DISSERTATION

At

U4RAD Technologies LLP

(14th march 2022- 15th June 2022)

A comparison in Reporting Turn Around Time of Computer Tomography and MRI between in-house and U4RAD

By Zeba Pasha

PG/20/017

Hospital Management

Under the Guidance of: B. S. Singh

POST GRADUATE DIPLOMA IN HOSPITAL AND HEALTH MANAGEMENT

2020-22

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT AND RESEARCH NEW

DELHI

COMPLETION OF DISSERTATION

The certificate is Awarded to

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and has successfully completed her Project on

A comparison in Reporting Turn Around Time of Computer Tomography and MRI between in-house and U4RAD

at

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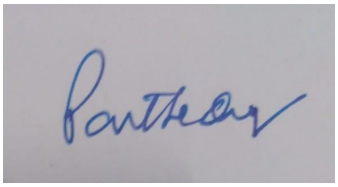
She comes across as a committed, sincere & diligent person who has

a strong drive & zeal for learning.

We wish her all the best in future endeavours.



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Founder and CEO

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B S Singh

B. S. Singh
Mentor
Associate Dean, Academic and Student Affairs IIHMR, New Delhi
IIHMR, New Delhi

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The following dissertation titled **"A comparison in Reporting Turn Around Time of Computer Tomography and MRI between in-house and U4RAD" at "U4RAD Technologies LLP"** is hereby approved

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Name: **Signature:**

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B S Singh

Dr. Rupra

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Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Zeba Pasha,** a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. She is submitting this dissertation titled **"A comparison in Reporting Turn Around Time of Computer Tomography and MRI between in-house and U4RAD "** at **"U4RAD Technologies LLP"** in partial fulfillment of the requirements for the award of the PGDM (Hospital & Health Management).

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

DSSingh

Mentor: B. S. Singh
Associate Professor
IIHMR, Delhi

Mr. Partha Dey
Founder and CEO
U4RAD Technologies LLP

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH,

NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **"A comparison in Reporting Turn Around Time of Computer Tomography and MRI between in-house and U4RAD "** and submitted by **Dr. Zeba Pasha, Enrolment No. PG/20/017** under the supervision of **B.S. Singh** for the award of **Postgraduate Diploma in Hospital and Health Management of the Institute** carried out during the period from **14th March 2022 to 15th June 2022** embodies my original work and has not formed the basis for the award of any degree, diploma associateship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Zeba Pasha

Signature

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Feedback Form

Name of the Student: Dr. Zeba Pasha

Dissertation Organization: U4RAD Technologies LLP

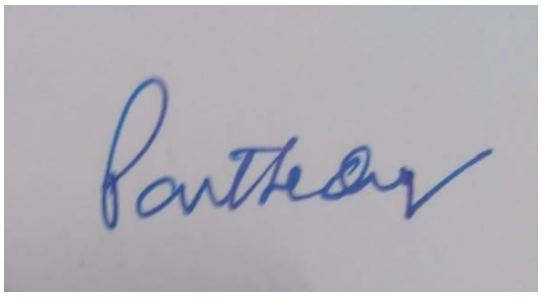
Area of Dissertation: Hospital

Attendance: 100%

Objectives achieved: 100%

Deliverables:

- **Worked with the Operations team and help them with the process of delivery of the services and delivering the reports on time.**
- **Helped in designing the various health packages.**
- **Helped in organizing various camps.**



Signature of the Officer-in-Charge/ Organization Mentor (Dissertation)

Date: 6 Sept 2022

Place: Gurgaon

IIHMR DELHI

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH (IIHMR)

Plot No. 3, Sector 18A, Phase- II, Dwarka, New Delhi- 110075
Ph. +91-11-30418900, www.iihmrdelhi.edu.in

CERTIFICATE ON PLAGIARISM CHECK

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Enrollment/Roll No.	PG/ 20/017	Batch Year	2020-22
Course Specialization (Choose one)	Hospital Management	~~Health Management~~	~~Healthcare IT~~
Name of Guide/Supervisor	Dr. B.S. Singh, Associate Professor		
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Plagiarism detects software used	"TURNITIN"		
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I acknowledge the tremendous contribution of my guide in the completion of the project right from the word goes. I would like to render my sincere thanks to **Mr. Partha Dey (Founder and CEO, U4RAD)** for providing me the opportunity to complete my dissertation.

I extend my words of thanks to all the staff for always being so cooperative and facilitating me. I am extremely grateful to my parents for their love, prayers, care, and sacrifices in educating and preparing us for our future. Finally, my thanks to all the people who have supported me to complete the research work directly or indirectly.

ORGANIZATION PROFILE

U4RAD TECHNOLOGIES LLP

U4RAD is revolutionizing radiology reporting with AI-assisted image analytics and a smart reporting toolkit.

They are revolutionizing remote radiology reporting by enabling process improvement, appropriate digital intervention, and selected AI (Artificial Intelligence) applications to help Radiologists become more efficient. Their AI-assisted Radiology Reporting technology will result in higher-quality diagnoses and shorter turnaround times. They want to double the productivity of radiologist reporting. They created an AI algorithm that can detect COVID 19 from a chest X-ray in a matter of seconds with >90% confidence, allowing it to be used as a Rapid Detection tool for the pandemic.

PUSHERS- DREAMERS- LEADERS:

Mr. Partha Dey

Founder and CEO

Partha Dey, Founder of Max Healthcare (Head Operations), Artemis Hospital Gurgaon (Chief Operating Officer), Apollo Gleneagles Kolkata (Centre Administrator), Member of CII, HIMSS, UNDP, AMCHAM and IMAI, Pioneer in promotion of AI-Cognitive technology in healthcare, was managing healthcare vertical for IBM in India/SA, Member of CII, HIMSS, UNDP, AMCHAM and IMAI, Member of CII.

Dr. Piyush Pandit

Director and Co- Promoter

Dr. Piyush Pandit is a Senior Radiologist who specializes in MR imaging and has over 25 years of clinical experience. Dr. Pandit has a unique combination of clinical reporting and diagnostic centre management experience. He was a key player in developing new radiology imaging centres and effectively administering them as a member of the core management team in several businesses. Dr. Pandit has worked in reputable diagnostic institutions in Delhi, including Dr. Gulati Imaging and MR Centre, where he has created a higher level of reporting and has a great connection with referring clinicians.

Dr. Vivek Sahi

Director

A dynamic healthcare IT (Information Technology) professional with over 24 years of experience in clinical practice, healthcare management, quality consulting, clinical change management, and healthcare digital transformation.

He is passionate about healthcare information technology and has a unique capacity to combine clinical knowledge, healthcare management expertise, and quality management skills to clearly understand and not only resolve difficulties faced by providers and payers, but also to assist them in developing and implementing solutions that effectively and efficiently satisfy their needs.

He is also interested in teaching physicians about EMRs and IT systems, as well as ensuring that electronic medical/health records are adopted through change management, as well as mentoring students and physicians preparing for jobs in healthcare administration and informatics.

His areas of expertise include IT Product Strategy, Mergers & Acquisitions, Product/Solution Business Planning & Development, Clinical Intelligence/Analytics Solutions, Provider & Payer Data Warehousing, EMR/HIS Configuration & Implementation, CPOE, CDSS, BCMA, Clinical Transformation, Healthcare Provider Process Optimization, CPOE, CDSS, BCMA, Clinical Transformation, Clinical Transformation, Clinical Transformation, Clinical Transformation, Clinical Transformation, Clinical Transformation, Clinical IT Training for Physicians, Project Management, and Business Development, Product sales, telemedicine, healthcare population data management, digital transformation consulting, Big Data, Artificial intelligence, and career counselling for healthcare management students.

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PREFACE

Abstract

The turnaround time (TAT) is an important measure when it comes to calculating and comparing efficiencies of equipment, tools, processes, and measuring the ultimate profit for an organization. It also includes important decisions like budgeting and allocation of resources. A shorter TAT does not only ensure possible services to more patients but also improves the pipeline as it makes resources available for subsequent cases.

In the field of radiology, it is essential that the TAT of the process is as short as possible. This ensures timely delivery of reports, earlier diagnosis, quicker treatment schedules, and lesser fatalities. Since radiology involves few of the early diagnostic processes, it is possible to saves more lives if the TAT for the required procedures is as short as possible.

In this study, we compare radiology processes for four distinct organizations with distinct capacities. The four organizations are Indraprastha Apollo Hospitals, New Delhi, and U4RAD, Gurugram, Rajiv Gandhi Cancer Institute and Research Centre, New Delhi, and Care Hospital, Hyderabad. We compare the TAT for MRI scans and CT scans in the four institutions and perform analysis on the reports for two months. The aim of this project is to understand the areas of improvement in radiology reporting and fill in the gaps where the institutions are lacking or may become better. We also aim to understand where each type of medical facility outperforms the other and what they can learn from each other. The analysis includes reading the metadata for the two types of tests for the months of March and April of year 2022 and

analyse the TAT for the different cases. We take the data for Apollo Hospitals as a base parameter to compare how the other institutions perform.

Abbreviations

TAT- Turn Around Time

CT- Computer Tomography

MRI- Magnetic Resonance Imaging

AI- Artificial Intelligence

About the Organizations

Indraprastha Apollo Hospitals, New Delhi

Indraprastha Apollo Hospital or Apollo Hospital, Delhi, is a multispecialty or tertiary care hospital. It is owned by the Apollo Hospitals group. The hospital has a capacity of 695 beds with a capability of increasing it to 1000 beds in the future. The hospital is based in National Capital Region of New Delhi. It is spread over 15 acres with a built-up space of 600,000 square feet.

The Apollo Hospitals group jointly established the new medical facility with the Government of Delhi in 1995. The hospital serves patients with ongoing treatments as well as post-treatment care. The hospital is home to many innovative procedures like robotic surgeries and other technology-based procedures. In 1998, the hospital witnessed the first pediatric and adult liver transplants in India.

In 2005, the Joint Commission International (JCI) USA accredited Apollo Hospital, Delhi making it the first hospital in India to get this recognition. It got reaccredited for the fourth time in 2011, which make the hospital the first one in India to do so.

The hospital has distinct areas dedicated to various departments like:

- Anesthesiology
- Advanced Pediatrics
- Bone Marrow Transplant
- Nephrology
- Oncology
- Robotic Surgery
- Cosmetic & Plastic Surgery
- Dental Care
- Dermatology
- Infertility Care
- Nuclear Medicine
- Elder Care
- Neonatology
- General & Advance Laparoscopic Surgery
- Urology and more.

The Heart Institute at Apollo is one of the largest cardiovascular groups in the world.

Indraprastha Apollo Hospitals was one of the first hospitals to be declared COVID hospitals by the government of India. Although it did not completely convert, it allocated a substantial portion of its facilities to cater to the needs of the hour.

U4RAD, Gurugram

U4RAD is a start-up organization catering AI-enabled mobile tele reporting services to patients who are unable to access facilities by physically reaching out to various institutes and hospitals. It was established in January 2020 and is led by radiologists and technology experts. The management of the organization includes radiologists and leaders from radiodiagnosis.

The co-founders are Partha Dey, Dr. Piyush Pandit, and DR. Vivek Sahi.

The services include e-reporting for daytime emergencies, o emergencies, routine, and subspecialty cases. In addition to the list, it also provides 3D multi planar reconstruction. Apart from the e-reporting system, U4RAD also provides Radiology Management Services for hospitals and diagnostic centers.

The institute is recognized and certified by:

- NASSCOM
- ISO 9001
- ISO/IEC 27001
- Ministry of Micro, Small, and Medium Enterprises of India
- Department of Promotion of Industry and Internal Trade of India.

U4COVID is an innovative technological solution designed and implemented for the rapid mass screening of possible COVID -19 cases. The solution claims a higher degree of sensitivity & accuracy metrics than thermal scanning that is currently being widely implemented. U4COVID employs an Augmented Intelligence (AI) cloud-based application that reads low dose, digital X-rays.

Rajiv Gandhi Cancer Institute and Research Centre, New Delhi

Rajiv Gandhi Cancer Institute and Research Centre is a venture with the National Chest Institute. It is an oncology centre providing world class cancer care to all its patients. It was founded in 1996 in New Delhi. It is one of the largest medical centres for cancer treatment and care in all of Asia. It had a soft opening in July 1996 but was formally inaugurated a month later in August 1996.

The medical institute is a well-equipped oncology facility providing medical and surgical treatment to oncology patients. The hospital has an operation theatre, a laboratory, 24-hour pharmacy, and an imaging center. The facility has around 302 beds spread over two storeys as wards and individual rooms. It has properly equipped emergency and intensive care units. There are 51 surgical ICU beds and 21 medical ICU beds in the hospital. The institute also has

- MUD transplant unit
- stem cell transplant unit
- leukemia ward
- thyroid ward
- bone marrow transplant unit.

The Tumor Board at the institute comprises of medical experts from different super-specialty institutes for difficult or rare cases. The hospital is a project by Indraprastha Cancer Society and Research Center.

The medical center like the other hospitals caters to international patients from Nepal, Bangladesh, Sri Lanka, along with domestic patients from the nation.

The institute is accredited by:

- National Accreditation Board for Hospitals & Healthcare Providers (NABH (National Accreditation Board for Hospitals))
- National Accreditation Board for Testing and Calibration Laboratories (NABL)
- Union for International Cancer Control

It has many other certifications and accreditations.

Apart from medical facilities, the institute also conducts scientific research on cancer, its prevalence, cause, distribution, treatment, and care. It also has a partnership with Thomas Jefferson University.

Care Hospital, Hyderabad

Care Hospitals is a chain of hospitals spread across 5 states in India. These 5 states have 14 distinct locations providing optimal care for all its patients under the banner. Care Hospital, Hyderabad, was founded in 1997 by Bhupathi Raju, the current Chairman and Managing Director of the Care Hospitals group. It is a home to major cardiac specialists, critical care specialists, and intensive care specialists. Dr. N. Krishna Reddy is the vice-chairman of the group.

Vision:

To be a trusted, people-centric integrated healthcare system as a model for global healthcare

Mission:

To provide the best and most cost-effective care, accessible to every patient through integrated clinical practice, education, and research.

Specialties in the hospital include:

- Nephrology
- Cardiology
- Geriatrics
- interventional radiology
- general surgery
- Surgical and medical oncology
- ENT
- haematology
- neurology
- nuclear medicine
- pulmonology
- Urology, and more.

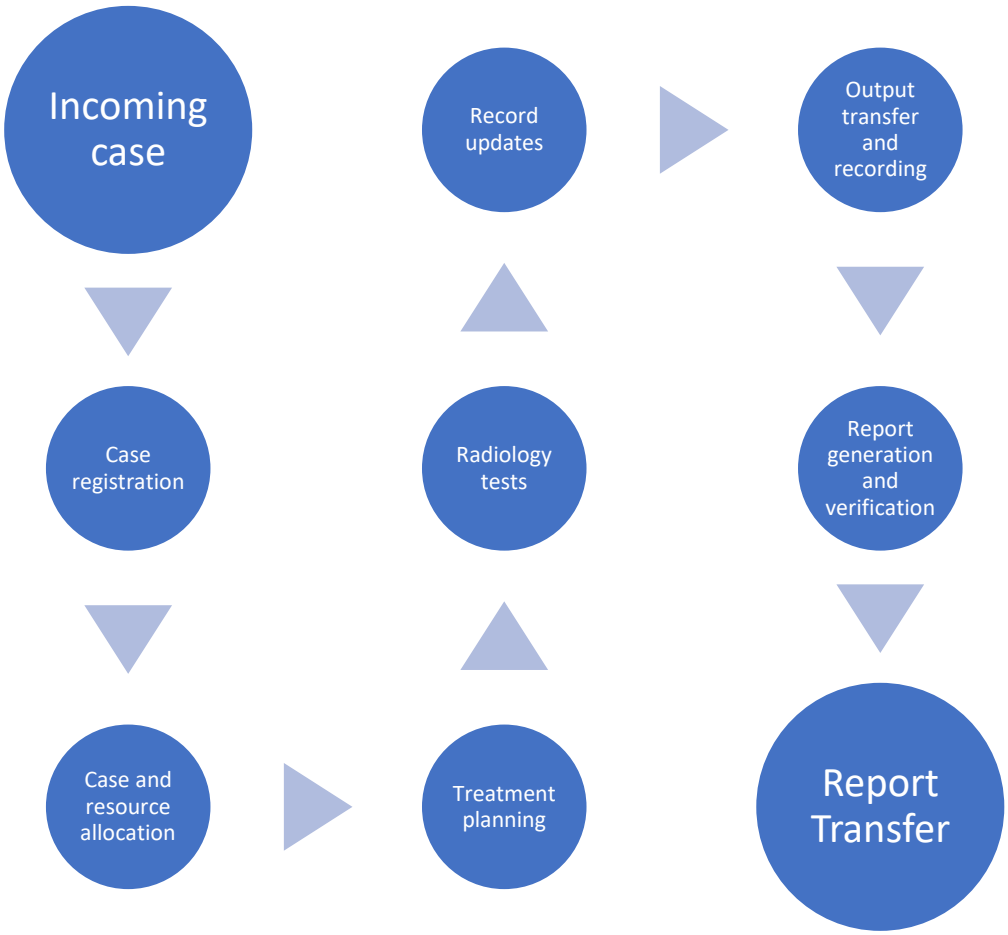
The Centre for Excellence includes departments where the hospital is recognised for optimal care and best possible treatment. These departments include departments for:

- Pulmonology
- Gastro Sciences
- Cardiac Sciences
- Neurosciences
- Orthopaedics
- Transplants
- Urology, and more.

There are many procedures that are managed within the hospital. Some of the treatments and procedures include plans for:

- Abdominoplasty
- Cancer
- Arthritis
- Blepharoplasty
- Chemotherapy
- cosmetic procedures
- cochlear implants
- cystectomy
- disc herniation
- dementia
- cognitive disorders
- endoscopy
- hysteroscopy
- transplants, and more.

General Process Flow



The general process for all radiological tests at the selected facilities follow a similar pattern. There are 9 basic steps in the process:

- Incoming case

  When a case arrives at any of the facilities, the patient is expected to bring along all medical history related information and documents if they possess them. It not only helps to keep a track of medical records but is also an essential part of improving accuracy.

- Case registration

Irrespective of whether the patient is a new patient or being readmitted to the facility, the case is registered with the administrative department. All health-related documents are collected and verified at this point, along with insurance information, if any.

- Case and resource allocation

  After the case is registered at the administrative department, doctors and radiologists who are available to manage the case get notified to accept the case. Once the case is accepted, the assigned team are provided with all the information and medical history.

- Treatment planning

  Once the medical practitioners and radiologist get the case, they go through the history thoroughly and decide what tests and procedures they need to plan for the patient. If all the facilities are available within the medical unit, they move ahead, otherwise, they inform the patient, and their attendants, where can get the remaining services outside the organization.

- Radiology tests

  Once the treatment plan is approved by the team, the patient may go through a single scan or series of various scans as required per the treatment plan. A centralized area ensures quicker transfers between the scans and tests. If the patient requires time between the tests, they may have to wait for resources to be available as per schedule.

- Record updates

  After conducting the tests, radiologists and assigned technicians update the information to the database management systems as accurately as possible. A slight mistake can drastically alter the possible treatment plan. They verify all the information before transferring it to the main database system.

- Output transfer and recording

  Once the team receives information and updated records from the laboratory, they enter the information to the main database management system of the facility to update the patient's health records. It also assists in generating the final reports based on which the medical practitioners can decide on a treatment plan after the services.

- Report generation and verification

  Once all the records are updated, reports are formulated to the highest accuracy with all the information in the database system at this point. They reports are manually verified by assigned medical practitioners and radiologists present at the facilities. Any misinformation or incomplete data is updated and verified again to ensure the patients get the best results and they health records reflect the correct information.

- Report transfer

  A copy of all the required reports is finally transferred or handed over to the patient and/or their attendants with the most recently updated information by the administrative department. Any information related further tests or required treatment is relayed at this point. Patients get information on the treatment plan after the check-ups if they require medical attention. The hospitals have resources and experts who manage these treatments. Testing facilities have information on who they can contact and recommendations of facilities where they can seek further treatment.

DISSERTATION REPORT

Introduction

Turnaround Time (TAT) is the time interval from the time of submission of a process to the time of completion of the process. In radiology, it means that TAT measures the time from the start of the process or acceptance of the case in the given stage to the time when the radiologist transfers the report back to the system.

Today, radiology is an essential tool to diagnose many diseases, monitor treatment, and predict outcomes. With advanced tools and techniques, radiology helps in investigating and explaining complexities and provide detailed information about various cases. Therefore, turnaround time (TAT) in the field of Radiology is a critical measure to analyse. It not only increases the effectiveness of the working of the industry and laboratories but also helps strengthen the relationship of the customers with industry authorities. Moreover, the effective implementation of the techniques for turnaround time reduction helps create a better atmosphere for the workers in the industry through proper time management and optimized utilization. Researchers have conducted numerous studies for the same. Radiologists are involved in the advancement of such studies and research. They analyse the weaknesses, work on appropriate imaging algorithms to maximize clinical effectiveness. Today, many tools and techniques are available to help cut down the total TAT in any pipeline process. Moreover, the reduction of TAT itself helps increase a company's profits. Optimize pipeline not only increases the revenue but also decreases the overall costs in operations. A smaller TAT helps an organization to be financially sound in the industry as well as maintain good customer care quality.

In this study, we are comparing the respective turnaround times of computer tomography and MRI scans of Indraprastha Apollo Hospital, Care Hospitals (Hyderabad), Rajiv Gandhi Cancer Institute and Research Centre, to that of U4RAD's tele-reporting and then finding out various solutions to improve U4RAD's Turnaround Time. We have the metadata reports for the various tests for two months of the current year and we aim to analyse and compare the respective reports of the two medical institutions.

Indraprastha Apollo Hospital is an older entity with well-equipped facilities and independent set-up for the mentioned tests. It uses these facilities for all their daily cases in each department. U4RAD is a newer institution investing its resources in Artificial Intelligence based technology to improve the efficiency and overall performance of the processes. Care Hospitals is a chain of multi-specialty healthcare hospitals with 14 hospitals in 6 cities across 5 states of India. Rajiv Gandhi Cancer Institute and Research Centre is one of the largest cancer institutes in Asia.

Literature Review

It has been around 100 years since the first radiological imaging. And since than there have been a tremendous number of technological advancements that have helped alleviate the problems in the field of radiology and improve the various processes involved. The last 25 years have been significant in this journey of development. The standard examination should be non-invasive. It should be repeatable and with a sensitivity and specificity of 100%. Sensitivity means detection of the lesion and specificity is the ability to predict the absence of disease.

Recent innovations in ultrasonography, computed tomography (CT) scanning and magnetic resonance imaging (MRI) have facilitated a more precise presentation of anatomical and functional structures and better spatial resolution. It has enabled us to detect minute lesions quicker than ever before. It has also significantly reduced the scan times. It in turn has enabled detection of new and recurrent diseases at earlier stages to improve survival rate. The innovations in imaging techniques have enabled detection of suspicious abrasions and procedures like stenting with minimal invasions. Magnetic resonance spectroscopy (MRS) and positron emission tomography (PET) examine in vivo tissue metabolism and provide a method allowing evaluation of normal and abnormal tissues, such as tumour. We can correlate certain metabolites with tumour metabolism. The response to treatment can thus be calculated based on the quantitative changes in the comparison. Hence, the two procedures can be termed valuable when it comes to evaluating chemotherapeutic agents in living mobile organisms. Through studies and research, we can optimally select patients who respond to certain drugs and treatment procedures and strategize the ideal treatment plans for them individually.

With further advancements on more specific indicators of diseases become available and we conduct studies and research on how tests respond to therapies, there will be more chances of survival because of the increased power of anatomical and functional imaging modalities. It is because the combination will enable earlier detection of diseases and quicker response with treatment plans.

Deep learning is the new technological advancement entering the field of radiology. The biggest benefit of the new entrant is the improve image quality. With processing compiled raw information or data, new AI and deep learning tools can enhance contrast and spatial resolution. It will enable radiologists to reduce scan times without compromising on the image quality. It may also provide them with higher quality images and potential dose reductions. The only warning is to make sure that the training data is diverse enough to ensure that there is no bias in the data as it will impact the ultimate results of the procedures. It will also impact the accuracy and integrity of the final decisions.

Provider impact: AI can help reduce the noise in the images, providing more accurate readings and timely diagnosis. It will enable the provider to serve more patients and conduct many more scans. There will also be a significant improvement to diagnostic sensitivity and specificity.

Patient impact: More accurate scan results will ensure less exposure of the patient to the radiations. The patient will require to spend lesser time to get scanned. It will also result in more accurate dosage of drugs and quicker treatments.

Fiscal impact: The AI application will reduce the scan times and operating costs. Thus, the institution can serve more patients and provide more efficient solutions.

On the market: Subtle Medical presents SubtlePET, a nationwide AI-driven tool that augments images compiled from faster scans. ContextVision has Altumira that enhances digital

radiography. It deals with issues over varying exposure and dose Medic Vision's iQMR (Intelligent Quick MRI) enhances noisy images. Research presented at the American Society of Neuroradiology revealed it can cut MRI brain scan time by 30% with no adverse image effects.

In 2021, European and FDA clinical recognized world's first photon-counting CT (PCCT) scanner. The innovative technology radically improves resolution ensuring reduction in radiation dose. This overpowers the previous technical limits of traditional CT. While this technology has been in development for over 15 years, a recent review highlights the potential of this technology to dramatically improve clinical CTs (Computer Tomography).

Rationale

With increasing healthcare costs and diseases around the world, it has become essential that hospitals and medical facilities use technology that can assist to achieve quicker and accurate results. Radiology is one area that is being used for earlier diagnosis of many diseases. Hence, reducing the TAT for teleradiological procedures and refining the accuracy of the reports can assist in achieving this objective.

Objective

- The objective of the study is to compare the turn-around time (TAT) of in-house reporting to that of teleporting in XRAi Digital. The four medical facilities have their own procedures to report radiological tests and perform well in their distinct divisions.
- We aim to evaluate which procedure is better and detect the gaps that the institution needs to fill in the coming years.

Key Questions

- Volume of cases: Average of the total cases recorded in the institutions for the stated period.
- Average TAT: Record and compare the average TATs (Turn Around Time) in the institutions.
- Recommendations: Analyse where the organizations can cut down on processes and resource run-time to save or shorten the TAT.

Methodology

- Study location:

  U4RAD (Gurugram, Haryana), Indraprastha Apollo Hospitals (New Delhi, Delhi), Rajiv Gandhi Cancer Institute and Research Centre (New Delhi, Delhi), and Care Hospital (Hyderabad, Telangana) are the four medical facilities in the study. Each of the organizations have their respective departments for MRI scans and CT scans. The data collected for the study were taken from the respective departments of the institutions.

- Study population:

  The sample for this study includes patients who underwent Computer Tomography (CT) and Magnetic Resonance Imaging (MRI) scans between the months of March and April of the year 2022. The study covers data for the stated two months. The data includes various procedures that require the two types of scanning, including full body check-ups.

- Study design:

  This study is a descriptive study based on quantitative secondary data analysis. It considers data for the months mentioned above, analyses the details of the TAT of various tests and scans, and draws a cumulative description of the scenarios.

- Data collection method:

The data for this study includes Quantitative Secondary data. The study compares MRI and CT scan-related data from two important sources for this study. One organization is a well-reputed hospital in the National Capital Territory of Delhi, i.e., Indraprastha Apollo Hospitals. The second organization is U4RAD, a new name in the industry of radiology reporting that uses AI-enabled technology to improvise and optimize reporting.

- Sample Selection:

  The data is being used for the Turn Around Time (TAT) of diverse types of reporting done in teleradiology. Non- probability Purposive Sampling method is used to choose a sample. Data is collected for two months.

- Data Analysis Tool:

  The study uses Microsoft Excel for data analysis. Pivot tables, comparison charts, and plots explain the major analysis of the study. Pivot tables include tables to record time lapses, time durations, number of cases, and other details.

- Expected Outcome:

  To reduce the time taken for reporting. The aim is to shorten the average TAT for all the processes. If the reporting time is reduced, the average TAT would decrease as well.

- Inclusion Criteria:

  The data included were recorded within the working hours of the organizations. Apollo Hospital, Delhi is open 24 hours a day, all 7 days a week. U4RAD is open from 10 AM

to 6 PM, all 7 days a week. Rajiv Gandhi Cancer Institute and Research Centre is open 24 hours a day, all 7 days a week. Care Hospital is open 24 hours a day, all 7 days a week.

- Exclusion Criteria:

  Data was not selected for the dates that were gazetted holidays and between the non-working hours of the day for the selected organizations.

- Time Frame:

  Project duration was from 14th March 2022 to 14th May 2022 (2 Months). The datasets recorded the patient and procedure details for all cases between the stated dates.

Analysis

Analysing the data, we can see the distinct TATs for the selected medical institutions.

Apollo Hospital

Allocation TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases are fair in terms of allocation of resources per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their allocation. We can see that the median allocation TAT for CT scans is approximately between 15-30 minutes. The approximate median allocation TAT for MRI scans is between 15-30 minutes.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-15 mins	1354	15-30 mins	234	15-30 mins
15-30 mins	1232		1238	
30-60 mins	232		212	
1-2 hours	450		450	
More than 2 hours	60		20	

Reporting TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases fair in term of reporting of results per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their reporting. We can see that the median reporting TAT for CT scans is approximately 2-4 hours. The approximate median reporting TAT for MRI scans is 4-6 hours.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-1 hours	211	2-4 hrs	56	4-6 hrs
1-2 hours	50		12	
2-4 hours	61		19	
4-6 hours	123		123	
6-8 hours	45		12	
8-10 hours	23		56	
More than 10 hours	12		21	

U4RAD Technologies LLP

Allocation TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases fair in term of allocation of resources per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their allocation. We can see that the median allocation TAT for CT scans is approximately between 0-15 minutes. The approximate median allocation TAT for MRI scans is between 0-15 minutes.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-15 mins	2085	0-15 mins	1298	0-15 mins
15-30 mins	430		306	
30-60 mins	385		172	
1-2 hours	266		155	
More than 2 hours	251		172	

Reporting TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases fair in term of reporting of results per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their allocation. We can see that the median reporting TAT for CT scans is approximately between 2-4 hours. The approximate median reporting TAT for MRI scans is between 2-4 hours.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-1 hours	861	2-4 hrs	412	2-4 hrs
1-2 hours	646		411	
2-4 hours	657		461	
4-6 hours	360		218	
6-8 hours	224		127	
8-10 hours	126		77	
More than 10 hours	543		397	

Rajiv Gandhi Cancer Institute and Research Centre

Allocation TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases fair in term of allocation of resources per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their allocation. We can see that the median allocation TAT for CT scans is approximately between 15-30 minutes. The approximate median allocation TAT for MRI scans is between 0-15 minutes.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-15 mins	23	15-30 mins	123	0-15 mins
15-30 mins	234		65	
30-60 mins	23		21	
1-2 hours	11		12	
More than 2 hours	34		1	

Reporting TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases fair in term of reporting of results per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their allocation. We can see that the median reporting TAT for CT scans is approximately between 4-6 hours. The approximate median reporting TAT for MRI scans is 6 hours 7 minutes.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-1 hours	133	4-6 hrs	8	4-6 hrs
1-2 hours	34		4	
2-4 hours	23		43	
4-6 hours	32		76	
6-8 hours	24		12	
8-10 hours	76		34	
More than 10 hours	103		45	

Care Hospital

Allocation TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases fair in term of allocation of resources per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their allocation. We can see that the median allocation TAT for CT scans is approximately between 0-15 minutes. The approximate median allocation TAT for MRI scans is between 0-15 minutes.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-15 mins	123	0-15 mins	226	0-15 mins
15-30 mins	43		45	
30-60 mins	2		6	
1-2 hours	2		5	
More than 2 hours	1		3	

Reporting TAT

The following table illustrates the median TATs measured to the closest approximation. The time measures how the different cases fair in term of reporting of results per CT scan and MRI scan.

The various cases have been distinguished in 7 different time slots according to the recorded time duration for their allocation. We can see that the median reporting TAT for CT scans is approximately between 4-6 hours. The approximate median reporting TAT for MRI scans is between 4-6 hours.

Parameter	**CT scans**	**Median CT TAT**	**MRI scans**	**Median MRI TAT**
0-1 hours	41	4-6 hrs	30	4-6 hrs
1-2 hours	15		10	
2-4 hours	20		23	
4-6 hours	41		14	
6-8 hours	21		26	
8-10 hours	34		18	
More than 10 hours	32		22	

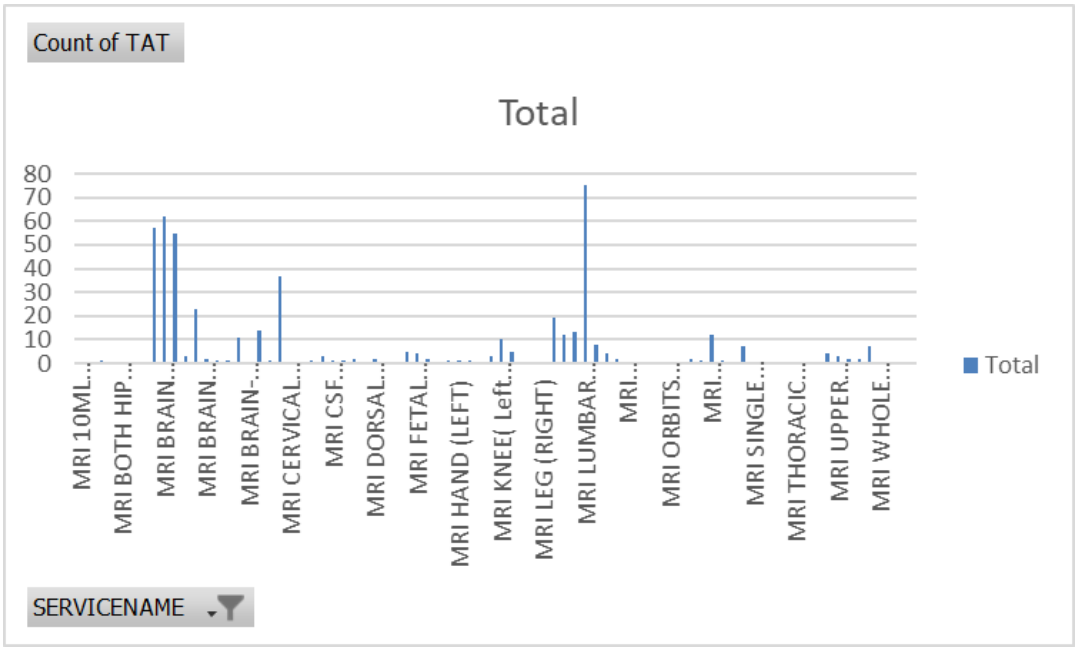
Findings

Pivot tables and Charts

Number of CT& MRI in the month of March and April.

- **MRI TAT - Apollo**

Row Labels	Count of SERVICENAME
MRI 10ML CONTRAST	24
MRI ANKLE (Left Ankle)	3
MRI ANKLE(BOTH JOINTS)	1
MRI ANKLE(Right Ankle)	4
MRI BOTH HIP JOINTS	5
MRI BRACHIAL PLEXUS (LEFT)	2
MRI BRACHIAL PLEXUS (RIGHT)	1
MRI BRAIN	58
MRI BRAIN (WITH CONTRAST)	67
MRI BRAIN PLAIN	56
MRI BRAIN WITH MR ANGIO (WITH CONTRAST)	3
MRI BRAIN WITH MR ANGIO AND NECK ANGIO	23
MRI BRAIN WITH MR VENOGRAM (INTRACRANIAL)	2
MRI BRAIN WITH PITUITARY GLAND (WITH CONTRAST)	1
MRI BRAIN-EPILEPSY PROTOCOL (WITH CONTRAST)	1
MRI BRAIN-EPILEPSY PROTOCOL (WITHOUT CONTRAST)	11
MRI BRAIN-STROKE PROTOCOL	11
MRI BREAST	14
MRI BREAST WITH CONTRAST 10ML	1
MRI CERVICAL SPINE	37
MRI CERVICAL SPINE (WITH CONTRAST)	6
MRI CERVICAL SPINE WITH CV JUNCTION	1
MRI CHEST WITH CONTRAST	1
MRI CHEST WITHOUT CONTRAST	3
MRI CSF CISTERNOGRAPHY	1
MRI CSF FLOW WITH BRAIN	1
MRI DEFECOGRAPHY	2



- **MRI TAT - U4RAD**

Row Labels	Count of TAT
MRI 10ML CONTRAST	
MRI ANKLE (Left Ankle)	
MRI ANKLE(BOTH JOINTS)	1
MRI ANKLE(Right Ankle)	
MRI BOTH HIP JOINTS	
MRI BRACHIAL PLEXUS (LEFT)	
MRI BRACHIAL PLEXUS (RIGHT)	
MRI BRAIN	57
MRI BRAIN (WITH CONTRAST)	62
MRI BRAIN PLAIN	55
MRI BRAIN WITH MR ANGIO (WITH CONTRAST)	3
MRI BRAIN WITH MR ANGIO AND NECK ANGIO	23
MRI BRAIN WITH MR VENOGRAM (INTRACRANIAL)	2
MRI BRAIN WITH PITUITARY GLAND (WITH CONTRAST)	1
MRI BRAIN-EPILEPSY PROTOCOL (WITH CONTRAST)	1
MRI BRAIN-EPILEPSY PROTOCOL (WITHOUT CONTRAST)	11
MRI BRAIN-STROKE PROTOCOL	
MRI BREAST	14
MRI BREAST WITH CONTRAST 10ML	1
MRI CERVICAL SPINE	37
MRI CERVICAL SPINE (WITH CONTRAST)	
MRI CERVICAL SPINE WITH CV JUNCTION	
MRI CHEST WITH CONTRAST	1
MRI CHEST WITHOUT CONTRAST	3
MRI CSF CISTERNOGRAPHY	1
MRI CSF FLOW WITH BRAIN	1

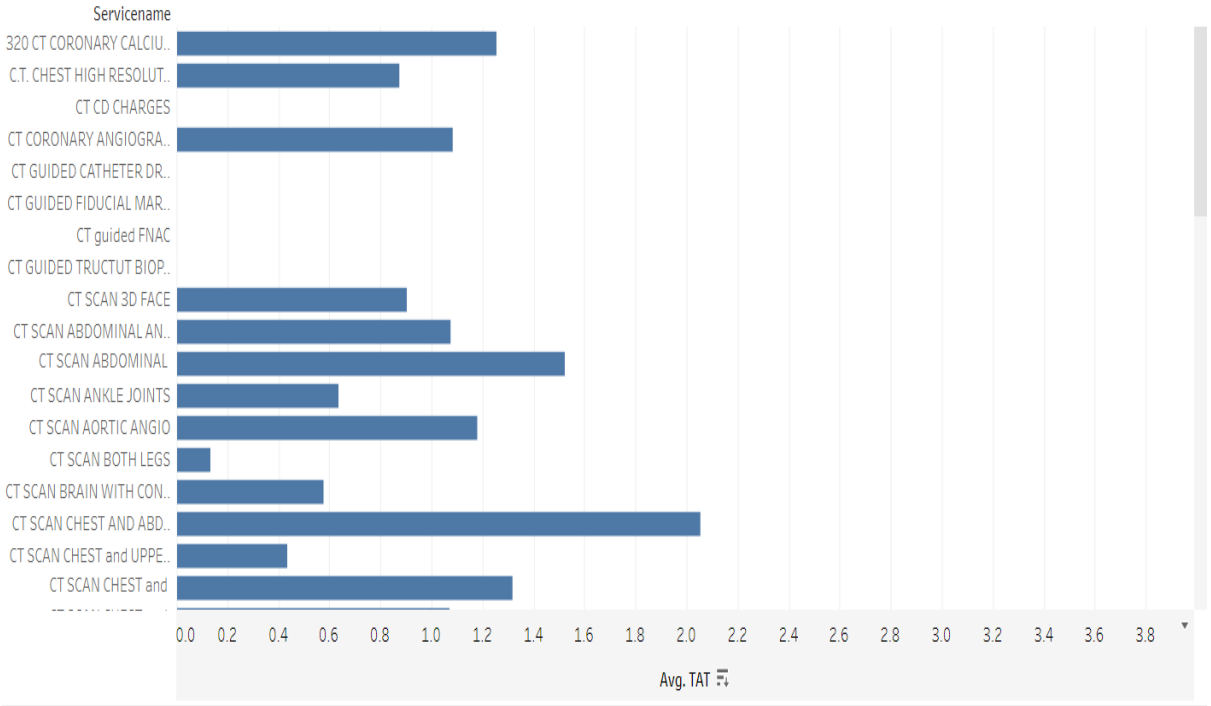
- **CT TAT - Apollo**

Row Labels	Count of SERVICENAME
C.T. ANGIO BRAIN (INTRACRANIAL VESSELS)	3
C.T. ANGIO BRAIN AND NECK (INTRA and EXTRA CRANIAL VESSELS)	10
C.T. CHEST HIGH RESOLUTION (HRCT)	144
C.T. SCAN NECK	2
C.T. SCAN NECK WITH CONTRAST	7
C.T. SCAN ORBITS (EYE) - PLAIN	2
C.T. SCAN UPPER ABDOMEN	3
C.T. SCAN UPPER ABDOMEN WITH CONTRAST	6
C.T. SCAN WHOLE ABDOMEN	15
CT CHEST VENOGRAM	1
CT CORONARY ANGIOGRAPHY	15
CT GUIDED TRUCTUT BIOPSY	8
CT SCAN ABDOMINAL ANGIOGRAPHY	7
CT SCAN ABDOMINAL AORTA WITH LOWER LIMB ANGIO	2
CT SCAN ANKLE JOINTS	2
CT SCAN BOTH THIGH	1
CT SCAN BRAIN WITH CONTRAST	2
CT SCAN CHEST and UPPER ABDOMEN	1
CT SCAN CHEST and UPPER ABDOMEN WITH CONTRAST	1
CT SCAN CHEST and WHOLE ABDOMEN	4
CT SCAN CHEST and WHOLE ABDOMEN WITH COTNRAST	14
CT SCAN CHEST ANGIOGRAPHY	3
CT SCAN CHEST WITH CONTRAST	22
CT SCAN RENAL ANGIO	12
CT SCAN RIGHT KNEE	1

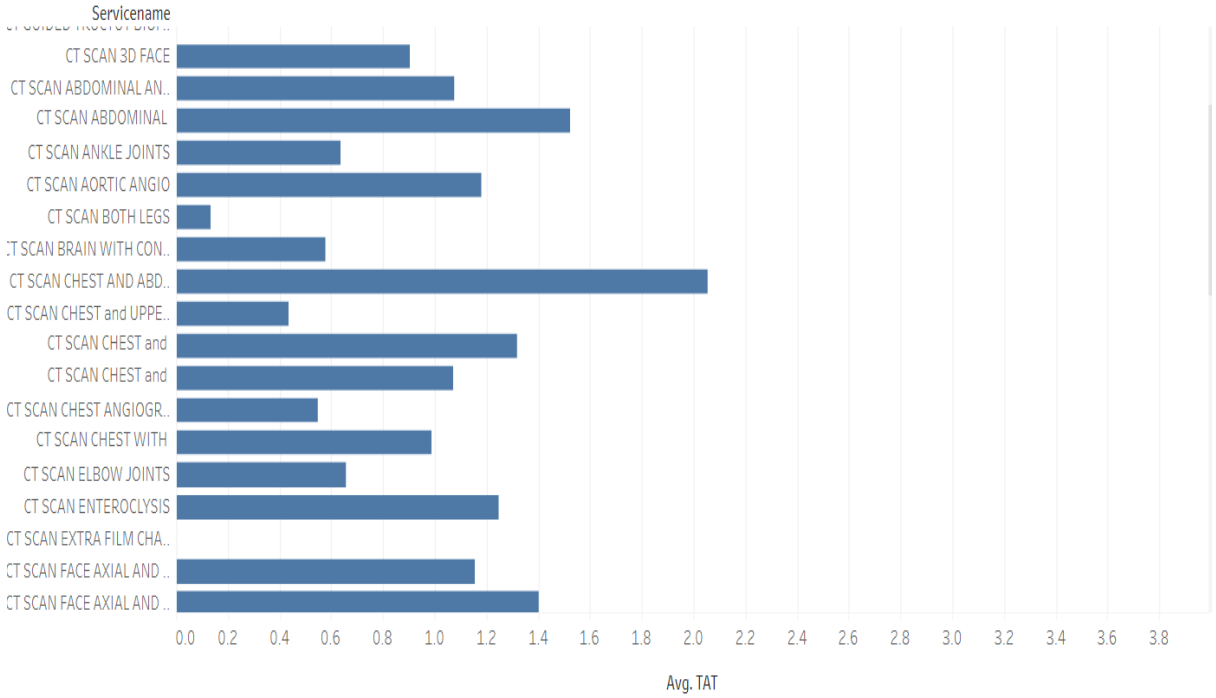
- **CT TAT - U4RAD**

Row Labels	Count of SERVICENAME
CT SCAN 3D FACE	10
CT SCAN ABDOMINAL ANGIOGRAPHY	14
CT SCAN ABDOMINAL AORTA WITH LOWER LIMB ANGIO	2
CT SCAN ANKLE JOINTS	6
CT SCAN AORTIC ANGIO	14
CT SCAN BOTH LEGS	1
CT SCAN BRAIN WITH CONTRAST	9
CT SCAN CHEST AND ABDOMEN ANGIOGRAPHY	4
CT SCAN CHEST and UPPER ABDOMEN WITH CONTRAST	3
CT SCAN CHEST and WHOLE ABDOMEN	2
CT SCAN CHEST and WHOLE ABDOMEN WITH COTNRAST	19
CT SCAN CHEST ANGIOGRAPHY	5
CT SCAN CHEST WITH CONTRAST	37
CT SCAN ELBOW JOINTS	3
CT SCAN ENTEROCLYSIS	9
CT SCAN EXTRA FILM CHARGES(PER FILM)	1
CT SCAN FACE AXIAL AND CORONAL	2
CT SCAN FACE AXIAL AND CORONAL WITH CONTRAST	2
CT SCAN FEET	1
CT SCAN FOREARM	1
CT SCAN GUIDED ASPIRATION	1
CT SCAN GUIDED CYTOLOGY FNAC	3
CT SCAN GUIDED TRU-CUT BIOPSY	7
CT SCAN HAND	1
CT SCAN HIP JOINTS	1
CT SCAN INNER EAR/ TEMPORAL BONE	10

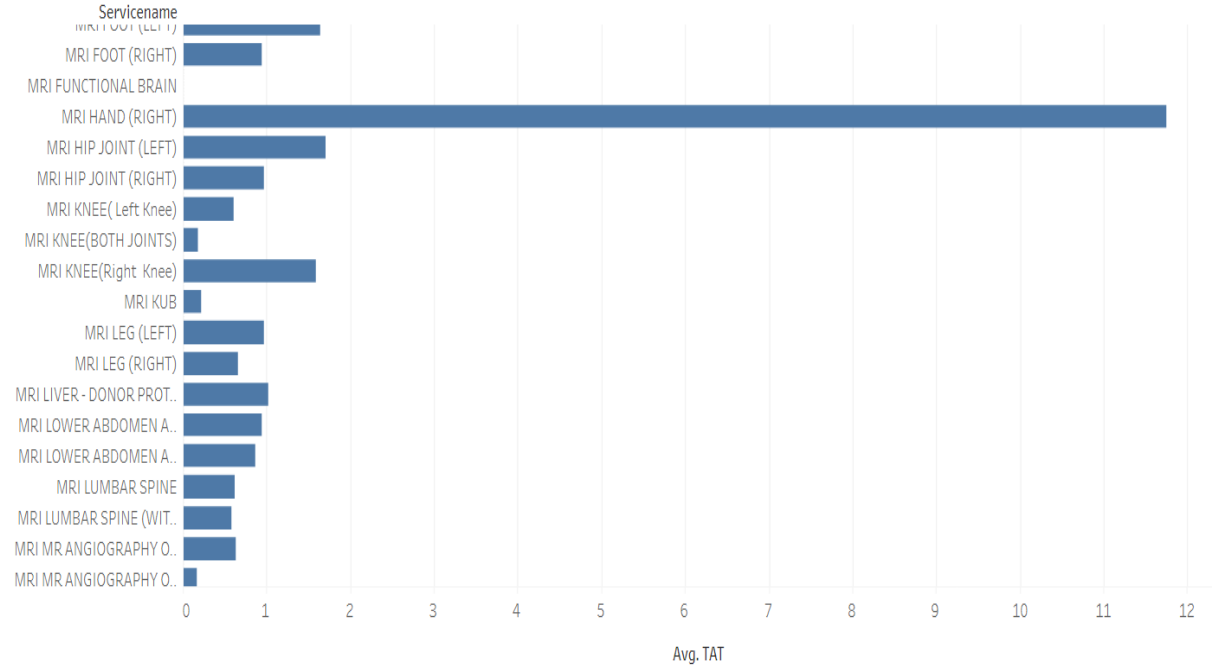
- **TAT of CT & MRI between Apollo Hospital & U4RAD**
    - **CT scan for Apollo**



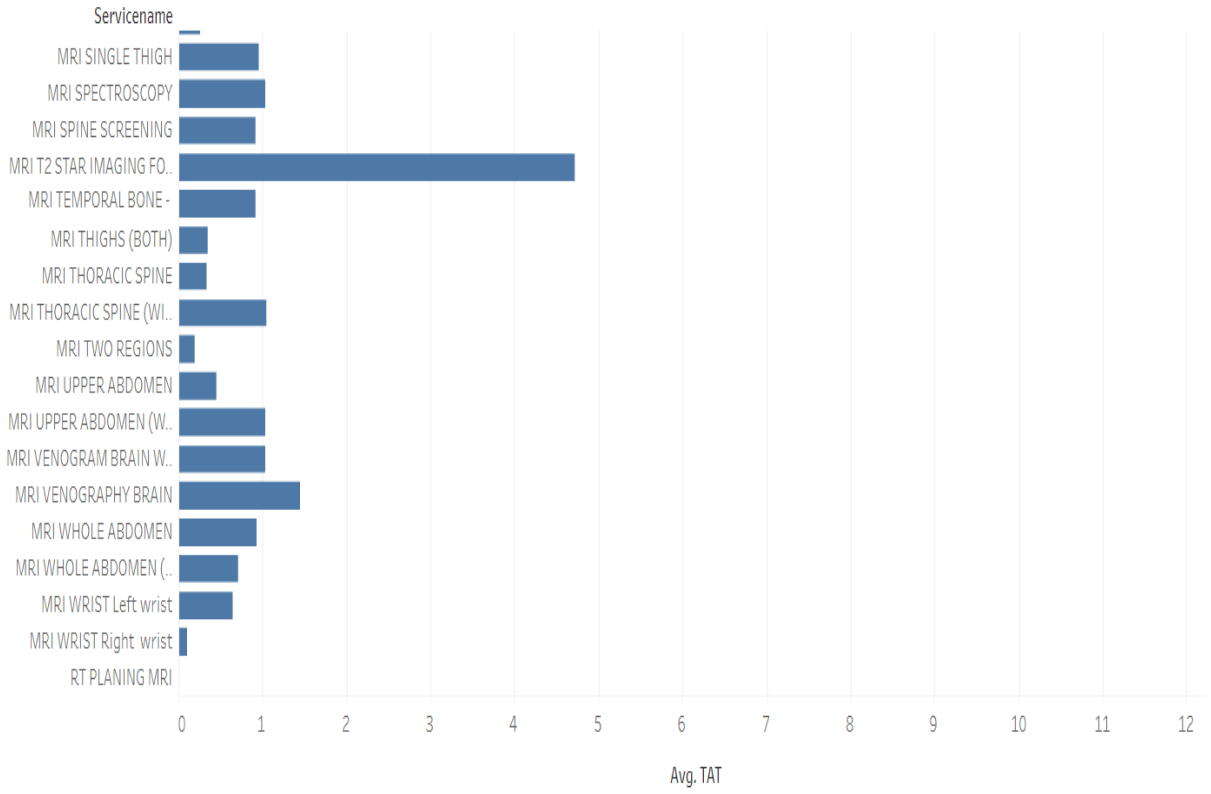
- **CT scan for U4RAD**



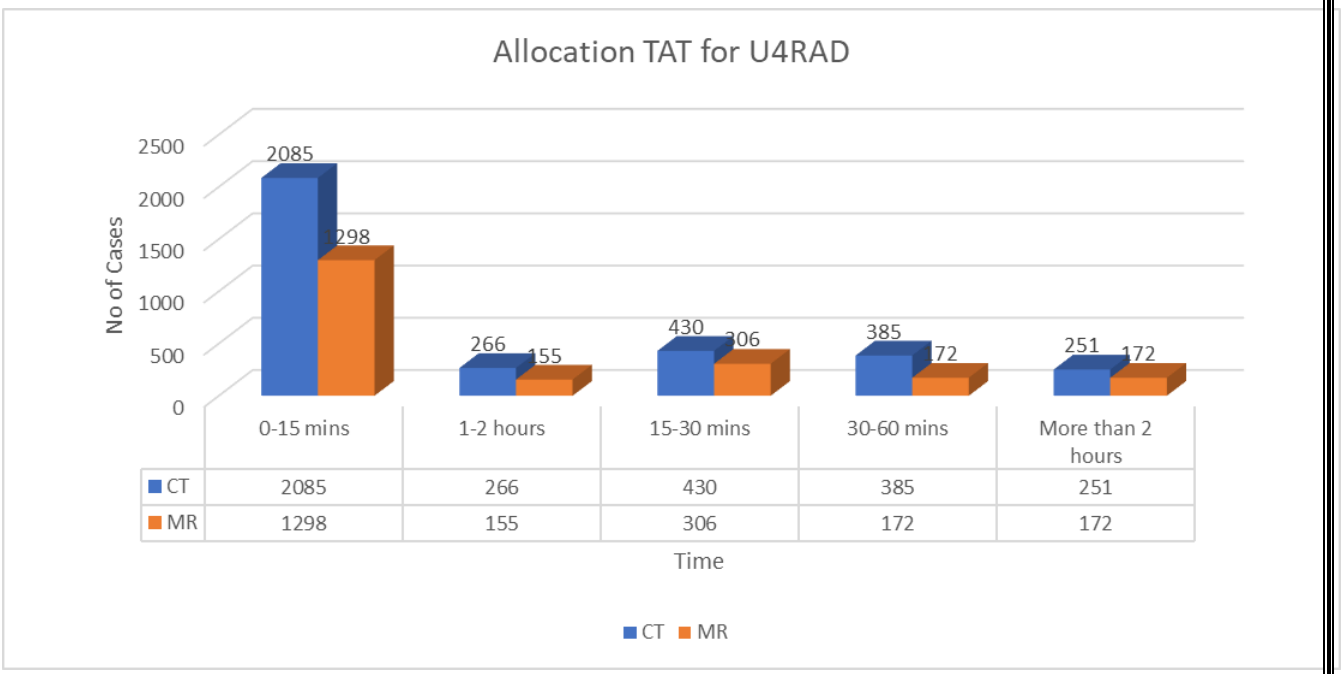
- **MRI scan for Apollo**



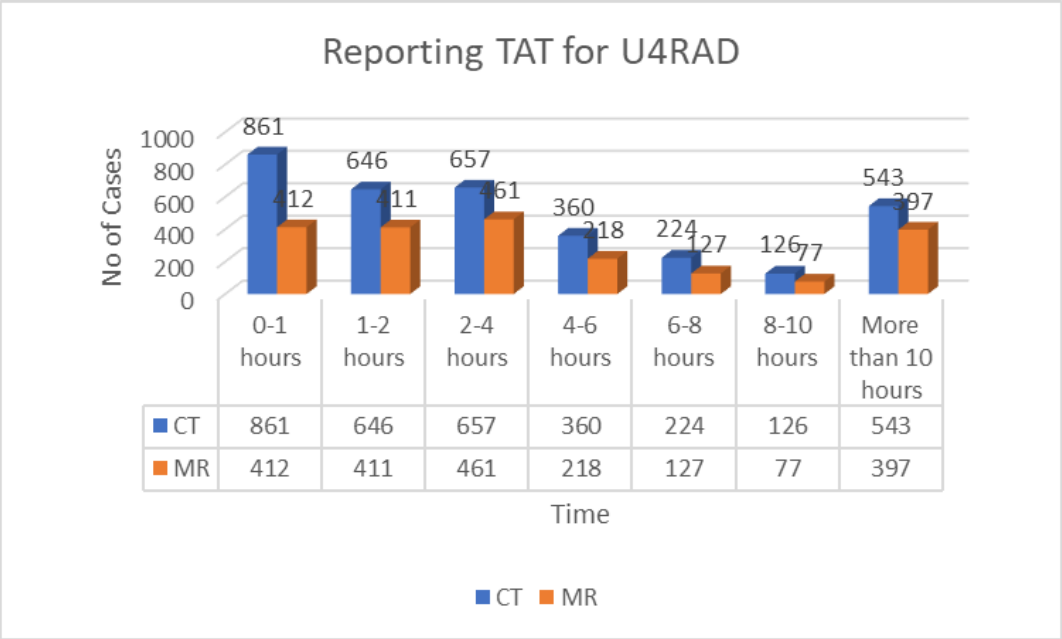
- **MRI scan for U4RAD**



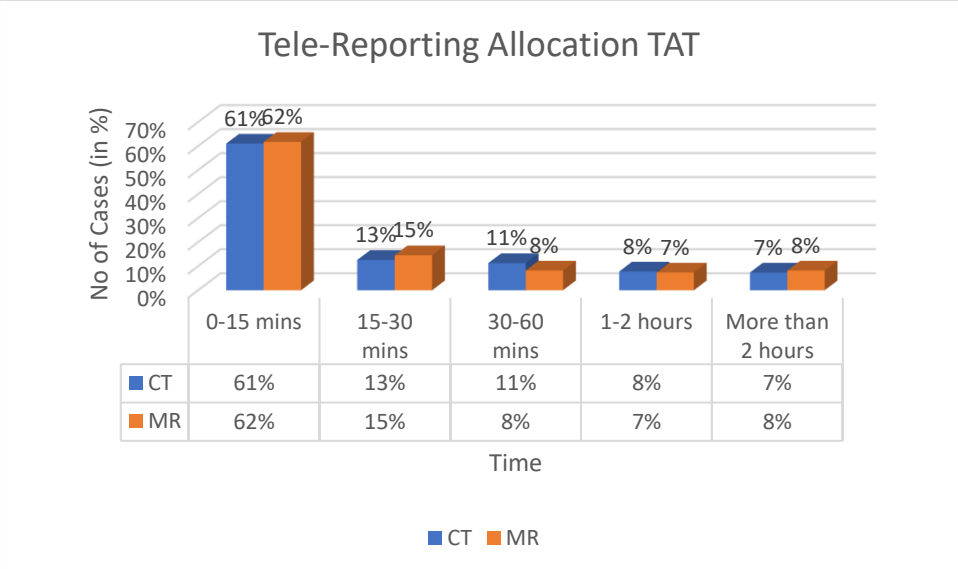
Allocation TAT For U4RAD

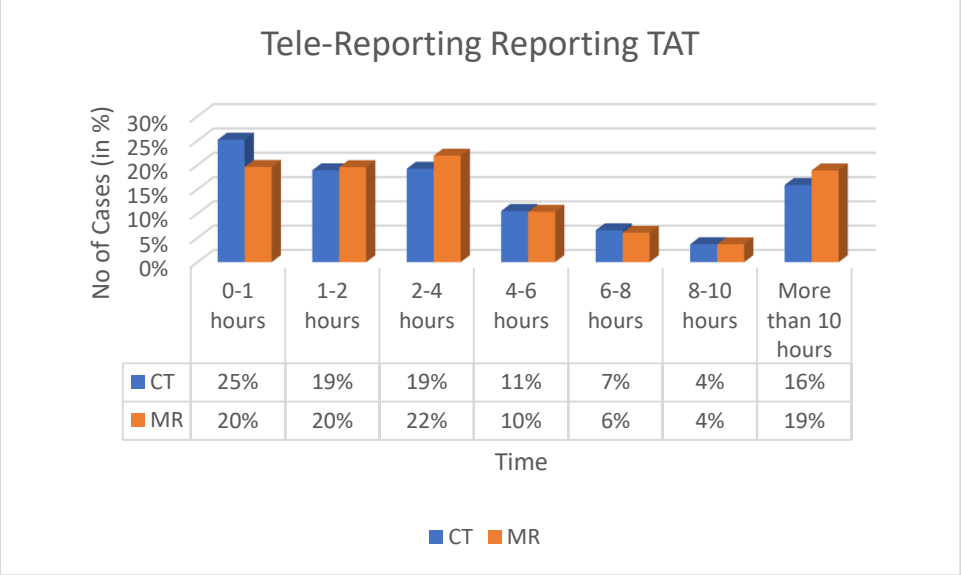


Reporting TAT for U4RAD

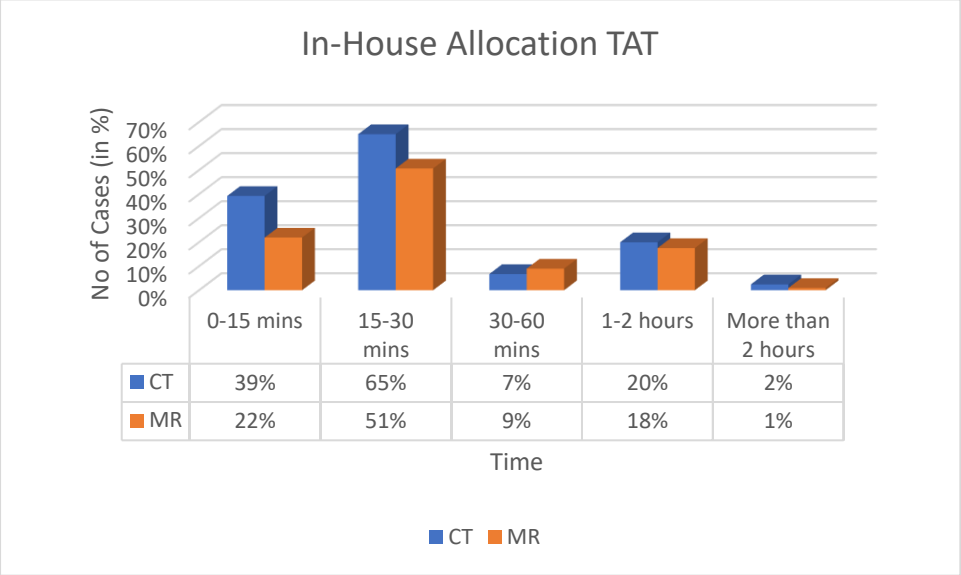


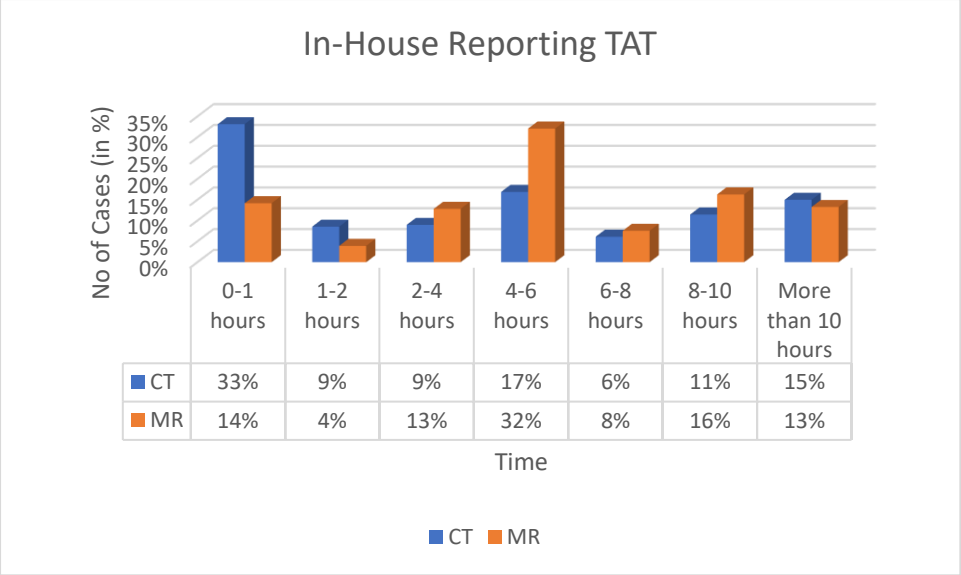
Tele-reporting Allocation & Reporting TAT





In house Allocation & Reporting TAT





Performance

Depending on the nature of implementation of the recommendations at the various medical facilities, results may vary. However, we can gauge the approximate results considering the points as mentioned during analysis. As of now this is how the hospitals and medical facilities perform.

Allocation TAT

Organization	Reported TAT – CT scan	Ideal median CT TAT	Reported TAT – MRI Scan	Ideal median MRI TAT
U4RAD	0-15 mins	10 minutes	0-15 mins	15 minutes
Apollo	15-30 mins		15-30 mins	
Rajiv Gandhi	15-30 mins		0-15 mins	
Care	0-15 mins		0-15 mins	

Reporting TAT

Organization	Reported TAT – CT scan	Ideal median CT TAT	Reported TAT – MRI Scan	Ideal median MRI TAT
U4RAD	2-4 hrs	4 hours	2-4 hrs	4 hours
Apollo	2-4 hrs		4-6 hrs	
Rajiv Gandhi	4-6 hrs		4-6 hrs	
Care	4-6 hrs		4-6 hrs	

Recommendations

- **Automation of the allocation process for the reporting doctors.**

  One of the areas where advancing technology can be used is the automatic allocation of cases to resources available in the pipeline. Often the dependency on manual intervention for the allocation of resources results in delays in the procedures. It also results in deadlocks and bottleneck delays in the process. Automation of the processes for allocation of resources and cases to reporting doctors can reduce the average TAT of the cases by reducing the transition time.

- **Recruiting of radiologist**

  Since bigger hospitals and medical institutions are more established facilities, it is bound to have the required number of resources in the appropriate departments. U4RAD needs to match this requirement. To ensure timely delivery of reports to the patients, it needs to

employ the required and optimal number of radiologists for all its services. It will not only ensure reduced number of bottlenecks in the processes but also reduce the number of deadlocks in the pipeline.

- **Install Middleware**

  Middlewares serve as a connector between the reporting system and the equipment. It can lessen the time involved and provide real-time quality assurance capabilities. Often the transition period of information transfer and report generation back to the system can cause the average TAT to increase, especially during high frequency time slots. Middlewares can manage the busy slots and increase efficiency.

- **Centralize areas for equipment**

  Since U4RAD aims to provide mobile services to those in need, it is hard to centralize the equipment for various procedures. However, using technology to synchronize results and furnish reports based on a centralized database can help improve the TAT. Like Middlewares and cloud computing, mobile service providers can use technology to shorten pipeline timelines. Institutes with stationary equipment can centralize testing areas to ensure that patients spend least time possible transferring between various scanning procedures.

- **Analysis of reporting errors**

  To ensure that the reports are accurate, it is essential that the institutions start involving AI-enabled technology. As stated in the previous sections, AI based tools not only reduce the

overall TAT, but they also reduce the errors and save costs. It also ensures that the patient receives least dosage required and goes through a smaller number of scans.

Better and more accurate results will ensure that the patients require minimum number of tests for diagnosis and receive only the absolute necessary dosage of medications.

- **Reduce the time between sample arrival and accessioning**

Major time reported is spent on receiving the samples and entering the required data into the database and the management system. If this time can be reduced, the overall TAT would decrease significantly. To do the same, the institution will require to use a centralized database management system that synchronizes with all its mobile testing platforms. Utilizing cloud computing and database systems can ensure easier mobility, access, and reporting of the required data.

Limitations

- Due to inequality in the manner of storing information, the manner of comparison of TATs for the different institutions vary.
- We Due to transition from the file format to digital format of patient electronic health records, the values in some cases are approximated to the nearest best possible minute record.

Conclusion

It is hard to say that one institution outperforms the other. Each has some areas where it does better than the other. The recommendations are listed in the section above. There are areas where all the institution can leverage the advancement in technology to cut down on processing time as well as costs involved in each of the procedures. With the above recommendations, it is also essential to ensure that all the resources the medical facilities employ are appropriately trained to accomplish the required tasks with excellence.

The average TATs for all the organizations in the current scenario vary according to the capabilities of each organization. As of today, the mean TAT for combined processes in the radiology department are as follows:

- Apollo Hospital:
- U4RAD Technologies LLP:
- Rajiv Gandhi Hospital:
- Care Hospital:

While the individual procedures are as optimized as possible with the current capabilities, the recommendations in this report can assist in further optimizing the processes. Not all the organization require or need to implement all the recommendations. However, best allocation of resources and simultaneously improving the processes can reduce the average TATs tremendously.

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Annexure

Zeba Pasha

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