

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

This Dissertation Is Submitted To



IIHMR UNIVERSITY, JAIPUR

For the partial fulfilment of the award of the degree of

Master of Business Administration (MBA) in

Hospital & Health Management

By: Dr. Apoorva Bhargava

Under The supervision & guidance of

Dr. Sheenu Jain

(2020-2022)

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Declaration

I would like to declare that this dissertation titled “**Study on patient flow & Waiting time of MRI & CT scans for outpatients & reduce waiting time in Radiology Department**” is my original thesis work and has not been submitted to any other university or Institution for the award of any degree, Any Information that is derived from published or unpublished work of others has been duly acknowledged.

Dr. Apoorva Bhargava

(Hospital management)

Date: 18/6/2022

DISSERTATION COMPLETION CERTIFICATE



Date: 18/06/2022

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dr. Apoorva Bhargava has successfully completed her study/thesis on topic "Study of patient flow & waiting time of MRI & CT Scans for outpatients & suggesting ways to reduce waiting time & improve process in Radiology Department" at Global Hospital, Parel, Mumbai under my supervision during her dissertation at Global Hospital, Parel. Dissertation Report has been reviewed & approved by me.

Yours Sincerely,

A handwritten signature in black ink, appearing to read 'Pushkar Mehta'.

Dr. Pushkar Mehta

(Head of Operations)

Global Hospital, Parel, Mumbai

GLOBAL HOSPITAL - SUPER SPECIALITY & TRANSPLANT CENTRE
(A Unit of Centre for Digestive and Kidney Diseases (India) Pvt. Ltd)

35, Dr. E. Borges Road, Hospital Avenue, Opp. Shirodkar High School, Parel, Mumbai - 400 012.
Tel.: 022-6767 0101 • Telefax : +91 22 6767 0121 • www.globalhospitalsindia.com • CIN: U85110MH2004PTC146014

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COLLEGE CERTIFICATE

We certify that this dissertation titled “Study on patient flow and waiting time of MRI & CT Scans for outpatients & Reduce waiting time in Radiology Department” is the work undertaken by Dr Apoorva Bhargava to fulfil the requirement of the MBA degree in Hospital & Health Management from the IIHMR University, Jaipur under my guidance & supervision and her approach towards research has been sincere, scientific & analytical

Faculty Guide - Dr. Sheenu Jain
Kumar

IIHMR University, Jaipur

School Dean - Dr. (Col) Mahender

IIHMR University, Jaipur

ABSTRACT

Title- Study on patient flow and waiting time of MRI & CT Scans for outpatients & Reduce waiting time in Radiology Department at Global Hospital, Parel Mumbai

Introduction- Medical imaging is an important part of the healthcare sector since it assists clinicians in diagnosing, treating, and preventing diseases, Time spent by a patient in a facility from arriving at the registration desk of the hospital until they depart after receiving 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 & comfort. Long waiting times can lead to fewer visits to the hospital, resulting in a significant reduction in healthcare utilization. Radiology Department is one of the most frequently visited & revenue-generating departments of a hospital. Patient satisfaction depends upon the quality & duration of service which includes multiple factors starting from his time of arrival to the hospital till the end of service.

Objective- To study patient flow in Radiology Department at Global Hospital, Parel and find out the reasons for long waiting times, suggest and implement various ways to improve it and observe its effects on patient satisfaction.

Findings- Causes of increased patient waiting time were 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, and Non-cooperative patients.

Suggestions- All computers in CT/MRI Console & at the 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

Frequently used words - Patients, Imaging, CT, MRI, Waiting time

ACKNOWLEDGEMENT

I am grateful to **Dr. Pushkar Mehta**, Head of Operations at Global Hospital for guiding me at every step of my thesis and teaching me various ways to analyse & come up with better solutions and develop a better understanding using his hospital management skills & Experience in-depth. I am thankful to the staff & patients for their support & patience during the data collection process & complete my thesis.

I would like to thank my college mentor **Dr. Sheenu Jain**, Assistant Professor IIHMR University, Jaipur for her constant support & guidance during my dissertation.

I am also grateful to the honorable Chairman, Mr. **Sudarshan Jain** & President Mr. **PR Sodani** at IIHMR University, Jaipur for making my academic journey at IIHMR University full of learning

I would also like to thank the Academic office staff & Library staff at IIHMR University for their constant support & help

Lastly, I would also like to thank My Family & Husband for supporting me and having full faith in me.

ABBREVIATIONS

AI – Artificial Intelligence

CT – Computerized Tomography

HRCT – High Resolution Computerized Tomography

MRI – Magnetic Resonance Imaging

EHR – Electronic Health Record

HIS – Hospital Information System

CECT – Contrast Enhanced Computerized Tomography

PACS – Picture Archiving & Communication System

PET – Positron Emission Tomography

RIS – Radiology Information System

OPD – Outpatient department

HC – Healthcare

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Chapter 1

STUDY BACKGROUND

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.

Medical imaging MRIs and CT scans allow doctors to monitor the effectiveness of treatment and make necessary modifications. Medical imaging produces rich data that allows patients to obtain better, more comprehensive care. also assist with the problem's therapy and follow-up care.

Medical imaging is the use of technology to see the human body in order to diagnose, monitor, and treat medical problems. We are familiar with some of the several types of medical imaging that are used. Various imaging techniques include magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET).

Radiology Department at Global Hospital, Parel, Mumbai provides advanced & best facilities of Medical Imaging such as:

- CT Scan - 128 Slice Console & 64 Slice CT
- MRI Scan - 3 TESLA
- Ultrasound
- Sonography
- Mammography
- Digital Xray

Scope of Study

- The amount of time spent waiting in the department produces a lot of complaints from patients, therefore it's something that needs to be addressed. Furthermore, minimising wait times can improve the department & organization's operational performance.

Purpose of Study

- A high-quality radiology report provides a consistent and informed diagnostic impression that directly answers important patient management questions and reflects the level of confidence that the examination itself provides
- The Department of Radiology currently adopts a supply-based planning approach, which makes it difficult to match resources with actual demand. The lack of infrastructure and the alignment of the planning function hamper the department's ability to meet stochastic demand (waiting lists) and to carry out its mission.
- In this thesis, we develop a demand-based centralized management system that encompasses all activities related to planning. The purpose of this system is to ensure that the capacity of the staff and material is adequate to the demand of the radiology department. The system will use the stochastic nature of production processes and health demand to plan. A simulation study analyses the possible intervention strategies for the management of waiting lists. This should lead to an improvement in the division's performance

ORGANIZATION PROFILE



Lower Parel is home to the Global Hospital, Considered one of the best transplant centers in Western India. The hospital is well-known for its clinical work in Hepatobiliary and Liver Surgery, Surgical and Medical Gastroenterology, Kidney Disease Management, and Neurosciences. NABH accredited hospitals have 200 beds. The modern Cath Lab and 8 operating theatres with state-of-the-art imaging services provide state-of-the-art emergency and critical care management in accordance with internationally recognized clinical protocols are the cornerstone of providing a variety of emergency services to the community. Clinical excellence has led the hospital to partner with all major cashless health insurance players and become the hospital of choice for all major businesses in the city. The hospital offers Video Consult services to its patient, IHH strives to provide a full range of integrated healthcare services with a dedicated workforce, reach and scale. We strive to be the most trusted healthcare network in the world, united by our goal of providing transformative care for all patients all over the world, including India, Africa, the Middle East, and South Asia.

Vision

Becoming the global leader of a value-based integrated healthcare

“We know that delivering the best patient experience is key to ensuring success in our business. We are obligated to provide the best possible care to those who come under our care”

Mission

“To make a difference in people’s lives through excellent patient care”

We are committed to providing high-quality, comprehensive healthcare that meets the needs of our patients and shareholders. We focus on creating value for everyone involved in our system.

Scope of Services (Table 1.1)

Anesthesiology	Cardiovascular Thoracic Surgery	Endocrinology	Kidney Transplant
Cardiology	Dermatology	General Laparoscopic & Minimal Access Surgery	Hematology and Bone Marrow Transplant (BMT)
Ear, Nose & Throat Care	Emergency, Acute Care and Trauma	Heart Transplant	Nephrology and Renal Transplant
Gastroenterology	General Medicine	Infectious Diseases	Lung Transplant
Neurology	Oncology	Radiology	Plastic and Reconstructive Surgery
Rheumatology	Transfusion Medicine	Spine Surgery	Vascular Surgery
Urology	Hepatology	Neurosurgery	Orthopaedics & Joint Replacements
Psychiatry	Pulmonology	HPB & Liver Surgery	Ophthalmology

RADIOLOGY DEPARTEMENT (Global Hospital, Parel, Mumbai)

Radiology Team: The Radiology department is headed by Dr. Paul Garde along with senior consultant Dr. Rashmi Bodre & Consultants Dr. Sudhir Pargewar, Dr. Ritesh Dhom & Dr. Aparna Patankar, Department has 24*7 availability of clinical associates & Technicians to ensure smooth functioning of the department.

Project Team:

CATEGORY	
RADIOLOGIST	Dr. Parul Garde (HOD)
TECHNICIAN	Mr. Sharad
NURSING	Mrs. Pallavi
MEDICAL OPERATIONS HEAD	Dr. Pushkar Mehta
SENIOR EXECUTIVE, MEDICAL SERVICES	Dr. Apoorva Bhargava
MEDICAL SERVICES, INTERN	Ms. Afreen

Table 1.2

IMPORTANCE OF WAITING TIME

The time spent by patients in a hospital 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 patient's satisfaction and comfort. Long waiting times can lead to fewer visits to the hospital, resulting in a significant reduction in healthcare utilization.

In a competitive healthcare environment, having long wait times for patients in the Outpatient Department can harm a hospital's ability to acquire new business. The waiting time is determined by a number of factors, including the number of patients and the workload of existing staff. With the advances in CT and MRI, the scope of diagnosis has expanded but the fees are still on the higher side, expectations from patients regarding quality of service as well as infrastructure are more. One of the hallmarks of a well-managed radiology department is the short waiting time for patients.

The time patients spend prior to accessing radiology services, and previous research on factors influencing patient satisfaction with health care services has shown that they are patient-centered, including time spent with health care providers, physicians listening to patients, and Treatment expectations

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 OBJECTIVES

Broad 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.

Specific Objective:

- To study patient flow for Radio Imaging Services MRI & CT Scans
- To identify points leading to increased waiting time in the process of MRI & CT Scans
- Ways to streamline patient flow, improvement in OPD & IPD patient scheduling to avoid scan delays
- On basis of analysis to what are the major causes of increased waiting time & suggesting ways to decrease waiting time & improve overall patient satisfaction.

PATIENT JOURNEY AT RADIOLOGY DEPARTEMENT

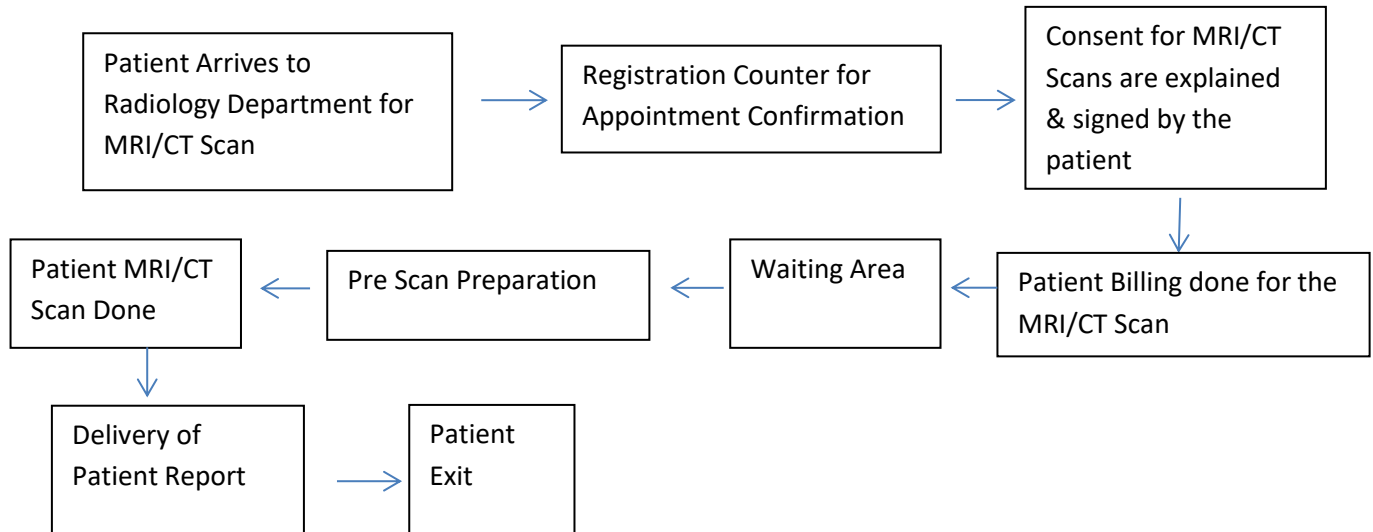


Figure 1.1

Patient Flow:

Is the movement of patients inside a healthcare facility including the medical, physical, and internal systems resources that are essential for movement of patients from admission to discharge and maintaining quality and patient/provider satisfaction. Improving patient flow is an important part of process management in hospitals and other healthcare settings.

To optimize patient flow, move patients along the care path, quickly, efficiently, and effectively to meet their care needs, while improving care coordination, patient safety, and health. Must be addressed. To optimize patient flow, providers strive to successfully adapt the right amount of resources to each hospitalization.

The value of a service depends on the benefits and burdens of the workload when the patient flow surges from 2 to 20 per hour, which can impact the work and its overall outcome. Increasing the burden leads to diminished benefits and overutilization of resources and workers.

To track variability, understand the patient's pathways in the management and clinical process, identify various obstacles, make improvements at each step of the process, consider cost factors, and not in the patient's process flow. It is important to eliminate the process. Is required. This reduces administrative burden and improves patient satisfaction and service benefits.

PROCESS FLOW IN RADIOLOGY DEPARTMENT & PACS

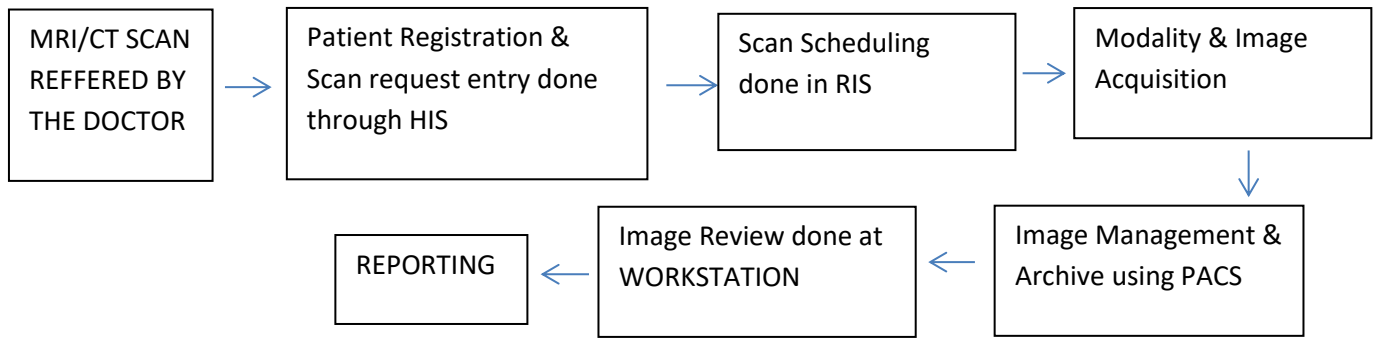


Figure 1.2

After receiving the CT / MRI request from the clinician, the patient comes to the billing counter. There, depending on the availability of the time slot and the urgency of the scan, appointments are given, and patient data and scan requests are registered in the system.

The patient's clinical history & details are scanned, based on these and the consultant's advice the radiologist decides the imaging protocols and the MRI/CT Scan is conducted by the radiographer in guidance of the radiologist and same is explained to the patient.

PACS system is used to store the images and is then interpretation is done by the radiologist, after final review the final MRI/CT Report of patient is generated and handed over.

- Image Acquisition is managed by the Radiology Technician
- Image Management – Review & Reporting done by Radiology Consultants

WORKFLOW

Radiologist	Entry into PACS Clinical Data Collection Examining the case & interpretation Reporting the final findings Review & Authentication of report by signature
Technologist	Patient data entry Getting scan done & take images Post-processing of the scan Uploading images to PACS Submission of study into RIS

Table 1.3

PACS (Picture Archiving & Communication System)

PACS uses software and hardware to store short-term and long-term images. After image capture, the captured image is sent to multiple connected systems using PACS as it is a convenient and cost-effective way to access MRI / CT scans and other medical images.

Components of PACS:

- A Digital Analogue device
- Secured network to the database for uploading & transferring images
- The workstation helps radiologists and doctors to visualize and study the image
- Archives are used for secure storage in which the image and its supporting documents can be stored and viewed by authorized personnel.

Advantages of PACS:

- availability of images increases
- Improvement in processing, Better storage of data along with multiple copies of the same image can be generated.
- Easy manipulation of images for overcoming the issues related to under or over exposure.
- Better quality of reporting along with increased speed
- Transmission of data from one hospital to another
- Digitizing of old films for easy storage and identification
- Better Reliability
- Better usage

Disadvantage of PACS:

- High Cost
- Trained personnel is required for the installation and maintenance
- Proper training to be provided to the technicians & users
- Breakdown of system
- Data Security concerns

LEAN SIX SIGMA

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:

1. Defining Phase
2. Measuring Phase
3. Analyzing Phase
4. Improving Phase
5. Controlling Phase

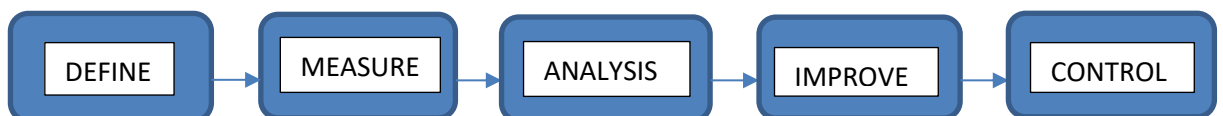
Define - We define the process improvement goals in relation to organizations strategy & customer demand

Measure - Data collection is done for measuring the vital aspects of the current process

Analysis - In this phase analysis of collected information is done to verify the cause & effect relation ensuring all factors are taken into considerations & identifying various barriers in the current process based on the collected data

Improve - The suggestions and ideas for improvement are evaluated and various experiments are designed to analyze the data and implementation is done to improve the process

Control - Any deviations from the target are identified and testing process capability is done after which mechanisms to control and monitor the process are implemented



Chapter 2 REVIEW OF LITERATURE

Author	Title	Methodology	Findings
<i>Kenneth K. Agwu et al, 2021</i>	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)
<i>L. Hoffman, 2014</i>	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.

<i>Dr (Brig). A.P. Pandit, Ms. Tanima Debmallik,2016</i>	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.
<i>Rajeev Saxena, Sartaj Sharma, Vivek Sharda, Nalini G, Manoj Kumar Yadav</i>	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.
<i>Shyamkumar Shriram,2012</i>	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	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

		the effect of various determinants on hospital waiting time	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
<i>V. Rema, and K Sikdar</i>	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 sampling 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
<i>Sabina Nuti, Milena Vainieri</i>	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
<i>Melesse Belayneh, Mirkuzie</i>	To access patients waiting time and its determinants in Debre Markos & Felge	Cross-sectional study design was used along with Quantitative data collection	The major causes of long waiting times were an outsized number of patients

<i>Woldie, Negalign Berhanu</i>	Hiwot referral hospitals of Amhara regional state in the north-west, Ethiopia	using a questionnaire and checklist	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
<i>Md Obaidul Haque, Sharmin Akter, Anwar Hossen, Zillur Rahman</i>	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
<i>Mor Armony, Shlomo Israelit, Avishai Mandelbaum, Yariv N. Marmor, Yulia Tseytlin, and Galit B. Yom- Tov</i>	Patient Flow in Hospitals: A Data Based Queueing Science Perspective	Queueing Model	As patients advance during their hospital stay, their medical needs change (generally for the better), and so does the precision with which their LOS can be predicted, operational performance is the simplest approach to define, measure, monitor, and react in real time. This knowledge can be highly beneficial for successfully juggling responsibilities.

Table 2.1

1. Study Design

- Descriptive, Cross-Sectional Study

2. Data Collection

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

1. 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

2. 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

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

6. Exclusion Criteria – IPD & Emergency Patients

7. Limitation of Study

- Fixed Duration of study
- Radiology department of a single hospital was the center of study , the result cannot be generalized to the whole population

- Data sources are patients - patients choosing not to give a correct answer is high, and dishonest answering by the patients can't be eliminated.

8. Ethical Considerations

- Permission from the Head of the Radiology Department to record and track the patient data shall be taken
- Permission from the Head of the Medical Services Department to record and track the patient data shall be taken

9. Data Analytical Tool

- MS Excel
- Process Mapping software

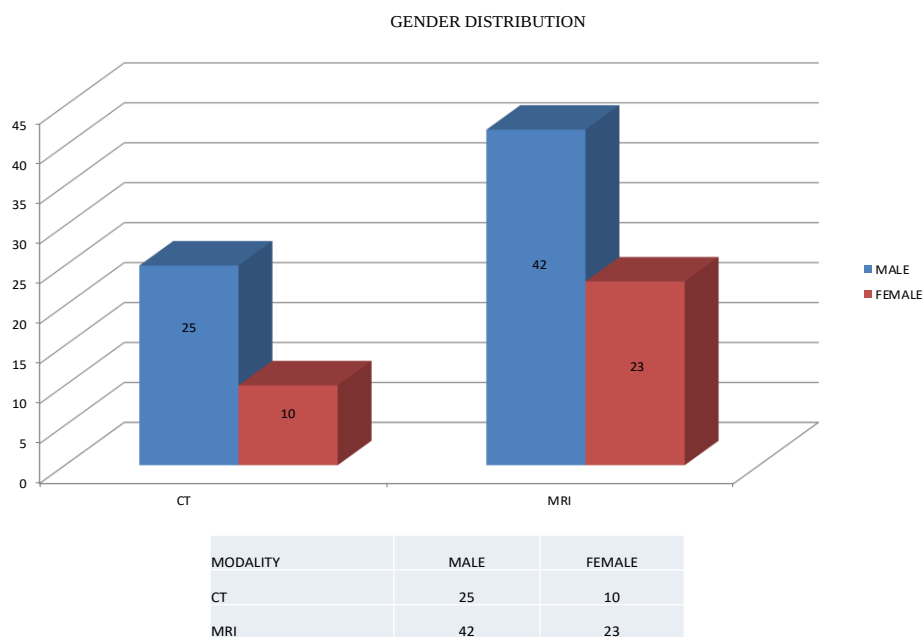
Demographic Data:

Figure 4.1

Gender Distribution

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

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

Scheduled & Unscheduled Patients

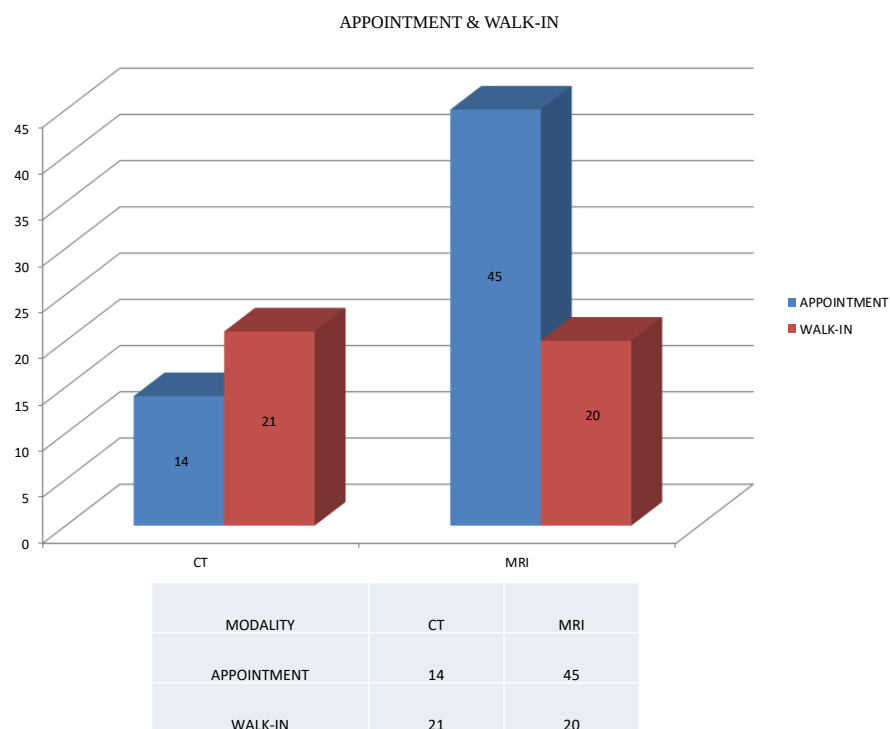


Figure 4.2

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)

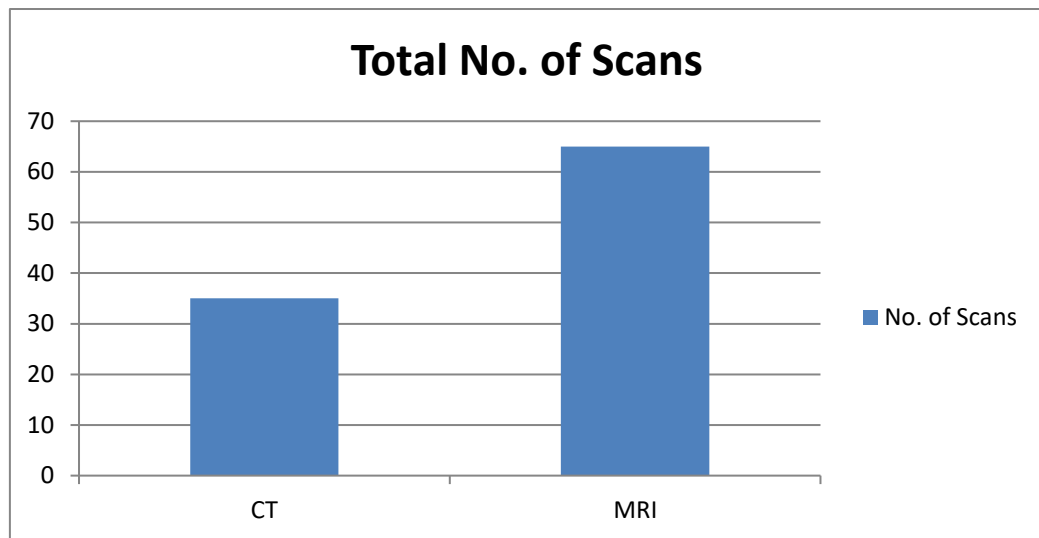


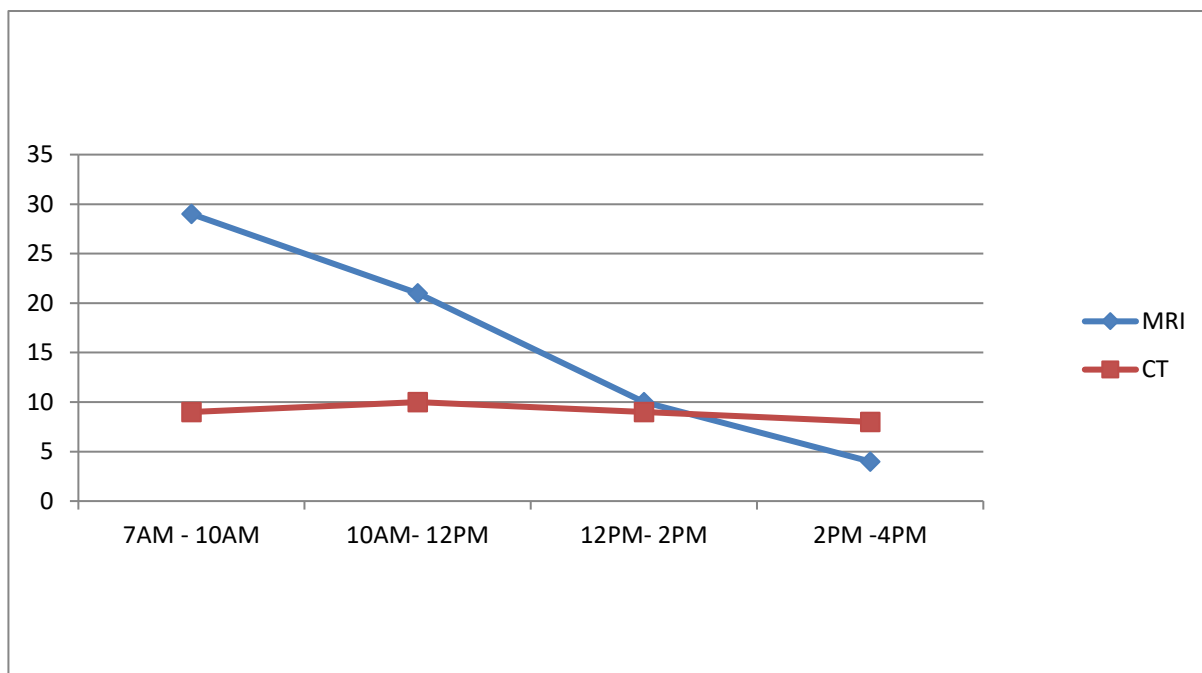
Figure 4.3

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)



Time	MRI	CT
7AM - 10AM	29	9
10AM- 12PM	21	10
12PM- 2PM	10	9
2PM -4PM	4	8

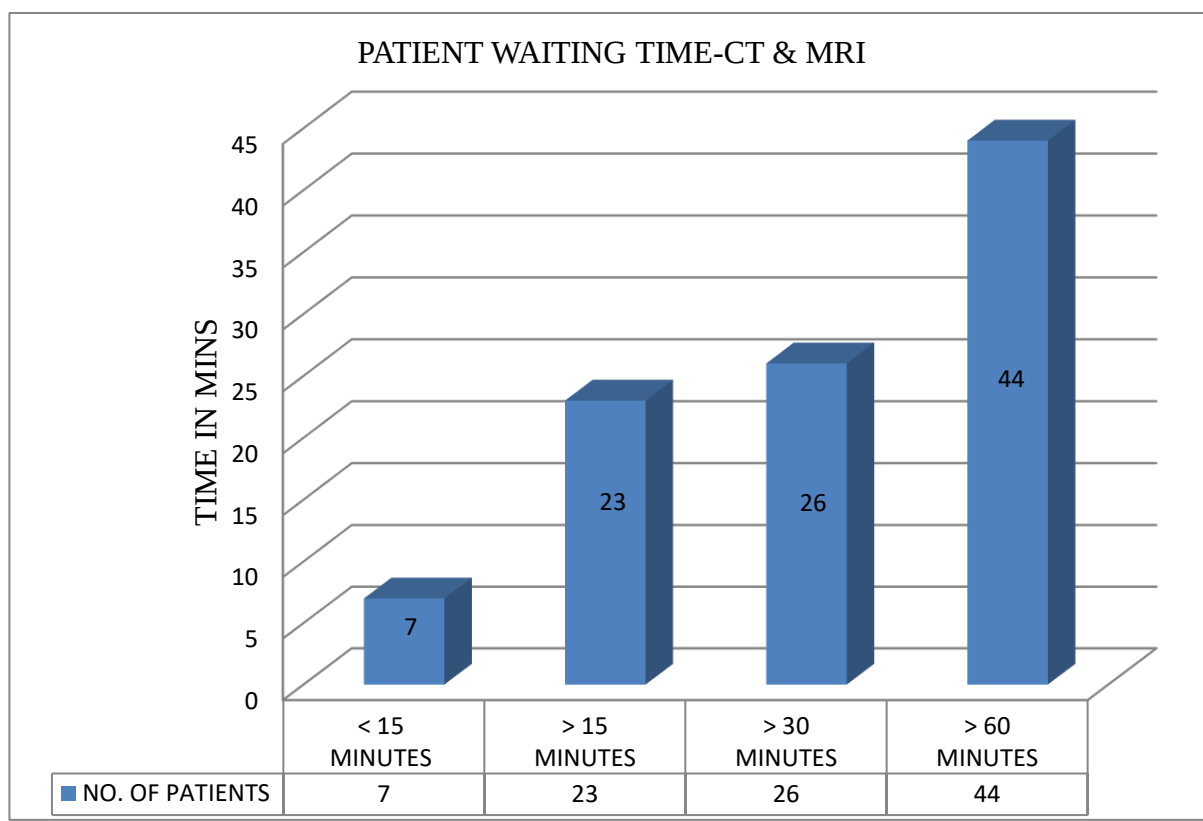
Figure 4.4

From above observation it can be seen that:

- 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**

WAITING TIME

Figure 4.5



WAITING TIME	NO. OF PATIENTS
< 15 MINUTES	7
> 15 MINUTES	23
> 30 MINUTES	26
> 60 MINUTES	44

From the above data we can observe that:

- **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

Value stream mapping is a process which allows creating a detailed visualization of all steps in a process from start to finish, it also helps to visualize every task that team works on and provide single glance report of project's project.

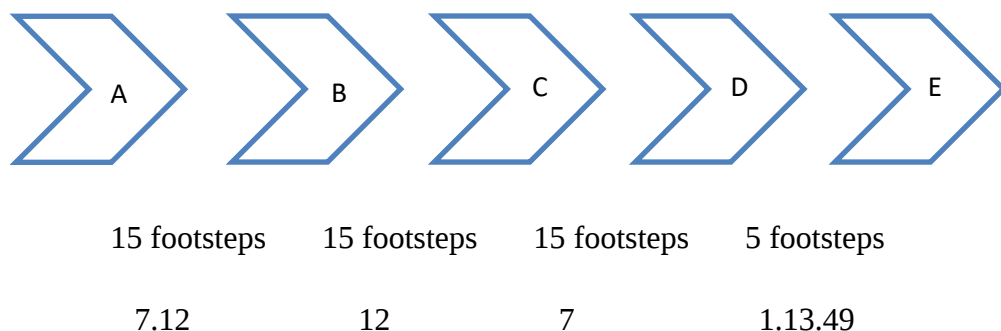
Advantages of VSM:

- Identification of wasteful activities in the process
- Provides a clear view of the work process and provides us a better idea about value-added & nonvalue-added services in the process and the time taken for the team to go through them
- Highlights current workflow and brings focus on future improvements

VSM CHART

Value stream mapping for MRI Scan

(Average Time taken by the patient at each step of the process)



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

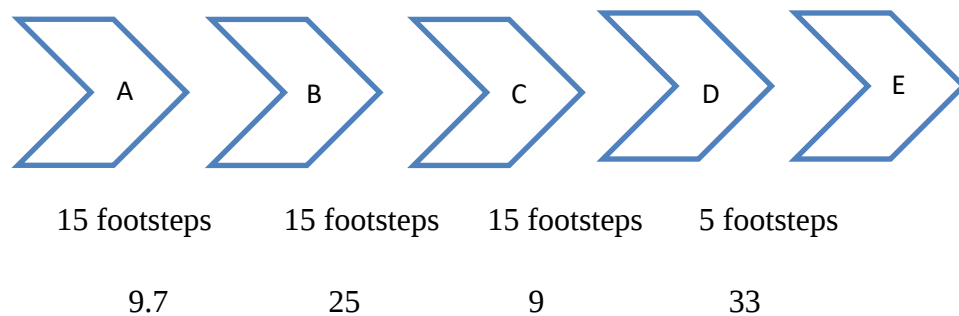
C - Patient billing is done and the patient is directed to the console to submit the consent form and show the bill to the technician

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

E - Patient is taken inside the MRI Room for the scan

As we can see from the above VSM Chart that the average waiting time for patients sitting in the waiting area to be taken in for the scan is very high (1:13:49)

Value Stream Mapping for CT Scan



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

As we can see from the above VSM Chart that the average waiting time for patients sitting in the waiting area to be taken in for the CT scan is high (00:32:00)

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

1) **SIPOC**

SIPOC is an advanced mapping tool which allows its user to get an overview about the process in limited detail and also used for narrowing the focus of a larger process and help in project selection

Components of SIPOC are:

- **Supplier** – provides input to the process, internal/external suppliers to the process
- **Input** – material, service and/or information used for generating the output
- **Process**- These are the chain of activities that enhances the value of inputs to produce output for the customer.
- **Output** – the product, service and/or information which is valuable to the customer
- **Customer**- output produced by the process utilized by the users

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

Figure 5.1

2) PARETO ANALYSIS

- 80% of profits come from 20% of the work. On the other hand, 80% of the problems can be caused by 20% of the causes.
- Helps to identify and prioritize problems and tasks
- assisting individuals in better organizing their workloads
- increasing productivity
- increasing profitability

As the process mapping was complete & tracking of scans progressed, the reasons for delay started to pour in that was leading to delays in scan and an increase in patient waiting time.

MAJOR CAUSES OF DELAYS

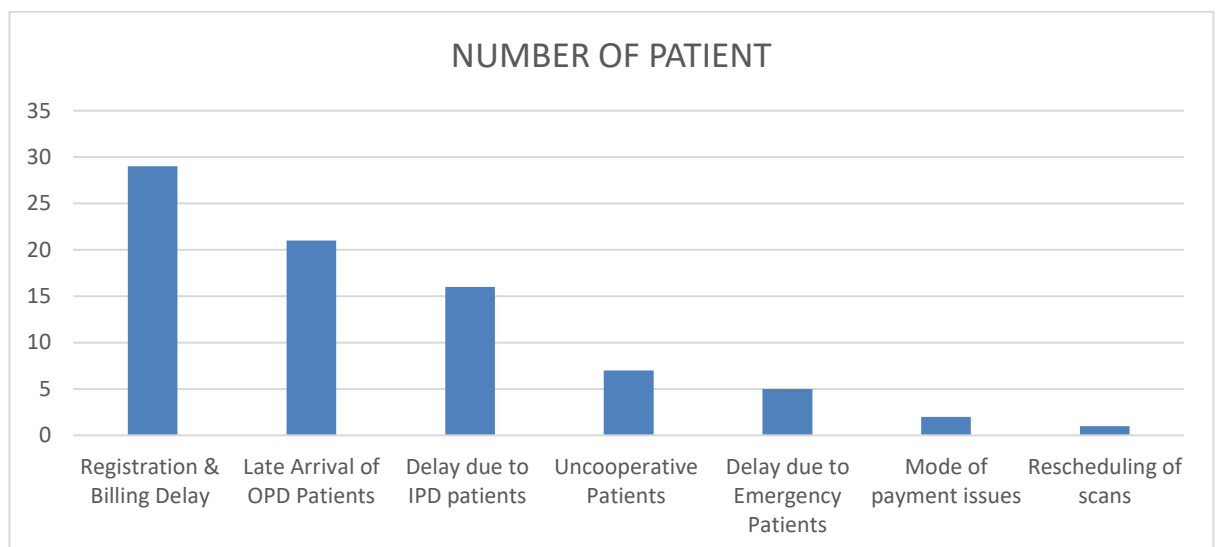


Figure 5.2

The reasons leading to increased waiting time we are categorized under below headings:

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

Table 5.1

In this we can see that 3/7 reasons lead to 80% of the delays which are:

- Registration & Billing Delay
- Delay due to IPD patients
- Late arrival of OPD patients

3) 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.

By using this, we can identify the main areas of concern and it also helps to identify, sort and display possible causes of specific problem or quality characteristic, it graphically illustrates relationship between effect and all the factors that influence the outcome.

Fishbone Diagram (regular)

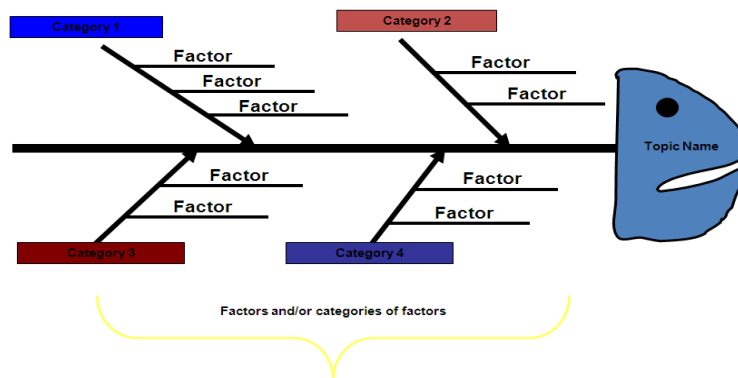


Figure 5.3

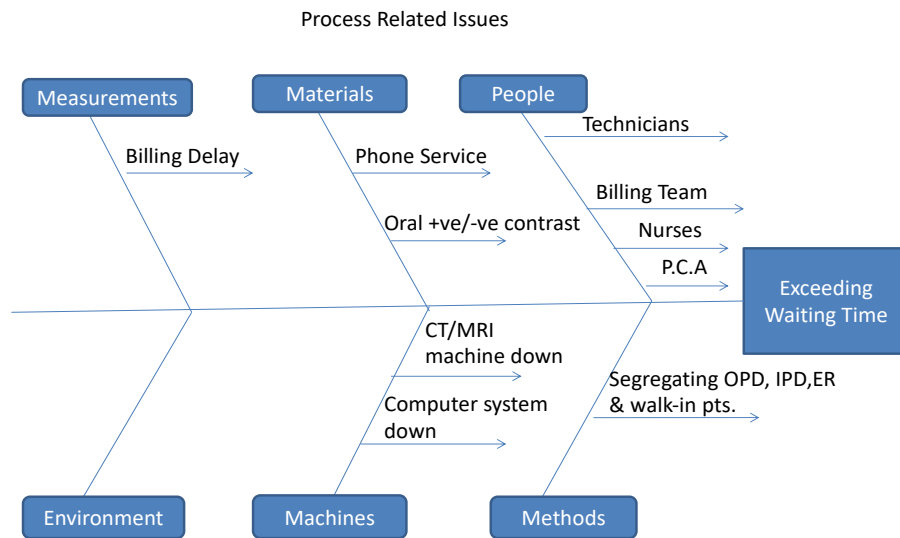
Steps in constructing a Fishbone Diagram are:

- Identify the problem (effect) along with the list of potential causes and its effect
- major causes of the problem will become the big branches
- Small Branches are filled with subcategory of each major cause until the lowest level is identified
- complete diagram is reviewed for verifying if listed causes/factors actually affect the problem to get resolved
- Most important causes are worked upon firstly
- Root cause is verified with the data collection collecting (Sampling) for validating the relationship with a problem
- Process is continued for identifying all the causes then finally reaching to the root cause

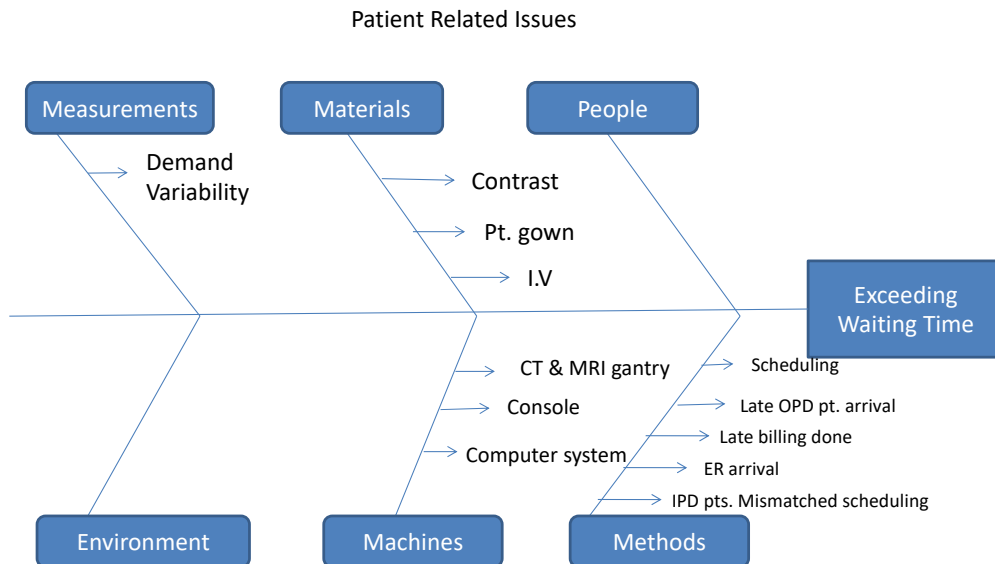
In this project (Two) FISHBONE Analysis was done namely:

- **PROCESS** Related
- **PATIENT** Related

PROCESS RELATED



PATIENT-RELATED



4) **VOICE OF CUSTOMER** (CTQ)

Critical to quality is the most important characteristic of a product or process where the performance standards or specification limits must be met for customer satisfaction. The critical quality trees aim to convert customer needs into requirements which can be measured and the organization can implement changes accordingly

Key Attributes of CTQ

1. Sensitive to the customer's perception of quality.
2. Measurable
3. Specification can be identified
4. Specification can be set to identify whether or not the CTQ has been achieved

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**

S – Specific

M – Measurable

A – Attainable

R – Relevant

T – Time bound

PROJECT CTQ

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

Table 5.2

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

- 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

Affinity Diagram

Solution	How	When	Monitoring
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	Monthly check by IT Executive
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	Monthly by Operations Manager
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	Monthly by IT Executive

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

Figure 8.1

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.

Waiting time is considered as an important component of the “service package” the longer a patient waits, their outlook on the amount of treatment they receive changes. Longer queues are an indicator of a mismanaged, poorly organized process.

To minimize the risks of losing their patients, hospitals need to understand the reasons of queuing and improve the overall process.

[https://www.researchgate.net/publication/335243595 Patient waiting time and d
eterminants](https://www.researchgate.net/publication/335243595)

[https://www.researchgate.net/publication/233930920 Managing waiting times in
diagnostic medical imaging](https://www.researchgate.net/publication/233930920)

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[https://www.researchgate.net/publication/325947707 Determinants of hospital w
aiting time for outpatient care in India how demographic characteristics hos
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THANK YOU