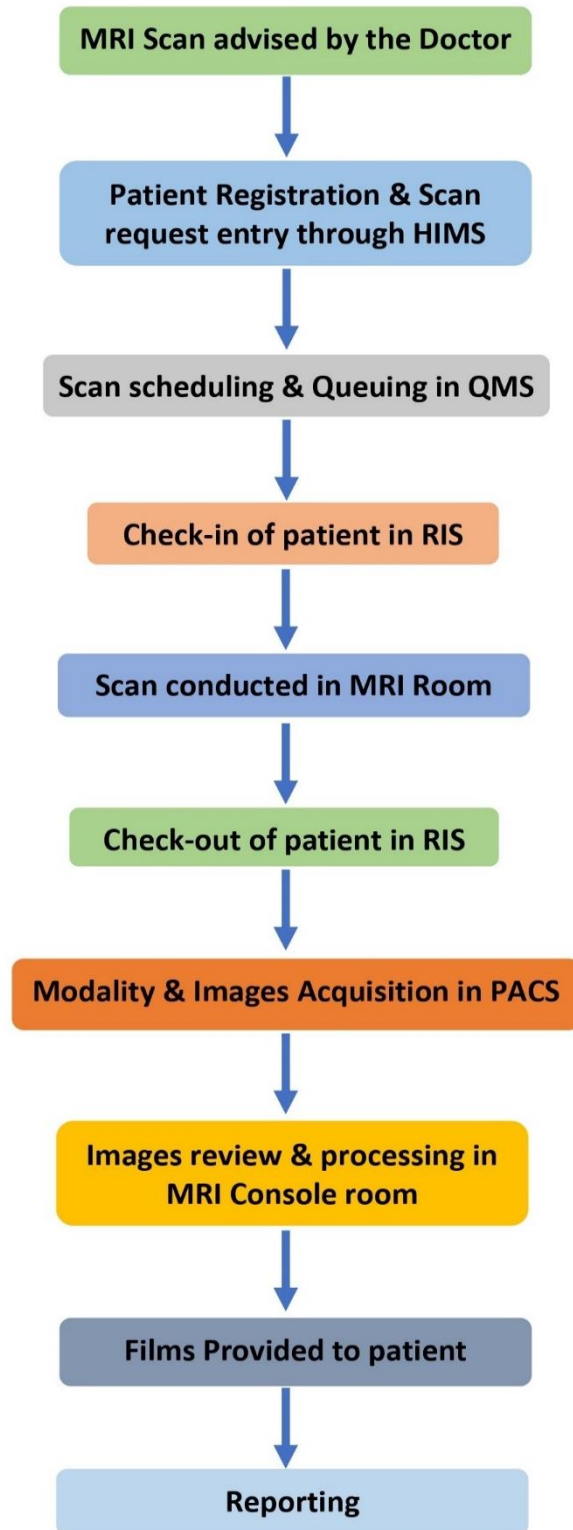


Figure- 1.1

1.7 LEAN SIX SIGMA

It is a problem-based approach which is used for process improvement and management and it also reduces variability. This uses: DMAIC Approach.

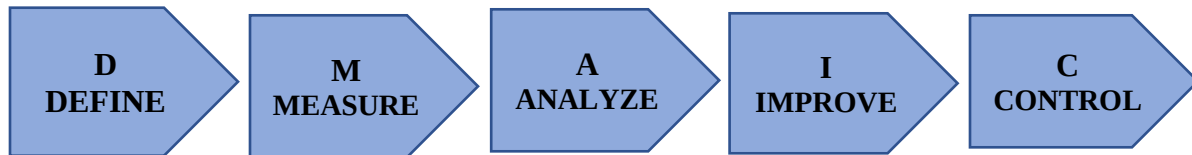


Figure- 1.2

DMAIC Approach: The whole process comprises of five phases which are:

1. **DEFINE:** We define a problem and the goals to be achieved at the end as per the need of the organization.
Here, the problem is delayed MRI scan time and increased waiting time. The goal to be achieved is to minimize the waiting time so as to attain the maximum level of patient satisfaction.
2. **MEASURE:** Data collection is done so as to assist the identification of problem and to develop strategies for improvement. Both primary and secondary data collection is done.
Here, Real time data is collected by observation.
3. **ANALYZE:** The collected data is analyzed so as to identify the gaps, barriers and most important of all is the root cause leading to the problems in the current process.
Here, data is analyzed with the help of MS-Excel. Bar graphs, pie charts, Fish bone diagram, Pareto Analysis is done.
4. **IMPROVE:** The relevant recommendations based on the study are given, and the strategies are made in order to improvise the current process.
Here, the suggestions given are implemented after detailed discussion and then the effects and results are observed.
5. **CONTROL:** It means that the team ensures that the goals achieved or the improvements made are sustained throughout and relapse of problem don't occur.
Here, timely audits are scheduled to achieve this phase.

CHAPTER-2

LITERATURE REVIEW

Author Name	Title	Methodology	Results
Michael P. Recht, Kai Tobias Block et al. (2019) ^[6]	MRI Turnaround Time Optimisation Using Dock able Tables and Innovative Architectural Design Strategies.	Turnaround times were measured at the new centre and two existing centres for all patients as well as circumstances where the next patient was ready to be brought into the scanner room after the prior patient's examination was completed.	The optimised MRI workflow saved an average of 5 minutes and 28 seconds per patient.
Bernhard Breil, Fleur Fritz, Volker Thiemann & Martin Dugas (2011) ^[7]	TAT Mapping to a Generic Timeline: A Systematic Review of TAT Definitions in Clinical Domains.	The information system under consideration is limited to clinical information systems that have a direct impact on an electronic health record. As a result, the study excluded systems typically utilised for billing, enterprise resource planning, or data warehousing. The users under consideration are hospital workers and patients. There was no distinction between processes for inpatients and outpatients because generic TAT definitions are relatively comparable.	Admission, order, biopsy/examination, receipt of specimen in laboratory, procedure completion, interpretation, dictation, transcription, verification, report available, delivery, physician views report, treatment, discharge, and discharge letter sent were the 15 terms that emerged from the consensus process.

Ashik Ahamed. A Victor R. Lazar Melinda Monica A (2019) ^[8]	In the institution, turnaround time (tat) and waiting time (wt) for general radiological investigations was evaluated.	This study included 300 participants (60 each modality), with an equal number of male and female patients in each modality. Each day (Monday-Saturday), two patients (1 male and 1 female) were chosen at random in all modalities of CXR, DXR, USG, CT, and MRI. Due to the priority of immediate scanning, Sunday, public holidays, night, and emergency patients were excluded.	Based on noncontract studies, this study discovered that the TAT for CXR, DXR, and CT are within the time frame set by our department. The maximum TAT for MRI investigation was 77 minutes longer than the specified time. The maximum TAT for USG investigation has been surpassed by 5 minutes. The average TAT for all modalities is within the department's time frame.
Abhinav Dileep Wankar (2014) ^[9]	An investigation into the determination of laboratory turnaround time in an Indian tertiary care hospital.	For the study, 232 samples were followed for three months and were counselled by OPD experts. A total of 232183 samples were collected for examination. The remaining 49 samples were omitted from the study.	The average delay between sample collection and lab arrival was 15 minutes and 38 seconds. The sample should arrive at the laboratory within 10 minutes of being collected. As a result, there is a transportation delay.

Michael Mayer, and Ronnie Sebro. (2019) ^[10]	Clinician Turnaround Time: Implications for Musculoskeletal Radiology - An Important and Often Ignored Turnaround Time in Radiology.	A total of 1765 patients had routine MSK MRIs between January 1, 2015 and December 31, 2016. Proportions were compared using Fisher's exact testing. To compare turnaround time data, Wilcoxon Rank Sum tests were performed.	There was no difference in TAT between studies done and interpreted on weekends and those performed and interpreted the following Monday (P = 0.750). However, doctors were substantially less likely to read weekend-interpreted reports than weekday-interpreted studies (P = 0.001).
Shireen E. Hayat Ghaibi Cecilia G.Cazaban (2011) ^[11]	The efficiency and turnaround time of paediatric outpatient brain magnetic resonance imaging: a multi-institutional cross-sectional study.	Four academic paediatric hospitals participated in this multi-institutional cross-sectional study. Children aged 0 to 18 years who had an outpatient MRI of the brain without the use of a contrast agent. The overall MRI TAT calculated from time stamps was the outcome of interest for us.	The average overall TAT varied widely across the four hospitals. A sedated brain MRI lasted from 158 to 224 minutes, a non-sedated MRI from 70 to 112 minutes, and a restricted MRI from 44 to 70 minutes. Having a sedated MRI was the most important predictor of a longer overall TAT.

CHAPTER-3

METHODOLOGY

3.1

Study Design: Observational cross-sectional descriptive study

Setting: Radiology department at KIMS Hospitals, Secunderabad, Telangana.

Radiology department at KIMS Sunshine Hospitals, Paradise, Telangana.

Study Population: Patients on machine 1.5 T and 3 T were observed for KIMS Hospitals Secunderabad and patients on 1.5T were observed for KIMS Hospitals Paradise as only 1.5 T machine is there.

- **Inclusion Criteria:** All the OP & IP patients visiting the radiology department for MRI during daytime.
- **Exclusion Criteria:** Anesthesia cases, Patients coming during night shifts, pregnant women, special or VIP Cases.
(Anesthesia cases excluded to eliminate the bias as these cases take longer to complete than usual cases. Patients coming in night shift excluded as my duty hours are during daytime from 9AM to 5PM.)
- **Study Tools:** Primary data collection was done by direct observation of In-time (patient entering the MRI Room) and Out-time (Patient exiting the MRI Room). Data Analysis is being done with the help of MS Excel. Secondary data collection from PACS, QMS.

Duration of Study: 3 Months i.e., from 27th Feb,2023 to 27th May,2023

Sample Size: 200 Patients visiting the Radiology department for MRI Scan. (100 each from Secunderabad & Paradise unit)

Sampling Technique: Systematic Random Sampling

Data Collection procedure: Checklist

Operational Definitions: TAT, Gap Analysis

3.2 DATA ANALYSIS PLAN: -

Data has been analyzed by observing the appointment time given to the patient or by noting the time the appointment was originally scheduled at and then comparing it with real time of scan. Also, the scan duration of each MRI Modality is duly noted so as to identify the scan time for each investigation and finding out the probable bottlenecks causing the delay and prolonged scans

durations.

- Quantitative Data was analyzed using MS-Excel by dividing data into:

Appointment time given to patient & patient actually entering into MRI Room for scan.	Waiting Time
Investigation-In & Investigation-Out Time	Scanning Time

Table- 3.1

- Qualitative Data was analyzed using frequency, pie charts, bar graphs.

3.3 ETHICAL CONSIDERATIONS:

The study has been approved by the Institutional Review Board (IRB) of KIMS Hospital, and all ethical considerations, such as informed consent, cause no harm, confidentiality, and anonymity, have been duly addressed.

3.4 IMPLICATIONS OF RESEARCH:

To understand the challenges faced by the radiology department in optimizing the patient flow, factors responsible for causing delay in investigation and giving appropriate suggestions to improvise the process flow so as to achieve maximum patient satisfaction and improvising the service quality. Thus, the implications of this study include:

1. **Patient Care:** By enabling doctors to make more prompt and precise diagnoses, expedited turnaround times can improve patient care. For patients with significant diseases that call for early treatment, this may be especially crucial.
2. **Cost-Effectiveness:** By eliminating the need for additional tests or treatments, quicker turnaround times can also result in cost savings for healthcare providers. This may lead to better resource management and more effective healthcare resource use.
3. **Quality of Care:** Analyzing MRI turnaround times can reveal areas in which the healthcare system needs to be improved in order to give patients higher-quality care. Better patient results and more patient satisfaction may result from this.

4. **Workload optimization:** MRI turnaround time research might aid healthcare professionals in streamlining their process.
5. **Overall Patient Experience:** Improved TAT and decreasing the delays would help to provide better patient satisfaction and would contribute in overall growth of the organization. The recommendations suggested at the end of the study will be implemented along with some changes in the process flow and introduction of advanced software and new technologies that would yield better future outcomes and will thereby improve the overall patient experience.

CHAPTER-4

OBSERVATIONS

4.1 KIMS HOSPITAL SECUNDERABAD

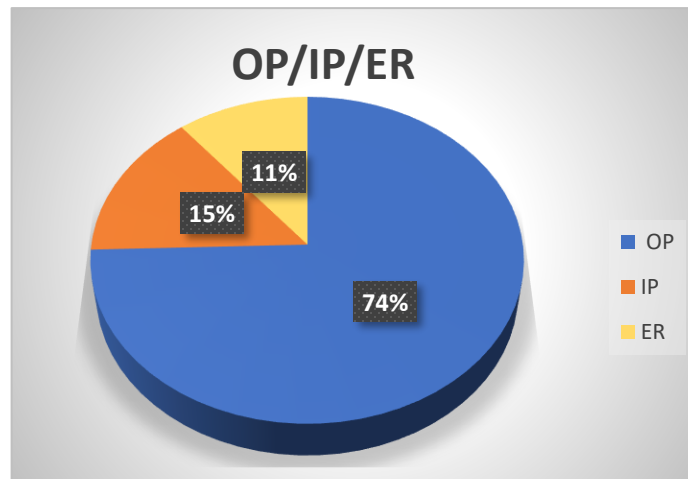


Figure- 4.1

- Out of 100 patients, 74% patients are OP, 15% patients are IP, & 11% patients are ER.

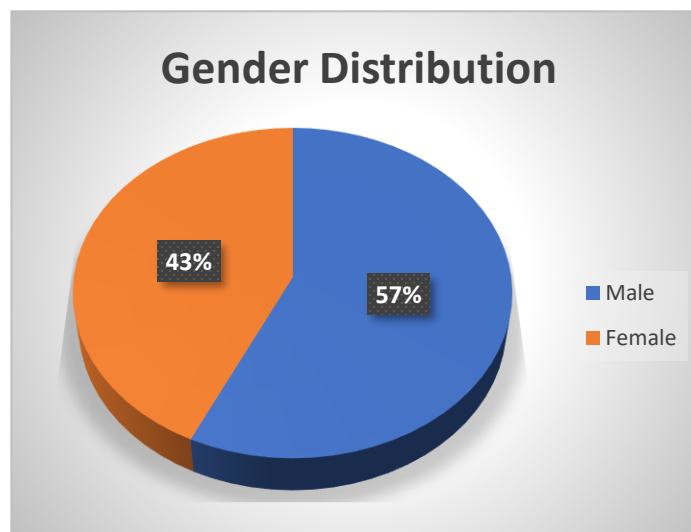


Figure- 4.2

- Out of 100 patients, 57% patients are males & 43% patients are females.
- Many females want female housekeeping staff to position them on MRI table.
- Also, it is observed that females were much more anxious than male patients during MRI scan.

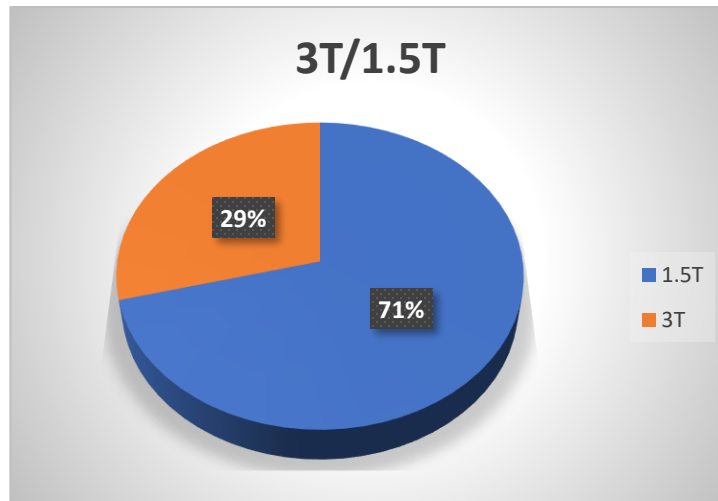


Figure- 4.3

- Out of 100 scans, 71% were conducted on 1.5T & 29% were conducted on 3 Tesla.
- MRI scans on 3T machine takes more time as compared to scans on 1.5 T machine.
- 3T machine gives better image clarity and thus more detailed and complex scans like MRI fistulogram, MRI Cisternogram, MRCP, Cardiac MRI, MRI abdomen etc. were conducted on it.

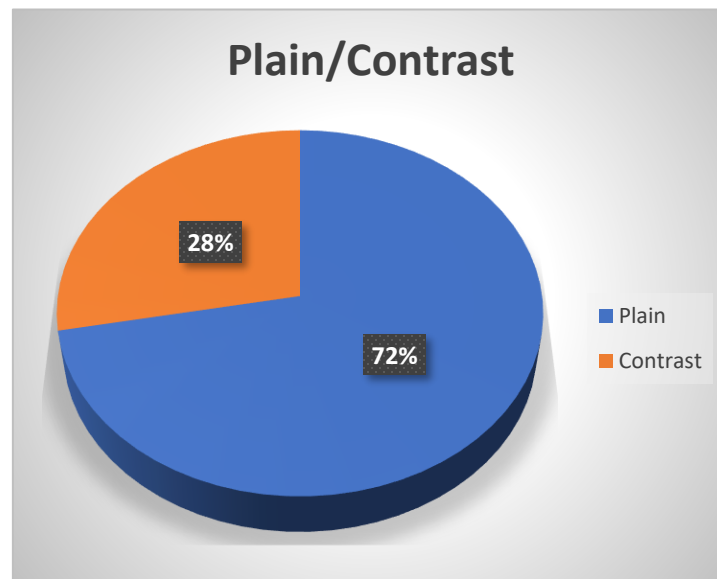


Figure- 4.4

- Out of 100 scans, 72% were plain (without administration of contrast) & 28% were done with the administration of contrast. Plain scans were required for preliminary purposes but contrast scan was done for more depth study and was specifically mentioned in the prescription by the doctor.
- MRIs with contrast take longer time than plain MRI's .
- Longer patient preparation time due to insertion of cannula for administration of contrast agent leads to delay.

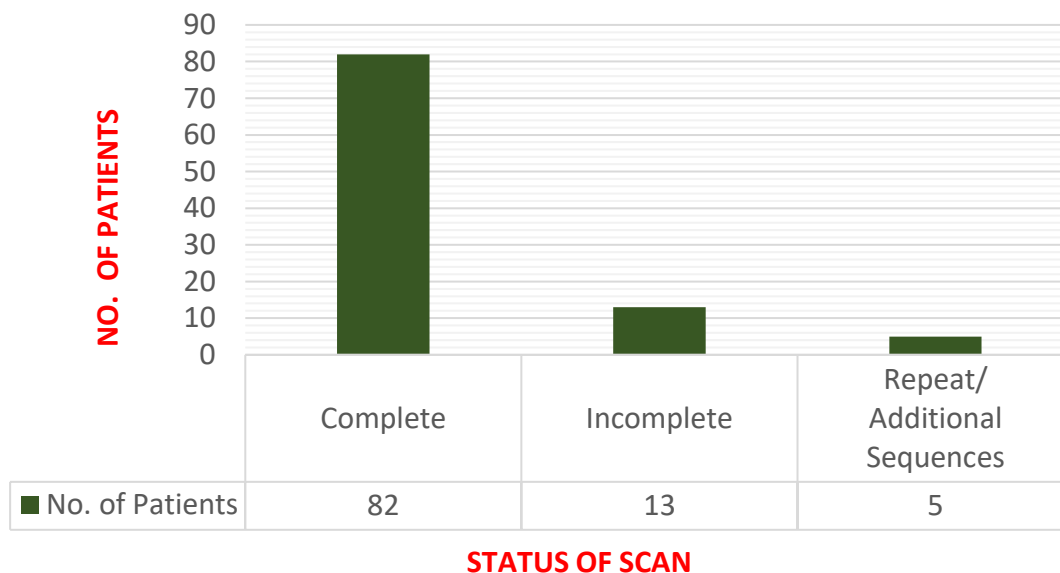
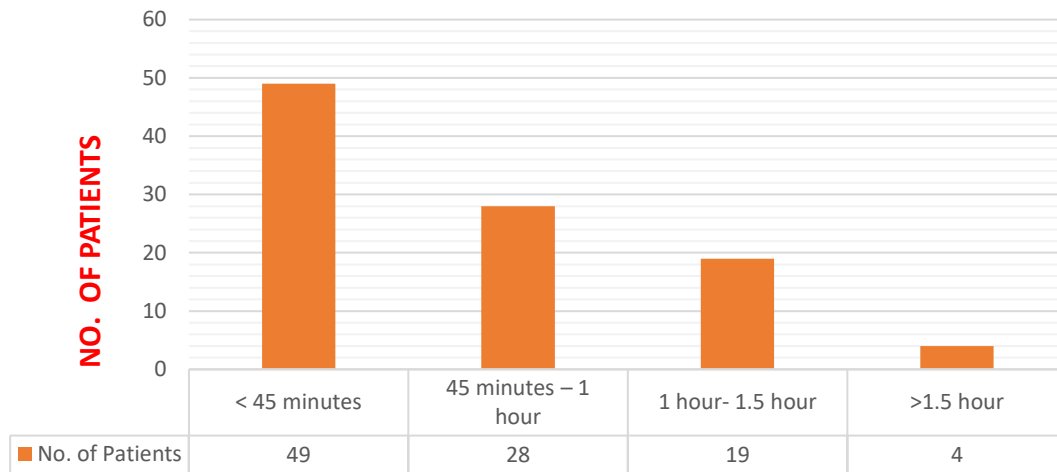


Figure- 4.5

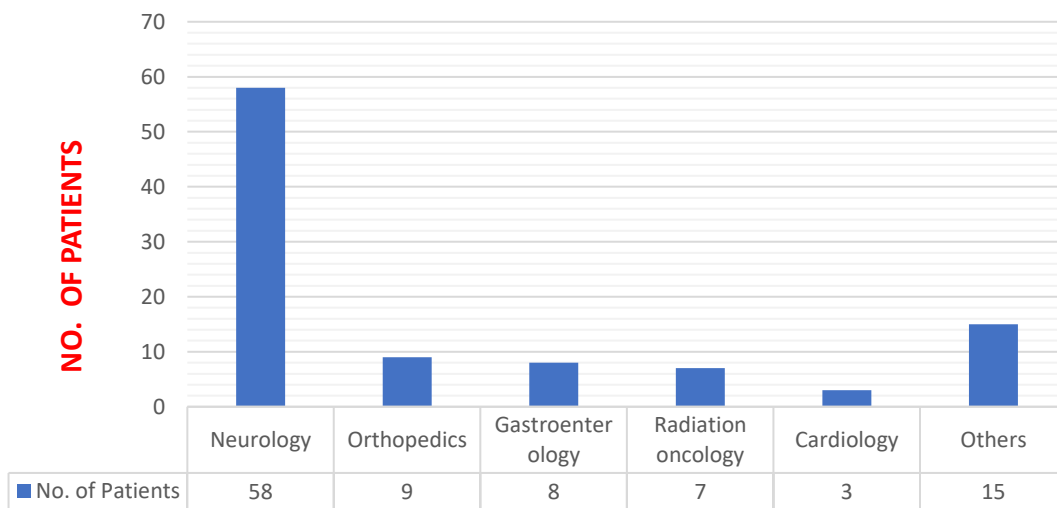
- Out of 100 Scans, 82 were complete scans, 13 scans were incomplete & 5 scans were the repeat scans.
- Incomplete scans are mainly due to non-cooperative patients because when observed from MRI Console room and later feedback was taken, patients mentioned that they were non-cooperative due to fear/pain/claustrophobia/high noise of MRI machine etc.
- Repeat scans are due to:
 - . Scans taken prior are not clear.
 - . Doctor asked for another scan with more clarity.
 - . Doctor asked for additional sequences for diagnosis.



SCAN DURATION

Figure- 4.6

- <45 Minutes: 49 Scans
- >45 Minutes: 51 Scans (28 + 19 + 4)
- As per the ideal time Table no.4.1, majority of scans must be finished under 45 minutes except for Cardiac MRI having ideal time of 45-50 mins. According to fig. no- 4.7, the number of Cardiac MRIs are 3. So, only 3 scans must go beyond 45 minutes ideally. But here, according to fig. no- 4.6, 51 scans are going beyond 45 minutes.



SCAN ACC. TO SPECIALITY

Figure- 4.7

- More cases of Neurology due to more MRI's of the brain as compared to other body parts/organs because Dr. X is a well-renowned neurologist in Secunderabad who conducts his OPD in KIMS hospital, Secunderabad.
- Others: Gynecology, Obstetrics, ENT, Pediatrics, Rheumatology.....etc.

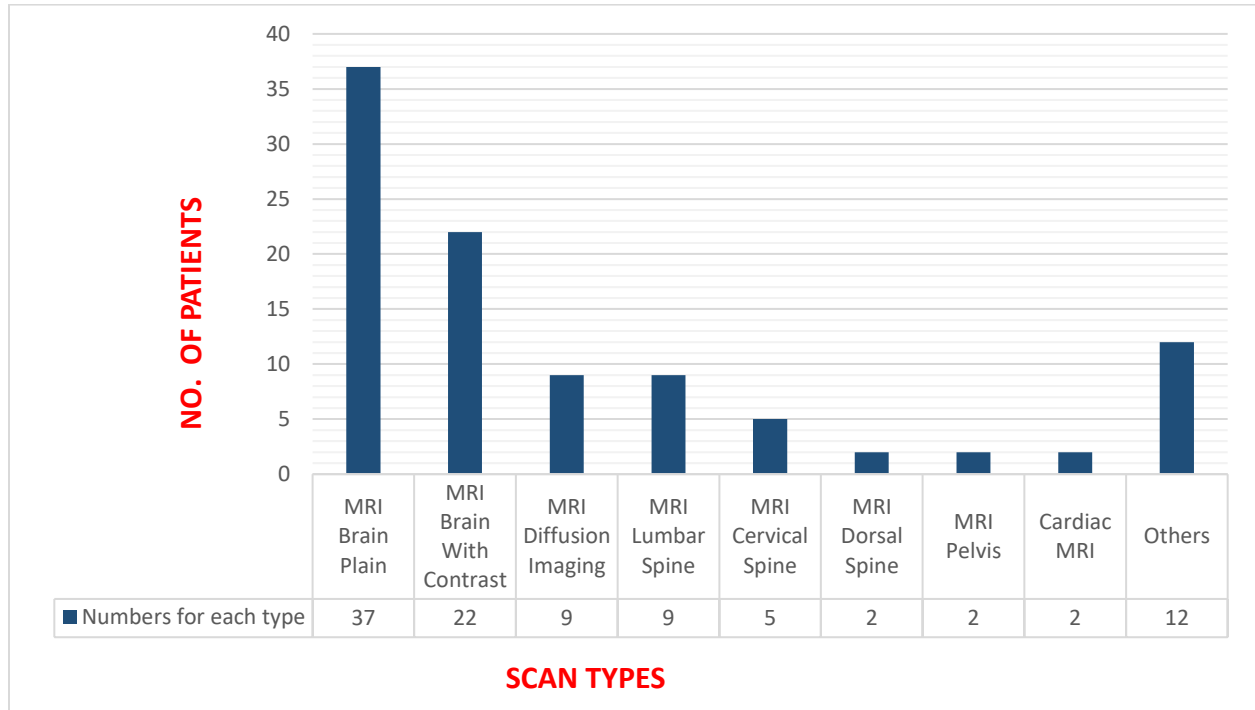


Figure- 4.8

*Others: MRCP, MRI-Epilepsy protocol, MRI- Stroke Protocol, MRI-Fistulogram, MRI-Venogram, MRI- Cisternogram, MRI- Knee, shoulder, elbow, ankle, foot etc....

SCAN MODALITY	TIME (IN MINUTES)		DEVIATION (T2-T1) (in Minutes)
	IDEAL SCAN TAT (T1)	ACTUAL SCAN TAT (Average)(T2)	
MRI Brain Plain	30	45	15
MRI Brain with Contrast	40	54	14
MRI Lumbar Spine	40	47	7
MRI Cervical Spine	40	50	10
MRI Diffusion Imaging	35	36	1
MRI Pelvis	30	53	23
Cardiac MRI	45	88	43
MRI MRCP	50	68	18

Table- 4.1

***{Source of Ideal Scan TAT : QMS Data of KIMS Hospitals, Secunderabad}**

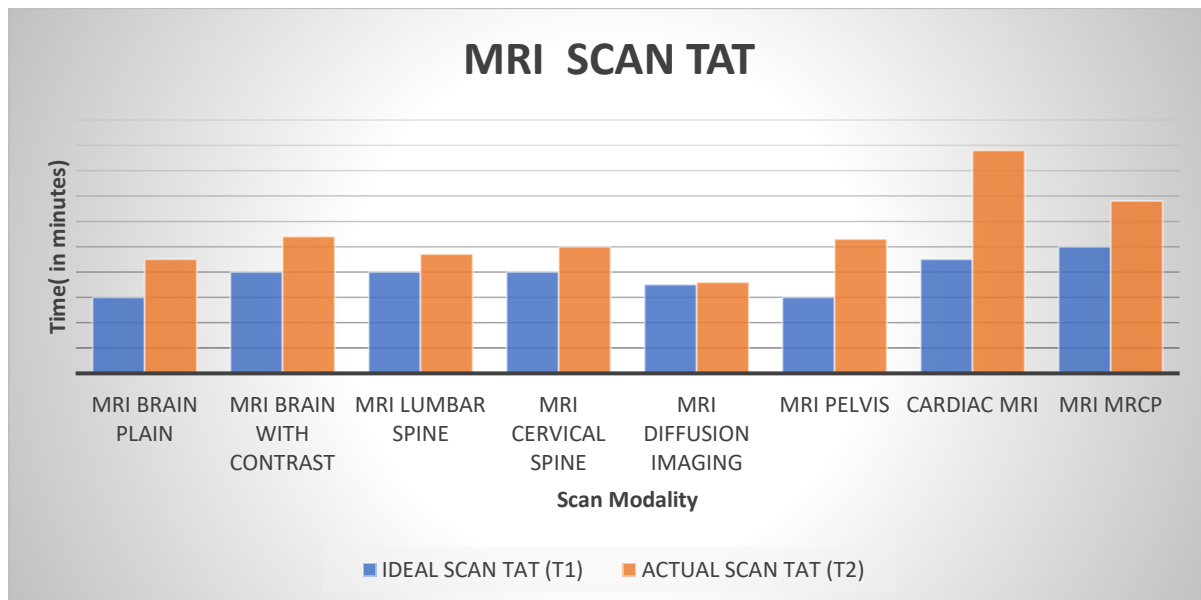


Figure- 4.9

- All the scan modalities are showing deviation from their ideal time.
- Least deviation has been shown in MRI Diffusion Imaging with deviation of 1 minute.
- Highest deviation has been shown in Cardiac MRI with deviation of 43 minutes.
- The reason for the deviation in cardiac MRI is that this is the specialized scan as it requires patient to hold the breath for approx. 15 seconds and involves breathing exercises. Patient finds it difficult to follow the instructions given during the scans, they are unable to hold the breath and thus it takes longer than usual to instruct them accordingly.

4.2 KIMS HOSPITAL PARADISE

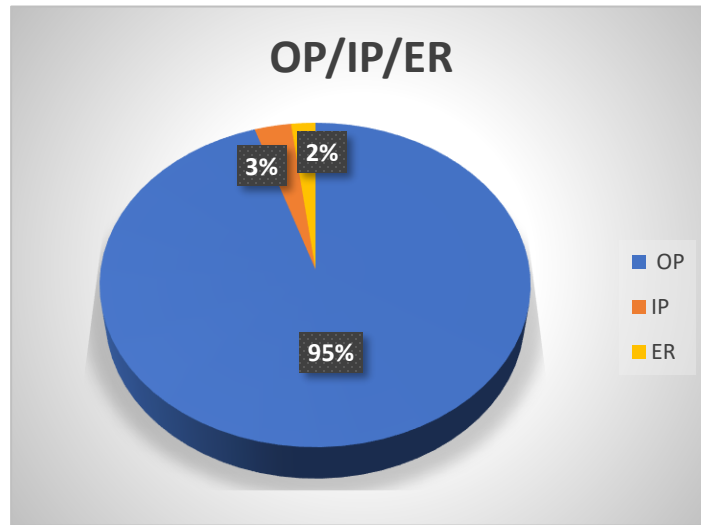


Figure- 4.10

- Out of 100 patients, 95% patients are OP, 3% patients are IP, & 2% patients are ER.
- During the observations, ER Patients were less.
- IP patient scans were conducted only when the machine was free (if not urgent).

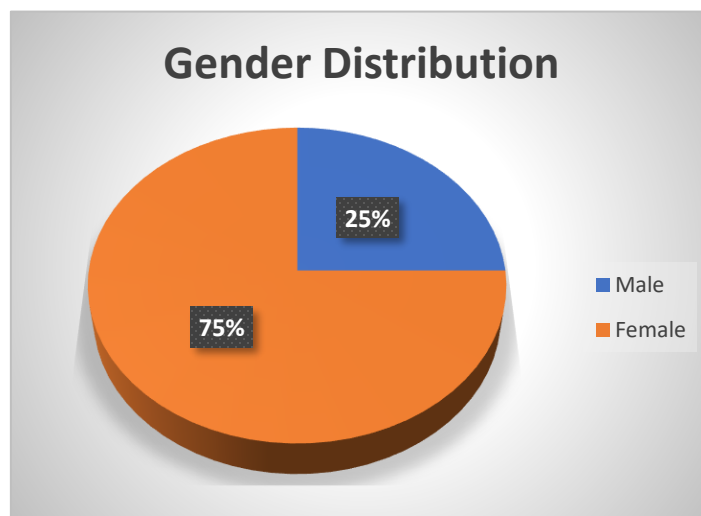


Figure- 4.11

- Out of 100 patients, 25% patients are males & 75% patients are females.
- Many females want female housekeeping staff to position them on MRI table and female housekeeping staff was readily available.

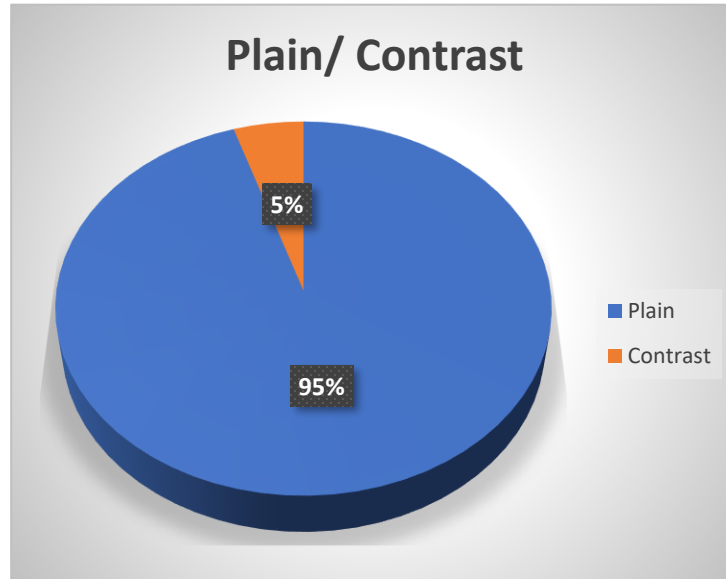


Figure- 4.12

- Out of 100 scans, 95% were plain (without administration of contrast) & 5% were done with the administration of contrast.
- MRIs with contrast take longer time than plain MRI's .

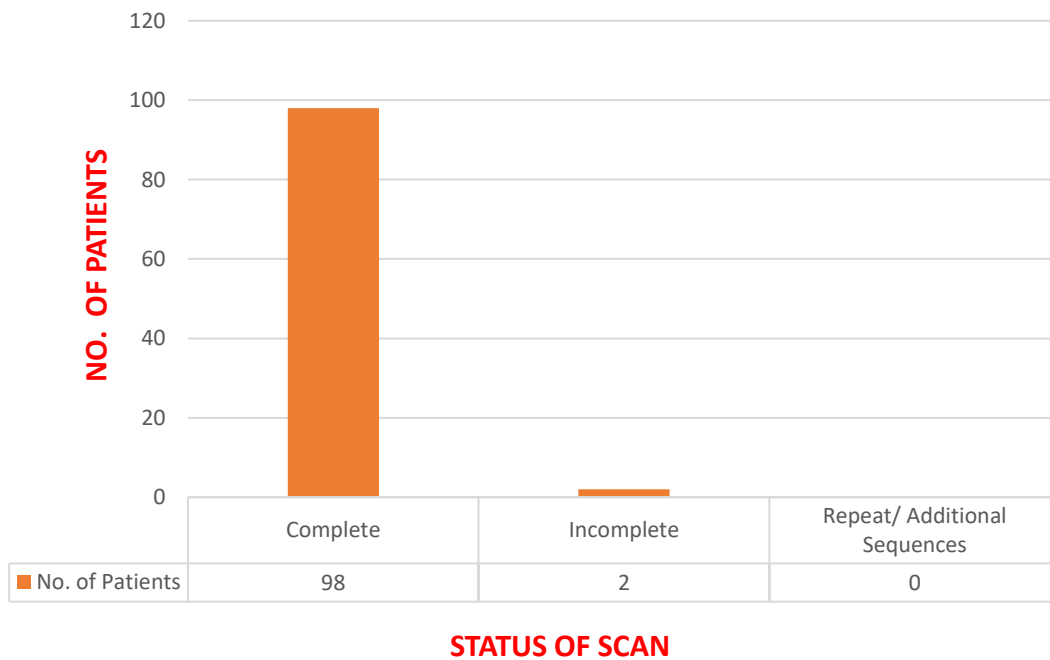


Figure- 4.13

- According to Figure-4.13, Out of 100 Scans, 98 were complete scans, 2 scans were incomplete & 0 scans were the repeat scans.
- Incomplete scans were due to non-cooperative patients.

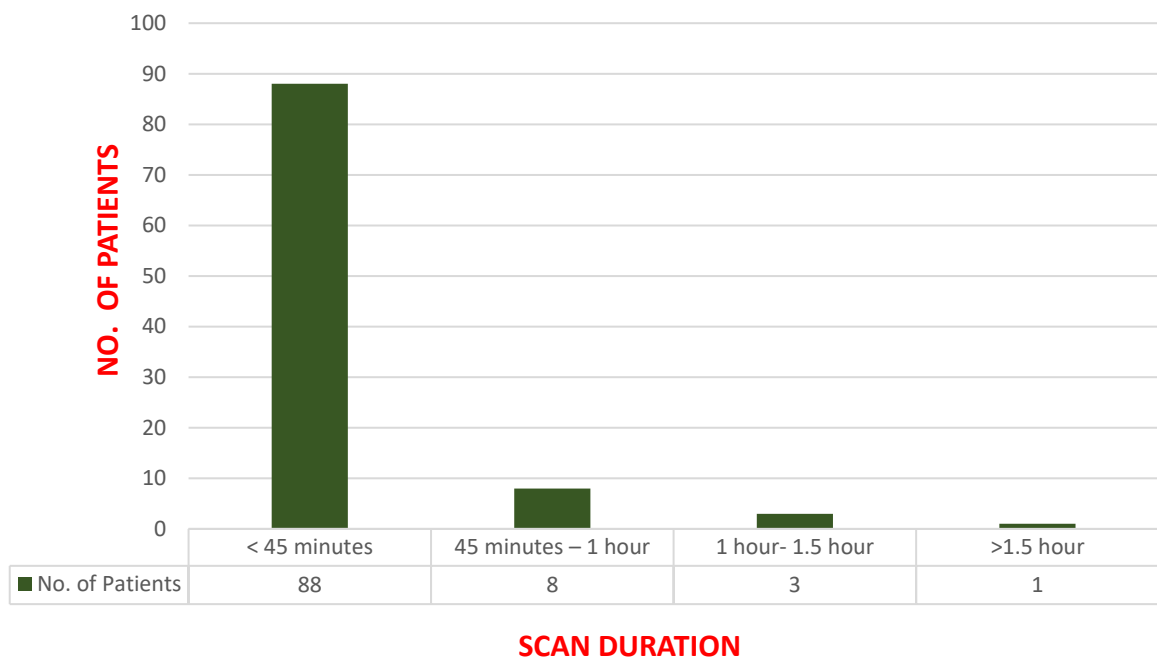


Figure- 4.14

- <45 Minutes: 88 Scans
- >45 Minutes: 12 Scans (8 + 3 + 1)
- Majority of the scans are completed in less than 45 minutes. The outlier was only 1 scan which was cardiac MRI as patients can't withhold their breath for 15 seconds and find it difficult to follow the instructions carefully.

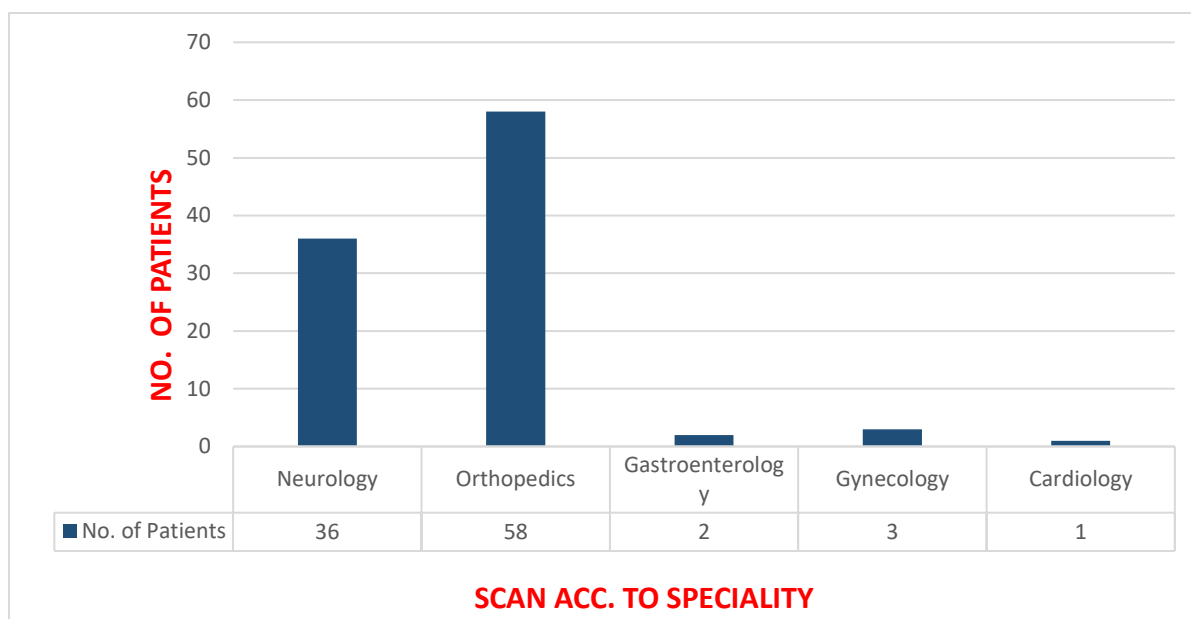


Figure- 4.15

- According to Figure 4.15 ,More cases of Orthopedics due to more MRIs of spine, limbs, shoulder etc. as compared to other body parts/organs because Dr. X is well renowned Orthopedic surgeon in Secunderabad who conducts his OPD in KIMS Sunshine hospital, Paradise. Also, this hospital is a dedicated hospital for spine and orthopedics.

SCAN MODALITY	TIME (IN MINUTES)		DEVIATION (T2-T1) (In Minutes)
	IDEAL SCAN TAT (T1)	ACTUAL SCAN TAT (Average)(T2)	
MRI Brain Plain	30	26	Finished early.
MRI Brain with Contrast	40	43	3
MRI Lumbar Spine	40	40	0
MRI Cervical Spine	40	29	Finished early.
MRI Pelvis	30	33	3
Cardiac MRI	25	74	49

Table- 4.2

***{Source of Ideal Scan TAT : QMS Data of KIMS Sunshine Hospitals, Paradise}**

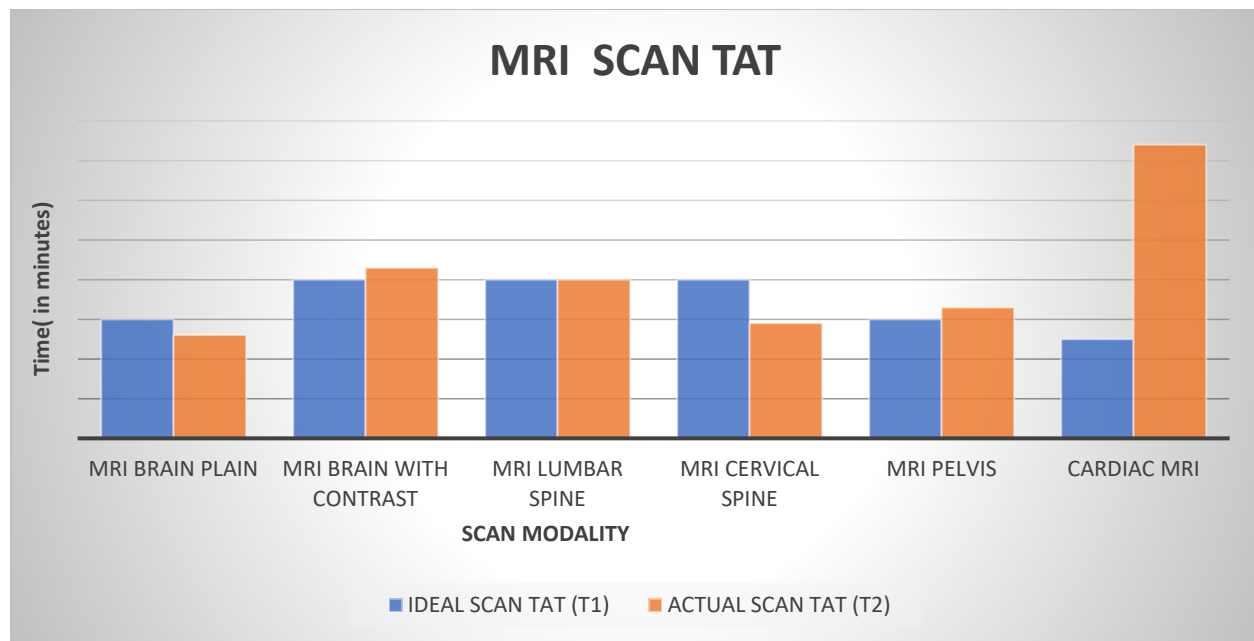


Figure- 4.16

- MRI Brain Plain & MRI Cervical Spine are being done in less than the ideal time.
- MRI Lumbar Spine is being done exactly within ideal time duration.
- MRI Brain with contrast & MRI Pelvis is showing slight deviation of 03 minutes each.
- Highest deviation has been shown in Cardiac MRI with deviation of 49 minutes.
- The reason for the deviation in cardiac MRI is that this is the specialized scan as it requires patient to hold the breath for approx. 15 seconds and involves breathing exercises. Patient finds it difficult to follow the instructions given during the scans , they are unable to hold the breath and thus it takes longer than usual to instruct them accordingly.

4.3 STUDY FINDINGS

Delay for scans and waiting time for MRI increased due to the following reasons: -

1. At Patient Level:-

- Delayed arrival of OP patients from their scheduled arrival time.
- OP patients' unavailability at radiology department even after their arrival.
- Non-cooperative patients due to anxiety, discomfort, pain, claustrophobia, decreased temperature in MRI scan room, old age patients, psychiatric issues, pediatric patients.

2. At Hospital Level:-

- In between arrival of Emergency cases, IP patients, patients referred by doctor
- Unpredictable delays due to additional sequences or repeat scans.
- Machine breakdown.
- Server error and system error.
- Delay in pre-scan patient preparation.
- Non - utilization of slots of cancelled scans.
- Too many sequences for a single scan type.
- Shifting delay of IP and emergency patients.
- Post processing of images in PACS by technicians increases TAT time.

3. At Service Provider Level:-

- Doctor asking for more sequences.
- Wrong scan mentioned in bill.
- Anesthesia and sedation cases take longer than usual time.

4.4 COMPARISON BETWEEN KIMS HOSPITALS – SECUNDERABAD & PARADISE

PARAMETERS	MRI- COMPARISON	
	SECUNDERABAD	PARADISE
Check-in & checkout of patients by technicians	Done on computers. So, they forget to do real-time check-in & check-out.	Done on tablets.so, they promptly do real time check-in & check-out.
Post processing of images.	During & even hours after scan completion.	Only during the scan.
No. of sequences per scan	More in number.	Less of number.
Repeat scans	Yes	No(Due to less number of sequences and radiologist presence while complex scans)
Patient entry in MRI room	Delayed	Immediate after previous scan completion.
Pre-scan patient preparation	Done at the time of scan or 5 minutes prior.	Done at least 15 minutes prior.
Non-cooperative patients	Lead to incomplete scans/longer duration of scan time.	Play calm soothing music to handle non-cooperative patient.
Incomplete scans frequency	More	Very less/zero.
Patient positioning done by	Housekeeping, so it leads to errors possibility.	Technician, so it means zero error possibility.
Contrast administration by	Nurse (delay due to non-availability)	Technician (No delay)
IP patient scan	During OPD timings.	Only when the machine is free i.e., when OP patients not there.
Films printing	1-2 hours after scan completion	Immediately after scan completion
Films distribution	Directly to patient from MRI console room	From queuing counter.
Patient cooperation rate	Low due to longer scan durations.	High due to less scan duration.
Utilization of cancelled slots	No	Yes

Table- 4.3

CHAPTER-5

DATA ANALYSIS

Here, it is done by two methods:

1. Pareto Analysis
2. Fish Bone Diagram/ Cause and Effect Diagram/ Ishikawa Diagram

5.1 Pareto Analysis: -

- It is an effective and powerful quality and decision-making tool.
- It works on 80 20 rules.
- According to 80 20 rules, 80 % of benefits come from 20 % of the work. Similarly, in other words, we can say that here, 80 % of MRI scan delays are arising due to 20 % of the causes.

As soon as the process mapping started and the tracking of the investigations were completed, many factors were noticed leading to delays. The causes leading to increased waiting time in MRI can be majorly categorized as: -

Category	No. of Patients
Late Arrival of OP Patients	29
Non- cooperative patients	21
Delay due to IP Patients	15
Patient shift delays (From ER, ICU, Wards)	6
Repeat/ Additional Scans	5
Server down/ System Errors	3
Re-scheduling of scans	3

Table- 5.1

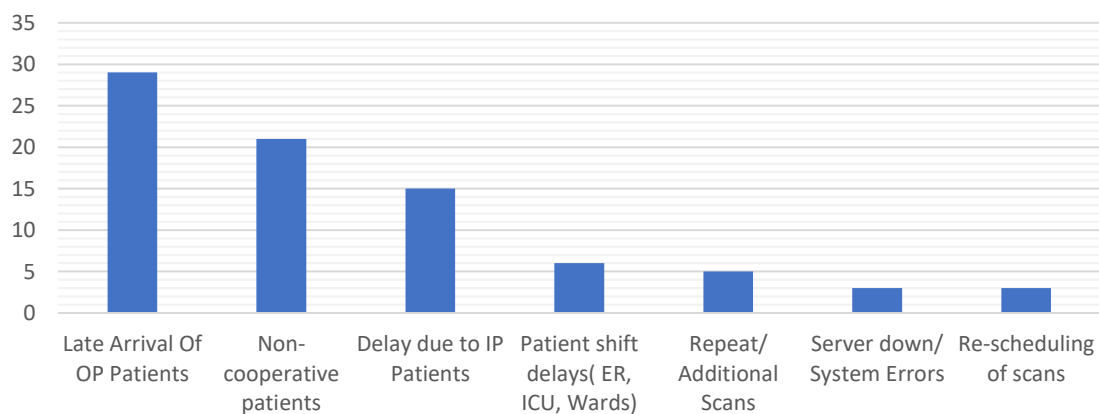


Figure- 5.1

So, here we can see that 3/7 reasons are responsible for 80% of delays in MRI which are:

- i. Late Arrival of OP Patients
- ii. Non- cooperative patients
- iii. Delay due to IP Patients

5.2 Fish Bone Diagram/ Cause and Effect Diagram/ Ishikawa Diagram^[12]

- This tool is mainly used to identify and track the root cause of the problem.
- The ‘problem statement’ is known as the ‘head’ of the diagram.
- The categories of major causes are connected to the ‘spine’ of the diagram.
- Primary Causes are connected to the categories horizontally.
- Secondary Causes are connected to the primary causes.

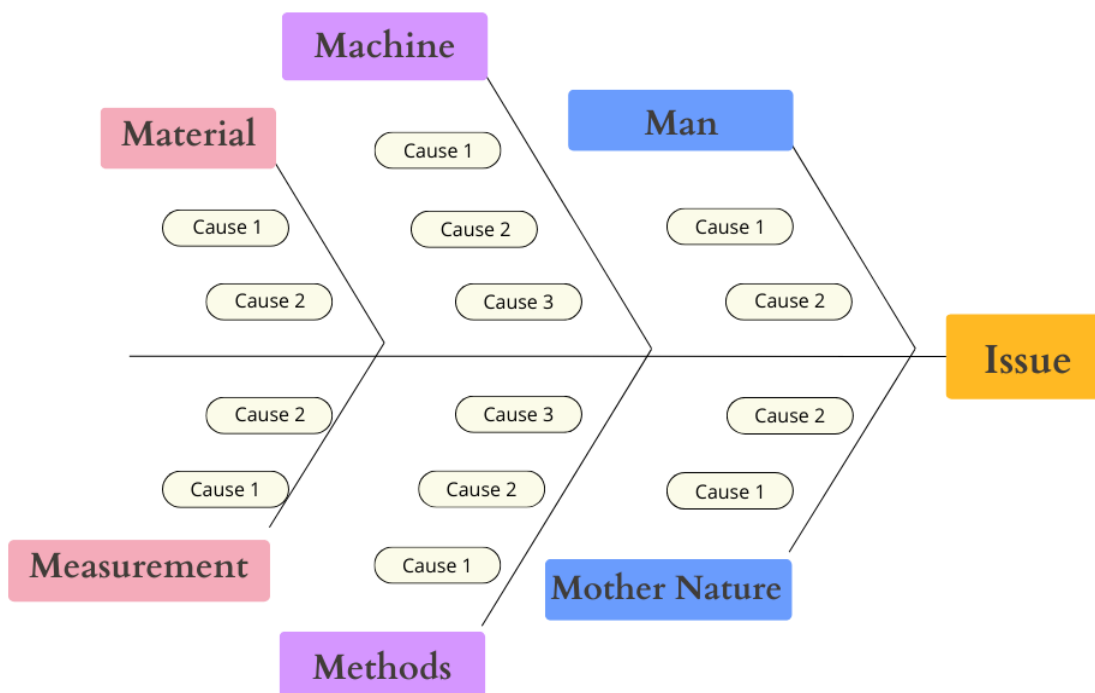


Figure- 5.2

Here, we are using two fishbone diagrams:

- Process Related
- Patient Related

PROCESS RELATED:

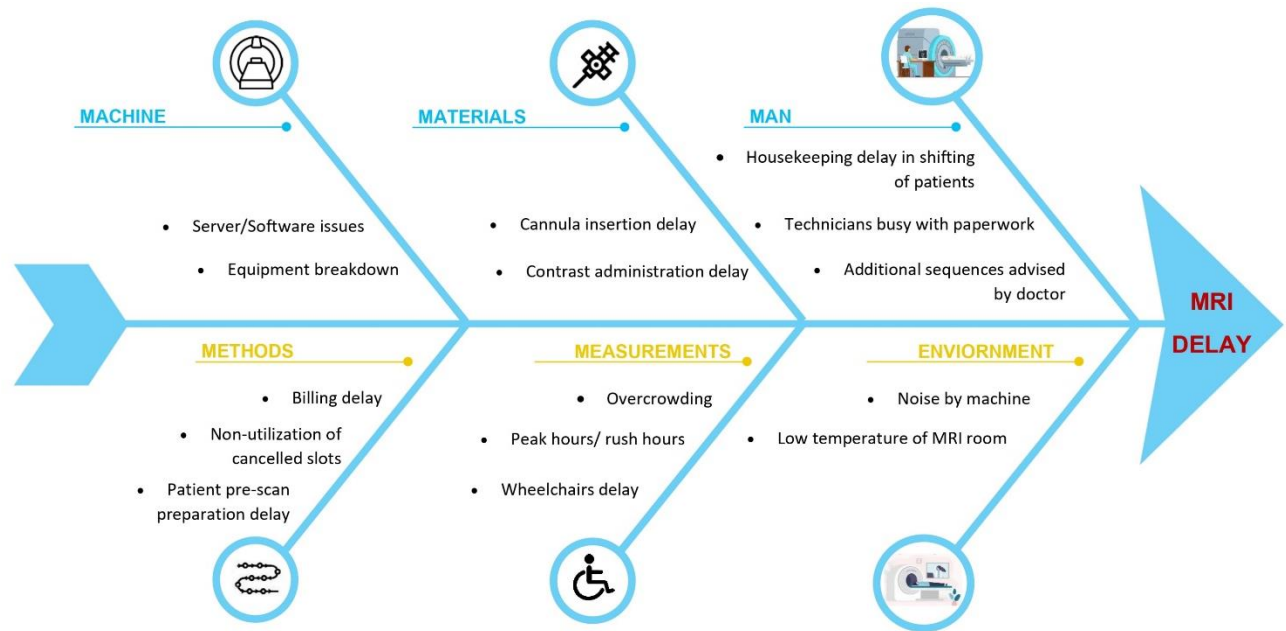


Figure- 5.3

PATIENT RELATED:

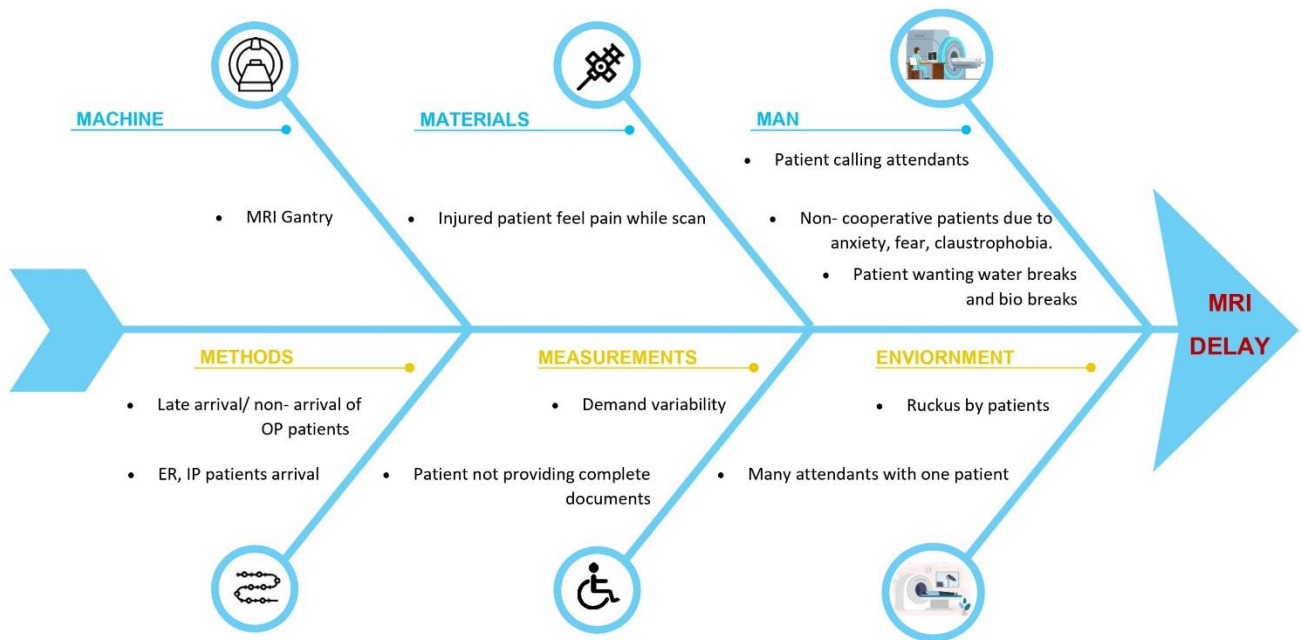


Figure- 5.4

CHAPTER-6

SUGGESTIONS

1. At Patient Level:-

- Dedicated help desk/ counseling desk to counsel and guide patients.
- Patients must be informed about the scheduled appointment time prior with the help of automated messages on their phone.
- MRI compatible cinema vision goggles to watch movies during MRI procedure.
- Melodious and calm music to pacify non cooperative patients during MRI scan.
- Number of attendants per patients must be strictly controlled.

2. At Hospital Level:-

- Temperature of MRI room must be well modulated.
- Streamline and utilization of the cancelled slots appointments must be done accordingly.
- Pre-scan preparation of patient must be done at least 20 minutes prior to scan.
- MRI films must be dispatched to the counter rather than providing it from the console room.
- Optimize scan protocols by reducing the number of slices or sequences.
- Automated post processing tools can be used to reduce delays due to post processing of images by technicians.
- Timely and periodic maintenance of machines.
- Scheduling maintenance during off hours.
- Shifting of patient must be done promptly. Strict instructions must be given to housekeeping staff.

3. At Service Provider Level:-

- Doctor must specify the scans clearly in prescription to avoid any confusion during scan.
- Scans of IP patients must be scheduled during night (If not urgent).
- Improvisation of communication between radiologists and technologists so as to reduce repeat scans.
- Contrast injection must be kept ready beforehand, and nurse must be called at least 10 minutes prior to administer contrast to patient.

CHAPTER-7

DISCUSSION

The time delay between the completion of a patient's MRI scan and the availability of the final report or pictures for interpretation by the healthcare provider or radiologist is referred to as the MRI TAT^[13] (Turnaround Time). The TAT varies according to the type of MRI study being performed. This study focuses on various possible reasons due to which MRI TAT increases and various gaps have been recognized for which suggestions are given at the end of the study to achieve better outcomes in future.

TATs may be longer for MRIs that require contrast material, such as brain with contrast, lumbar spine with contrast, and pelvic MRI, because the pictures must be carefully evaluated to verify that there are no abnormalities or issues from the contrast administration. Diffusion MRI scans, on the other hand, may have shorter TATs since they often do not require contrast material and are frequently utilized to swiftly identify disorders such as strokes or other acute neurological events. Due to the specialized nature of the study and the necessity for several imaging sequences and ECG gating, cardiac MRI studies may have longer TATs. This, however, is solely dependent on the diagnostic procedure being done and the amount of available and utilized resources like manpower, equipment etc.

Therefore, in other words it would be correct to say that the TAT for MRI or any other diagnostic investigations is a measure of certain aspects and it greatly depends on demand variability, the number of technicians on duty, other manpower availability like nurses, housekeeping, the presence of radiologists, communication between radiologist and technicians, machine/ server accessibility, and many other factors like this that are sometimes beyond control and discussion. So, it is very crucial to debate and discuss about the discrepancy between ideal TAT and the real time TAT. This discrepancy has to be reduced and it could be achieved by a teamwork by working on the factors leading to delay. It must be kept in mind that for the sake of improving TAT, the quality of scan and diagnosis must not be compromised at any instance.

CHAPTER-8

CONCLUSION

In conclusion, we can say that to obtain the best possible outcomes keeping both the aspects in mind that is hospital revenue and patient centered care, excellent services has to be provided. This means that the investigations done in laboratory or radiology must be carried out efficiently and the reports must be promptly handed over to the patient. All the process gaps occurring whether due to hospital, manpower or patient's end must be minimized to such a level that it must be seen as a benchmark and as a competition in the parallel world . Monitoring and improving MRI turnaround times requires the implementation of a system of checks and balances, such as daily reporting and regular evaluations of turnaround times. Furthermore, institutions should seek to improve efficiency and reduce wait times by using newer technology like computerized scheduling and tracking systems. Furthermore, it is critical to undertake initiatives to shorten wait times, such as increasing the number of available seats.

CHAPTER-9

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