

ASSESSING RADIOLOGY DEPARTMENT EFFICIENCY AND ANALYSING
OUTLIERS TO IMPROVE IT'S PERFORMANCE AT DHARAMSHILA NARAYANA
SUPER-SPECIALTY HOSPITAL, NEW-DELHI.

By

Tasbi Anand

Dissertation submitted in partial fulfilment of the requirements of the degree

MBA Hospital and Health Management

Academic year, 2019-2021

Dr. Nitin Sharma

Prof. Jagajeet prasad Singh



The IIHMR University, Jaipur

1, Prabhu Dayal Marg, Sanganer, Airport

Jaipur 302029, Rajasthan

Ph: 0141 3924700, Fax: 3924738

Website: www.iihmr.edu.in

ASSESSING RADIOLOGY DEPARTMENT EFFICIENCY AND ANALYSING
OUTLIERS TO IMPROVE IT'S PERFORMANCE AT DHARAMSHILA NARAYANA
SUPER-SPECIALTY HOSPITAL, NEW-DELHI.

By

Tasbi Anand

Dissertation submitted in partial fulfillment of award of

MBA Hospital and Health Management

Academic year, 2019-2021

Dharamshila Narayana Super-Speciality Hospital, New-Delhi.



The IIHMR University, Jaipur

1, Prabhu Dayal Marg, Sanganer, Airport

Jaipur 302029, Rajasthan

Ph: 0141 3924700, Fax: 3924738

Website: www.iihmr.edu.in



Date: 1 July 2021

To Whomsoever It May Concern

This is to certify that **Tasbi Anand** in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur has successfully completed her internship in the department of **Operations** from **1 Feb 2021 to 31 May 2021**.

During her tenure of the training she was committed, responsible and hardworking. She has exhibited good interpersonal skills and had a high level of acceptance among the employees at various levels.

We wish her all the best in her future endeavours.

With Best Wishes,
For Dharamshila Narayana Superspeciality Hospital

Ms. Savita Anand
DGM – Human Resources



Dr. NITIN KUMAR SHARMA
Deputy Medical Superintendent
Dharamshila Narayana
Superspeciality Hospital



H - 2008 - 0023
Nov 21, 2017 - Jun 30, 2021
Since Nov 21, 2008



Dharamshila Narayana Superspeciality Hospital

(A Unit of Dharamshila Cancer Foundation and Research Centre)

Hospital Address: Vasundhara Enclave, Near New Ashok Nagar Metro Station, Delhi 110 096

Tel +91 11 4306 6666 | www.narayanahealth.org | info.dnsh@narayanahealth.org

Appointments

1800-309-0309 (Toll Free)

Emergencies

73700-73700

TO WHOMSOEVER MAY CONCERN

This is to certify that Ms. Tasbi Anand student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at Dharamshila Narayana Super Speciality Hospital Delhi from 1th February 2021 to 1st June 2020.

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical. The Internship is in fulfillment of the course requirements. I wish her success in all her future endeavour

Dean, Academics and Student Affairs
The IIHMR University, Jaipur

Professor
The IIHMR University, Jaipur

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **“ASSESSING RADIOLOGY DEPARTMENT EFFICIENCY AND ANALYSING OUTLIERS TO IMPROVE IT’S PERFORMANCE AT DHARAMSHILA NARAYANA SUPER-SPECIALTY HOSPITAL, NEW-DELHI.**

NEW-DELHI.” submitted by Ms. Tasbi Anand, Enrolment No. IIHMR-U/01/201921/1026 under the supervision of Prof. Jagajeet Prasad Singh for award of MBA in Hospital and Health Management in Health and Hospitals of the University carried out during the period from 11th February 2020 to 10th May 2020 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Signature

ACKNOWLEDGEMENT

It has been my privilege to have had this opportunity to complete my dissertation from a reputed organisation such as Dharamshila Narayana Super-Speciality Hospital, New-Delhi.

In the entire duration of my association with the organisation, I have gained immense knowledge in various departments of the hospital and has helped garner a better understanding of the on-ground processes that are implemented in a tertiary care institute.

I would like to express my gratitude to Cdr. Navneet Bali, Regional Director, Narayana Health for providing me with this opportunity to undergo the dissertation process with such an esteemed institute.

I would like to sincerely thank my organisation mentor, Dr.Nitin Sharma , Deputy Medical Superintendent , Dharamshila Narayana Super speciality Hospital for his invaluable inputs, guidance, enthusiasm and constructive discussion as a mentor. It was his constant counselling and support during the entire phase of the dissertation along with the academic zeal and thorough knowledge of the subject to bring about the best in me for which I shall be grateful to forever even during such uncertain times. He has not only helped me with the dissertation process but also has judiciously provided me with opportunities in other projects undertaken by the organisation.

My special thanks to the entire hospital staff of Dharamshila Narayana Super-speciality Hospital, New Delhi with a special mention to my team and the Department of Radiology team for their cooperation and support throughout my time here in Dharamshila Narayana Super speciality Hospital, New Delhi.

I would also like to thank my institutional mentor, Mr. Jagajeet Prasad Singh, Professor, IIHMR University who has truly been a pillar of strength and has been there at every turn for successful completion of my dissertation. It was through his expertise that helped me to have a better grasp of the entire project as well as the healthcare system in totality.

TABLE OF CONTENTS

ACKNOWLEDGEMENT.....	5
ABBREVIATION.....	7
ABSTRACT.....	8
INTRODUCTION.....	9-12
REVIEW OF LITERATURE.....	13-17
METHODOLOGY.....	18-20
DATA ANALYSIS.....	21-29
DISCUSSION.....	30
RECOMENDATIONS.....	31
CONCLUSION.....	32-33
REFERENCES.....	34-35

LIST OF FIGURES

FIGURE 1: THE TREND FOR RATE OF REDO’S	
IN RADIOLOGY DEPARTMENT.....	28
FIGURE 2: THE REASONS FOR REDO’S	
IN RADIOLOGY DEPARTMENT.....	29
FIGURE 3: THE TREND FOR INCIDENCE RATE OF	
REPORTING.....	30
FIGURE 4: TYPES OF REPORTING ERRORS DONE	
IN RADIOLOGY DEPARTMENT.....	31
FIGURE 5: TREND ANALYSIS FOR CLINICAL CORRELATION	
IN RADIOLOGY DEPARTMENT.....	32
FIGURE 6: TREND ANALYSIS FOR TURN AROUND TIME	
IN RADIOLOGY DEPARTMENT.....	33
FIGURE 7: THE REASONS FOR DELAY	
IN RADIOLOGY DEPARTMENT.....	34
FIGURE 8 ISHIKAWA DIAGRAM FOR	
RADIOLOGY DEPARTMENT EFFICIENCY.....	36

List of tables

TABLE 1: Reasons For Redo's	28
TABLE 2: Type of reporting errors done in Radiology Department.....	30
TABLE 3 : Reasons for Delay in Radiology TAT	33
TABLE 4: Calculation for spearman's correlation coefficient for No. of Redo's and Total footfalls of Radiology department.....	34
TABLE 5: Calculation for spearman's correlation coefficient for No. of Reporting errors and Total footfalls of Radiology department.....	35

ABBREVIATIONS

TAT – Turnaround Time

ER – Emergency Room

OPD – Out-Patient Department

IPD – In-Patient Department

RIS – Radiology Information Systems

PACS – Picture Archiving and communication System

MRI – Magnetic Resonance Imaging

CT SCAN – Computed Tomography scan

USG – Ultrasound

ABSTRACT

Background

Diagnostic Process is the driving anchor to disease management. Early diagnosis will always results in better prognosis and lower mortality and morbidity rate. Without diagnosis there is no treatment. The branch of Radiology came in the play of medical science back in 1880 by pierrie currie who discovered piezo electricity.

The goal of quality management is to improve the efficacy of therapies while also increasing patient satisfaction with the service.

In all radiological departments, quality, safety, and performance improvement initiatives must be designed and maintained. Adherence to basic quality management concepts, as well as the appropriate use of quality tools, are critical components of such programe.

Objectives

To assess the efficiency of the radiology department we analyzed the quality indicators according to NABH standards. Indicators used in the study are

Rate of Redo's in radiology department, Rate of Reporting error, Percentage of correlation coefficient and Turn Around Time in radiology department.

Material and Method

Trend analysis was done for the indicators over a period of 15 months from January 2020 – March 2021 to assess the variations in an upward trend for service efficiency.

Results

The average rate of redo's is 3.98 per 1000 investigation, average rate for reporting error is 1.2 per 1000 investigations average percentage of Clinical correlation of diagnostic reports in radiology department is 91% and average TAT in radiology department for IPD patients is 23:03:01 hours.

Conclusion

Following this an analytic association was drawn between the Rate of Redo's and Rate of reporting errors with total footfall in radiology department. We analyzed the association using spearman's correlation coefficient in SPSS analytic tool. The value redo's rho $p = 0.397$ and that for the reporting error is $p = 0.707$.

It was found that due to limitation across all the four indicators ; there was an overall decrease in efficiency of the radiology department. Hence, only upon working on all the four indicators together we would lead to significant improvements in the department.

TITLE

ASSESSING RADIOLOGY DEPARTMENT EFFICIENCY AND ANALYSING OUTLIERS TO IMPROVE IT'S PERFORMANCE AT DHARAMSHILA NARAYANA SUPER-SPECIALTY HOSPITAL, NEW-DELHI.

Introduction

Healthcare services are extremely complicated and risky in nature, as well as the usual lack of competence possessed by consumers, healthcare services stand out among other services. As a result, it is both more crucial and more difficult to conceptualize and measure service quality in healthcare settings.

With a vast range of tools and procedures available for detection, staging, and therapy, radiology plays a critical role in illness management. Diagnostic imaging can reveal structural or disease-related alterations in detail. It is possible to save a person's life if they receive treatment early on. There can be no treatment and no cure without a proper diagnosis. Treatment efficacy is the goal of quality management.

Previous research has recommended that the TAT for a report of an inpatient radiology examination should be shorter than 8 hours. In both the emergency department and outpatient settings, shorter TATs yield similar benefits [3,4]

Quality, safety, and performance improvement programmes are intended to be established and maintained in all radiological departments. Adherence to basic quality management principles and proper application of quality instruments are essential components of such programmes.

One of the most common causes of medical malpractice is diagnostic error, which is an underappreciated patient safety risk. Furthermore, in recent decades, diagnostic mistake has significantly increased the health burden. Between 1990 and 2018, an estimated 94000142,000 persons died as a result of diagnostic errors over the world. Approximately 850,000 diagnostic errors occur in affluent countries. [7].

Over the last three decades, the exponential increase in the number of imaging tests has pushed radiology departments to improve processes in order to produce reports more quickly. Because of the growing demand for precision and precise exams in all clinical settings, optimising the turnaround time (TAT) of radiology reports is critical in the radiology department. These numbers are increasing.

Imaging is an important part of the diagnosis process for many patients. Estimates of average diagnostic error rates range from 3% to 5%, implying that approximately 40 million diagnostic errors using imaging occur globally each year. Detecting and learning from these errors has the potential to improve diagnostic performance and protect patients. Regardless, the relatively large diagnostic performance while avoiding patient harm Despite this, despite decades of research and

interventions, relatively high diagnostic error rates have persisted in our field. Diagnostic errors in radiology may appear to occur haphazardly at times.

Diagnostic problem solving in radiology, on the other hand, isn't a mysterious black box, and diagnostic errors aren't unavoidable. Diagnostic mistakes, on the other hand, are foreseeable events with easily identified contributors, many of which are influenced by how we think or interact with the outside world.

Both perceptual and interpretative errors are caused by these contributing elements.

Identifying contributing factors is one of the most important steps in developing interventions to reduce or mitigate diagnostic errors.

The National Quality Forum recently concluded in a report titled Improving Diagnostic Quality and Safety that "while most people will experience at least one diagnostic error in their lifetime, stakeholders in quality measurement and patient safety have largely ignored the issue." Despite decades of research and practise, radiology continues to have relatively high diagnostic error rates and redo rates.^[2]

The flow of information is crucial to the modern radiology department. Ordering providers make requests for imaging studies, technologists conduct the labour required for the imaging studies, and radiologists interpret and report on the results. Data travels between many information systems, most notably the radiology information system, as each of these phases is accomplished.

The pursuit of the quickest turnaround time (TAT) is not new; in many ways, it has been the holy grail of radiology for more than a decade. Obviously, achieving a quick report turnaround time necessitates the use of an efficient RIS/PACS solution. One metric that is frequently used as an optimal marker for radiology efficiency is radiology report turnaround time. The disease will be reduced if it is detected early and diagnosed correctly.^[9]

TAT of imaging reads, from study completion to radiology report issuance, has been the focus of recent studies concentrating on radiological imaging turnaround times in the ED. Increased staff, new technology, and addressing physician behaviour and practise are often required to improve this component of total TAT for radiological reads, which can be challenging and time-consuming.

Humans are prone to making mistakes, thus when it comes to quality improvement and safety in radiology, the focus should be on correcting the procedure that allowed the error to occur. At the ARRS 2015 annual meeting in Toronto, Eric Walker, MD, of Penn State Hershey Radiology, conveyed this message. Walker outlined the initial effort for medical quality and safety.^[4]

Radiology is being scrutinised more and more by payers and regulators ^[1-4], with all parties challenging the value and effectiveness of practitioners. Medical errors are all too common, necessitating the need for quality and safety.

In radiology, a "excellent" technical quality product is correct diagnostic information obtained with the least amount of potential harmful factors and at the lowest possible cost. Repeat

exposures, for example, due to poor image quality, lower product quality by increasing patient risk and cost.

Adverse reactions to contrast material are also taken into account in this context. In radiology, regular monitoring of quality indicators such as redo rate, reporting error rate, correlation with clinical diagnosis, and TAT is typical practise for continuous quality improvement.

Customers in radiology include not only patients but also referring physicians and department employees, and their satisfaction is based on impressions formed at all points of contact with the institution.

Patients' quality judgement is often relied exclusively on their subjective experiences throughout the process because they lack the ability to evaluate technical quality, necessitating the measurement and assurance of both quality components in a radiology department.

To maintain the radiology department's maximum efficiency, we must maintain the sweet spot of our services and achieve the highest level of effectiveness by combining goals such as no diagnostic errors or incorrect interpretation, a low incident rate of redo's, and a shorter TAT (Turn Around Time) for early disease detection.

Thus, benchmarking processing against established quality indicators is critical for sustaining Continuous Quality Improvement (CQ) in the radiology department.

In this study, the following indicators will be compiled and compared to the benchmark to determine the efficiency of the Radiology department:

- Incidence rate of reporting errors per 1000 investigations.
- Incidence rate of redo's per 1000 investigations.
- The proportion of reports that are associated with a clinical diagnosis.
- Turn-Around-Time (TAT) for diagnostic procedures.

Benchmarking Processing for Continuous Quality Improvement

Non-performers/underperformers in several departments who fall short of the stated target are recognized.

An investigation into the root causes has been completed.

Corrective action has been taken as needed.

The efficacy of corrective intervention is evaluated.

The corrective action will be changed if necessary.

Preventive measure to be taken.

Effectiveness of the preventive measure is evaluated.

▼ If a given department or process maintains consistency in meeting stated targets, a new target is created after obtaining consensus from all stakeholders.

To achieve it, the objective is raised a few notches.

This cycle repeats again, with each department/performance process's and quality improving.

Research question

What is the level of conformity with NABH standards for various quality indicators used to evaluate the efficiency of the Radiology Department and to ensure ongoing quality improvement?

What are the most common causes of radiology department efficiency outliers?

Aim

The study's goal is to evaluate the efficiency of the Radiology department using standardized key performing quality indicators.

Objectives

1. In the Radiology Department, to examine different important performance quality indicators according to the NABH standard.
2. Conduct a trend analysis of quality indicators over the last 12 months to evaluate how they have changed.
3. Determine outliers and the primary causes of deviations and discrepancies.
4. To determine the relationship between the various variables studied for Radiology Department efficacy.
5. To recommend methods to eliminate prospective errors and increase the compliance.

CHAPTER - 2

LITERATURE REVIEW

STUDY TITLE	STUDY DESIGN	STUDY POPULATION	OUTCOME VARIABLES	SALIENT FEATURES
Hofmann et al., (2015) – Hoffmann sign: clinical connection between cervical spine and brain neurological imaging findings	Cross-Sectional	In January of 2014, all exposed photos were evaluated at two direct digital laboratories at a Norwegian hospital. The sort of examination, the number of photographs exposed, and the duration of the examination are all factors to consider. as well as the amount of deleted photographs. Each The grounds for removing the photograph were noted and a separate analysis was performed on it.	Repetition Rate in Digital Radiography	596 of the 5417 exposed pictures were repeated, resulting in an 11 percent repetition rate. Following the previous faults, the percentage 51.3 percent was repeated. In terms of order, the knee, hip, and ankle tests had the largest percentage of deleted photos, at 20.6 percent, 18.5 percent, and 13.8 percent, respectively.
A study on turn around time of reports in radiology department _ Akriti Dubey	Descriptive and crosssectional	The research was carried out for a month at the EHCC's Radiology Department in Jaipur. The study included a sample of 406 reports, including 175 X-Ray reports, 130 USG reports, 70 CT Scan reports, and 31 MRI reports.	Turn Around Time for Reports	The reporting of X-rays and CT scans was found to be significantly delayed. Further interventions and modifications, such as human resource management and a digital recording system, can improve the process and reduce the time it takes to report. This will, in the end, improve the entire experience of patients who visit the department and smooth out its operation.

STUDY TITLE	STUDY DESIGN	STUDY POPULATION	OUTCOME VARIABLES	SALIENT FEATURES
Issa et al., 2015 – A study on discrepancy rate in Radiology department	Cross- Sectional	From June 2011 to May 2012, all residents and radiologists in the Department of Diagnostic Radiology at the American University of Beirut Medical Centre were studied.	Discrepancy Rate	The discrepancy rate, or overall difference rate, was 1.62 percent. Inconsistency was higher among first- and second-year residents (1.62 percent and 1.96 percent, respectively) than among third- and fourth-year residents (1.35 percent and 1.24 percent). It was 2.13 percent for computed tomography (P=0.01), 1.29 percent for radiography, and 0.8 percent for ultrasound (P=0.01). value0.01), as well as musculoskeletal disorders.
Remma perotte, Greg O Lewin_ Improving Emergency Department Flow: Reducing Turnaround Time for Emergent CT Scans	Cross- Sectional	During an eight-month period before to the intervention, our emergency department ordered 10,063 CT scans.	Turn Around Time for Ct Scan	The average time it took from placing a CT order to receiving the radiologist's final report was 5.9 hours (median=4.2 hours). We formed a multi-disciplinary team of physicians, nurses, technicians, transporters, informaticians, and engineers to identify bottlenecks and implement technology and humanfactors solutions.

STUDY TITLE	STUDY DESIGN	STUDY POPULATION	OUTCOME VARIABLES	SALIENT FEATURES
Teshome Mulisa, Fasil Tessema & Hailu Merga – Patients’ satisfaction towards radiological service and associated factors in Hawassa University Teaching and referral hospital, Southern Ethiopia	crosssectional study	Using a stratified sample technique, a cross-sectional research of 321 adult patients presented for radiological care in the study area was done. SERVQUAL was used to gauge patient satisfaction (Service Quality	accessibility, quality of radiological service, courtesy of radiology staff, existence of good communication with service provider and desk worker, physical environment and privacy technique.	The majority of respondents in this survey were pleased with the radiological services. The satisfaction condition was influenced by the respondent's educational level, occupation, and the length of time it took to enter the examination room. As a result, a determined effort is required to continually enhance patient satisfaction in order to get superior radiological returns as a result of improved patient satisfaction

j

STUDY TITLE	STUDY DESIGN	STUDY POPULATION	OUTCOME VARIABLES	SALIENT FEATURES
Young stephanie ming,, Rupesh Agrawal _ Clinical, radiological and histological correlation in diagnosis of orbital tumours	Descriptive and correlational	Between September 2000 and August 2010, 83 patients who had an orbital lesion biopsy or orbitotomy were studied clinically, radiologically (CT), and histopathologically to examine if there was a link between clinical radiology and histopathology report.	Clinically, radiologically (CT), and histopathologically, patients undergoing biopsy or orbitotomy were assessed.	There was a perfect relationship in all of the cases assessed under congenital orbital tumours, lacrimal gland tumours, and sac tumours. The highest unfavourable correlation between clinical diagnosis and final histology was found in lymphocytic illnesses and ocular inflammation. The most commonly misunderstood types of orbital lesions are lymphocytic illness and ocular inflammation.

CHAPTER:3

RESEARCH METHODOLOGY

In this section description of research method is given. Under research method various steps were explained in detail. These steps involved study design which explains about how desired secondary data of the period January 2020-May2021 was selected from HMIS system, and compilation of data was done to calculate the efficiency.

Excel format was used to collect data to in order to calculate quality indicators to be assessed for the analysis.

KEY RESEARCH QUESTION

- What is the level of conformity with NABH standards for various quality indicators used to evaluate the efficiency of the Radiology Department and to ensure ongoing quality improvement?
- What are the major reasons for outliers of efficiency in radiology department?

STUDY DESIGN

- A Descriptive and observational study was chosen as the design for this research to assess the efficiency of Radiology Department in Dharamshila Narayana SuperSpecialty Hospital, New Delhi.
- Secondary data came from the Radiology department's HMIS system (MOKSHYA), as well as their capture sheets and record registers. The received raw data was then compared to the formula and indicator definitions provided by NABH in their book.
- The numerator and denominator definition and capture processes for each indicator were then reviewed to ensure there were no gaps or discrepancies in the back-end process.
- Incorrect sample size adherence, as well as misinterpretations or defaulted computations, were fixed in the department as well as in the Quality Department's master record.
- The processed data was then collated according to a predetermined format, which was utilised to tabulate the data for the previous six months, from December 2020 to May 2021.
- The numerator and denominator of the data obtained were verified and evaluated in the form of a formula.

Study Site

- The study is done in Radiology Department of Dharamshila Narayana Superspecialty Hospital, New Delhi is a new age Super-specialty hospital spread over 3.5 acres in pleasant landscape with 350 bed capacity.

Research Approach

- Quantitative in Nature

Study Duration

- The study was conducted for a period of 15 months starting from January 2020 to March 2021.

MODE OF DATA COLLECTION

SECONDARY RESOURCES

HOSPITAL RECORDS • NABH GUIDELINES • CAPTURE SHEETS • HOSPITAL POLICIES AND MANUAL

STUDY TOOL

QUALITY INDICATORS TO BE ASSESSED FOR THE ANALYSIS

- Incident Rate of Reporting Errors per 1000 investigations
- Incident Rate of Redo per 1000 investigation
- Percentage of Clinical-Corelation of Diagnosis
- Turn Around Time for Radiology Reports

Inclusion Criteria

- All of the reporting errors made in the Radiology Department for IPD patients
- Reports Turnaround Time IN Radiology Department for IPD Patients
- Clinical-Correlation of Diagnosis in Radiology Department for IPD Patients
- Reports Turn Around Time IN Radiology Department for IPD patients

Exclusion Criteria

- Quality indicator data from Emergency department and OPD department is not included.
- Turn Around Time for Radiology guided procedures were not included in the study.

Data Analysis plan

- After the data has been collected and compiled, a trend analysis will be performed for each indicator, using an internal target as a benchmark to ensure consistency in the study.
- Outliers were discovered by examining all of the indicators for a few months in which the values were above the benchmark and indicated deviations. Outliers were detected, analysed, and the root cause of those specific events was discovered.
- The Descriptive analysis of the data was done by using MS – Excel software for defining and analysing the trend of quality indicators over a period of 6 months based on standardised internal benchmark.
- The Inferential analysis of the data was done by using SPSS software for analysing the relationship between the variables using Spearman’s rank Correlation Coefficient.

Numerical Formulas to be used in Data Analysis:

1. Incident rate of Reporting errors per 1000 investigations in Radiology

$$\left(\frac{\text{No. of imaging reports in which errors detected}}{\text{Total tests done in radiology}} \right) * 1000.$$
2. Incident rate of Redo’s per 1000 investigations in Radiology

$$\left(\frac{\text{No. of imaging reports in which Redo’s are done}}{\text{Total tests done in radiology}} \right) * 1000.$$
3. Percentage of Radiology reports co-relating with clinical diagnosis.

$$\left(\frac{\text{No. of imaging reports which are correlating with clinical diagnosis}}{\text{Total tests done in radiology}} \right) * 100.$$
4. Average Radiology TAT.

$$\left(\frac{\text{Total time taken by all the radiology procedures}}{\text{Total number of radiology procedures done.}} \right)$$

CHAPTER-4

RESULTS

To assess the efficiency of the radiology department we analyzed the quality indicators according to NABH standards.

Trend analysis was done for the indicators over a period of 15 months from January 2020 – March 2021 to assess the variations in an upward trend for service efficiency.

Causes for outliers were assessed and analyzed using pareto diagram and bar chart to ensure maximum efficiency achievement by omitting the major reasons for underperformance of the department.

Trend analysis for Average Turn Around Time for Radiology Reports is also done over a period of 6 months from January 2020 – May 2021 to analyze the outliers against the Internal benchmarks.

Association was assessed between Total footfall in the Radiology Department against the No. of Redo's done in Radiology Department and No. of Reporting errors in Radiology Department using Spearman's Rank Correlation Coefficient.

ANALYSIS FOR REDO'S IN RADIOLOGY DEPARTMENT

Trend analysis for rate of redo's per 1000 investigation was done by using line chart as a descriptive tool to analyze the pattern of Redo's done in the Radiology department over a period of 15 months as more number redo's results in resource wastage in the department , patient's service experience and it will affect the overall efficiency of the department .

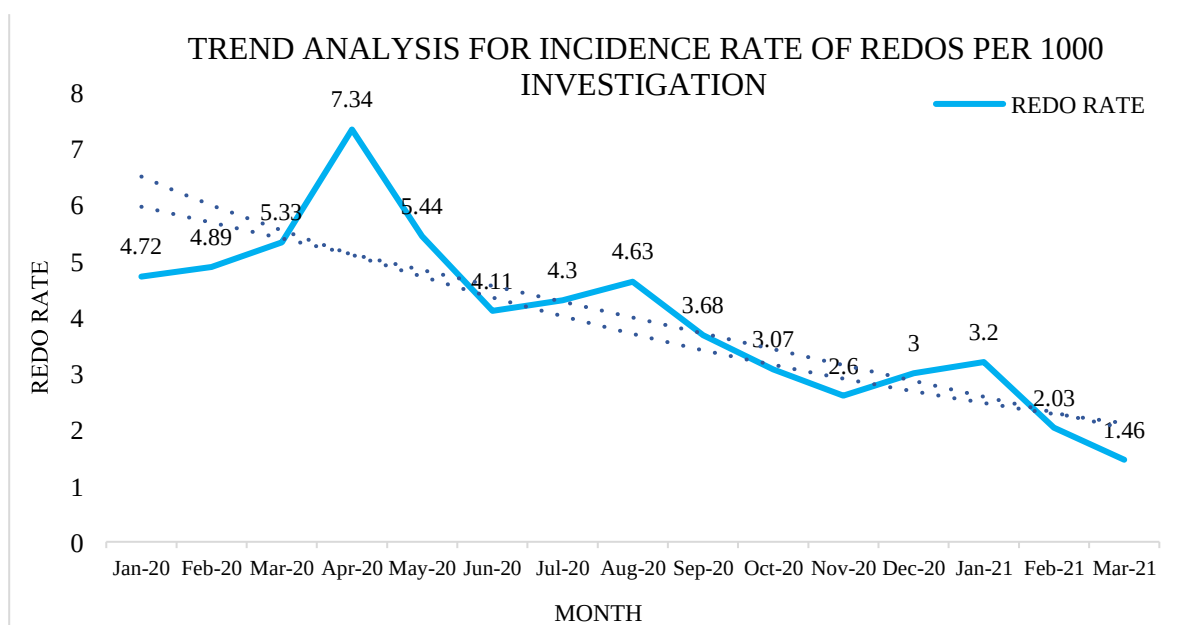


Fig. 1 This line graph depicts the trend for Rate of Redo's in Radiology department over a period of 15 months. We can see that this graph shows a downward slope in the incidence rate of Redo's. the highest rate of incidence was observed in April-20 and lowest was observed in March-21.

S.NO	REASONS FOR REDOS
1	ROTATED IMAGE
2	BLUR IMAGE
3	EXPIRATION IMAGE
4	POOR PREPARATION
5	METAL ARTIFACT
6	PATIENT RESTLESS
7	UNDER EXPOSED

TABLE1: Table depicts the reasons For redo's

Pareto analysis for Radiology Redo causes.

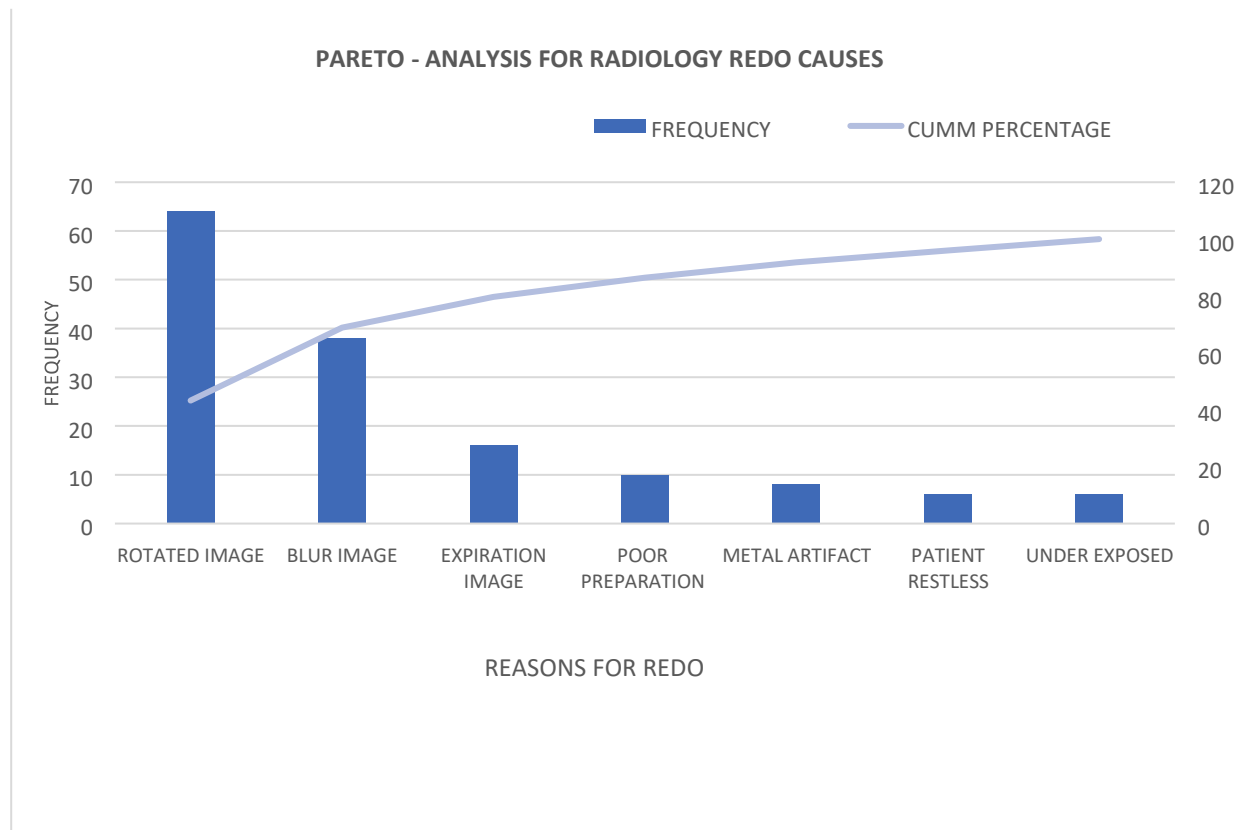


Fig.2 The above pareto depicts the reasons for Redo's in Radiology Department

The pareto chart depicts that the maximum number of redo's in the radiology department were done due to Rotated Image during examination and Blur Image during Examination.

Other reasons like expiration image, poor preparation, metal artifact and under exposed also results in redo. After assessing this pareto diagram we can conclude that 80 percent of the Redo's were done because of above mentioned reasons.

ANALYSIS OF REPORTING ERROR IN RADIOLOGY DEPARTMENT

Trend analysis for rate of reporting errors per 1000 investigation was done by using line chart as a descriptive tool to analyze the pattern of reporting error done in the Radiology department over a period of 15 months as more number reporting errors results in resource wastage in the department, patient's service experience and it will affect the overall efficiency of the department.

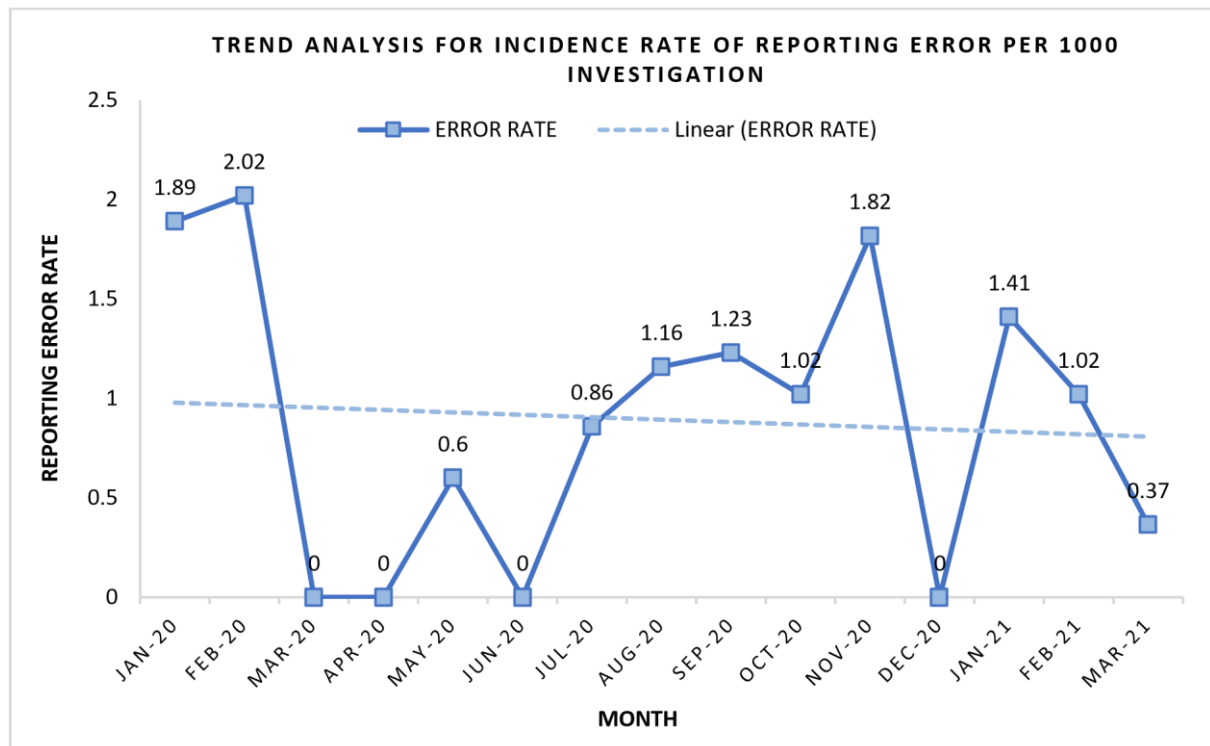


Fig 3. This line graph depicts the trend for incidence rate of reporting error per 1000 investigations in radiology department

After assessing this line graph we can analyze that the maximum rate of reporting error in radiology was in February -20 that was 2.02 and lowest was 0 in the month of March, April, June and December.

Also the graph depicts that from the last 3 months the Reporting error rate is decreasing consistently

S.NO	Type of REPORTING ERROR
1	WRONG INVOICE NO ENTERED
2	TYPOGRAPHICAL ERROR
3	PRINTING ERROR
4	PROCEDURE DONE ON WRONG PATIENT
5	MISINTERPRETATION BY RADIOLOGIST

Table 2: The above-mentioned table shows the type of reporting errors done in Radiology Department.

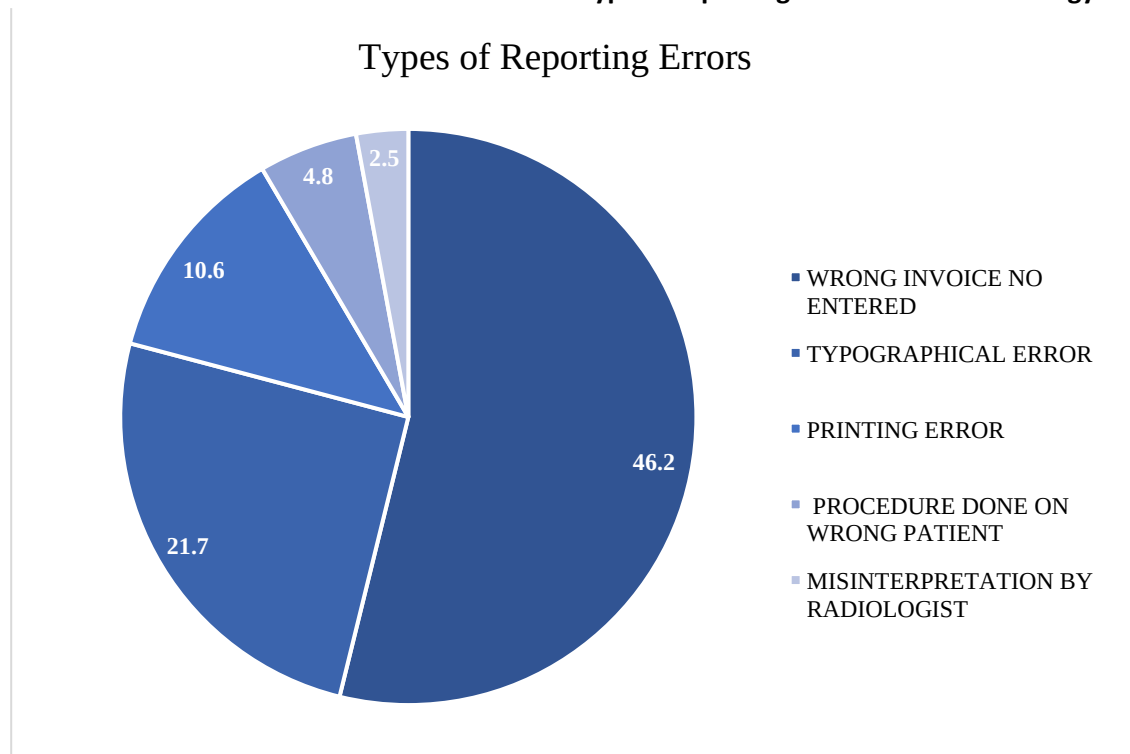


Fig 4: The above-mentioned pie-chart depicts the types of reporting errors done in radiology department.

This pie- chart tells us about the different types of reporting errors identified in the Radiology department. We can see that that reporting error of wrong invoice number entered has maximum frequency whereas misinterpretation by Radiologist had the lowest frequency.

Analysis for clinical correlation of diagnosis in radiology department.

Trend analysis for clinical correlation of diagnosis in radiology department was done by using line chart as a descriptive tool to analyze the pattern of clinical correlation of diagnosis in radiology department over a period of 15 months as higher the correlation of radiological diagnosis more accurate and early treatment can be given to the patient.

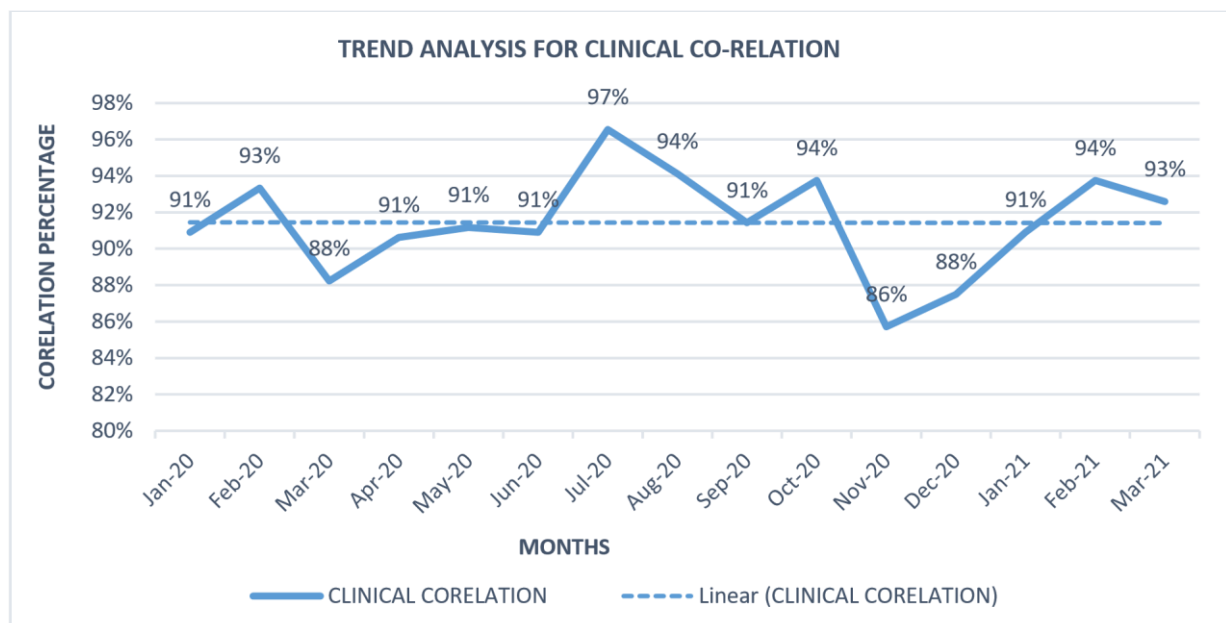


Fig. 5 The above-mentioned line graph depicts the trend analysis for clinical correlation in radiology department.

ANALYSIS OF TURN AROUND TIME IN RADIOLOGY DEPARTMENT

Trend analysis for Turn Around Time was done by using line chart as a descriptive tool to analyze the pattern of Turn Around Time in the Radiology department over a period of 6 months as higher the Turn Around Time for radiology department higher is the efficiency of the radiology department.

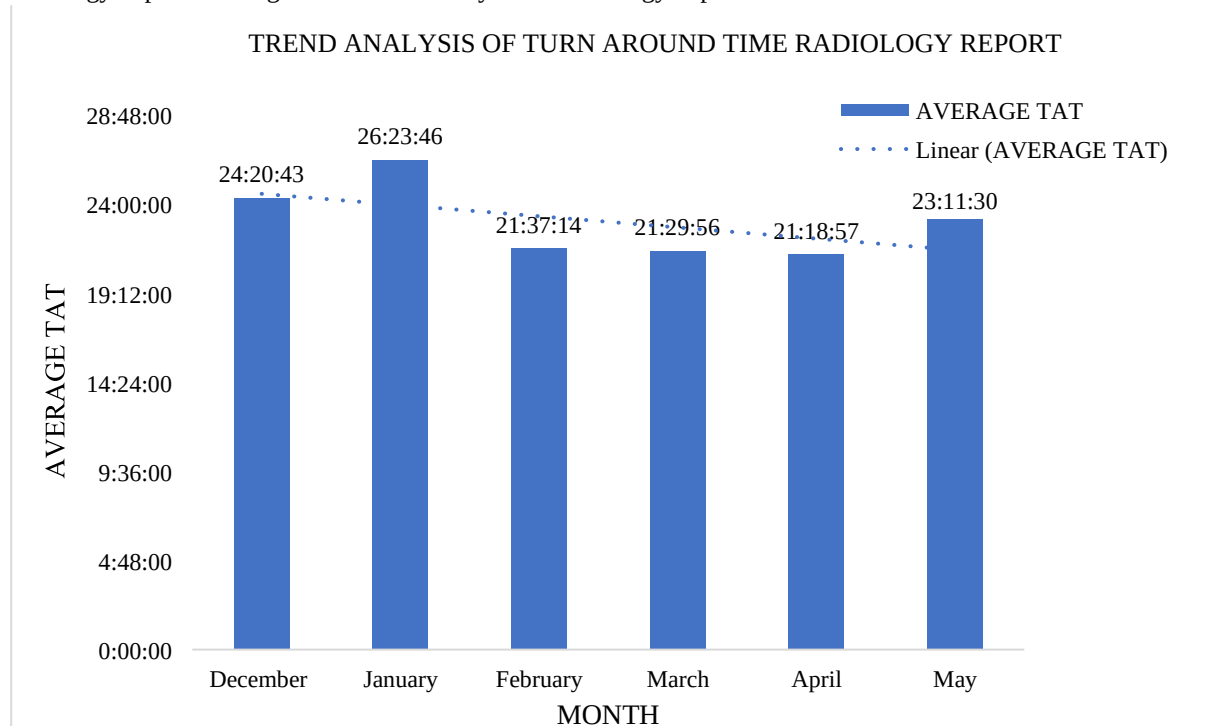


Fig 6 :The above graph depicts the trend analysis for Turn Around Time in Radiology Department .

The internal benchmark for radiology Turn Around Time for the hospital is 24 hours and the above-mentioned trend shows that the from last 6 months the average TAT is lower than 24 hours with an outlier of 20minutes and 2 hours 20 minutes in December and January respectively.

S.NO	REASONS FOR DELAY IN RADIOLOGY TAT
1	Lack of staff due to high footfall
2	Unavailability of staff on Sunday to finalize the report
3	Poor preparation of patient for Radiology procedure
4	Delay due to HMIS breakdown
5	Delay due to equipment breakdown due to Down Time

Table 3: The above-mentioned table shows Reasons for Delay in Radiology TAT Delay Department.

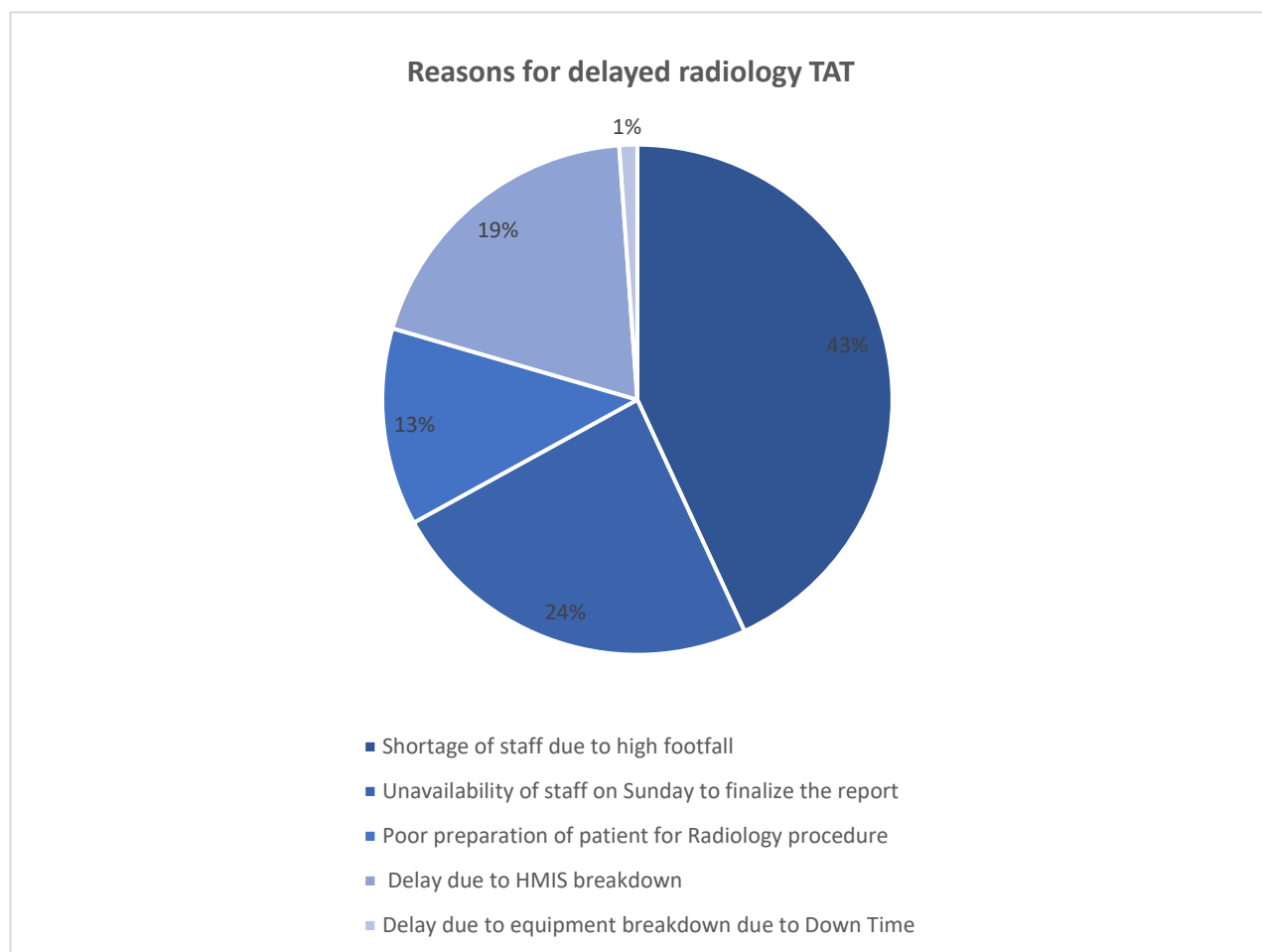


Fig 7: The above-mentioned pie-chart depicts the reasons of reporting delay TAT in radiology department.

This pie-chart tells us about the different reasons of reporting delay identified in the Radiology department. The major reason for delay reporting TAT is lack of staff due to high footfall and staff unavailability on Sunday.

INFERENCE ANALYSIS OF THE DATA TO ASSESS THE ASSOCIATION BETWEEN THE VARIABLES

Management of human resource in hospital department has always been an issue for the managers, similarly in situation of high flow footfall in radiology department a situation like overcrowding and under staffing can lead to errors and negligence.

A. To the assess the association between the no. of redo's and total footfall of the Radiology department by using spearman rank correlation coefficient

NULL HYPOTHESIS: There is no association between the No. of redo's and total footfall in the radiology department.

ALTERNATE HYPOTHESIS: There is an association between the No. of redo's and total footfall in the radiology department.

Correlations

		no_of_redo
Spearman's rho	Correlation Coefficient	0.391
	Sig. (1-tailed)	0.075
	N	15
	Correlation Coefficient	1.000
	Sig. (1-tailed)	
	N	15

Table 4: The above-mentioned table shows the calculation for spearman's correlation coefficient for No. of Redo's and Total footfalls of Radiology department.

The spearman's correlation coefficient for No. of Redo's and Total footfalls of Radiology department is 0.391. Thus, we can conclude that there is positive association between the two mentioned variables.

B. To the assess the association between the no. of reporting error and total footfall of the Radiology department by using spearman rank correlation coefficient

NULL HYPOTHESIS: There is no association between the No. of reporting error and total footfall in the radiology department.

ALTERNATE HYPOTHESIS: There is an association between the No. of reporting error and total footfall in the radiology department.

Correlations		no_of_error
Total	Correlation Coefficient	.707**
	Sig. (1-tailed)	0.002
	N	15
no_of_error	Correlation Coefficient	1.000
	Sig. (1-tailed)	
	N	15

** . Correlation is significant at the 0.01 level (1-tailed).

Table 5: The above-mentioned table shows the calculation for spearman's correlation coefficient for No. of Reporting errors and Total footfalls of Radiology department.

The spearman's correlation coefficient for No. of Reporting errors and Total footfalls of Radiology department is 0.707. Thus we can conclude that there is a strong positive association between the two mentioned variables.

DISCUSSION

After assessing the above analyzed results the conclusion about the potential factors affecting the efficiency in radiology department using Ishikawa diagram (Fish -bone cause and effect diagram)

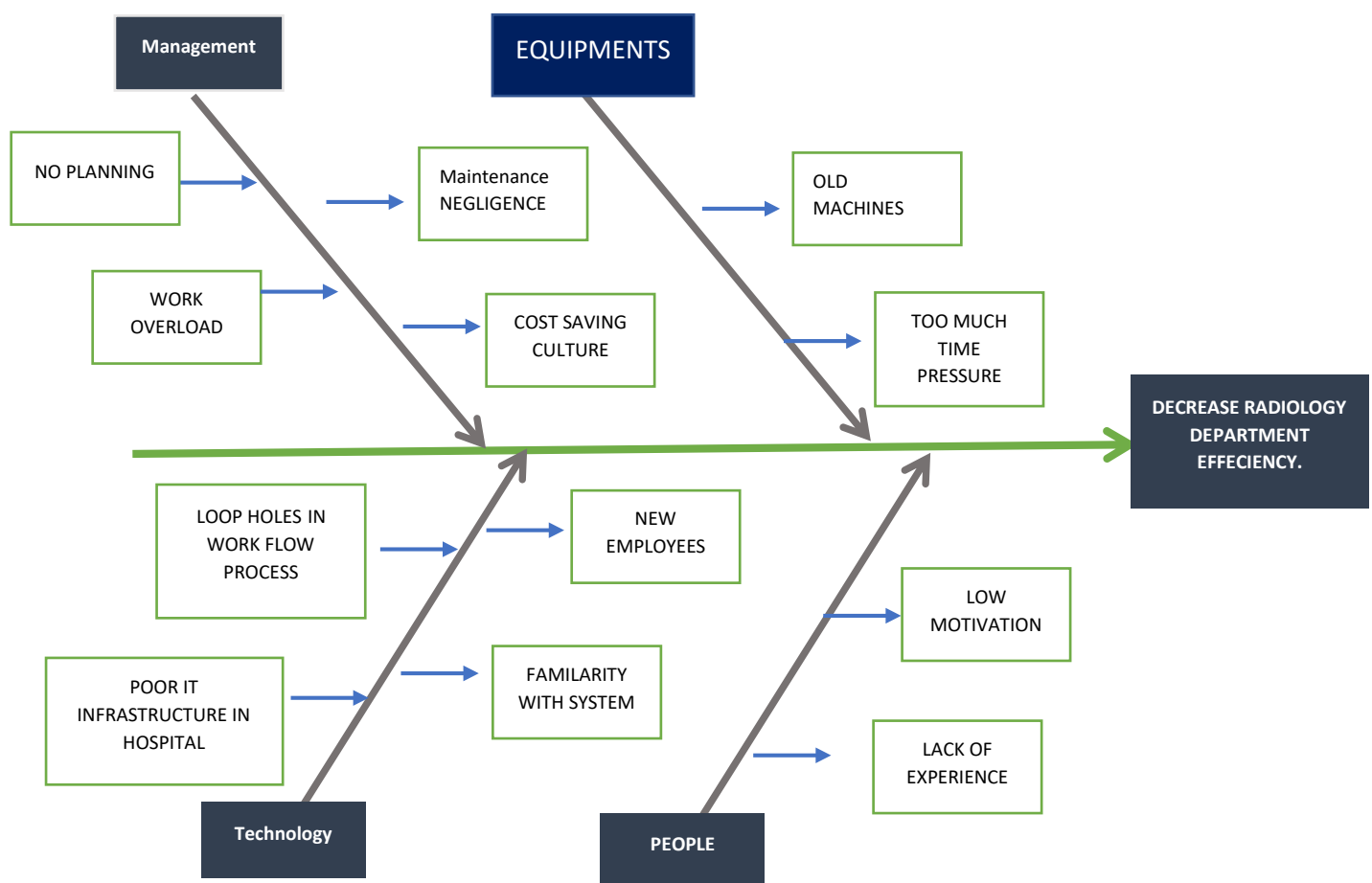


Fig 7. Ishikawa diagram for Radiology Department efficiency.

- Major errors occur in Radiology department due to poor work planning of workforce in the radiology department to handle the overcrowding situations.
- Loopholes in work flow process due to staff negligence results in wastage of resources
- Time pressure to reduce the working TAT results in redoes and errors.
- Delay and errors in HMIS system results in delay
- Lack of motivation in staff to improve the quality of the department.

RECOMMENDATIONS

- A thorough rooster will be designed, with a larger crew available for the hospital's peak hours. Due to the unit's increasing workload, this is primarily geared at catering to the morning hours.
- Training of technical staff for equipment management.
- Establishing a monthly feedback system to address any technical difficulties that arise.
- Dual checking report generation system should be encouraged to reduce the reporting error rate in the department.
- Positive reinforcement should be given for maintaining the practice of punctuality among the staff and reduce rate of absenteeism to avoid delays and work overload in the department.
- Implementation of a quarterly audit plan throughout all three phases to ensure that the outcomes achieved are in line with established benchmarks.

Conclusion

The study was carried out with an aim to assess the current efficiency of the radiology department and enhance the flow process by resolving the issues of outliers.

We studied data from four quality indicators in the Radiology Department of Dharamshila Narayana Super-Speciality Hospital to determine efficiency. Over a 15-month period, trend analysis was performed on all of the variables, which included the Rate of Redos in Radiology and the Rate of Reporting Errors in Radiology. In the radiology department, the percentage of clinical correlation and the trend analysis for Radiology Reports Turn -Around -Time was done over a period of 6 months.

All of the indicators improving in a steady manner. The average rate of redos in the radiology department is 3.98 per 1000 investigations, the average rate of reporting errors is 1.2 per 1000 investigations, the average percentage of clinical correlation of diagnostic reports in the radiology department is 91%, and the average TAT for IPD patients in the radiology department is 23 hours.

Also it has been observed that there is a significant association between the rate of Redo's and Reporting errors in the radiology department along with total footfall in the radiology department. We analysed the association using spearman's correlation coefficient the value redo's $\rho = 0.397$ and that for the reporting error is $p = 0.707$.

It was found that due to limitation across all the four indicators ; there was an overall decrease in efficiency of the radiology department. Hence, only upon working on all the four indicators together we would lead to significant improvements in the department

A thorough rooster would maximise the usage of the manpower required to give effective and efficient service to the end user while also assisting in the department's overall efficiency.

Another significant finding at the Radiology Department was the failure of the RIS system as well as an overabundance of equipment. To offset these findings, a monthly maintenance programme, as well as radiology technical staff training, could be a beneficial solution.

Another proposal for lowering overall turnaround time was to make the most of the RIS in the final step of the process for certification of reports with keywords and predesigned templates, as well as making them more accessible to consultants.

Policies must be developed and implemented, as well as regular audits, in order to improve overall turnaround times. This would not only improve patient satisfaction, but it would also reduce patients' length of stay, lowering their financial burden.

The results of our present study show that a lot can be done to improve the efficiency of the department.

REFERENCES

1. Hitti E, El-Eid G, Tamim H, Saleh R, Saliba M, Naffaa L. Improving Emergency Department radiology transportation time: a successful implementation of lean methodology. 2021.
2. Steele JR, Schomer DF. Continuous quality improvement programs provide new opportunities to drive value innovation initiatives in hospital-based radiology practices. **J Am Coll Radiol** 2009;6(7): 491–499.
3. Stern C, Boehm T, Seifert B, et al. Subspecialized radiological reporting expedites turnaround time of radiology reports and increases productivity. *Rofo*. 2018;190:623-9.
4. Verma, N., Pacini, G. S., Torrada, J. P., Oliveira, D. M. de, Zanon, M., Marchiori, E. Hochegger, B. Subspecialized radiology reporting: Productivity and impact on the turnaround times for radiology reports in a middle-income country. *Radiologia Brasileira*. (2020)
5. Brenner DJ, Hricak H. Radiation exposure from medical imaging: time to regulate? **JAMA** 2010; 304(2):208–209.
6. Vosshenrich, J., Nesic, I., Cyriac, J., Boll, D. T., Merkle, E. M., & Heye, T. Revealing the most common reporting errors through data mining of the report proofreading process. *European Radiology*, 31(4), 2115–2125. (2021)
7. Poorolajal, J., Rezaie, S., & Aghighi, N. Barriers to medical error reporting. *International Journal of Preventive Medicine*, 2015-October.
8. Mulla, F. A. SRDG THESIS The experiences of radiographers working with PACS and RIS in Gauteng. *Dissertations & Theses*. (2014).
9. Boland GW. Stakeholder expectations for radiologists: obstacles or opportunities? *J Am Coll Radiol*. 2006;31,56-63.
10. Towbin AJ, Iyer SB, Brown J, Varadarajan K, Perry LA, Larson DB. Practice policy and quality initiatives: decreasing variability in turnaround time for radiographic studies from the emergency department. *Radiographics*. 2013;33(2):361–71
11. David, Samuel N. J., & Valas, S. National Accreditation Board for Hospitals and Healthcare Providers (NABH) Standards: A review. *Current Medical Issues*, 15(3), 231. (2017).

12. Abujudeh, H. H., Kaewlai, R., Asfaw, B. A., & Thrall, J. H. Quality initiatives: Key performance indicators for measuring and improving radiology department performance. *Radiographics*, 30(3), 571–580. (2010).
13. Patel, V., Sindhwani, G., Gupta, M., Arora, S., Mishra, A., Bhatt, J., ... Gehani, A comprehensive approach towards quality and safety in diagnostic imaging services: Our experience at a rural tertiary health care center. *Journal of Clinical and Diagnostic Research*, 11(8), TC10–TC16 (2017)
14. Fairbanks RJ, Guarrera TK, Bisantz AB, Venturino M, Westesson PL. Opportunities in IT support of Workflow & Information Flow in the emergency department digital imaging process. Proc Hum Fact Ergon Soc Annu Meet. 2010;54(4):359–63.
15. Andriole KP, Avrin DE, Weber E, Luth DM, Bazzill TM. Automated examination notification of emergency department images in a picture archiving and communication system. *J Digit Imaging*. 2001;14(2 Suppl 1):143–4
16. Kahn CE, Langlotz CP, Burnside ES et al. Toward best practices in radiology reporting. **Radiology** 2009;252(3):852–856.
17. Reiner BI. The challenges, opportunities, and imperative of structured reporting in medical imaging. **J Digit Imaging** 2009;22(6):562–568.