

**OPTIMIZING WAITING TIME AND OPERATIONAL EFFICIENCY IN
RADIOLOGY DEPARTMENT: A CASE STUDY OF MANIPAL HOSPITAL,
VARTHUR ROAD, BENGALURU**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

By

Monika Sharma

Under the Supervision and Guidance of

Col. Dr Mahender Kumar

2024



26th June, 2024

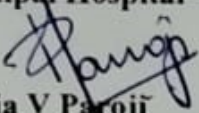
TO WHOMSOEVER IT MAY CONCERN

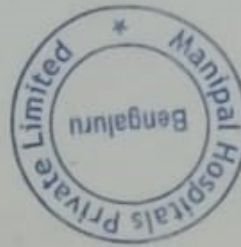
Manipal Hospitals Pvt. Ltd. presents this letter of Internship completion to **Ms. Monika Sharma**, from **IIHMR University, Jaipur** in recognition of successfully completing the **Internship** from **26th March 2024 to 26th June 2024** at **Manipal Hospitals Varthur Road** in the department of **Operations**.

We wish her all the best in future endeavors.

Yours Sincerely,

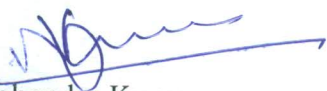
For Manipal Hospital – Varthur Road


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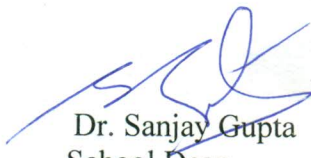


CERTIFICATE

This is to certify that dissertation title **OPTIMIZING WAITING TIME AND OPERATIONAL EFFICIENCY IN RADIOLOGY DEPARTMENT: A CASE STUDY OF MANIPAL HOSPITAL, VARTHUR ROAD, BANGALURU** is a record of the research work undertaken by Monika Sharma 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.

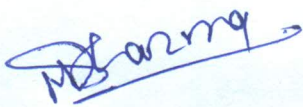

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Optimizing Waiting Time and Operational Efficiency in the Radiology Department: A Case Study of Manipal Hospital, Varthur Road, Bengaluru** is the bonafide record of my original research work. 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 work of others has been duly acknowledged in the text.



Monika Sharma

Date: 04-07-2024

ABSTRACT

This study investigates “Waiting Time and Operational Efficiency in the Radiology Department” over a 90-day period. Data collection focused on patients visiting for X-ray, USG, CT, and MRI scans, analyzing factors influencing patient flow and service delivery. Key metrics such as time-motion studies for X-ray and USG, billing turnaround times (TAT), and patient conversion rates from outpatient (OPD) to radiology were assessed.

The findings reveal significant issues in patient conversion for CT and MRI scans, primarily attributed to lack of proactive patient contact and technical failures. Approximately 35% of eligible patients were not contacted proactively, leading to missed revenue opportunities amounting to Rs. 3 lakhs over two days. Similar issues were observed in X-ray and USG departments, with missed opportunities due to patient disinterest and absence of proactive follow-up practices.

Operational inefficiencies were also identified in film dispatching processes, causing delays and errors in patient service. Billing processes exhibited a median waiting time of 6 minutes, with longer delays attributed to a single counter serving multiple functions.

Proposed solutions include implementing proactive patient contact protocols, enhancing dispatching procedures, and optimizing billing processes through dedicated counters for different services. These improvements aim to enhance patient satisfaction, operational efficiency, and financial performance of the radiology and admission departments.

Keywords: Radiology, Patient Conversion, Operational Efficiency, Billing Turnaround, Healthcare Management.

ACNOWLEDGEMENT

I would like to express my heartfelt gratitude to the following individuals during my tenure for dissertation.

First, I want to thank Dr. Sumeetha Chawla (Head of Operations – Manipal Hospital Varthur road Bangalore). She gave me great advice, support, and encouragement. Her leadership helped me grow as a healthcare professional.

I also want to thank Dr. Ashwini P R (Director of Operations – Manipal Hospital Varthur road Bangalore) for entrusting me with the opportunity to work and learn at such a prestigious organization.

I would also like to express my gratitude towards Dr. P R Sodani, President of IIHMR University, Jaipur for allowing me to use this opportunity and grow as a healthcare professional. Also, I am grateful to Dr. Mahender Kumar for his cooperation, guidance and supervision.

Lastly, I thank the Placement Cell of my university for guiding me through the internship process and providing helpful guidelines.

This opportunity is a significant milestone in my career. I will apply the skills and knowledge I have acquired effectively and continue to enhance my abilities to achieve my career objectives.

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ABBREVIATIONS

SN	Abbreviation	Meaning
	X-Ray	X-Ray Scanning
	CT	Computed tomography
	MRI	Magnetic Resonance Imagining
	TAT	Turnaround Time
	MWOL	Manipal Way of Living
	RVUs	Relative Value Units
	USG	Ultra Sonography

CHAPTER 1: INTRODUCTION

1. 1 Background:

In the realm of healthcare, radiology departments play an important role in diagnosing and managing various medical conditions. Efficient operation within these departments is extremely crucial to ensure timely patient care, reduce waiting times, and improve overall hospital performance. Radiology departments, often characterized by high patient volumes and complex workflows, face significant challenges in maintaining operational efficiency while delivering high-quality care.

The waiting time and operational efficiency of a Radiology department are pivotal factors in the overall effectiveness of healthcare delivery. Timely access to radiological services is critical for diagnosis, treatment planning, and patient management across various medical specialties.

Reducing waiting times in the Radiology department directly impacts patient satisfaction by minimizing anxiety and improving the overall patient experience. Shorter waiting times also contribute to enhanced clinical outcomes by facilitating quicker diagnosis and treatment initiation, which is crucial in emergency situations and for patients with urgent medical conditions.

Operational efficiency in Radiology involves optimizing workflow processes, resource allocation, and scheduling to maximize the utilization of equipment and personnel. Efficient operations lead to reduced idle time for equipment, decreased turnaround times for imaging studies, and improved patient flow through the department. This, in turn, supports healthcare institutions in meeting patient demand effectively while maintaining high standards of care.

Furthermore, enhanced operational efficiency in Radiology can result in cost savings by minimizing resource wastage and improving staff productivity. It enables healthcare providers to allocate resources more strategically, ensuring that patient care is delivered promptly and effectively.

In summary, the waiting time and operational efficiency of a Radiology department are crucial for delivering timely and high-quality diagnostic services, improving patient outcomes, enhancing patient satisfaction, and optimizing resource utilization within healthcare facilities

Manipal Hospital, located on Varthur Road in Bengaluru, stands as a vital healthcare institution renowned for its comprehensive medical services and advanced diagnostic capabilities. However, like many other hospitals, it faces challenges related to waiting times and operational efficiency in its radiology department. Long waiting times can lead to patient dissatisfaction, delayed diagnoses, and increased operational costs. Hence, optimizing waiting time and improving operational efficiency in the radiology department is of paramount importance for both patient outcomes and the hospital's overall effectiveness.

1.2 Objectives of the study:

The primary objective of this dissertation is to explore and implement strategies to optimize waiting times and improve operational efficiency in the radiology department of Manipal Hospital, Varthur Road, Bengaluru. This study aims to:

1. Identify the key factors resulting to longer waiting time
2. Identify the key factors leading to operational inefficiencies as well we nonconversions
3. Analyze the current process flow and resource allocation within different segments of the radiology department
4. Develop and implement actionable proposals to streamline processes and reduce waiting times
5. Develop and implement actionable proposals to improve operational efficiencies and increase conversions
6. Evaluate the impact on patient satisfactions, department efficiency and conversions as concerned within the radiology department

1.3 Scope and Significance:

The scope of this dissertation encompasses a detailed case study of the radiology department at Manipal Hospital, Varthur Road. By conducting an in-depth analysis of the department's operations, this study will provide valuable insights into the factors influencing waiting times and operational efficiency. The findings and recommendations derived from this study can serve as a blueprint for other radiology departments facing similar challenges, thereby contributing to the broader field of healthcare management.

The significance of this study lies in its potential to enhance patient experiences and outcomes. Reduced waiting times not only improve patient satisfaction but also allow for quicker diagnoses and timely medical interventions. Additionally, optimized operational efficiency can lead to better resource utilization, cost savings, and improved staff morale, ultimately benefiting the hospital's overall functioning.

1.4 Process Brief:

The radiology department is a key diagnostic hub within the hospital, providing essential imaging services such as X-rays, CT scans, MRIs, and ultrasounds. Efficient operations in this department are crucial for timely patient diagnosis and treatment, enhancing patient satisfaction, and maintaining operational efficiency. This section details the typical process flow in the radiology department, from the initial patient referral to the delivery of imaging results.

1. Initial Consultation: Patient goes for a consultation and is advised for radiology scan
2. Data collection, Documentation: Hospital staff collects the data of consultation, patient records

3. Patient calling and follow ups: Once the patient is advised for the radiology scan and data is recorded, hospital staff is made responsible to follow up with the patient either through calling or automated messages through text or whatsapp.
4. Clinical Referral: The process begins when a clinician refers a patient to the radiology department for diagnostic imaging. Referrals may be for routine check-ups, follow-up evaluations, or specific medical condition diagnostics.
5. Appointment scheduling: Upon receiving a referral, administrative staff in the radiology department schedule the patient's appointment, considering the urgency, equipment availability, and patient preferences. Patients receive appointment details via phone, email, or text messages, along with any necessary pre-procedure instructions.
6. Patient Registration: On the day of appointment, patients register at the registration desk. Administrative staff verify patient information, update their medical records, complete documentations like insurance, consent form etc. if applicable
7. Patient Preparation: Depending on the imaging procedure, patients requiring specific preparations like wearing hospital gowns, removing metallic objects, drinking water or fasting are guided by the staff
8. Patient escort and positioning: Patients are escorted to the imaging room by radiology technologists. For patients with mobility issues, appropriate assistance is provided. Technologists position patients correctly on the imaging equipment to ensure high-quality images and patient comfort.
9. Imaging Acquisition: Radiology technologists or radiologists perform the imaging procedure, operating the equipment and capturing the necessary images while ensuring patient safety. Technologists guide patients to remain still and follow instructions to achieve clear and accurate images.

10. Image processing: After the imaging procedure, the acquired images are processed and stored in the hospital's systems. Technologists review the images for quality and completeness before they are made available for interpretation.
11. Image interpretation: Radiologists access the processed images through PACS and analyze them to identify any abnormalities or diagnostic findings. They may consult with other specialists if needed to ensure accurate interpretations.
12. Report Generation: Radiologists generate detailed reports based on their interpretations, outlining the findings and providing diagnostic conclusions.
13. Communication of results: Referring clinicians review the radiology report and discuss the findings with the patient. In urgent cases, radiologists may directly communicate critical results to clinicians to expedite care. Patients receive follow-up instructions based on the diagnostic outcomes and any necessary further interventions.
14. Consultation: The patient is given a suitable time for the consultation. It can be immediately on the same day after some time basis scheduling or some other day basis availability of the slot. Patient arrives during their appointment time for the consultation with the doctor.

The radiology department conducts regular quality assurance checks to maintain high standards of imaging and diagnostic accuracy. This includes equipment calibration, adherence to protocols, and periodic reviews of imaging practices.

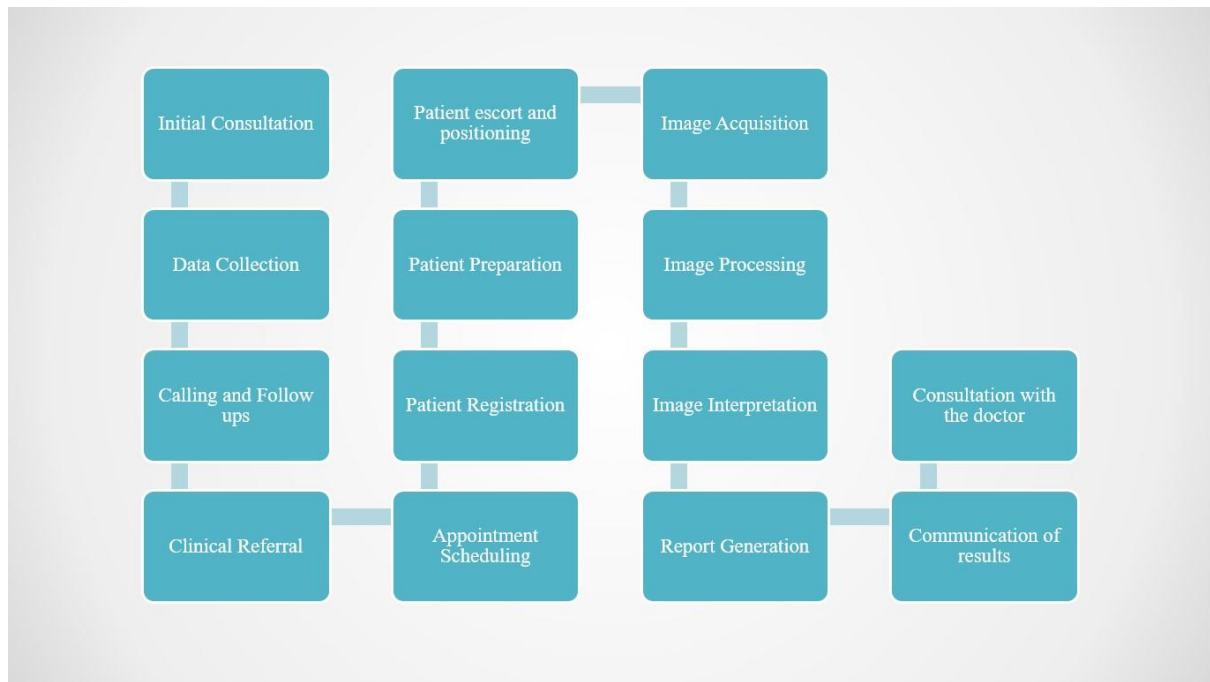


Figure 1: Process Brief

1.5 Stakeholders in Radiology Department

Stakeholders in the radiology department play crucial roles in ensuring the efficient operation and delivery of diagnostic imaging services. These stakeholders are various individuals and groups involved in different facets of the department's functioning, each contributing to patient care and departmental effectiveness. Key stakeholders are:

1. **Radiologists:** Radiologists are specialized physicians responsible for interpreting medical images to diagnose illnesses or injuries. They play a central role in the diagnostic process, providing expert analysis and recommendations based on imaging findings.
2. **Technologists:** Technologists operate imaging equipment such as X-ray machines, CT scanners, MRIs, and ultrasounds. They ensure that imaging procedures are performed safely and accurately according to protocols. Technologists also assist in patient positioning and preparation.

3. **Nurses and Technicians:** Nurses and technicians support radiology operations by assisting with patient care, managing administrative tasks, and ensuring patient comfort during procedures. They play a critical role in patient preparation and postprocedure care.
4. **Administrative staff:** Administrative personnel handle appointment scheduling, patient registration, and the coordination of imaging services. They manage patient records, insurance documentation, and facilitate communication between patients, clinicians, and radiology staff.
5. **Referring Physicians:** Referring physicians, such as primary care doctors, specialists, and surgeons, refer patients to the radiology department for diagnostic imaging. They rely on radiology reports to guide treatment decisions and patient management.
6. **Hospital's Operations/Management Team:** They strategic direction and operational policies of the radiology department. They allocate resources, manage budgets, and ensure compliance with regulatory standards to support efficient departmental functioning.
7. **Quality and IT:** This is the team that monitors imaging quality, adherence to safety protocols, and regulatory compliance within the radiology department. IT support personnel manage the technical infrastructure.

1.6 Importance of a TAT

Waiting times in healthcare, particularly within diagnostic departments like radiology, can significantly impact patient care and operational efficiency. There are several distinct types of waiting times that influence the overall patient experience and healthcare delivery:

1. **Waiting time before patient goes for the scan:** This refers to the time patients wait from their scheduled appointment time until they undergo the imaging procedure. Efficient scheduling and patient flow management are essential to minimize this

waiting time, ensuring that patients receive timely diagnostic tests without unnecessary delays.

2. Waiting time to get image scan results: Once the imaging procedure is completed, patients may experience waiting time until the images are processed and available for interpretation.
3. Waiting time for scan interpretation: After images are available, there is additional waiting time for radiologists to interpret the results and generate the final diagnostic report. Timely interpretation is crucial for clinicians to make informed decisions about patient care, initiate treatments promptly, and provide necessary follow-up care.

Managing Turnaround Time (TAT) effectively across these waiting time categories is paramount for several reasons:

1. Enhanced patient care: Shorter TAT ensures that patients receive timely diagnosis and treatment, improving health outcomes and patient satisfaction.
2. Operational Efficiency: Efficient TAT management optimizes resource utilization, minimizes idle time for equipment and staff, and enhances overall departmental productivity.
3. Regulatory Compliance: Meeting TAT targets aligns with healthcare standards and regulatory requirements, ensuring quality assurance and patient safety.
4. Financial Implications: Reduced waiting times and improved TAT contribute to cost savings through streamlined workflows and enhanced patient throughput.
5. Continuous Improvement: Monitoring and optimizing TAT metrics enable healthcare facilities to identify areas for improvement, implement process enhancements, and deliver higher quality care consistently.

1.7 Importance of Patient Conversion to Hospital Radiology Department

In a healthcare setting, patient conversion refers to the process of transitioning patients from an initial consultation to undergoing recommended diagnostic procedures, such as those

offered in the radiology department. This conversion is crucial for several reasons, impacting both patient care and the operational efficiency of the healthcare facility.

1. **Timely and Accurate diagnosis:** Post-consultation conversions to the radiology department enable timely and accurate diagnosis of medical conditions. Imaging tests such as X-rays, CT scans, and MRIs provide critical information that supports clinicians in making informed treatment decisions.
2. **Comprehensive Patient Care:** Diagnostic imaging is often a vital component of comprehensive patient care. It allows for the early detection and monitoring of diseases, contributing to better health outcomes and preventing complications.
3. **Improved Treatment:** Radiological imaging results are integral to developing effective treatment plans. Converting patients to the radiology department ensures that necessary imaging tests are conducted, facilitating precise and targeted interventions.
4. **Patient Reassurance:** Diagnostic imaging provides clarity and reassurance to patients regarding their health status. By ensuring patients proceed with recommended imaging tests, healthcare providers can address patient concerns and promote peace of mind.
5. **Optimal Resource Utilization:** High conversion rates to the radiology department enhance the utilization of imaging equipment and resources. This contributes to the department's operational efficiency and justifies investments in advanced imaging technologies.
6. **Streamlined Workflow:** Efficient patient conversion post-consultation ensures a steady flow of patients through the radiology department, reducing bottlenecks and improving overall departmental workflow.
7. **Revenue Generation:** Increased patient conversion to the radiology department generates additional revenue for the healthcare facility. Diagnostic imaging services are often a significant source of income, supporting the financial sustainability of the institution.

8. **Enhanced Reputation:** Providing comprehensive diagnostic services, including seamless conversion to the radiology department, enhances the hospital's reputation as a provider of high-quality, patient-centered care. This can lead to increased patient referrals and loyalty.
9. **Patient Engagement:** Facilitating the conversion of patients to the radiology department post-consultation enhances patient engagement in their own care. Informed patients are more likely to comply with recommended diagnostic and treatment plans.
10. **Increased Patient Satisfaction:** Efficient conversion processes that minimize delays and ensure timely diagnostic imaging contribute to higher levels of patient satisfaction. Satisfied patients are more likely to have positive experiences and recommend the healthcare facility to others.

In conclusion, the importance of patient conversion to the radiology department postconsultation cannot be overstated. It is essential for accurate diagnosis, effective treatment planning, and comprehensive patient care. Additionally, it supports operational efficiency, financial stability, and enhances the overall reputation of the healthcare facility. By prioritizing patient conversion to radiology, healthcare providers can ensure better health outcomes, improved patient satisfaction, and sustainable institutional growth.

1.8 Problems at Radiology Department

Problems related to long waiting time

1. Delayed diagnosis: Prolonged waiting times for imaging procedures can delay diagnoses, preventing timely treatment and potentially worsening patient outcomes.
2. Patient Dissatisfaction: Long waits contribute to patient frustration and anxiety, leading to decreased satisfaction and trust in the healthcare facility.
3. Increased No-Show rates: Extended waiting periods can lead to higher no-show rates, where patients miss their scheduled appointments, disrupting workflow and reducing efficiency.
4. Staff Burnouts: Continuous high workload and stress from managing long queues can lead to staff burnout, impacting their performance and patient care quality.

Problems related to Non-Conversions of Patients Post Consultations

1. Missed diagnosis: Failure to convert patients to the radiology department means missed opportunities for essential diagnostic imaging, compromising patient care and treatment outcomes.
2. Financial loss: Low patient conversion rates impact revenue generation for the radiology department, affecting the overall financial health of the healthcare facility.
3. Poor Patient Engagement: Low conversion rates indicate poor patient engagement and adherence to medical advice, highlighting the need for better patient education and communication.

Operational and Logistical Issues

1. Scheduling Conflicts: Ineffective scheduling systems can lead to conflicts, overbooked slots, and inefficient use of radiology resources.

2. **Technological Limitations:** Outdated or insufficient imaging equipment can slow down processes, reduce the quality of diagnostic images, and limit the department's capacity to handle patient volume.
3. **Data management Issues:** Challenges in managing and storing large volumes of imaging data can lead to delays in accessing and interpreting results, impacting overall workflow.
4. **Coordination with other departments:** Poor coordination and communication with other departments can result in delays, miscommunications, and inefficiencies in patient care.

1.9 Mitigating the problems

To mitigate these issues, there is a need to implement comprehensive strategies like:

1. **Optimizing scheduling system:** Use advanced scheduling software to minimize conflicts and ensure efficient patient flow.
2. **Investing in Technology:** Upgrade and maintain imaging equipment to enhance diagnostic capabilities and reduce downtime.
3. **Improving Patient communication and Empathy:** Educate staff on empathy, patients on the importance of diagnostic imaging and streamline the referral process to increase conversion rates
4. **Enhancing Data Management:** Implement robust data management systems to ensure quick access to imaging results and maintain data integrity.
5. **Training and Development:** Provide continuous training for radiology staff to keep them updated on the latest technologies and best practices.

6. Improving Inter-departmental coordination: Improve communication and collaboration with other departments to ensure seamless patient care.

CHAPTER 2: LITERATURE REVIEW

This table presents a comprehensive review of recent literature on optimizing waiting times and operational efficiency in radiology departments. The review includes studies and case studies focusing on various strategies, technological integrations, and outcomes related to patient care and departmental performance.

SN	Literature	Authors and Year	Study Location	Sample Size	Sampling Technique
1	Effect of radiology study flow on report turnaround time	Rathnayake, Samira Nautsch, Felix Goodman, Thomas Robin Forman, Howard P, Gunabhushanam, Gowthaman (2017)	Department of Radiology and Biomedical Imaging, Yale University School of Medicine	7378	Convenient Sampling

Table 1: Literature Review 1

Salient Feature: Investigated the effect of radiology study flow on report turnaround time. Found that streamlined workflows significantly reduce TAT. The purpose of this study was to assess the importance of relative value unit (RVU) flow and other factors in report turnaround time (TAT) in emergency radiologic operations.¹

SN	Literature	Authors and Year	Study Location	Sample Size	Sampling Technique
2	Mapping TAT to a generic timeline: A systematic review of TAT definitions	Breil, Bernhard Fritz, Fleur Thiemann, Volker Dugas, Martin (2011)	Institute of Medical Informatics, University of Münster, Münster, Germany	1000	Convenient Sampling

Table 2: Literature Review 2

Salient Feature: Assessing turnaround times can help to analyse workflows in hospital information systems. This paper presents a systematic review of literature concerning different turnaround time definitions.²

SN	Literature	Authors and Year	Study Location	Sample Size	Sampling Technique
3	Radiologist report turn-around time: Impact of pay-for-performance measures	Boland, Giles WL Halpern, Elkan F, Gazelle, G. Scott (2010)	Department of Radiology, Massachusetts General Hospital and Harvard Medical School	100000	Convenient Sampling

Table 3: Literature Review 3

Salient Feature: Expedited finalized radiologist report turnaround times (RTAT) are considered an important quality care metric in medicine. This study was performed to evaluate the impact of a radiologist pay-for-performance (PFP) program on reducing RTAT.³

SN	Literature	Authors and Year	Study Location	Sample Size	Sampling Technique
4	Algorithmic Prediction of Delayed Radiology Turn-Around-Time during Non-Business Hour	Shah V et al. (2019)	From the Radiology and Biomedical Imaging, University of California, San Francisco (UCSF), San Francisco,	15,177	Random Sampling

Salient Feature: Developed an algorithmic model to predict delayed turnaround time (TAT) specifically during non-business hours in radiology departments. Utilized machine learning techniques to analyze and predict TAT based on historical data. Specific details such as study location, sample size, and specific sampling techniques were not provided in the available information.

SN	Literature	Authors and Year	Study Location	Sample Size	Sampling Technique
5	Practice policy and quality initiatives: Decreasing variability in turnaround time for radiographic studies from the emergency department	Towbin AJ, Iyer SB, Brown J, Varadarajan K (2019)	From the Department of Radiology and Division of Emergency Medicine Cincinnati Children's Hospital Medical Center,	8602	Random Sampling

Salient Feature: Introduced and evaluated quality improvement measures to mitigate TAT variability specifically in ED radiographic studies. Conducted a retrospective analysis to identify root causes of TAT variability, focusing on operational challenges. Utilized prospective methods to assess the impact of standardized protocols and training on enhancing TAT predictability. Investigated the integration of IT solutions to streamline processes and enhance TAT reliability across ED radiology services.

SN	Literature	Authors and Year	Study Location	Sample Size	Sampling Technique
6	Turning around cancer: Oncology imaging and implications for emergency department radiology workflow	Succi MYun,BRao SRao SGottumukkala RGlover MWhite BLev MRaja APrabhakar A (2020)	Department of Radiology SCIEOL Brazil.	208,516	Random Sampling

Salient Feature: studies from Brazil and Malaysia predominantly. Sample sizes vary widely, from case studies to large-scale analyses. Various sampling techniques employed, including random, consecutive, and stratified sampling. Common themes include impact on turnaround times, report accuracy, workload, financial implications, and educational outcomes. Limited details on sample characteristics (e.g., demographics of radiologists, specific hospitals) in some studies.

SN	Literature	Authors and Year	Study Location	Sample Size	Sampling Technique
7	System approach to prevent lost studies and improve radiology report turnaround time	System approach to prevent lost studies and improve radiology report turnaround time (2022)	Penn State College of Medicine, Hershey, Pennsylvania, USA 2Radiology, Penn State Health Milton S Hershey Medical Center	1125	Random Sampling

CHAPTER 3: METHODOLOGY

3.1 Key Research Questions

1. What is the average TAT in the radiology department across different departments?
2. What are the factors that result in longer TAT?
3. How do waiting time impact patient satisfaction and clinical outcomes in radiology department?
4. What strategies can be implemented to optimize operational efficiency and reduce waiting time?
5. What are the factors that lead to non-conversions of patients post consultation?
6. What strategies can be implemented to optimize operational efficiency and improve patient conversion?

3.2 Research Design

This study will employ a mixed-methods research design, combining qualitative and quantitative approaches to gather comprehensive insights into the factors affecting waiting times and operational efficiency in radiology departments. All the data was collected from the observations of sample of over 250+ patients and registered hospital data through the internal MIS system. The sample comprises patients across various department of radiology, age, gender, occupation and complexities.

3.3 Study Setting

The study will be conducted at Manipal Hospital, Varthur Road, Bengaluru, focusing on its radiology department. This setting was chosen due to its reputation and diverse patient population, providing a robust environment for studying waiting times and operational processes.

3.4 Study Population

The sample size has over 250 patients across different gender, age, medical complexities etc who were either advised for a scan at radiology department or have already scanned. These patients may or may not be the resident of the city.

3.5 Research Procedure

The research procedure employed are:

1. **Qualitative phase:** Through observations as well as through conducting interviews and focus groups with key stakeholders (patients, radiologists, administrative staff) to understand their perspectives on waiting times, operational challenges, and potential solutions.
2. **Quantitative phase:** Analyze operational data from hospital records, including waiting times, patient throughput, and resource utilization along with recording own data of waiting time and conversions.

3.6 Operational Definitions

1. **Waiting Time:** The duration from the patient's appointment time to start of their radiology procedure
2. **Conversion:** Percentage of patents who availed radiology service at the hospital out of the total patients who were advised

3.7 Inclusion Criteria

1. Patients across all age groups
2. Patients who availed the services of X-Ray, USG, CT and MRI
3. Staff: Radiologists, technicians, and administrative personnel directly involved in radiology service delivery.

3.8 Exclusion Criteria

1. Patients who refused to be a part of the study
2. Staff: Not directly related to the radiology department
3. In-patient patients going for x-ray and ultrasound.

3.9 Ethical Consideration

1. **Informed Consent:** Participants were fully informed about the study's purpose, procedures, and potential risks.
2. **Confidentiality:** Data collected are anonymized to protect participant confidentiality. Only aggregated data will be reported to ensure anonymity.

CHAPTER 4: RESULTS

The results will cover 4 parts:

1. Time Motion Study – X-Ray Analysis
2. Billing TAT Analysis
3. CT and MRI Non-Conversion Analysis
4. X-Ray Non-Conversion Analysis

3. Time Motion Study – X-Ray Analysis

This study examines the time taken for the technician to do the X-Ray of the patient and time taken to get the film out.

Duration: April'24 and May'24

Total Patients studied: 134

Data	Time Taken X-Ray	Time Taken Film Out
Max Time Gap	18 mins	139 minutes
Min Time Gap	2 mins	2 mins
Avg Time Gap	6 mins	11 mins
Median Time Gap	5 mins	6 mins

Table 4: Time Motion Study at X-Ray

4. Billing TAT Analysis

This study examines billing time taken at the registration desk of the radiology department.

Duration: May'24

Total Patients studied: 181

Data	TAT
Max Time	46 mins
Min Time	1 min
Avg Time	7 mins
Median Time	6 mins

Table 5: Time study at Billing

Waiting time less than 5 mins: 88 out of 181 patients

Waiting time 5-10 mins: 48 out of 181 patients

Waiting time 10-20 mins: 43 out of 181 patients

Waiting time more than 20 mins: 2 out of 181 patients

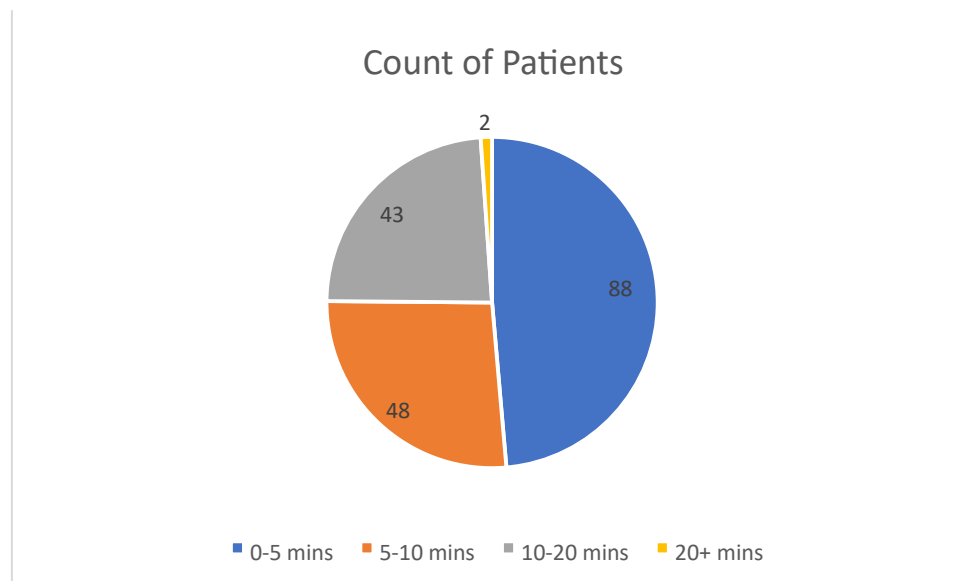


Figure 2: Pie chart for Billing TAT Analysis

3. CT and MRI Non-Conversion

This study examines the conversion % of patients who have been advised undergo CT or MRI at the hospital.

Total Patients Observed: 57

Row Labels	Count of Patients
Calling/Follow up not done	20
Calling/Follow up Done	37
Total	57

Table 6: Calling status on CT and MRI

The above table shows the data of calling / follow ups done by the hospital staff to the patients who have been advised to take CT or MRI scan. The observation shows that only 65% patients are being contacted leaving a huge scope for a non-conversion.

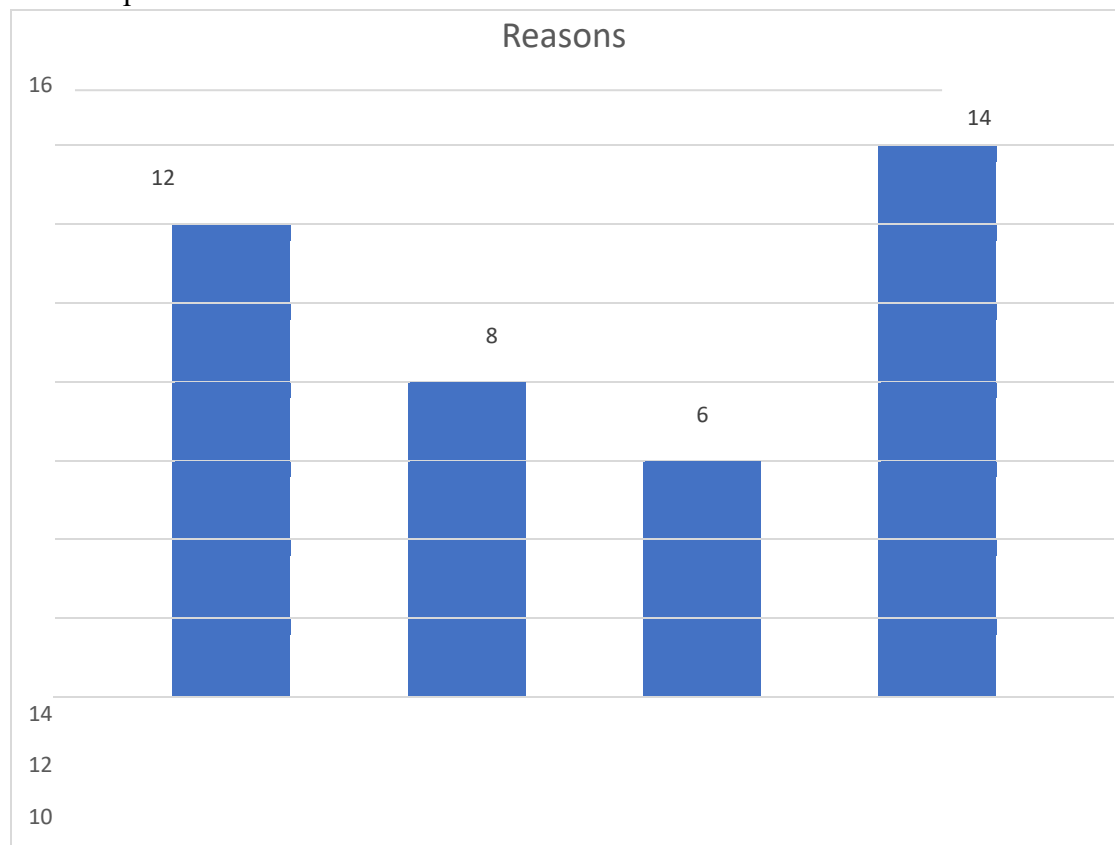
Following are the responses on calling:

Row Labels	Count of Patients
Scan Done	6
Scan not applicable for now	8
Patient not interested	8
Scan could not be done – machine issue	12
Patient not responding	6
Patient took appointment post calling	3
Patient scanned from outside	14
Total	57

Table 7: Responses on calling for CT and MRI

The data reflects are potential non-conversion risk of at-least 40 patients out of 57.

Major reasons for potential non-conversions are:



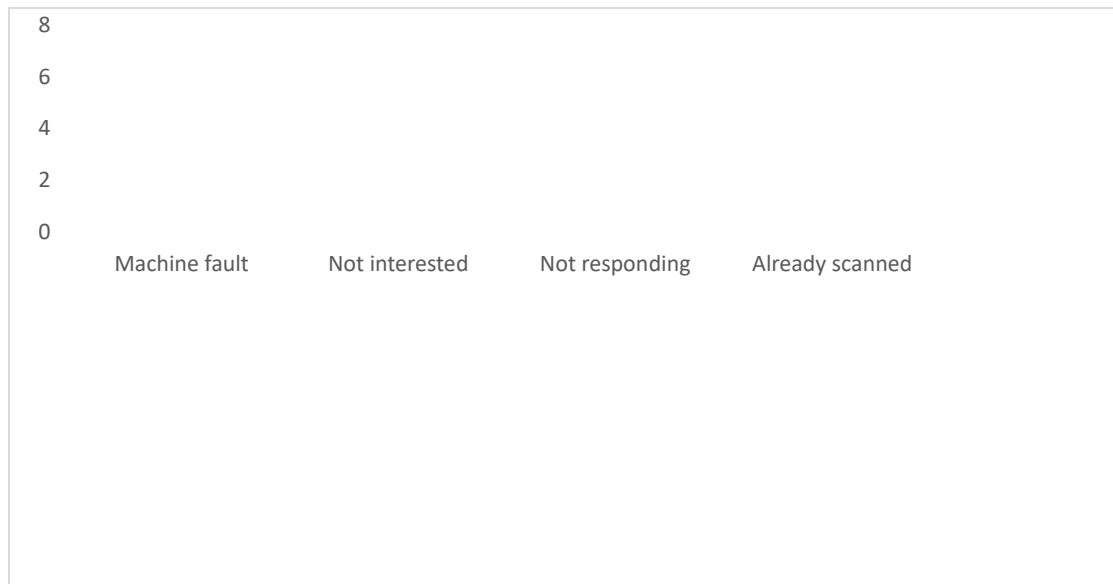


Figure 3: Bar chart for potential non-conversion reasons for CT/MRI

- 12 patients could not scan due to machine fault
- 8 patients seemed not interested
- 6 patients were not responding
- 14 patients already scanned from outside

4. X-Ray Non-conversion Analysis

This study examines the conversion % of patients who have been advised take the X-Ray scan.

Total Patients observed: 52

Row Labels	Count of Patients
X-Ray done at the hospital	14
X-Ray not done at the hospital	38
Total	52

Table 8: X-Ray conversion

This study reveals that:

- Follow up calling for X-Ray patients is not a norm/practice
- Generally, 73% patients do not take X-Ray at the hospital

CHAPTER 5: DISCUSSIONS

The discussion and further analysis will be divided into 4 parts:

1. Time Motion Study – X-Ray Study
2. Billing TAT Study
3. CT and MRI Non-Conversion Study
4. X-Ray Non-Conversion Study

This chapter will include the discussions of the findings of the research and implications.

1. Time Motion Study – X-Ray Analysis

This analysis showed that the average time gap for X-Ray is 5 mins and to get the film is 6 mins, there have been significant count of cases wherein the waiting time has exceeded beyond expected. At one instance the waiting time for getting the X-Ray film was 139 minutes.

Major reasons leading to longer waiting time for X-Ray are:

1. Equipment downtime: When X-ray machines or film processing equipment require maintenance or repair, it can delay the production and retrieval of X-ray films for patients.
2. High Patient Volume: A large number of patients requiring X-rays within a short timeframe can overwhelm the department's capacity, leading to backlog and delays in film processing.
3. Staffing Issue: Insufficient staffing or uneven distribution of workload among radiology technicians and support staff can slow down the overall process of X-ray film retrieval and delivery.
4. Technical Issues: Malfunctions in computer systems used for storing and accessing X-ray images can hinder the retrieval and distribution of films to patients and healthcare providers.
5. Human errors: Sometimes technicians forget to give the print on time

6. Lack of training/skills: Sometimes technicians are unable to position the patient as required during the scan

2. Billing TAT Study



Figure 4: Waiting queue at radiology department registration desk

The study revealed that at-least 25% had experienced a waiting time of over 10mins at the billing counter of radiology department which seems to be unusual. Major reasons leading to longer waiting time are:

1. Insufficient staff at the billing counter: Insufficient staff at the billing counter can result in longer queues and delays in processing payments and paperwork.
2. Complex billing procedures: Complicated billing processes or outdated systems that require manual entry or verification can slow down the billing process.
3. High Patient Volume: A large number of patients needing billing services within a short period can overwhelm the department's capacity, leading to delays.

4. **Technical Issues:** Problems with billing software, network connectivity issues, or hardware malfunctions can disrupt the billing process.
5. **Staff Training:** Inadequate training of billing staff or frequent turnover can impact efficiency and contribute to longer wait times.

3. CT and MRI Non-Conversion Study

The study revealed that 35% patients are not reached out / contacted for the scan. Also, major reasons leading to non-conversions and the implied loss of revenue are:

Row Labels	Count of Patients	Loss of Revenue	% Cases
Patient not interested	8	60,000	20%
Machine Issue	12	90,000	30%
Patient not responding	6	45,000	15%
Scanned from outside	14	1,05,000	35%
Total	40	3,00,000	100%

Table 9: Loss of revenue due to non-conversion at CT/MRI

The analysis reflects that there is a loss of revenue of about 3,00,000 over 57 patients out of which 40 patients were potential non-conversion cases.

4. X-Ray Non-Conversion Study

This study reveals that while there is no process of follow up or calling for patients who have been advised to take X-Ray scan, there is also a case of 73% patients not taking the X-Ray scan at the hospital.

CHAPTER 6: CONCLUSION

The comprehensive studies conducted across various facets of the radiology department highlight critical insights into operational inefficiencies and patient care challenges. Each study has revealed distinct factors contributing to delays, non-conversions, and revenue losses within the department.

Time Motion Study – X-Ray Analysis:

The analysis of X-ray processes underscored significant variability in waiting times, with averages of 5 minutes for the procedure itself and 6 minutes to obtain the film. However, instances of excessively long waits, such as the recorded 139 minutes for film retrieval, indicate systemic issues. Major reasons identified include equipment downtime, high patient volumes overwhelming capacity, staffing inadequacies, technical glitches, human errors, and deficiencies in technician training. Addressing these factors through improved maintenance protocols, staffing optimizations, and enhanced training programs is crucial to enhancing efficiency and patient satisfaction in X-ray services.

Billing TAT Study:

Analysis of billing turnaround times (TAT) revealed that a notable 25% of patients experienced wait times exceeding 10 minutes at the billing counter, indicating suboptimal service standards. Factors contributing to prolonged waits include insufficient staffing, complex billing procedures, high patient volumes, technical challenges with billing systems, and inadequate staff training. Streamlining billing processes, upgrading systems, and investing in staff training are essential steps to improve efficiency and reduce patient wait times at the billing counter.

CT and MRI Non-Conversion Study:

The study highlighted a significant issue of non-conversion, with 35% of patients not proceeding with scheduled CT and MRI scans. Reasons for non-conversion included patient disinterest, machine issues, lack of patient response, and patients opting to get scans done outside the hospital. This non-conversion resulted in a substantial revenue loss of ₹3,00,000,

reflecting the need for improved patient communication strategies, proactive issue resolution, and service quality enhancements to retain patient trust and maximize revenue opportunities.

X-Ray Non-Conversion Study:

Findings from the X-ray non-conversion study revealed a staggering 73% of patients not following through with recommended scans at the hospital. Lack of follow-up processes and patient outreach were identified as contributing factors. Implementing systematic patient follow-up procedures and personalized communication strategies could potentially mitigate non-conversion rates, thereby improving diagnostic completion rates and overall service utilization.

CHAPTER 7: RECOMMENDATIONS

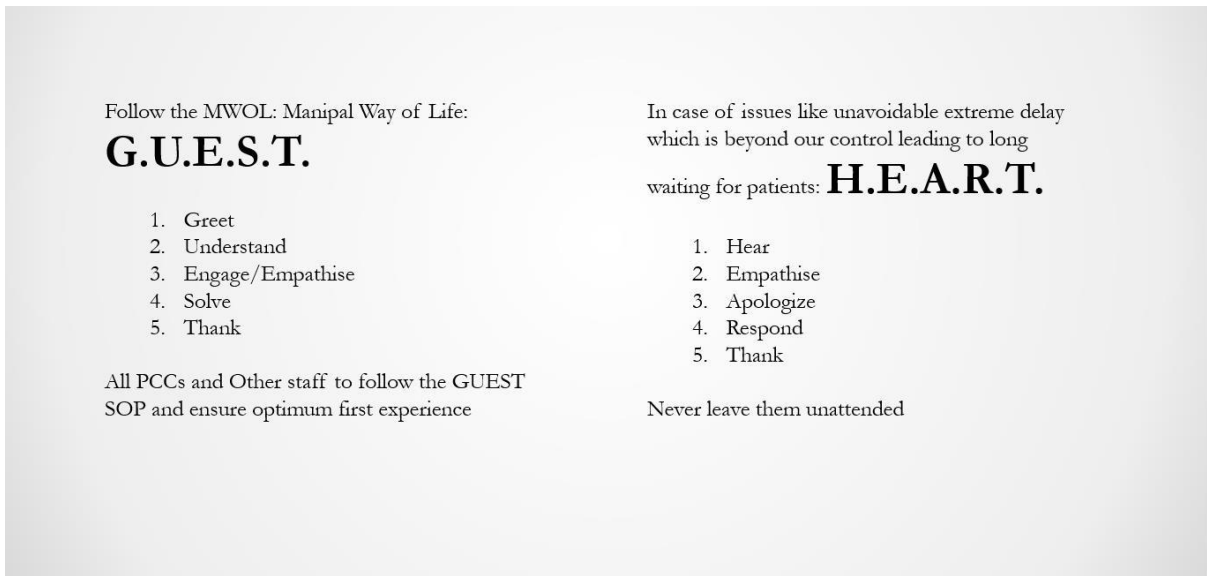


Figure 5: Suggested Manipal Way of Life (GUEST and HEART)

To address these findings comprehensively, the radiology department should consider the following recommendations:

1. **Enhance Equipment Maintenance:** Implement regular maintenance schedules to minimize downtime.
2. **Optimize Staffing Levels:** Ensure adequate staffing to manage patient volumes effectively.
3. **Upgrade Technological Infrastructure:** Invest in robust IT systems to streamline operations and reduce technical disruptions.
4. **Improve Training Programs:** Provide ongoing training to staff to enhance technical skills and patient interaction.
5. **Enhance Patient Communication:** Implement proactive communication strategies to reduce non-conversion rates and improve service uptake. (GUEST and HEART)

By implementing these recommendations, Manipal Hospital can enhance operational efficiency, improve patient satisfaction, and optimize revenue generation in its radiology department.

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