STUDY ON PATIENT FLOW & WAITING TIME OF MRI & CT SCANS FOR OUTPATIENTS & REDUCE WAITING TIME IN RADIOLOGY DEPARTMENT AT GLOBAL HOSPITAL, PAREL, MUMBAI

Dissertation Submitted To

IIHMR UNIVERSITY, JAIPUR
By: Dr. Apoorva Bhargava
Roll No.1074

Under The supervision & guidance of
Dr. Sheenu Jain
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INTRODUCTION

- Medical imaging is a crucial component of the healthcare industry since it helps doctors identify, treat, and prevent diseases. A diagnosis must always be supported by medical imaging. An essential component of validating any diagnosis is medical imaging. Medical imaging is a crucial component of validating any diagnosis, in addition to medical knowledge and discernment, which form the basis of health practitioners' diagnoses and conclusions.
- The time a patient spends in a facility from the time they arrive at the registration desk until they depart or receive their last service is referred to as waiting time. In hospitals, waiting time is a significant issue that can have a negative impact on patients' satisfaction and comfort. Long waiting times can lead to fewer visits to the hospital, resulting in a significant reduction in healthcare utilization.

LEAN SIX SIGMA APPROACH

- Lean Six Sigma is used to reduce variability through a problem-based approach, and Lean is used to eliminate unnecessary processes and waste.
- We use DMAIC Approach - the lean six sigma methodology for process improvement

- **DMAIC** is a five-step process that includes various components such as:
- Defining Phase
- Measuring Phase
- Analyzing Phase
- Improving Phase
- Controlling Phase

Research Question

Q1. Patient flow in Radiology Department coming to get CT & MRI done?

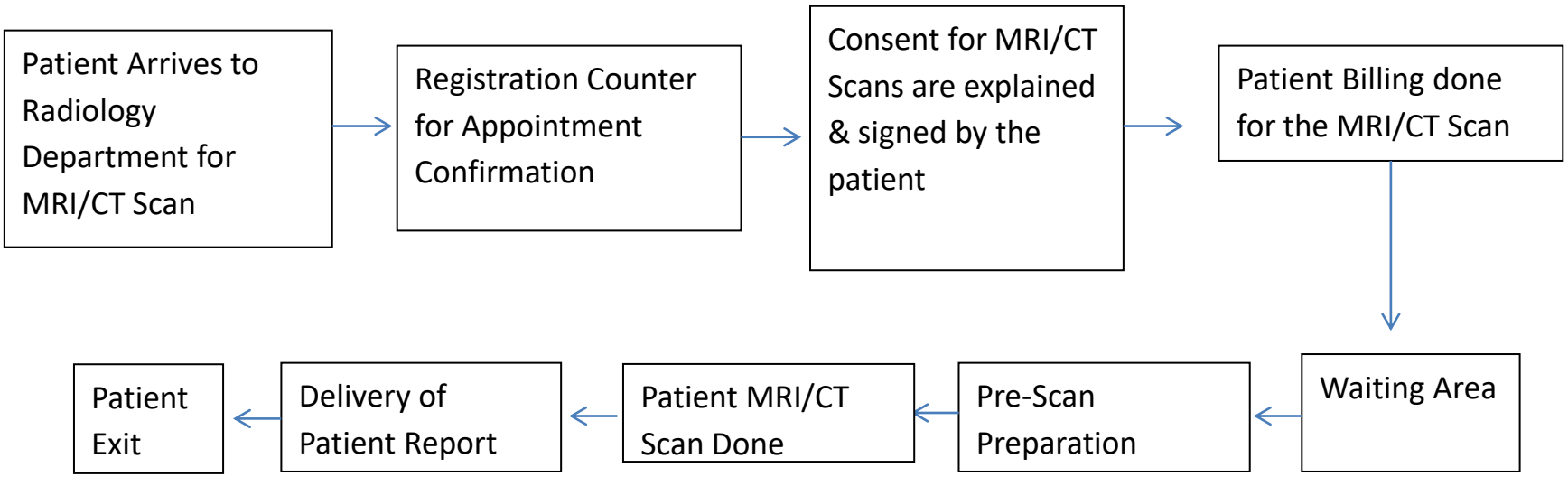
Q2. Causes of Scan Delay leading to increased patient waiting time?

Q3. Finding Possible solutions to decrease patient waiting time & improve overall patient satisfaction & workflow process in Radiology Department for CT & MRI Modalities?

Research Objective

To Study patient flow in Radiology Department at Global Hospital, Parel and find out reasons for long waiting time and suggest and implement various ways to improve waiting time and study its effect on patient satisfaction.

PATIENT JOURNEY AT RADIOLOGY DEPARTEMENT



PROCESS FLOW CHART- CT & MRI

- Appointment is Given to the patient as per availability of slots (on call / walk-in)
- Patient Arrives at the billing desk for enquiry

- Consent for MRI / CT scan is signed by the patient/Relative
- Patient is sent to billing desk for payment
- Preparation for the scan is done by the nursing & housekeeping staff – Changing of patient clothes , IV cannulation if required , Vitals are checked for coronary angio CT

- Patient is taken inside the CT/MRI for the scan
- After Scan is complete patient is shifted out and in case of iv cannulations nursing staff removes the cannula after 10 minutes , Patient changes his/her clothing .

Methodology

Study Design - Descriptive, Cross-Sectional Study

Data Collection

Primary Data Collection , Observer-based tracking , A one-on-one conversation with patients & staff , Data entry from the RIS & computer system

Study population

Outpatients visiting the radiology department to avail of the MRI /CT Scan services at the hospital with prior appointment or intimation both Male & Female Population

Age criteria- 4 years to 92 years

Sampling

- Sampling Technique - the quantitative study of patient flow for MRI & CT Scans
- Study Setting – Radiology Department, Global Hospital, Parel, Mumbai
- Sample Size – 100 (MRI – 65 Samples, CT – 35 Samples)
- Sampling Method – Purposive
- Type of Data – Quantitative data
- Tools- MS Excel, process mapping software

Inclusion Criteria All Outpatients coming to the radiology department for MRI/CT Scan services with prior appointment or intimation

Exclusion Criteria IPD & Emergency Patients

Limitation of Study

- Fixed Duration of study
- study was done in the radiology department of a single hospital, the result cannot be generalized to the whole population
- Data sources are patients

Literature Review

Author	Title	Methodology	Findings
Kenneth K. Agwu et al, 2021	Improving Patient Flow: -Case Study of Radiology at Miyoshi Hospital	Cross-sectional study analysed the patient flow system and examined options for optimizing patient planning in radiology	There was uncertainty and unpredictability in the pattern of patient arrival times. Arrived with an average of 7 + -5.4 patients/hour per day. From 7 am to 10 am, patient arrivals peaked at 12 patients per hour. The average service time was 15 minutes. The average total waiting time was 116 minutes. Wait time was directly correlated with arrival rate (P <0.05)
L. Hoffman,2014	Capacity Management in Isala's Radiology-Management of Planned and Unplanned Patient Arrival Variability	Cross-sectional study	Bottlenecks that negatively impact performance, variability can be reduced by changing the planning process, it was almost impossible to predict demand due to the volatile demand. Eliminating bottlenecks can improve performance in terms of access time, latency, utilization, workload, and cost.

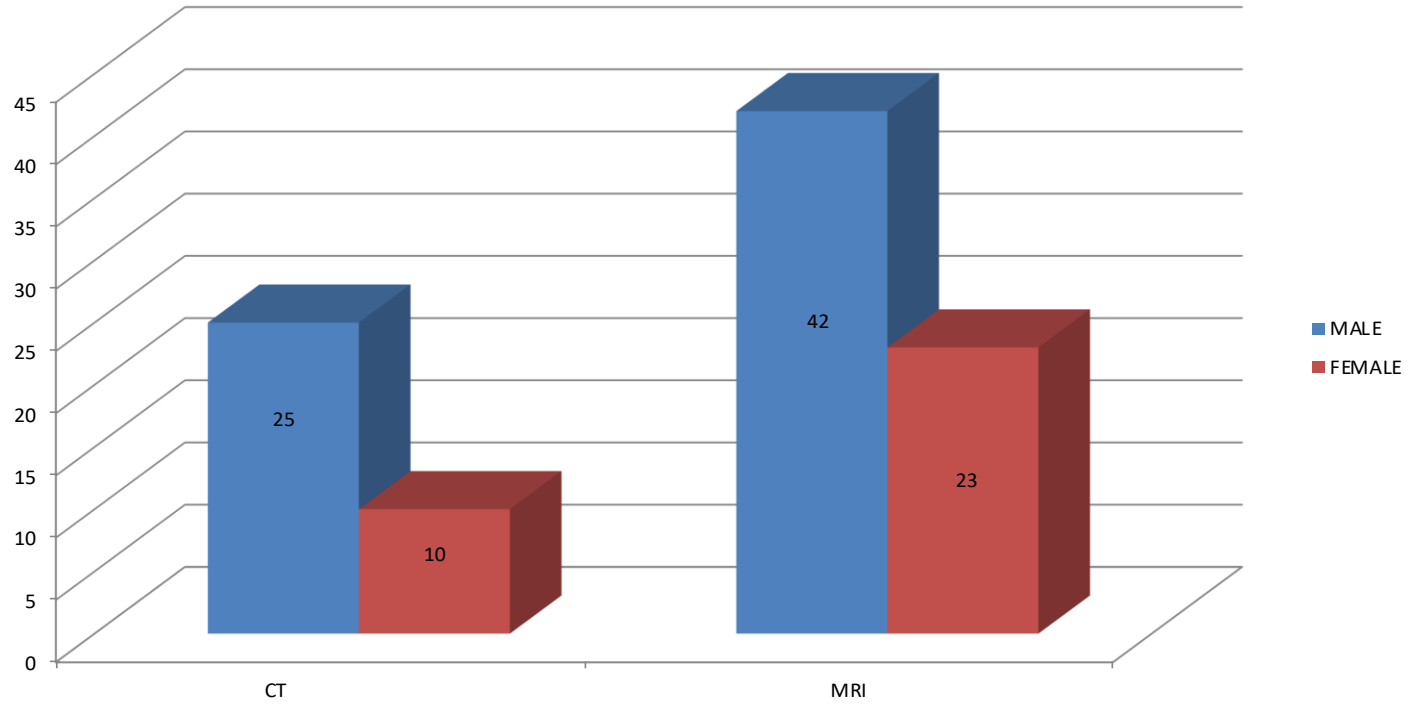
Dr (Brig). A.P. Pandit, Ms. Tanima Debmallik,2016	**Radiology Waiting and Reporting Times at Kolkata Tertiary Medical Hospital Reduced Using Lean Six Sigma**	**Six Sigma DMAIC approach, Genbawalk interviews and time motion studies**	**The cause of the delay was shown using a Pareto chart. As the solution approaches to improve patient orientation and readiness to perform scans, pre-test latency is reduced, and operation is smoother.**
Rajeev Saxena, Sartaj Sharma, Vivek Sharda, Nalini G, Manoj Kumar Yadav	to visit the outpatient clinic and provide new recommendations for conducting research to enhance the healthcare system	From a pool of patients who visited various OPDs, 100 respondents were chosen at random. Data were collected by questionnaires and in-person interviews.	The majority of patients (95) registered in less than 30 minutes, while 49% had consultations that lasted longer than 30 minutes. One of the main causes of delay has been due to a number of factors, including round overlap, OPD wait times, lab sample transportation, and preparation times in radiology. A real-time waiting system, advanced simulations, and queueing techniques will all be very beneficial for delivering effective and appropriate medical care.
Shyamkumar Shriram,2012	How demographics, hospital ownership and ambulance arrivals affect waiting time	For this study, data was collected from 830 patients seeking outpatient treatment in 30 randomly selected districts in Nellore, India. Linear and logistic regression models were used to identify the effect of various determinants on hospital waiting time	Profit-owned hospitals have a shorter wait time than other hospitals, patients who arrive by ambulance have a shorter wait time than patients who don't arrive by ambulance. It has also been observed that people of high economic status have shorter waiting times than others, so some changes need to be made to the health system to ensure equal access to health care for all categories of patients

V. Rema, and K Sikdar	**Optimizing waiting time in the outpatient department of a multi-speciality Indian hospital**	**Introduction of technology and model based on Queue Monte Carlo simulation, snowball samplin g technique using questionnaire was used to collect the data**	**Key performance indicators have been calculated to enable the management of patient flows and improve the operational efficiency of the service by identifying ways to reduce delays**
Sabina Nuti, Milena Vainieri	To analyze variation in the delivery of diagnostic services in order to suggest possible solutions to reduce waiting time and increase quality of service and decrease financial cost	Waiting time measured per day was compared on the basis of the utilization rate of CT and MRI imaging in Tuscany	Significant differences were found in domains related to age, gender, and mortality, suggesting that radiology services were suboptimal and that services are underused or overused and need improvement
Melesse Belayneh, Mirkuzie Woldie, Negalign Berhanu	To access patients waiting time and its determinants in Debre Markos & Felge Hiwot referral hospitals of Amhara regional state in the north-west, Ethiopia	Cross-sectional study design was used along with Quantitative data collection using a questionnaire and checklist	The major causes of long waiting times were an outsized number of patients with few doctors, the long attempting to find patient cards, and also the long waiting time for registration. there's a requirement for healthcare facilities and hospital administration to handle gaps in human resources, infrastructure and other internal procedures getting to reduce waiting time and ensure effective healthcare

Md Obaidul Haque, Sharmin Akter, Anwar Hossen, Zillur Rahman	Study on Outpatient Waiting Time for Treatment using Multiple Servers Queuing Model at Public Eye Hospital in Bangladesh	Queuing Model	According to this calculation, (i) at BIOEH, the average waiting time for each patient in this system is 29.4 minutes and the average number of patients is 1264.2. The average number of patients or patient flow in this hospital is very high, but the number of specialists in this hospital is not enough. This hospital must therefore increase the number of specialists. (ii) In the ophthalmology department of Comilla Medical College Hospital, the average number of patients is very low, but a large number of specialists. In conclusion, to increase the patient flow of this hospital, this hospital could go digital
Mor Armony, Shlomo Israelit, Avishai Mandelbaum, Yariv N. Marmor, Yulia Tseytlin, and Galit B. Yom-Tov	Patient Flow in Hospitals: A Data Based Queueing Science Perspective	Queuing Model	operational performance is that the easiest to quantify, measure, track and react upon in real time, As patients progress in their hospital stay, their medical needs change (mostly reduce) and also the accuracy during which one can predict their LOS. This information may be very useful in successfully balancing workload

OBSERVATIONS

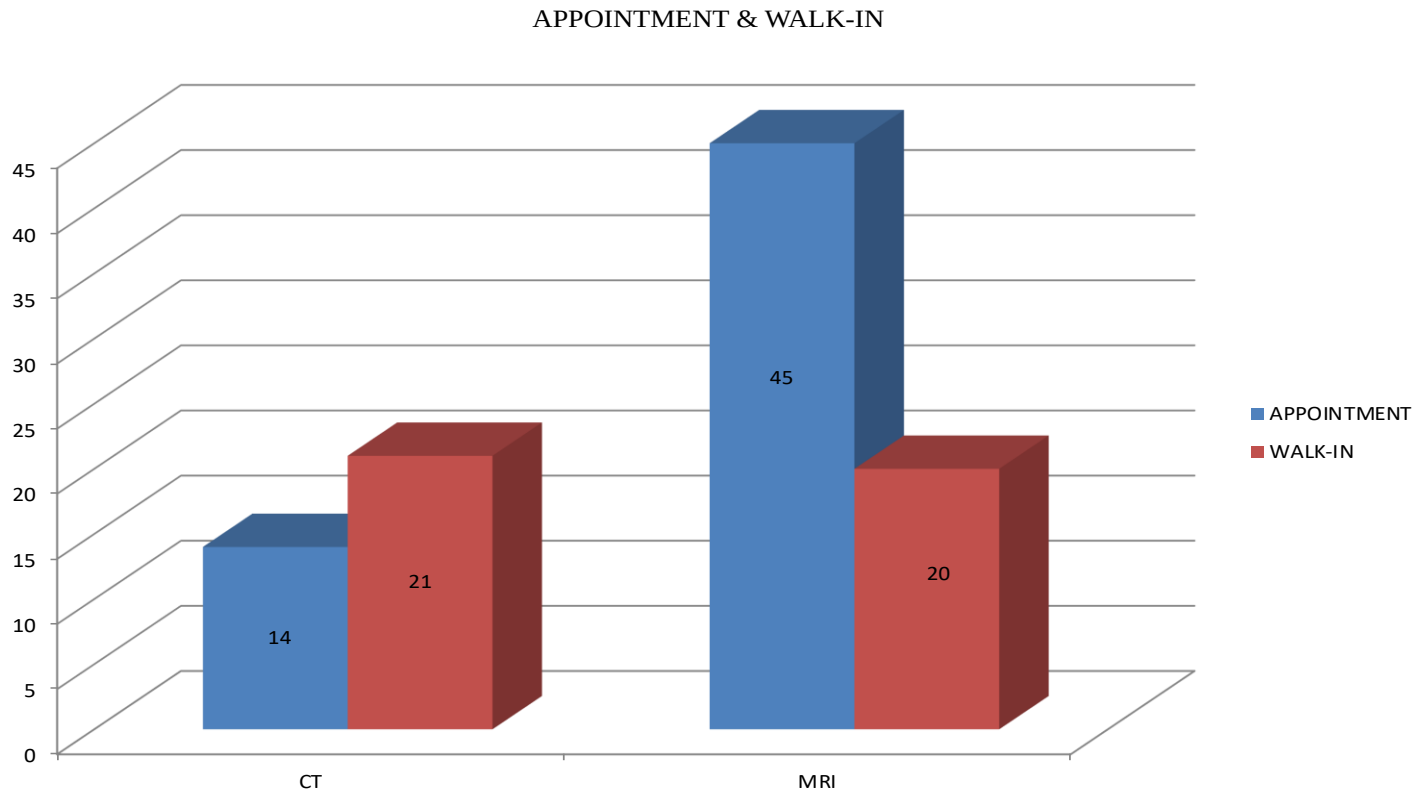
GENDER DISTRIBUTION



MODALITY	MALE	FEMALE
CT	25	10
MRI	42	23

Out of Total patients who visited the Radiology department for MRI/CT Scan at Global hospital, Parel:

- **65%** Males
- **35%** Females



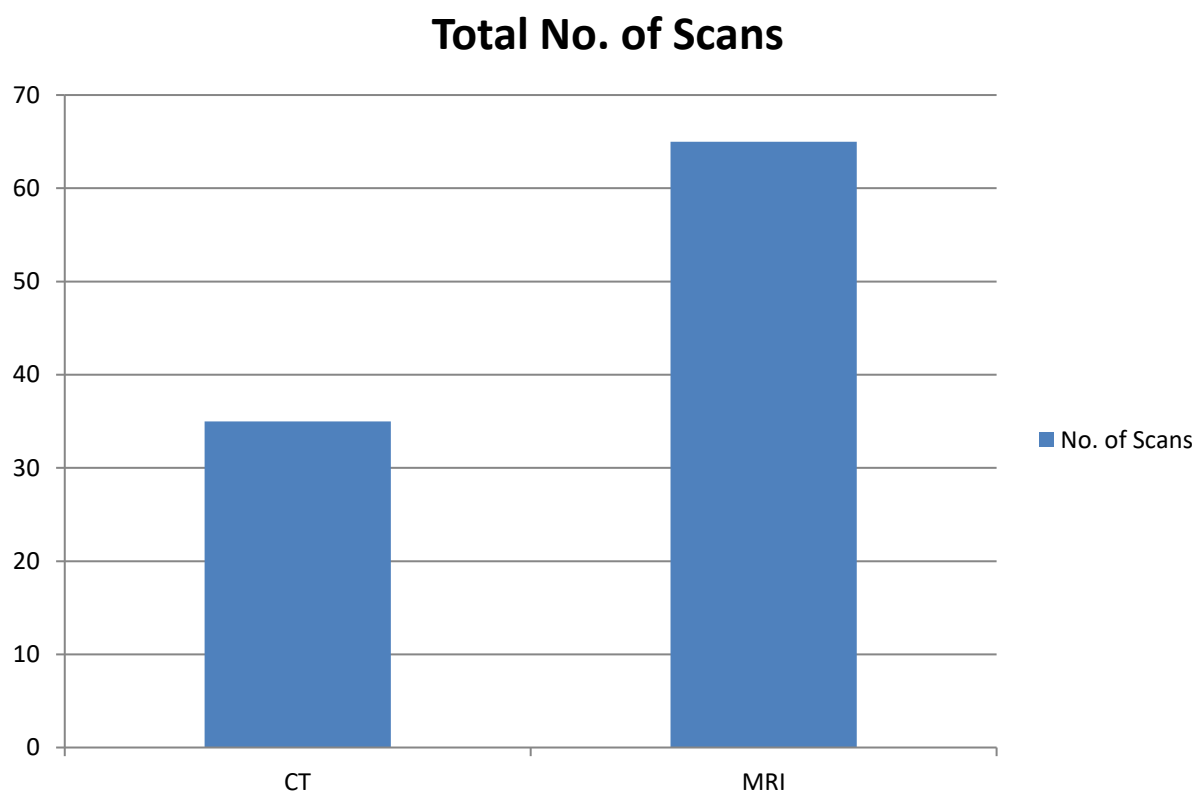
MODALITY	CT	MRI
APPOINTMENT	14	45
WALK-IN	21	20

Patients who visited Radiology Department for MRI/CT Scans:

No. of patients who came for scan taking a prior appointment are: **59%**

No. of patients who came for scan without prior appointment are **41%**

(21st April 2022 till 20th May 2022)

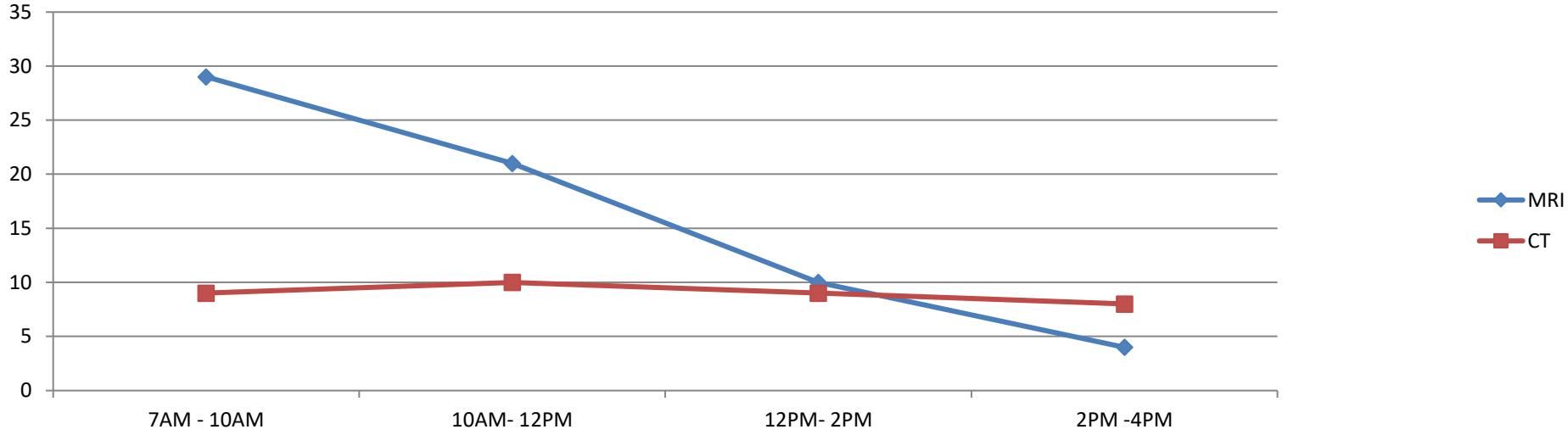


Out of 100 sample size

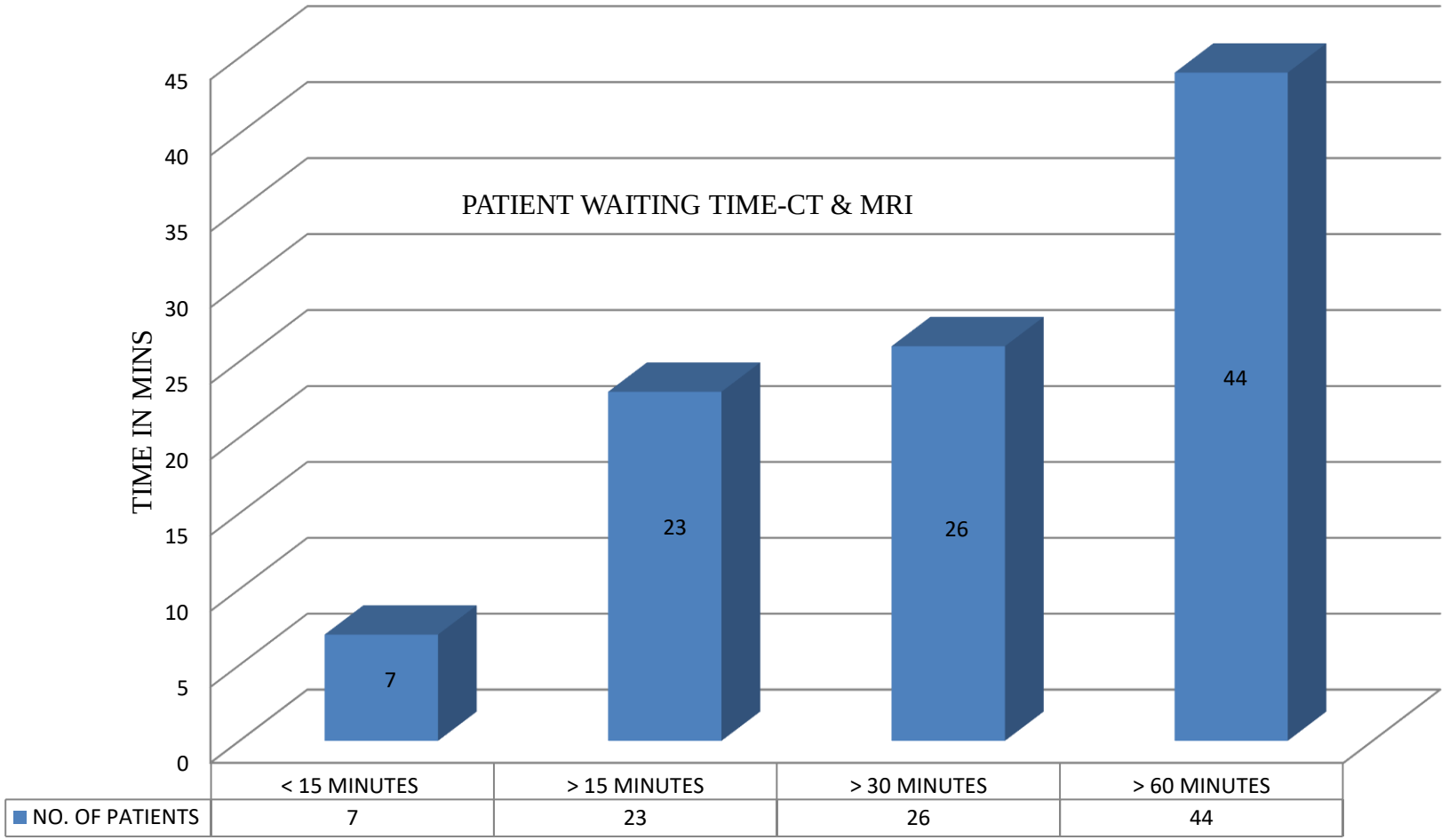
- Total number of CT Scans – **35 patients**
- Total number of MRI Scans – **65 patients**

PATIENT FLOW TIME

(For OPD Patients)



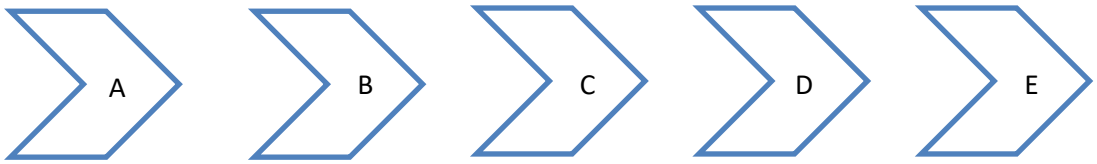
- Maximum OPD patient flow for MRI Scan is from **7am to 10am**
- Minimum OPD patient flow for MRI Scan is from **2pm to 4pm**
- Maximum OPD patient flow for CT Scan is from **10am to 12pm**
- Minimum OPD patient flow for CT Scan is from **2pm to 4pm**



•**44%** of patients had to wait more than 60 minutes to get their MRI/CT Scans done
•**26%** of patients had to wait between 30 to 60 minutes to get their MRI/CT Scans done
•**23%** of patients had to wait between 15 to 30 minutes to get their MRI/CT Scans done
7% of patients were taken on time for their MRI/CT Scans

Target Waiting Time is 15 minutes

VALUE STREAM MAPPING (MRI)



15 footsteps	15 footsteps	15 footsteps	5 footsteps
7.12	12	7	1.13.49

A - Patient reaches the reception at the radiology department & is told to collect the consent form from the console

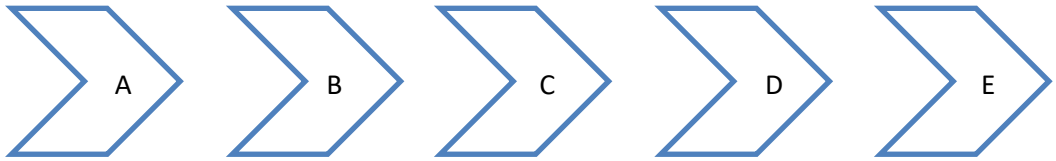
B - The consent form is handed over by the technician to the patient and the patient is directed to the billing counter

C - Patient billing is done and the patient is directed to the console to submit the consent form and show the bill to the technician

D - The consent form is handed over to the technician and the patient is made to sit in the waiting area

E - The patient is taken inside the MRI Room for the scan

Value Stream Mapping for CT Scan



15 footsteps	15 footsteps	15 footsteps	5 footsteps
9.7	25	9	33

A - Patient reaches the reception at the radiology department & is told to collect the consent form from the console

B - The consent form is handed over by the technician to the patient and the patient is directed to the billing counter

C - Patient billing is done and the patient is directed to the console to submit the consent form and show the bill to the technician

D - The consent form is handed over to the technician and the patient is made to sit in the waiting area

E - The patient is taken inside the CT Room for the scan

ISSUES FACED BY RADIOLOGY DEPARTMENT

- IPD patients mismatched scheduling in radiology department – Delay in patient being transferred from wards for scans
- Late billing done due to donor package patients
- ER patient's arrival – Patient from Emergency department arrives in between for urgent MRI/CT Scan due to which OPD patient has to wait.
- Uncooperative patients – Patients become anxious, Old age patients, Patient with Psychiatric issues, Pediatric age group patients
- OPD patients arriving late than their given appointment time
- OPD patients not available in radiology department after arriving to the hospital due to their personal reasons

ANALYSIS

SIPOC

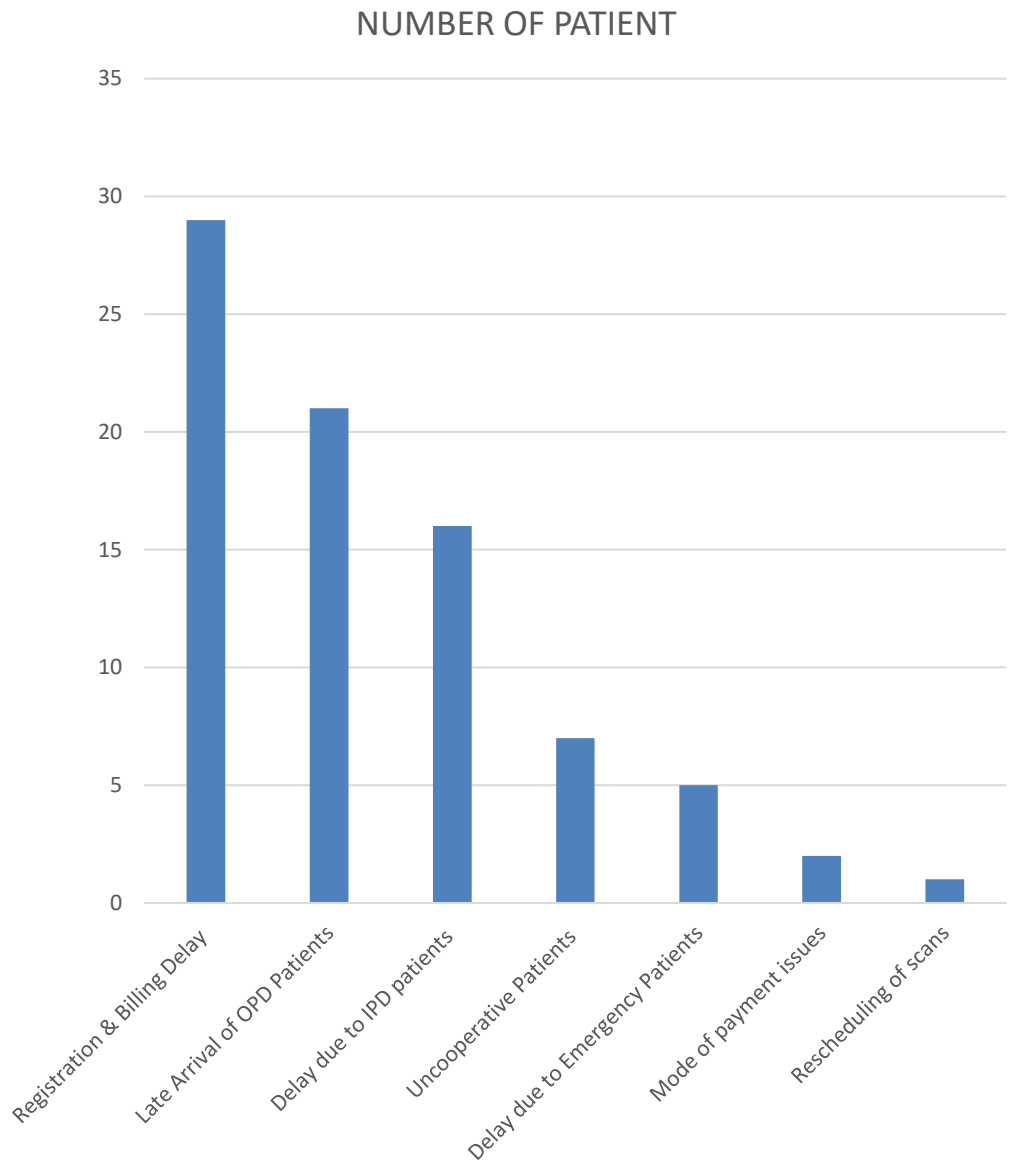
SIPOC is a high-level mapping tool that allows the user to see the process in limited detail. It is often used to narrow the focus of a larger process or to aid in project selection

SIPOC

- S- OPD and Customer Requests
- I- Registration and billing, console, technicians, housekeeping, nursing
- P- As earlier
- O- Patient taken up for scan
- C- Patients advised scan

PARETO ANALYSIS

According to the Pareto Principle, 80% of a project's benefit comes from 20% of the labor. Or, on the other hand, 80% of issues may be traced back to 20% of causes. The Pareto Analysis finds the problem areas or tasks with the highest return on investment.



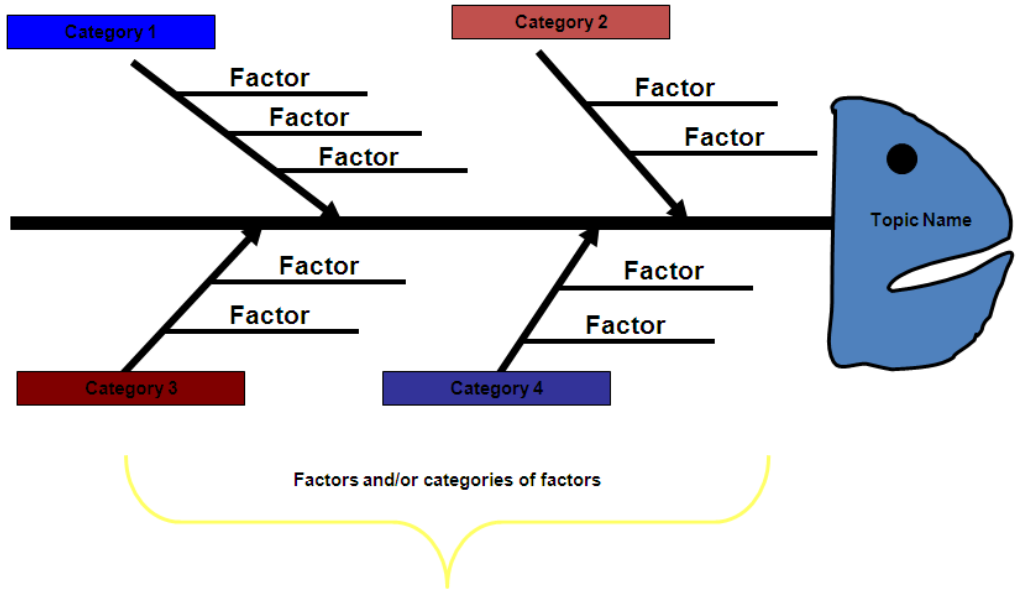
CATEGORY	NUMBER OF PATIENT
Registration & Billing Delay	29
Rescheduling of scans	1
Mode of payment issues	2
Delay due to IPD patients	16
Late Arrival Of OPD Patients	21
Delay due to Emergency Patients	5
Unccoperative Patients	7

3/7 reasons lead to 80 percent of the delays

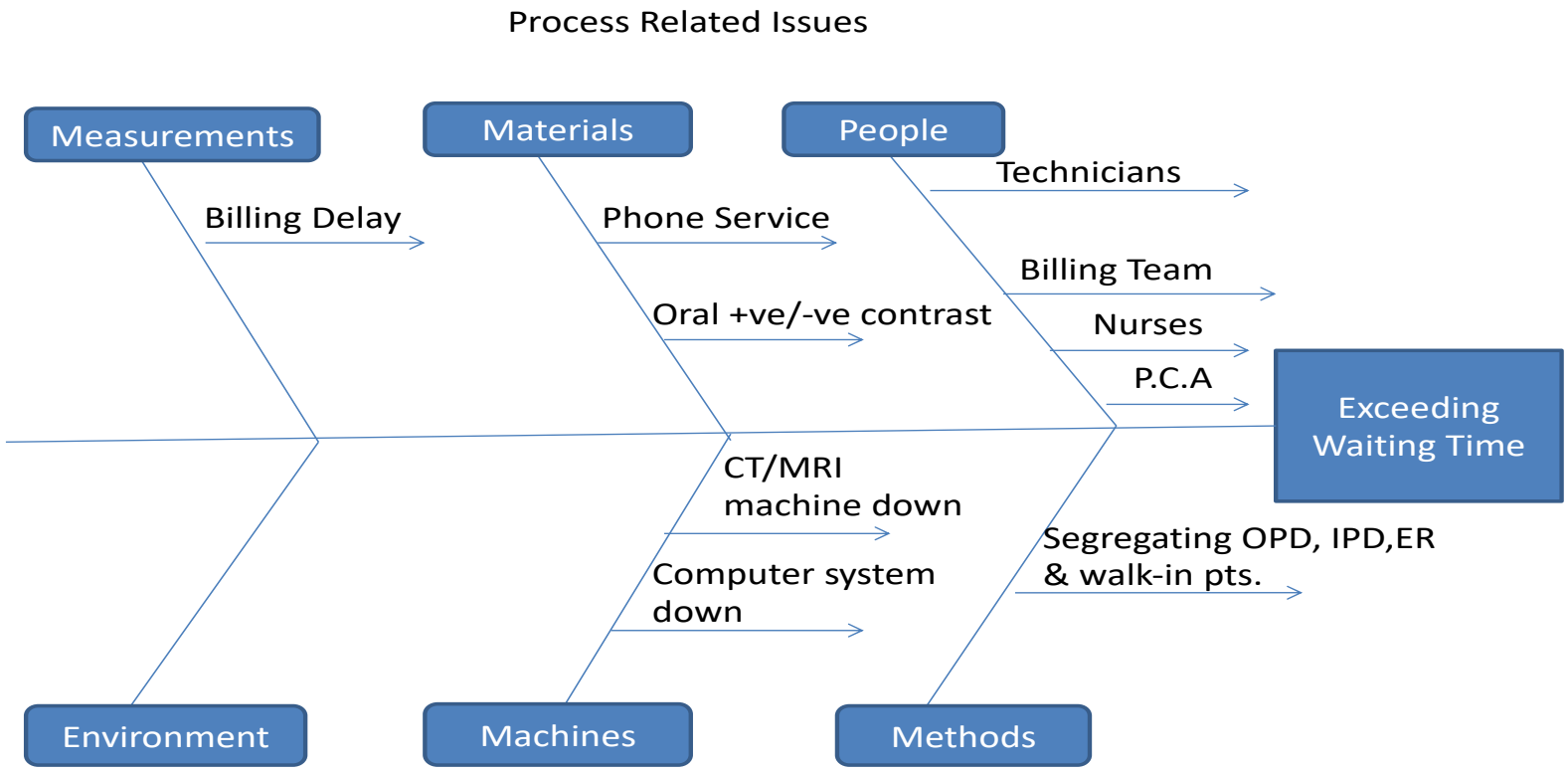
FISHBONE ANALYSIS

Also called as Ishikawa diagram, this tool is used to visualize, identify and classify the possible causes in a process, product or service, also known as the cause & effect diagram.

Fishbone Diagram (regular)

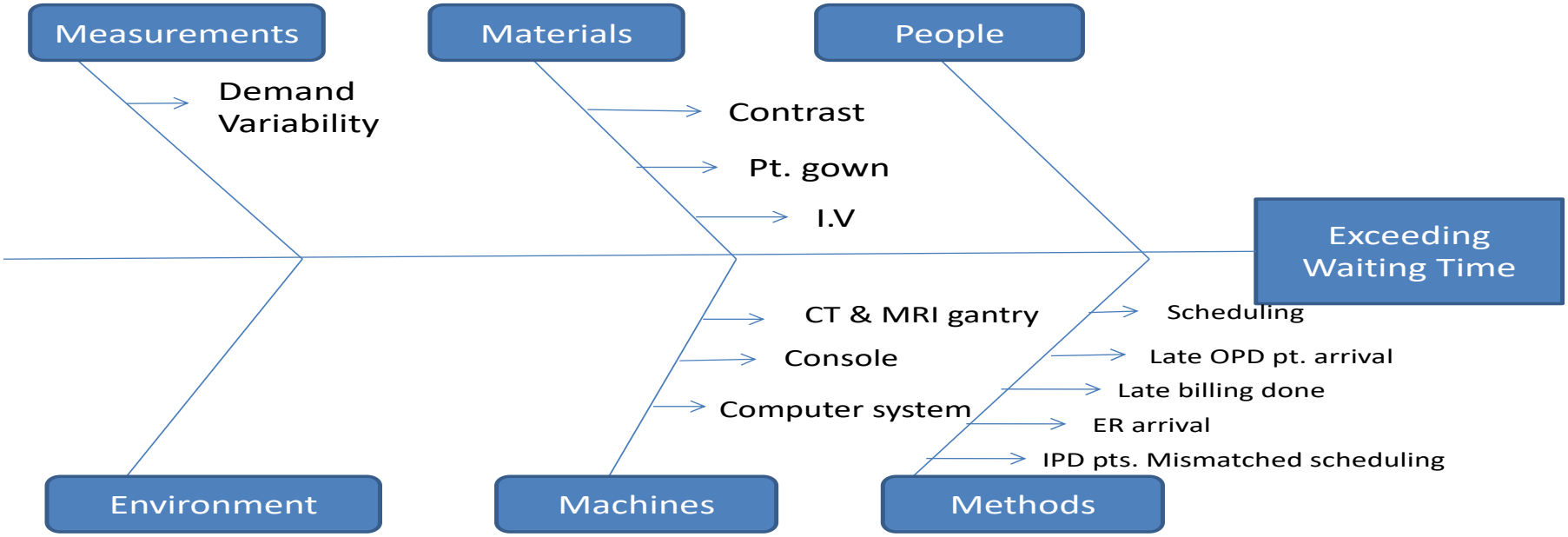


PROCESS RELATED



PATIENT-RELATED

Patient Related Issues



VOICE OF CUSTOMER (CTQ)

CTQs (Critical to Quality) are the most important measurable characteristics of a product or process whose performance standards or specification limits must be met in order to satisfy the customer. The purpose of critical quality trees is to convert customer needs/wants into measurable requirements that the organization can implement

Parameters of CTQ:

- Critical to quality (CTQs) conveys quality of a product or service that is derived from Voice of Customer (VOC).
- Critical to Performance (CTP) conveys efficiency of the process derived from Voice of Business (VOB).
- A good CTQ/CTP should be **SMART**

VOICE OF CUSTOMER	DRIVERS	IDENTIFICATION OF CTQ
File given inside for Xerox of patient history leading to delay in consent taking and had to wait longer for MRI scan	Housekeeping & Technicians Time	No of consents Observed delay No of diagnosis done with previous historical records Waiting Time scan process was delayed due to history taking -15 patients
My MRI scan was rescheduled and had to come next day from far for contrast scan	Doctors & Radiologist	Total number of patients whose scans got reschedule - 5 patients
My CT scan got delayed due to oral contrast had to wait 1 hr.	Technician Doctor	No of delays Total Time due to delay in pre scan preparation - 10 patients
My billing got delayed as American express card not accepted	Billing	Payment delays due to online/Card payments -10 patients

Major Reasons for Patient Delay

- Late arrival of IPD patients
- Arrival of ER patients for scan
- Late arrival of OPD patient from given appointment time
- Delay in pre-scan preparation of the patient
- Delay in billing- donor package or corporate patients with credit letters
- Non-cooperative patients
- CT & MRI machine and computer system down
- Mismatched scheduling of IPD patients
- Billing period prolonged due to patient's personal payment issues
- Unorganized scheduling of appointments of OPD patients

SUGGESTIONS

- All computers in CT/MRI Console & at billing desk should have same time for proper data collection & analysis
- OPD & IPD Patients should have time slots depending upon the footfall rate.
- Re-looking at the blank slots
- Appointment slots should also depend upon the type of scan
- Patients to undergo Coronary Angio / 4 phase Angiography/CT KUB /Contrast CT & MRI should be informed to come 30 Minutes prior to the pre-scan preparation
- The patient should be properly counselled and Reassured about the procedure
- Billing should be done promptly & before the scan along with available modes of payment clearly explained to patient

SOLUTIONS

Affinity Diagram

Solution	How	When
All computers in CT/MRI Console & at billing desk should have same time for proper data collection & analysis	Coordinating with the IT Team to ensure that all computers in radiology department have same timings for calculating TAT precisely	Instant After getting approval from the administration and Radiology HOD
OPD & IPD Patients should have time slots depending upon the patient footfall rate	Depending upon the timing of patient footfall OPD & IPD slots for the decrease in OPD waiting time	Instant After getting approval from the administration and Radiology HOD
Appointment slots should depend upon the type of scan	The appointment scheduling system should capture time taken for a particular scan and block slot accordingly, no blanket or fixed slots to be decided Example: Current scheduling Appointment is given at 30 minutes interval of previous scan Proposed Process: Scheduling Software detects the scan Suggest the time taken for the scan, example: MRI liver ca takes 50 minutes Next appointment should be given automatically after 50 minutes by the system depending upon availability of slot	Instant After getting approval from the administration and Radiology HOD

Billing should be prompt & before the scan	**The billing should be done more promptly and before the scan to decrease patient waiting time**	**Instant** **After getting approval from the administration and Radiology HOD**	**Monthly by Billing Manager**
Patients to undergo Coronary Angio / 4 phase Angiography/CT KUB /Contrast CT & MRI should be informed to come 30 Minutes prior to the pre-scan preparation	Patient at time of giving appointment should be informed to come 30 minutes prior than given appointment for timely pre-scan preparations so that patient's scan gets started and completed on time	Instant After getting approval from the administration and Radiology HOD	Monthly by Front desk Manager

CONCLUSION

Medical imaging is an important part of the healthcare sector, since it assists clinicians in diagnosing, treating, and preventing diseases. Medical imaging MRIs and CT scans allow doctors to monitor the effectiveness of treatment and make necessary modifications. Waiting time is time spent by patient from time he arrived the OPD of the hospital and time patient actually leaves, waiting time leads to poor outcome of treatment, lost appointment and failure or delay in start of service.

The result drawn from this study that patients had to wait more than one hour thirty minutes after billing for MRI Scan and around thirty minutes for CT Scan. Longer the patient waits leads to increase in patient dissatisfaction. Major reasons found for increased waiting time were late arrival of OPD Patients, Arrival of Emergency patients and IPD patients in between, billing delay, uncooperative patients. Various ways for decreasing waiting time were suggested such as relooking blank slots according to patient footfall rate and scan type, IPD & OP patients to have separate slot for scans, improving billing process and ensuring various modes of payment available and not available is well explained to the patient prior, Proper counselling and reassurance to the patient for procedure of scan and pre scan preparations.

REFERENCES

https://www.researchgate.net/publication/335243595_Patient_waiting_time_and_determinants

https://www.researchgate.net/publication/233930920_Managing_waiting_times_in_diagnostic_medical_imaging

https://www.researchgate.net/publication/350775309_Optimizing_Patient_Waiting_Time_in_the_Outpatient_Department_of_a_Multi-specialty_Indian_Hospital_The_Role_of_Technology_Adoption_and_Queue-Based_Monte_Carlo_Simulation

https://www.researchgate.net/publication/325947707_Determinants_of_hospital_waiting_time_for_outpatient_care_in_India_how_demographic_characteristics_hospital_ownership_and_ambulance_arrival_affect_waiting_tim

https://www.jchm.in/article-details/12805

https://essay.utwente.nl/66068/1/Hofman_MA_MB.pdf

https://www.gleneaglesglobalhospitals.com/best-hospital-in-mumbai/parel-about-us

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