

**IMPROVING CARDIOLOGY INVESTIGATIONS TURNAROUND TIME BY
REDESIGNING THE QUEUE MANAGEMENT SYSTEM**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree
of Master of Business Administration (MBA)

in

Hospital and Health Management

By

Deepshikha Singh

Under the Supervision and Guidance of

Piyusha Majumdar

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Declaration by Student

I hereby declare that this dissertation titled “**Improving Cardiology Investigations Turnaround Time and Redesigning Queue Management System**” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

(Signature)

Name of the student- Deepshikha Singh

Date

Completion Certification

CERTIFICATE

This is to certify that Deepshikha Singh in partial fulfillment 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 at KIMS Hospitals, Secunderabad from February 27th - May 26th, 2023.

Place:

Date:

Preceptor/Head of the
Organization Name of the
organization

CERTIFICATE

This is to certify that the dissertation titled “**Improving Cardiology Investigations Turnaround Time and Redesigning Queue Management System**” is a record of the research work undertaken by **Deepshikha Singh** in partial fulfillment of the requirements for the award of the degree of MBA Hospital and Health Management from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide
IIHMR University, Jaipur

Date

School Dean
IIHMR University, Jaipur

Date

INTRODUCTION TO THE HOSPITAL

Krishna Institute of Medical Sciences (KIMS) was established by Dr. Bhaskar Rao Bollineni in Nellore in 2000. There are ten hospitals with a total bed capacity of roughly 4000 beds in Telangana (Secunderabad and Kondapur), Andhra Pradesh (Nellore, Rajahmundry, Srikakulam, Ongole, Visakhapatnam, Anantapur, and Kurnool), and Maharashtra (Nagpur).

KIMS Secunderabad, which was established in 2004, is a 1000-bed multi-specialty hospital with 885 operating beds on a huge 5-acre campus in the heart of the city. The National Accreditation Board for Hospitals and Healthcare Providers (NABH) and ISO 9001:2015 certification, as well as the National Accreditation Board for Testing and Calibration Laboratories (NABL), have all been granted accreditation to the facility.



Mission and vision of the organization:

- **Vision:** To be the most preferred healthcare services brand by providing affordable care and the best clinical outcomes to patients, and a healthy and best place to work for doctors and employees.
- **Mission:** Provide Affordable quality care to our patients with a patient-centric system and process. Enable clinical outcome-driven excellence by engaging modern medical technology. Provide a strong impetus for doctors to pursue academics and medical research.
- **Values:** Commitment, Respect, Accountability, Excellent Service, and Compassion.
- **Quality Policy:** To give patients the best care possible by never-ending striving for perfection at work and taking advice from our customers. We are dedicated to following the rules and enhancing the quality management system's efficiency over time. Our aim is to “**Cure with Passion ... Care with Compassion**”.

ABSTRACT

Background-

Cardiology investigations are critical in the diagnosis and monitoring of cardiovascular disorders, and early access to these investigations is essential for effective treatment and management. However, many hospitals encounter delays and extended wait times in the cardiology department, which can have a detrimental influence on patient satisfaction, clinical decision-making, and overall healthcare delivery.

Recognizing the importance of these difficulties, the research aims to use quality improvement approaches to improve the efficiency of the cardiology investigation process. The study intends to simplify patient flow, minimize waiting times, optimize resource allocation, and improve the overall patient experience by improving the queue management system.

The study emphasizes that making modifications to the queue management system demands extensive knowledge of the current workflow, resource limits, and patient needs. The study intends to identify bottlenecks, errors, and opportunities for improvement by thoroughly examining the present system, including data collecting and stakeholder feedback.

Overall, this study seeks to bridge the gap between current practices and optimal performance in cardiology investigations by redesigning the queue management system, ultimately contributing to the delivery of high-quality and timely care in the hospital's cardiology department.

Research question-

- What is the current TAT for cardiology investigations in the hospital's cardiology department and how can the queue management system be redesigned to improve time management in cardiology investigations?
- What is the current queue management system in the hospital and how does it affect the TAT for cardiology investigations?

Objectives-

- Calculate the TAT for cardiology investigations in the hospital's cardiology department.
- To identify the current queue management system in the hospital's cardiology department.

- To redesign the queue management system to improve the TAT for cardiology investigations.

Method-

To calculate and improve the cardiology investigation TAT within a hospital, Analysis of Pre- and post-intervention of both qualitative and Quantitative data is considered.

The qualitative analysis data was acquired through in-depth interviews with patients and healthcare providers. The interviews were largely aimed at identifying the critical factors influencing Cardiology investigation TAT and evaluating feasible solutions for boosting effectiveness and lowering delays.

Conclusion-

Redesigning the cardiology investigation queue management system is a strategic step toward optimizing patient care and increasing outcomes. Healthcare institutions can drastically reduce TAT and improve the overall efficiency of their cardiology departments by employing technology, innovative scheduling algorithms, streamlined workflows, and integrated communication systems. The application of new approaches to queue management will eventually lead to improved patient experiences and results in cardiology treatment.

ACKNOWLEDGEMENTS

I'd want to offer my heartfelt gratitude and appreciation to all the people who have supported me along the way at KIMS Hospital.

First and foremost, I want to thank **Ms. Renuka Radhakrishnan** (HOD of Operations) for her extravagant advice, support, and encouragement throughout my service. Her leadership and mentorship have shaped my growth and development in the domain of healthcare.

I would also like to thank my mentors, **Dr. Ayushi**, and **Mr. Prabhuniteja**, for their continuous support and advice throughout my tenure at KIMS Hospital. Their skill, knowledge, and dedication have been a constant source of inspiration and motivation for me, and I am glad for the opportunity to learn from them.

Furthermore, I would like to convey my heartfelt thanks to **Dr. Kiran**, the Medical Superintendent of KIMS Hospital, for giving me the opportunity to work and learn in such a prominent healthcare institution. His vision and leadership have helped to establish KIMS Hospital as a leading center of excellence in healthcare.

Finally, I'd like to thank **Dr. P.R. Sodani** (President, IIHMR University, Jaipur) for the opportunity he gave me to pursue this internship. I would like to thank **Ms. Piyusha Majumdar** too for the exceptional cooperation, guidance, and supervision she provided during this journey. This report is the outcome of her meticulous and generous approach.

This opportunity represents a significant step forward toward my professional career. I will strive to put my acquired skills and information to good use and will continue to enhance myself to explore more heights in my forthcoming career.

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LIST OF ABBREVIATIONS: -

<u>S. no.</u>	<u>Abbreviation</u>	<u>Meaning</u>
1.	KIMS	Krishna Institute of Medical Sciences
2.	NABH	National Accreditation Board for Hospitals and Healthcare Providers
3.	NABL	National Accreditation Board for Testing and Calibration Laboratories
4.	IP	In Patient
5.	OP	Out-Patient
6.	TAT	Turnaround Time
7.	RS	Radiology secretary
8.	ECG	Electrocardiogram
9.	2D-Echo	2D-Echocardiograms
10.	TMT	Treadmill test
11.	DSE	Dobutamine Stress Echocardiogram
12.	TEE	Transesophageal Echocardiogram
13.	Dr. Sec	Doctor secretary
14.	CS	Case Sheet
15.	PF	Process Flow

1. INTRODUCTION

Cardiology investigation Turnaround Time (TAT) refers to the duration it takes from the initiation of a cardiology investigation i.e. From a patient booking their appointment till the time he checks into the investigation rooms and receives his reports. It is one of the important areas of improvement for cardiology investigations and the management of queues in hospitals as long waiting times can lead to frustration and anxiety for patients, and delays in diagnosis and treatment can have serious consequences; Therefore, it is important to improve the queue management system and reduce the TAT for cardiology investigations. This study aims to calculate the TAT and redesign the queue management system in a hospital's cardiology department.

For healthcare systems to be effective and ensure the well-being of patients, efficient and timely delivery of healthcare services is crucial. Optimizing turnaround times for cardiology investigations and patient queue management in hospitals is one area that often requires improvement. Accurate diagnosis, appropriate treatment planning, and overall patient satisfaction depend on timely access to cardiology investigations. To summarize, this introduction will discuss the importance of determining cardiology investigation turnaround time, and the significance of redesigning the queue management system in a hospital, focusing on quality improvement.

Satisfaction depends on timely access to cardiology investigations. To summarize, this introduction will discuss the importance of determining cardiology investigation turnaround time, and the significance of redesigning the queue management system in a hospital, focusing on quality improvement.

- **Importance of Cardiology Investigation Turnaround Time:**

Cardiology investigations, such as electrocardiograms (ECGs), 2D-Echo, TMT, TEE, DSE Test, etc. are crucial in diagnosing cardiovascular conditions. To ensure accurate and prompt diagnosis, these investigations must be completed in a timely manner so that physicians can initiate treatment strategies as soon as possible. Delayed cardiac investigations can lead to prolonged hospital stays, increase patient anxiety, delay treatment, and compromise patient outcomes. Optimizing cardiology investigation turnaround time can positively impact patient care and healthcare system efficiency.

- **Challenges in Queue Management:**

To provide timely and streamlined care, patient queues must be managed effectively in healthcare settings. Overcrowded waiting rooms, prolonged waiting times, and dissatisfaction among patients are common problems hospitals face when organizing and prioritizing patients. Effective queue management is even more important in cardiology departments, where many patients require a variety of investigations. It improves both patient experience and hospital efficiency to receive investigations promptly and minimize waiting times.

- **Redesigning the Queue Management System:**

A quality improvement study can address turnaround time and queue management challenges in cardiology investigations. The purpose of this study is to identify bottlenecks and inefficiencies in the existing system, propose innovative solutions, and implement changes to improve the overall process. A queue management system redesign involves evaluating current protocols, analyzing workflow patterns, identifying areas for improvement, and implementing strategies to streamline patient journeys. The optimization of scheduling processes, the improvement of communication between healthcare providers, the use of technology for efficient information sharing, and the implementation of triage systems that prioritize patients based on their needs may be part of this process.

1.1 Aim-

- To reduce the cardiology Investigation TAT by redesigning the Current Queue Management system
- What is the current TAT for cardiology investigations in the hospital's cardiology department and how can the queue management system be redesigned to improve time management in cardiology investigations?
- What is the current queue management system in the hospital and how does it affect the TAT for cardiology investigations?

1.2 Objectives of the internship-

The primary objectives of this quality improvement study are to:

- To identify the current queue management system in the hospital's cardiology department.
- Identify areas of improvement and potential bottlenecks in the current process
- Develop strategies and interventions that increase the efficiency and effectiveness of the system.
- To redesign the queue management system to improve the TAT for cardiology investigations.
- Implement the recommended changes and assess their impact on cardiology investigation turnaround time, patient waiting times, and overall patient satisfaction.
- Monitor and evaluate the sustained benefits of the redesigned queue management system over a specified period.

Through this quality improvement study, healthcare organizations can enhance patient flow, optimize cardiology investigation turnaround times, and improve the overall quality of care.

This introduction concludes by emphasizing the importance of calculating cardiology investigation turnaround time and redesigning hospital queue management systems. Performing a quality improvement study can help healthcare organizations identify areas for improvement, implement innovative solutions, and increase patient satisfaction and efficiency.

1.3 Process Mapping of Cardiology Investigation-

1.3.1 OP patients:

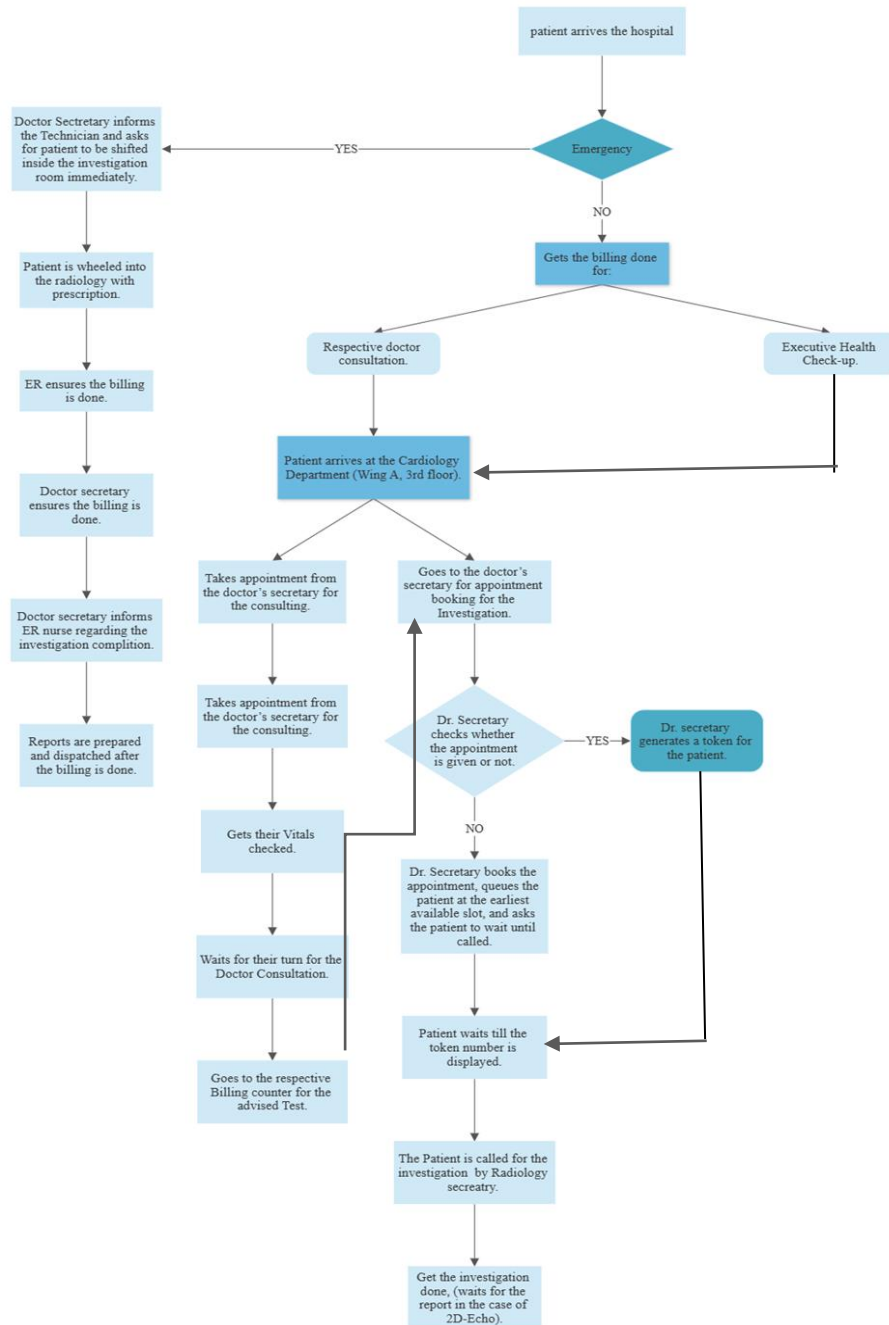


Fig. 1.1

1.3.2 IP patients:

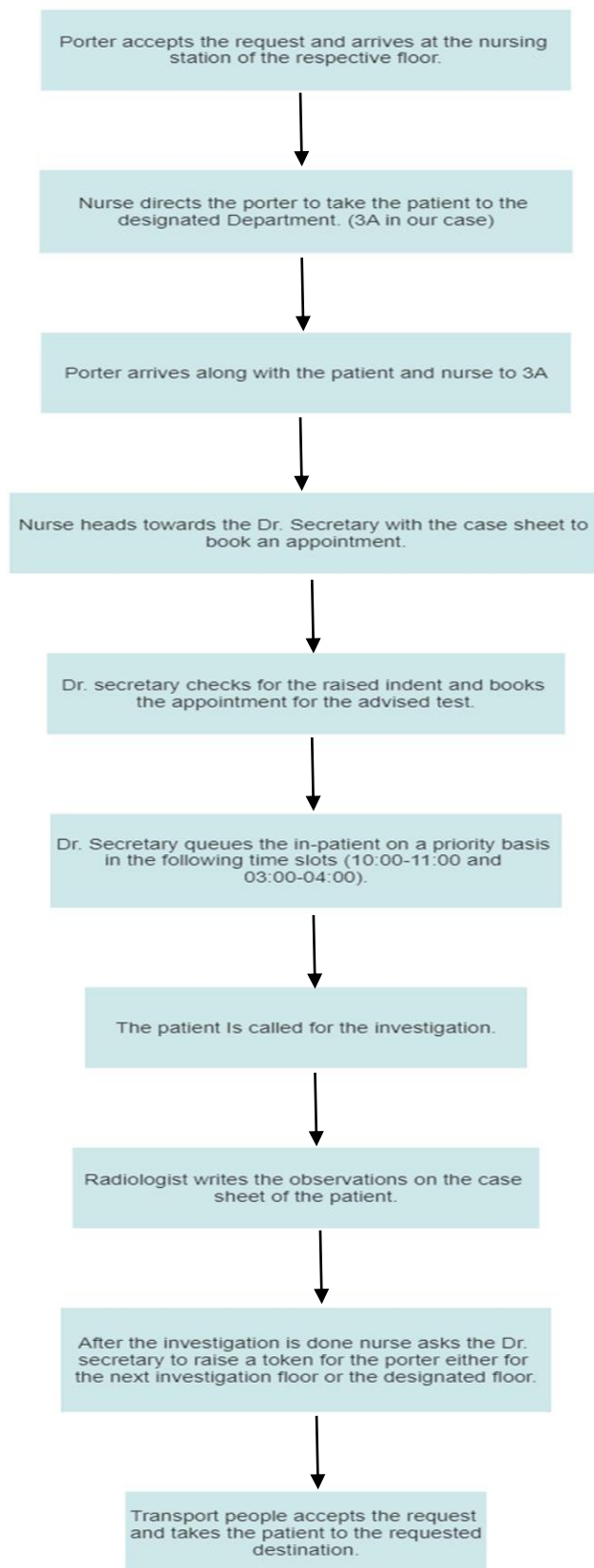


Fig-1.2

1.3.3 inpatient emergency patient

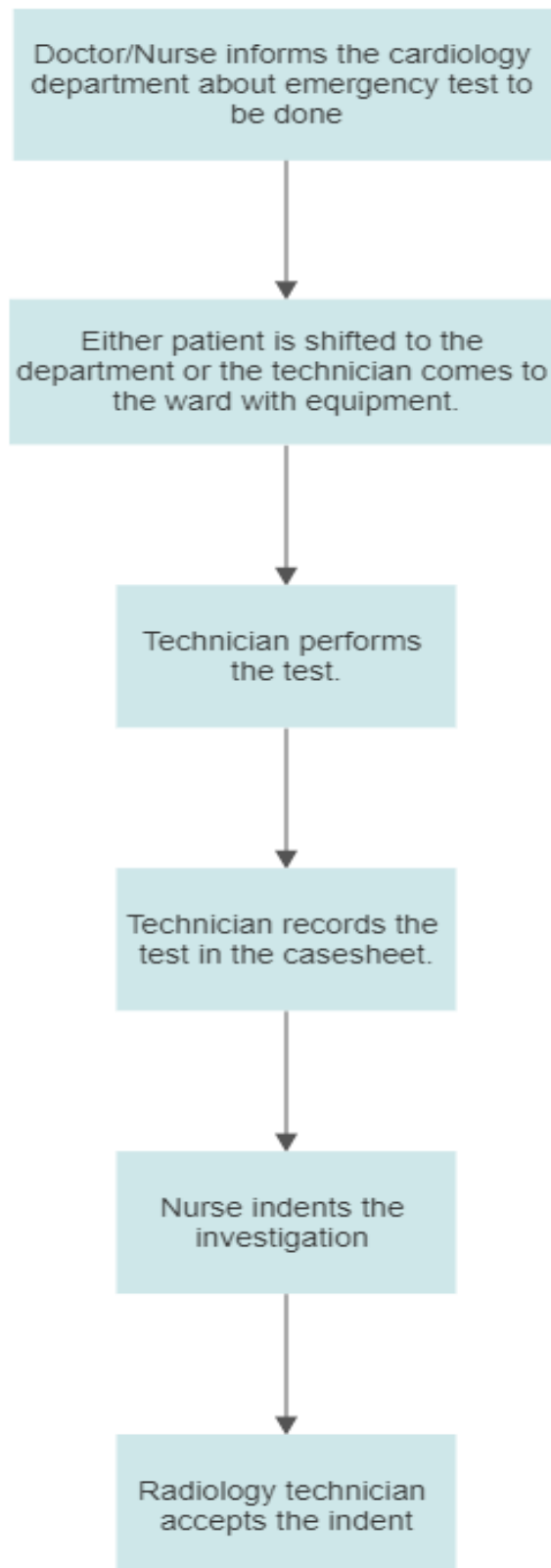


Fig-1.3

1.4 Stakeholders in the Cardiology Investigations:

1.4.1- OP Billers:

- Does the billing for Investigations/ Doctor consultation

1.4.2- Doctor secretary:

- **Scheduling and coordinating appointments:** Doctors construct a diagnosis based on the results of cardiac testing and the overall clinical assessment. They determine the underlying heart ailment or disease and devise a treatment plan. This could include lifestyle changes, medication management, referral for additional specialized care, or interventional procedures like angioplasty or heart surgery.
- **Managing Medical Imaging Orders:** Medical imaging orders are collected and processed by radiology secretaries from healthcare professionals. They ensure that the necessary information, such as the type of procedure and any special instructions, is included by checking the accuracy and completeness of the orders. To clarify any ambiguous or incomplete orders, they may also speak with medical professionals.
- **Coordination with Radiology Staff:** Within the radiology department, radiology secretaries collaborate closely with radiologists, radiology technicians, and other medical specialists. They organize appointments, communicate vital patient data, and make sure that each surgery has the required supplies and tools.
- Asks patient for OP Prescription.
- Accepts indents for IP patients.
- Queues the patients as per the earliest available slot.
- Raises tokens for the transporters.

1.4.3- Doctor:

- **Initial evaluation and history-taking:** Cardiologists are responsible for doing the initial evaluation of patients. For assisting the investigation, they gather relevant medical information, such as symptoms, risk factors, and prior illnesses. The right tests and investigations must be chosen based on a thorough grasp of the patient's history.

- **Clinical examination:** Medical professionals perform a comprehensive clinical examination to evaluate cardiovascular health. Taking vital signs, listening to heartbeats, checking for evidence of cardiac issues, and evaluating peripheral circulation may all be a part of this examination. Clinical results can act as a roadmap for further research and offer important diagnostic cues.
- **Diagnosis and treatment planning:** Based on the findings of cardiac testing and the whole clinical evaluation, doctors develop a diagnosis. They develop a treatment strategy after identifying the underlying heart condition or disease. This could involve making lifestyle adjustments, managing medications, referring patients for more specialized treatment, or undergoing interventional procedures like angioplasty or heart surgery.
- **Long-term management and follow-up:** Cardiologists continue to be involved in the long-term management and follow-up of patients after conducting studies in the field of cardiology. They monitor the patient's progress, assess the effectiveness of the therapy, adjust the dosage of any medications as necessary, and carry out additional research as required. By scheduling frequent follow-up visits, doctors can keep an eye on their patient's cardiac health, identify any changes or problems, and modify the treatment strategy as necessary.

Briefly describing the functions of a doctor:

- Provides consultation to the patients.
- Advice investigations to the patients as per their condition.
- Reviews the reports of the investigation.

1.4.4- Radiology Secretary:

- **Managing Medical Imaging Orders:** Medical imaging orders are collected and processed by radiology secretaries from healthcare professionals. They ensure that the necessary information, such as the type of procedure and any special instructions, is included by checking the accuracy and completeness of the orders. To clarify any ambiguous or incomplete orders, they may also speak with medical professionals.
- **Coordination with Radiology Staff:** Within the radiology department, radiology secretaries collaborate closely with radiologists, radiology technicians, and other medical specialists. They organize appointments,

communicate vital patient data, and make sure that each surgery has the required supplies and tools.

- **Handling inquiries and communication:** The Radiology secretary is the point of contact for questions about cardiac investigations. They may answer phones, send emails, and communicate with patients, healthcare providers, and other staff members to answer questions, offer information, and assist with any administrative issues relating to cardiology examinations.
- **Coordinating with other departments:** Cardiology investigations frequently entail coordination with different departments and healthcare specialists. To maintain a seamless flow of patient information and efficient coordination of services, the Radiology secretary may be responsible for working with other departments such as cardiology clinics, the medical records department, or the cardiac catheterization lab.
- **Maintaining patient confidentiality and conforming to privacy requirements:** Maintaining patient confidentiality and following privacy standards are critical in any healthcare setting. To preserve patient privacy and data protection, the Radiology secretary should handle patient information with care, adhere to privacy protocols, and maintain tight secrecy.
- Informs the patient regarding their Turn for investigation.
- Checks in the patient while entering the investigation room.
- Checks out the patient after the investigation is done.
- Maintains a register with all the patient details.

1.4.5- Radiologist/Technician:

A Radiology technician's function in cardiology investigations entails executing numerous imaging procedures as well as assisting in the diagnostic process. In the context of cardiac investigations, they can play the following roles:

- **Conducting cardiology Investigation:** Radiology technicians may execute a variety of cardiac imaging techniques to aid with cardiology investigations. This includes ECG, 2D-Echo, and TMT. They operate the

imaging equipment, position patients correctly, and capture high-quality images of the heart and related structures.

- **Preparing patients for imaging procedures:** Radiology technicians are in charge of preparing patients for cardiac imaging procedures. This may include explaining the operation, addressing questions, and assuring the patient's comfort and safety. They may also acquire pertinent medical history and information from patients to aid in the imaging procedure.
- **Ensure patient safety and comfort:** During the imaging procedure, radiology personnel prioritise patient safety and comfort. They adhere to correct safety protocols, such as using sterile techniques, monitoring patients' vital signs, and ensuring optimal patient placement and immobilization. They also offer emotional support to patients, allowing them to relax during the treatment.
- **Quality control and equipment maintenance:** Radiology technicians help to assure the dependability and accuracy of imaging procedures by participating in quality control methods. They undertake regular equipment checks, calibration, and quality assurance testing to ensure the imaging equipment's operation and accuracy. They may also report any defects or difficulties with equipment to the relevant personnel for repair or maintenance.
- **Write the findings on the patients Case sheet-** briefs the findings and condition of the patient on the case sheet so that doctor can read and analyse the severity of patient's condition.
- **Signs the Printed reports-** They are responsible for signing the final printed reports, to ensure that everything is mentioned correctly and avoid discrepancies.

1.4.6- Transporters:

- **Patient transport:** Patient transporters are responsible for securely and comfortably transporting patients from their various places, such as their hospital room or outpatient waiting area, to the areas where cardiology investigations will be performed. This can entail bringing patients to the imaging department for procedures such as echocardiography, cardiac CT scans, or cardiac MRI scans, as well as the cardiac catheterization lab for invasive treatments.

- **Communication and coordination:** Transporters interact and coordinate with numerous healthcare specialists participating in cardiology studies. They may accept transport requests from nurses, doctors, or other staff members and ensure that they have all of the essential information about the patient's location, any special requirements, and the scheduled timing of the investigation.
- **Patient safety and comfort:** During transit, transporters prioritise patient safety and comfort. They ensure that patients are appropriately fastened in wheelchairs or stretchers and that adequate safety precautions are taken during transportation. They also make an effort to provide a peaceful and soothing environment for patients, addressing any worries and offering support as needed.
- **On-time Transportation:** Transporters play an important role in ensuring that patients are transported in a timely way in order to minimize delays in cardiac examinations. They prioritize patient transfer while taking into account the investigation timetable and other considerations such as patient condition and urgency.

1.4.7- Patients and their attendees:

- **Providing accurate information:** The patient and their attendant must provide accurate information about the patient's medical history, current medical condition, and any other essential information to the healthcare team, which includes the doctor, nurses, and other healthcare professionals.
- **Medication adherence:** The patient and their caretaker must follow the doctor's recommended medication schedule, which includes taking drugs as instructed and on time.
- **Visits for follow-up:** The patients and their attendant's responsibility is to schedule and attend any necessary follow-up visits with their physiotherapist healthcare providers.

1.5 Basic structure of Cardiology Department at KIMS: -

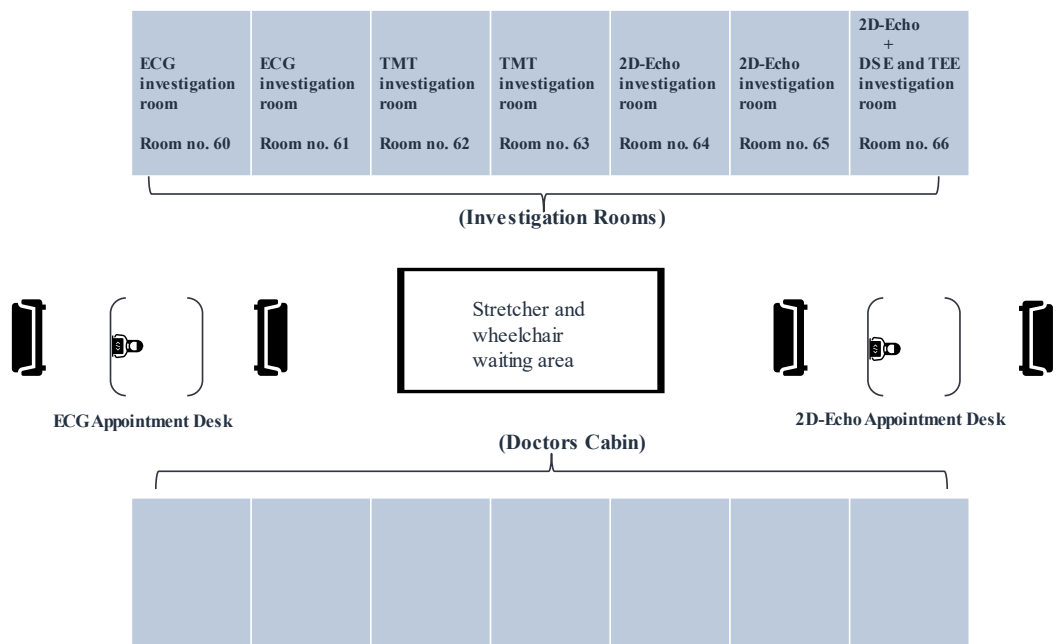


Fig-1.4

2. LITERATURE REVIEW

S No.	Authors (years)	Study Location	Sample Size	Sampling Technique	Salient features
1	Singh et al. (2021)	Kolkata, India	150 patients	Stratified	Conducted a time-motion study to identify workflow bottlenecks and implemented process optimization measures.
2	Gupta et al. (2018)	Delhi, India	300 patients	Convenience	Implemented a digital queue management system with real-time tracking, reducing waiting times by 30%.
3	Verma et al. (2022)	Bengaluru, India	350 patients	Convenience	Explored the use of artificial intelligence algorithms for predictive scheduling and optimizing resource allocation.
4	Patel et al. (2019)	Mumbai, India	250 Patients	Random Sampling	Assessed the impact of staff training programs on improving communication and coordination in the queue system.
5	Sharma et al. (2020)	Chennai, India	200 Patients	Quota sampling	Introduced telemedicine consultations for follow-up visits, reducing in-person visits and associated waiting times.

Table-1

3. METHODOLOGY

3.1 Research Questions:

- What is the current TAT for cardiology investigations in the hospital's cardiology department and how can the queue management system be redesigned to improve time management in cardiology investigations?
- What is the current queue management system in the hospital and how does it affect the TAT for cardiology investigations?

3.2 Research Design:

As it is operational research the information was gathered at the beginning and end of the internship from a sample of patients who underwent a cardiac investigation. The length of time between the Investigation appointment and the actual time of investigation was calculated and the difference in TAT is analyzed.

The sample comprises Out-patients and In-patients from various wards and departments.

3.3 Study setting: The study is conducted in KIMS Hospital, Secunderabad (India).

3.4 Study population: The study was conducted over a sample size of 200 patients.

3.5 Research Approach:

- **Quantitative Approach-** The qualitative approach comprises gathering feedback from staff, family, and patients about their experiences with the cardiac investigation technique. As qualitative measurements, interviews with open-ended questions on communication, information sharing, and delay reasons with the cardiology investigation process, from scheduling an appointment to receiving reports, were employed. This method allows for the identification of process bottlenecks.
- **Quantitative Approach-** In this method, both primary and secondary data are used. The primary data is collected by manually observing and noting the check-in and check-out time of patients by random sampling who comes for cardiology investigation, the secondary data is retrieved from the compliance report of the current Queue management system.

3.6 Inclusion criteria: The study population will comprise all OP-IP patients who undergo cardiology investigations in the hospital's cardiology department.

3.7 Exclusion criteria: Patients who refuse to participate in the study or patients with incomplete medical records will be excluded from the study.

3.8 Study Approach

- **Sample Size Calculation:** Randomized sampling technique is used to calculate the sample size. As it is a comparative analysis the data is collected at the beginning (13th march-18th march) and end (15th May-20th May) of the study. Approx 150 Outpatients were observed for various cardiology investigations such as ECG, 2D-Echo, TMT etc on a daily basis in the cardiology department which sums up to nearly 2100 patients in two weeks. Hence, a considerable sample size of 200 patients was taken for the conduction of the study.
- **Sampling Technique:** The study's participants were chosen using a random sampling approach, as there are 5 different cardiology investigations, namely- ECG, 2D-Echo, TMT, DSE, and TEE with the majority of patients from ECG and 2D Echo test hence an observational study with comparison of pre-and post-intervention of the data collection.
- **Study Instrument:** This study uses a few modes to retrieve information regarding the calculation of Cardiology investigation TAT. The first one being the check-in check-out time from the current Queue Management System of the department, The manual register maintained by radiology secretary in every investigation room to tally the data with the compliance report from the QMS, Radiology module for PF of IP and OP, IP daily activity module for QMS details, I-porter app for the transportation of patient from cardiology department to the designated place.
 - Queue Management System
 - Manual Register
 - Radiology Module
 - IP daily activities module
 - I-porter App

- **Operational definition:**

- Arrival Time- The time at which the Patient enters the hospital premises is known as arrival time.
- Appointment Time- The time at which the Patient gets the appointment for either consultation or Investigation is known as Appointment Time.
- Check-in Time- The time at which the patient enters the investigation room.
- Check-out Time- the time at which the patient exits the room.
- Waiting Time- The difference between the time when a patient gets his/her Appointment, and the check-in time is known as Waiting Time.
(Appointment Time – check-in Time)
- Procedural time- The total time taken for an investigation to be completed i.e. the difference between the check-in and Check-out Time of a patient is called Procedural time.
- Differ Time- the difference between the arrival time and the appointment time via Billing is called Differ Time.

3.9 Data Collection Procedure-

The data is retrieved from the compliance report of the current Queue Management system and is also collected manually observing the check-in and check-out time of the patient. Cardiology investigations TAT is the time that is taken for a patient to get into the investigation room after getting an appointment and Procedural TAT is the extra time taken from the average time taken to conduct an investigation. The data is also cross-verified from the register maintained manually in each room.

3.10 Ethical Consideration-

Throughout the study, data security and confidentiality are maintained; patient information such as UMR numbers, names, and dates of birth are not disclosed. Maintaining data security during the hospital investigative process study is critical to protecting patient privacy and the confidentiality of their medical records.

Obtaining the necessary permissions and approvals from relevant authorities, such as hospital ethics committees and regulatory bodies; using secure data storage and transfer

methods, such as encrypted communication channels and password-protected databases; de-identifying patient data by removing or encrypting personally identifiable information; and restricting data access to authorized individuals are some actions that can be taken to ensure data security. Both the staff and the patients must vocally consent.

Both the staff and the patients must vocally consent. They are alleged to have been told of the purpose of the photography. Oral Informed agreement was obtained from staff, mentors, and patients to photograph them and utilize them in the dissertation.

4. RESULT

As it is an Operational research, pre-and post-intervention of the data of ECG, 2D-Echo, and TMT is compared. Efficiency in cardiac investigations is required to provide prompt diagnosis and treatment, improve patient outcomes, improve patient experience and satisfaction, optimize resource utilization, produce cost savings, and enable data-driven decision-making. These components all work together to improve healthcare system performance and provide high-quality cardiac care.

After analyzing the data here are the following findings:

The main objective of this project was to reduce Waiting time also known as TAT for the patient coming for cardiology investigation. As we can see from the below mentioned graphs in Fig-4.1 and 4.2 we could easily comprehend that TAT has reduced nearly by 48% in the case of 2D-Echo, by 35% in the case of ECG and by 32% in TMT by the redesigning of the QMS and Implementation of operational changes.

We can also conclude that waiting time is not an issue in the case of DSE and TEE, as the wait time is even less than 5 minutes. As observed in Fig-, DSE and TEE are time-consuming tests that are performed in one of the 2D-Echo rooms, resulting in increased waiting time for 2D-Echo by blocking one of the rooms.

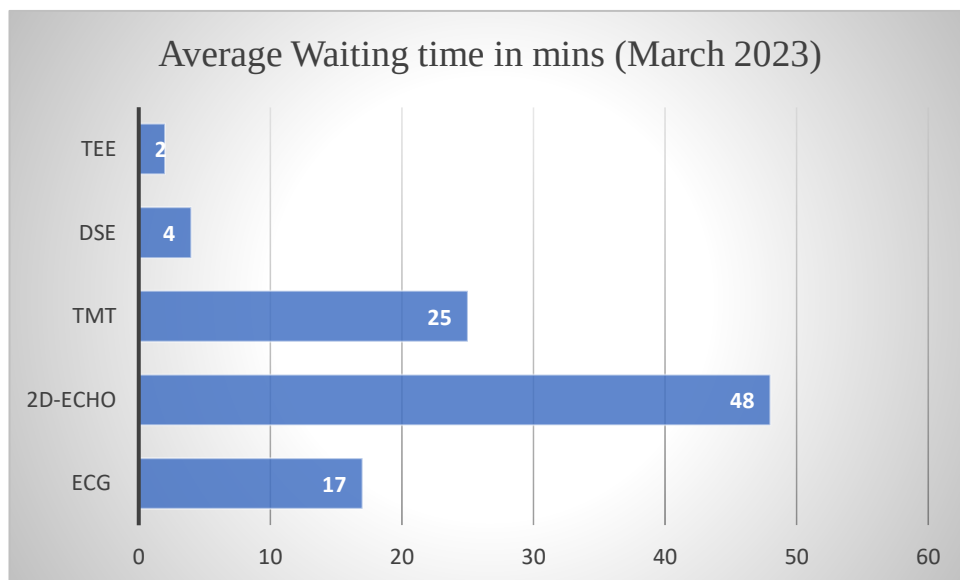


Fig-4.1

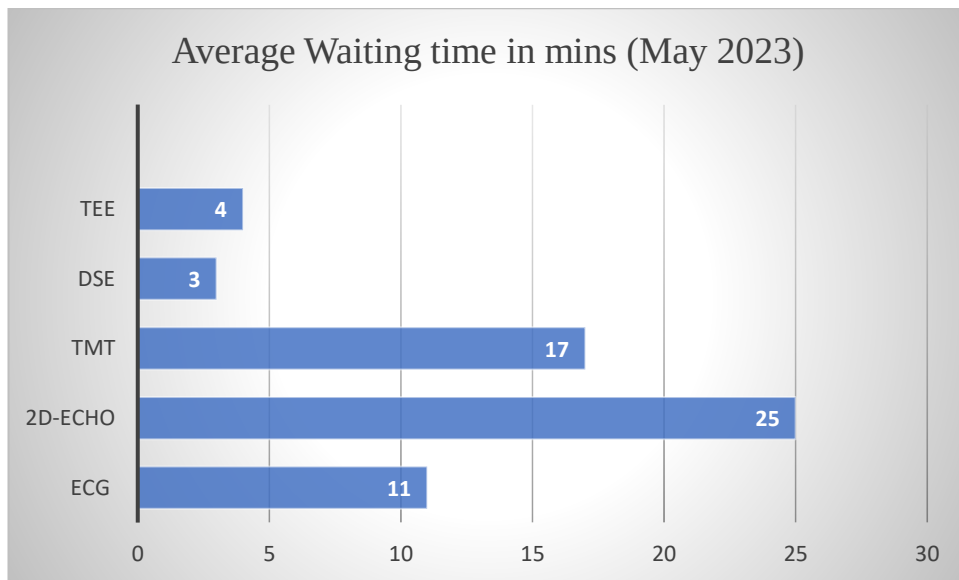


Fig-4.2

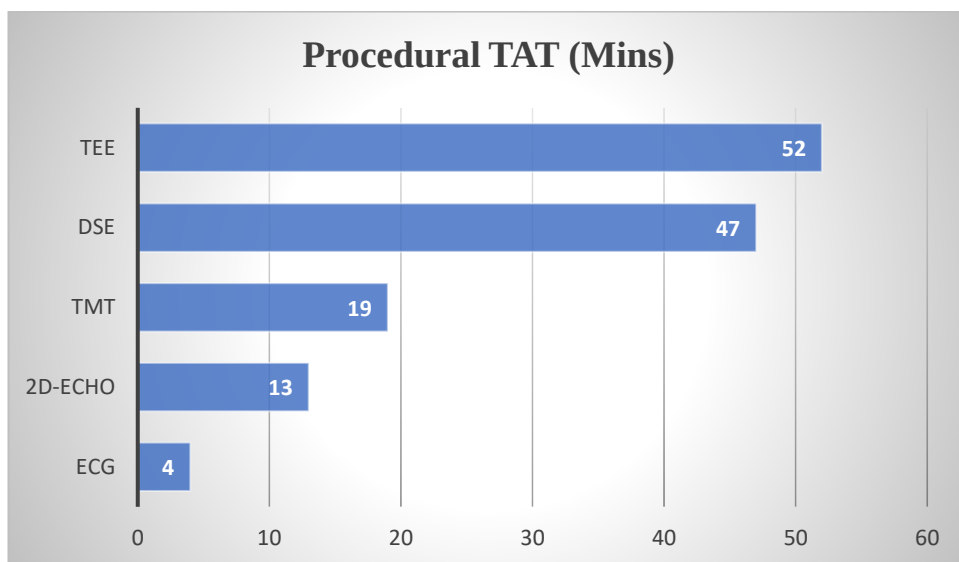


Fig-4.3

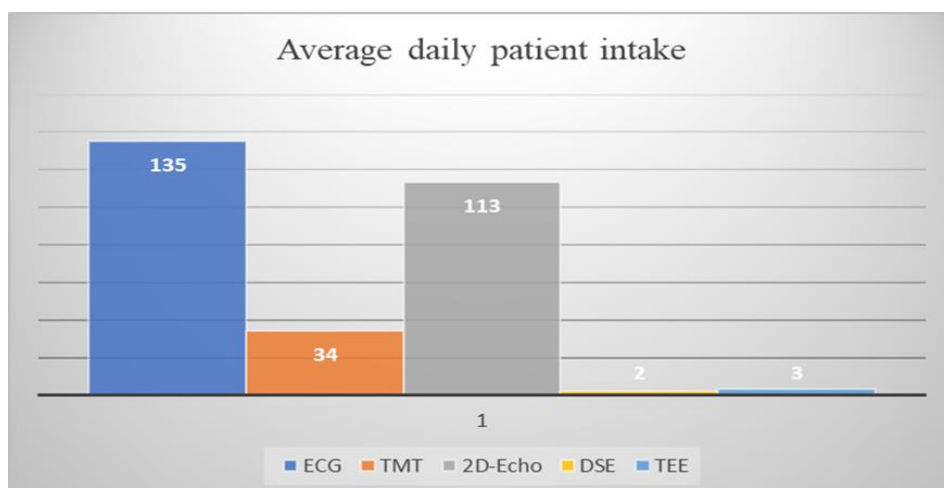


Fig-4.4

From the graph mentioned in Fig-4.3 and 4.4, we can conclude that DSE and TEE are the most time consuming and least frequent test conducted in KIMS cardiology department, Hence, dedicating a separate room for these two tests will be a waste of resource, in return what we could do is utilize a room as spare 2D-echo conducting room, In case there is an appointment for DSE or TEE.

And as majority of DSE and TEE appointments are pre-booked, one must try to give the appointments on days with less patient flow like on Saturdays and should also make sure to not book appointment for peak hours i.e., 10:00 AM to 02:00 PM (Fig-4.9) in case of 2D-Echo.

4.1 ECG

The average number of patients daily

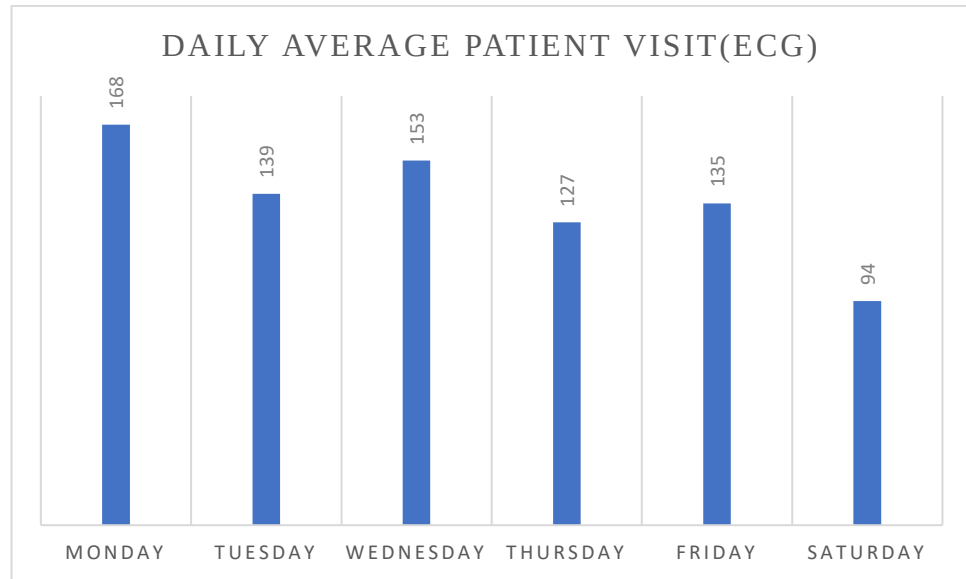


Fig-4.5

The graph in Fig-4.5 depicts that Mondays are the busiest day with maximum numbers of appointments, followed by Wednesday. This graph also shows that the cases are minimum on Saturdays.

As per Fig-4.5, The peak hour for ECG is 10:00 AM to 02:00 PM, which means more attention is required during this time to maintain easy flow of the patients.

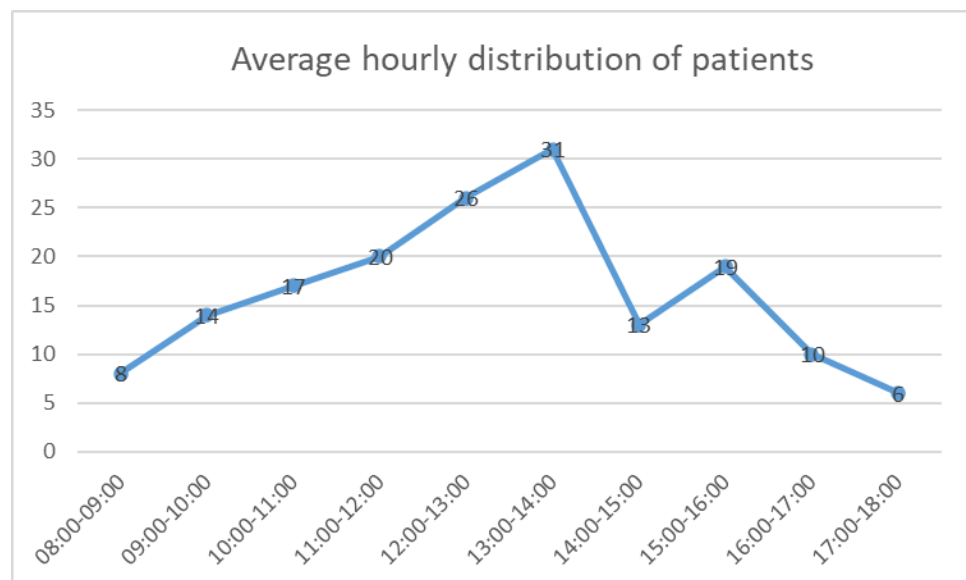


Fig-4.6

4.2 TMT

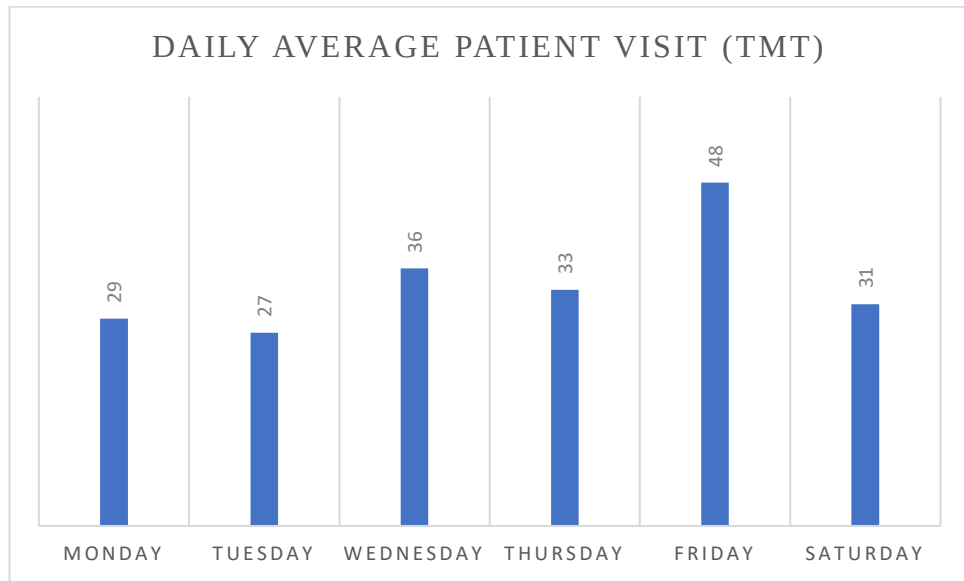


Fig-4.7

As the total number of investigations in case of TMT are considerably lesser when compared to ECG and 2D-Echo. The graph in Fig-4.5 states Friday as the busiest day with maximum numbers of appointments, followed by Wednesday. This graph also shows that the cases are minimum on Tuesday.

The graph in Fig-4.6 states that the peak hour for TMT is from 11:00 AM to 02:00 PM.

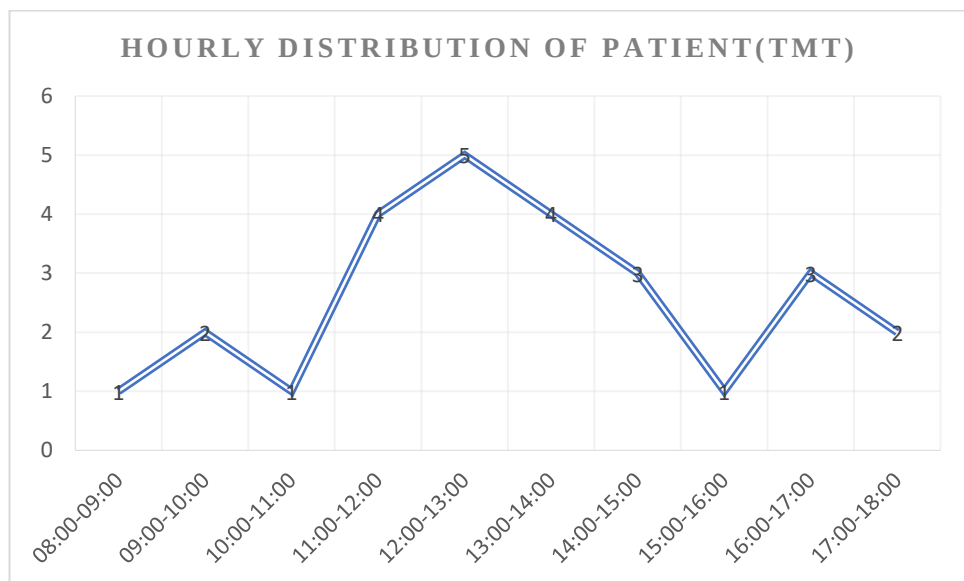


Fig-4.8

4.3 2D-Echo

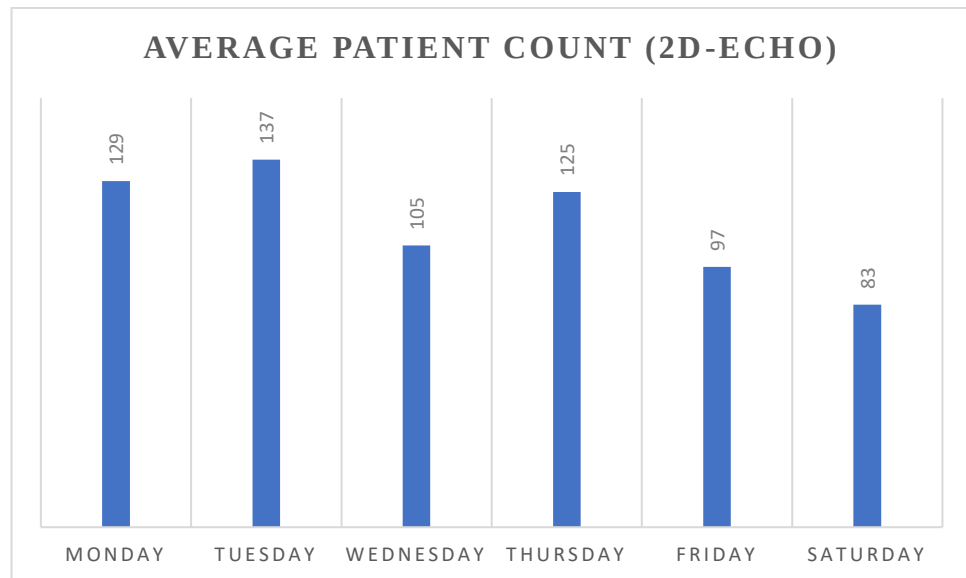


Fig-4.9

The graph in Fig-4.7 depicts that Mondays and Tuesdays are the busiest day with maximum numbers of appointments, followed by Thursday. This graph also shows that the cases are minimum on Saturdays.

As per Fig-4.9, The peak hour for 2D-Echo is 10:00 AM to 02:00 PM, which means more attention is required during this time to maintain easy flow of the patients.

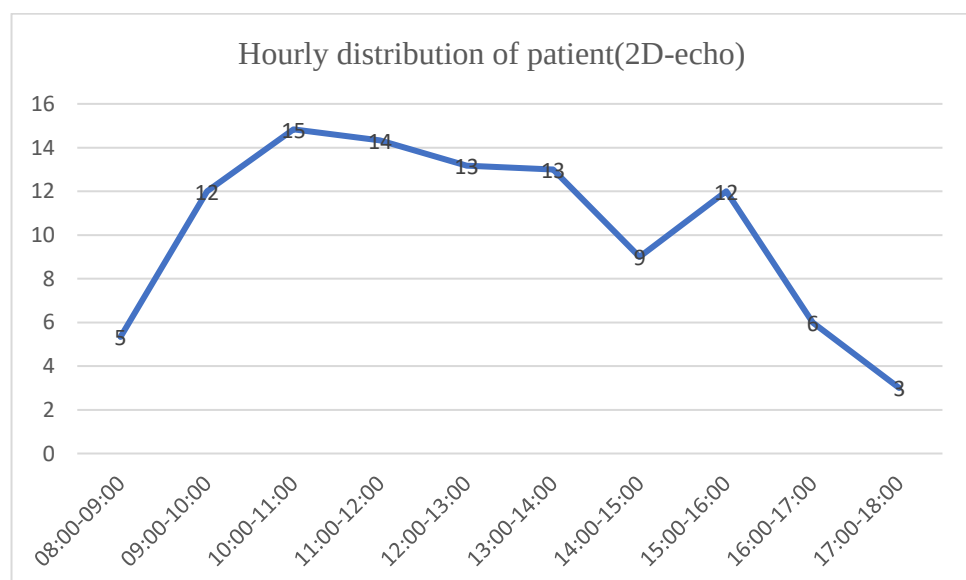


Fig-4.10

4.4 TEE

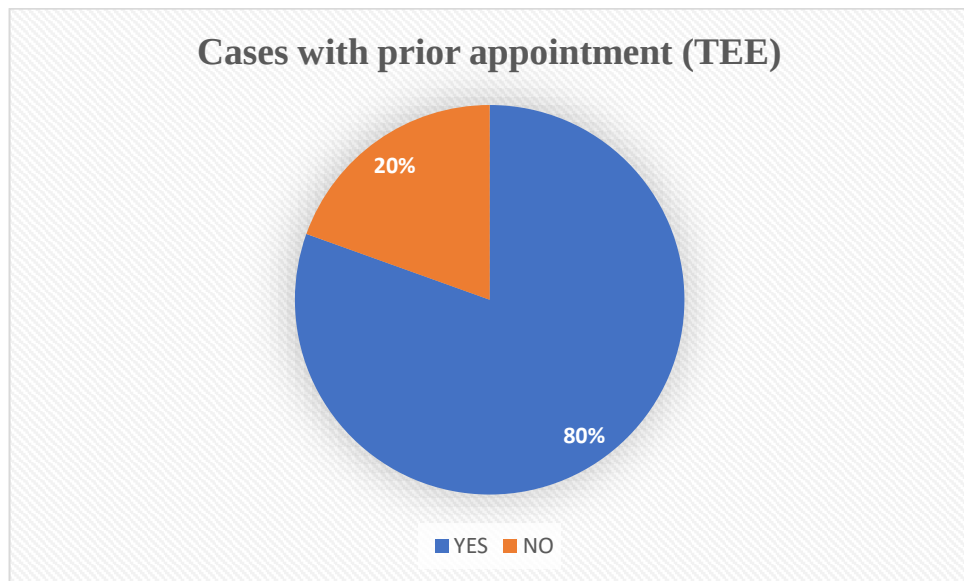


Fig-4.11

As majority of appointments for TEE and DSE (Fig-3.9 and 3.10) are pre-scheduled, one must make sure to book appointment on days when the Patient flow for 2D-Echo is supposed to be less; and not during the peak hour of investigation.

4.5 DSE

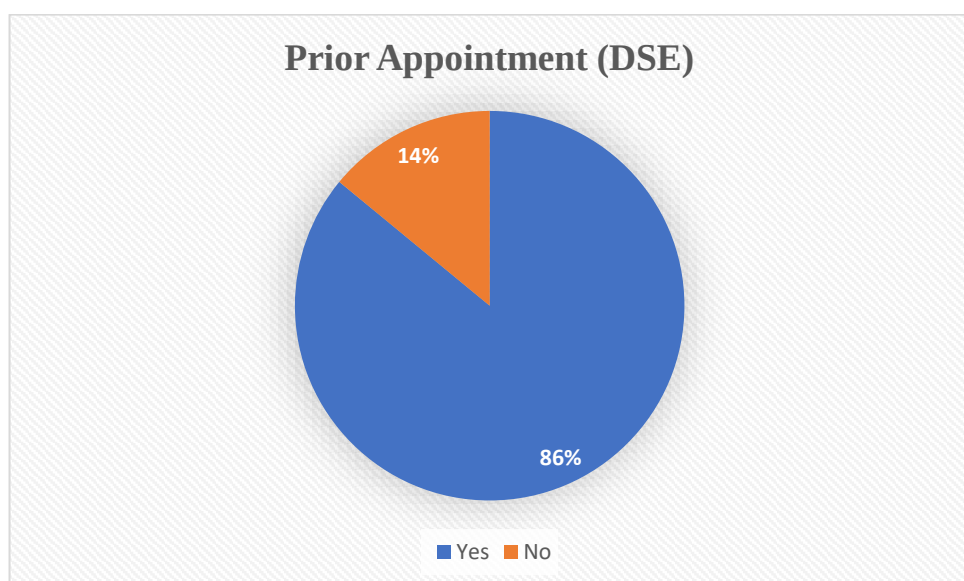


Fig-4.12

5. DISCUSSION

5.1 Suggested changes in the Queue Management System: -

1.

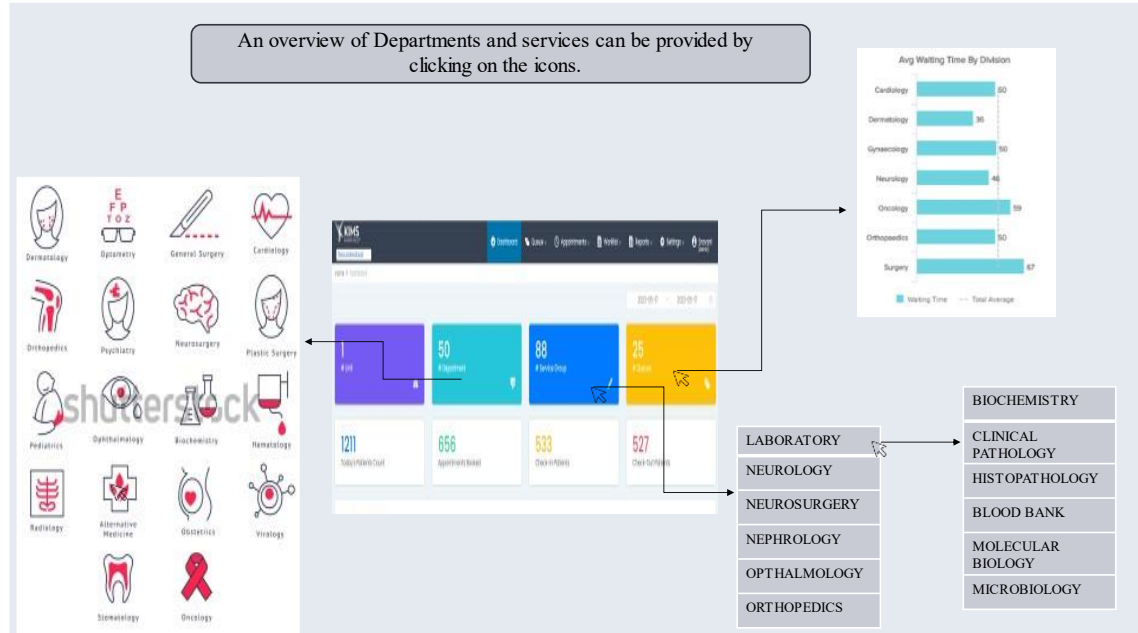


Fig-5.1

To enhance the User Interface of the dashboard of current QMS some features must be added to give a better insight of the hospital, and to make it convenient even for the 1st time user.

Hence, clicking on icons such as “Department”, “Services”, and “Queue” must show the list of “departments available”, “services Provided” and “Waiting time of different departments” at KIMS.

2.

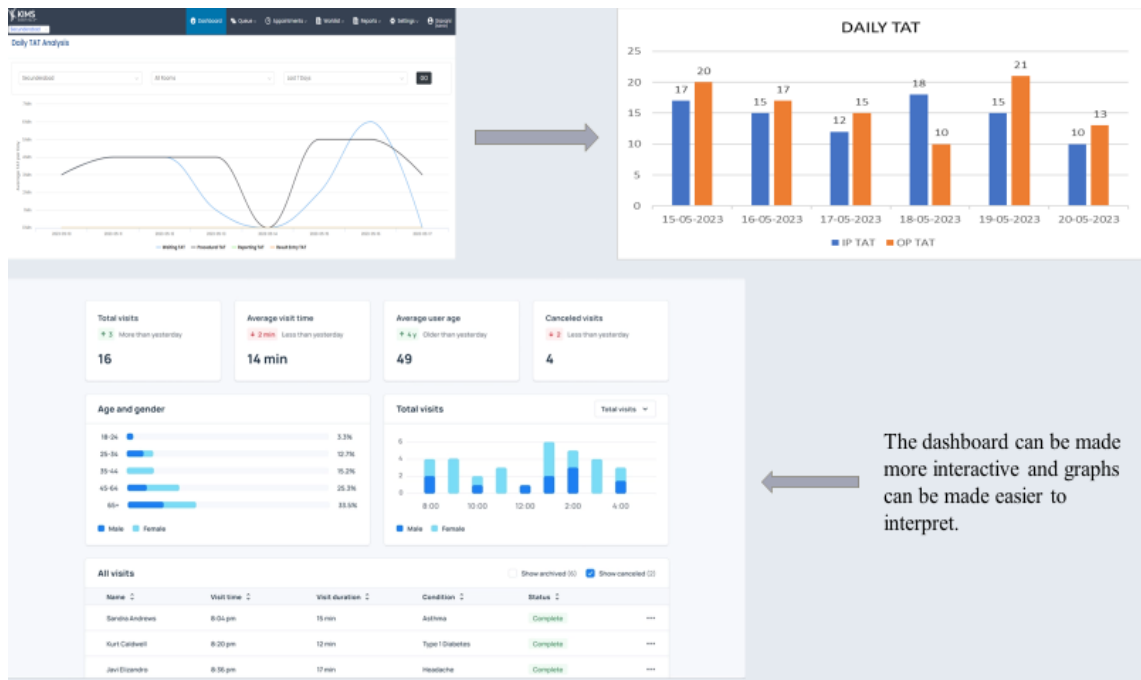


Fig-5.2

The graph present on the dashboard is quiet tough to understand, and even shows incorrect waiting time, Hence, an easily comprehensible graph must be represented to shoe the real time TAT in various departments, so that people can identify the area of utmost need

3.

Fig-5.3

Generation of unique barcode for specific UMRs for quick appointment booking, therefore; leading to reduced waiting time of the patient.

4.

TAX INVOICE

ORIGINAL

GST REG NO. M2007905-5

ISSUE DATE / FB 31.03.2017 1051 hrs Page 1 of 1

PATIENT: MR JOHN SMITH

Tax Invoice Number: 681008238300005

SS Ref Number: 68100823830-0005-01

Tax Invoice Date: 31.03.2017 1051 hrs

Patient Name: MR JOHN SMITH

Visit Date: 31.03.2017 0941 hrs

Visit / SS Location: GCL7HGGCL7HGGTO

Payment Class: PRIVATE

Type of Supply: Cash/Credit

SERVICE CODE	DESCRIPTION	QUANTITY	AMOUNT (\$S)	
			Full Rate	Amount Payable
76000205	PROFESSIONAL FEES - DOCTOR SNR CONS - REPEAT VISIT Subtotal	1	61.00	61.00
	DRUGS / PRESCRIPTIONS / INJECTIONS			
PHANDQ	BENGAY GREASELESS 202	2	26.60	26.60
PHAND2	TRAMADOL HCL 50MG CAP	90	9.00	9.00
PHAND2	ALENDRONATE 300 TONG VIT D 2800 IU TAB	3	196.00	196.00
PHAND2	KETOPROFEN 30MG PLASTER W/S	6	8.34	8.34
PHASTO	PARACETAMOL 500MG TAB	240	12.00	12.00
PHASTO	CALCIUM 450MG, VITAMIN D 200 U TAB	180	9.00	9.00
	Subtotal		348.94	348.94
TOTAL CHARGES				
AMOUNT PAYABLE			325.94	325.94
AMOUNT PAYABLE BEFORE TAX			325.94	325.94
ADD: 7% GST			22.81	22.81
AMOUNT PAYABLE AFTER TAX			348.75	348.75
NET AMOUNT PAYABLE			348.75	348.75
MR. JOHN SMITH				
PAYMENT				
MR. JOHN SMITH 31.03.2017 AMEX			348.75	348.75
AMOUNT DUE FROM				
MR. JOHN SMITH				0.00

*** You are served by: MARY TAN DEMO ONLY ***

Only party who is under a contractual obligation to reimburse the medical expenses shown on this bill, is required to refund to Medixim and Medixim (OP) the Medixim-approved Integrated Plan. To make payment to Medixim and Medixim (OP), please send a cheque to GPF Board or pay over the internet online, accompanied by a valid ID card. To make payment to the Medixim-approved Integrated Plan, please send a cheque directly to the private insurer, accompanied by the Medixim-approved Integrated Plan. All payments are to be accompanied with a photocopy of this bill and a payment advice or the payment of reimbursement to be received by Medixim and Medixim (OP) the Medixim-approved Integrated Plan. (Occupational category and deductible against Medixim contract for services approved under the Medixim scheme)

This may only be paid at Medixim (OP), Sun 8 (Sun 8 Public Hospital). Cheques should be issued and made payable to SINGAPORE GENERAL HOSPITAL. Please quote the Code Number, Paper Name and Content No. before the cheque. Payment can also be made at any A&P outlet. (A&P outlet, A&P outlet, Singapore Post branches or other e-wallets, etc.) (Cheque, a payment, at Singapore Post branches should be issued and made payable to Singapore Post Limited). A handling fee will be imposed for request of additional copy of the bill.

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3008-23-005-A (HCV 06)

Addition of a QR Fig-5.4 containing information regarding self-appointment for the investigations advised by the doctor.

‘Or’

Booking of appointment for the tests automatically which the patient gets billed.

5.2 Implemented solutions that helped in reducing Cardiology Investigation TAT are:

1. **Bifurcation of OP and IP patients-** An IP patient is someone who has been admitted to the hospital for a lengthy period, frequently needing nightly stays. These patients may have a serious or complex medical condition that requires close monitoring, intense treatment, or surgical treatments. They are treated at the hospital's inpatient units, such as medical wards, intensive care units (ICUs), or specialized departments.

As they are admitted to the hospital, they have the flexibility of getting diagnosed at their convenience. Giving dedicated slots for Inpatients for 2D-

Echo investigation i.e. (10 am- 11 am) and (3 pm – 4 pm) has considerably decreased the waiting time for the In-patient and has helped in managing the flow of In-patients.

2. Tracking Porters- Transportation is one of the major problems across the hospital and as we can clearly see that efficient transporter flow can significantly reduce the Turnaround Time (TAT) of cardiology examinations in a hospital by Streamlining the processes, Monitoring whether the transportation request is sent to the nearest porter or not. Hence, keeping a close track of porters has significantly increased their efficiency and has led to the major problems faced by them.
3. As ECG is mandatory for 2D-echo, hence a notification can be sent to the 2d Echo counter to book a prior slot for the same while the patient checks into the ECG room, this made the appointment booking more convenient.

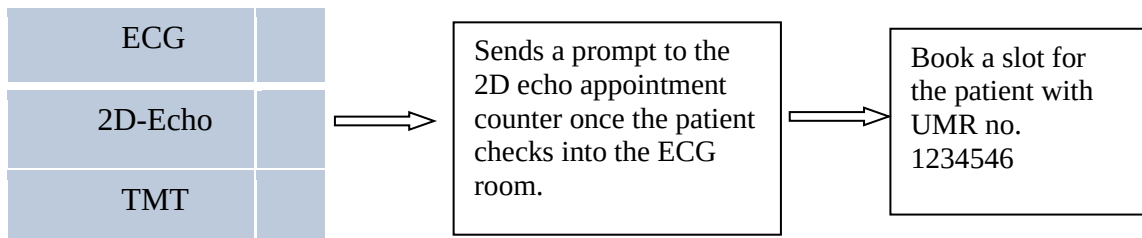


Fig-5.5

4. Changing the slot configuration of 2D-echo in the QMS from 6 mins to 15 mins, as the average procedural time of 2D- echo is 15 mins.
5. Addition of a buffer time slot of 1 slot (5 mis in case of ECG/15 mins in the case of 2D-echo) after every 5 patients to prevent a domino effect and cover up the extra time taken by any patient.

5.3 Observational problems in the cardiology department with suggested solutions

1. OP Patients

Problems Faced in Cardiology Department	Suggested Solutions
No proper sign boards are available for the patient's ease.	Proper Boards with signs should be placed on the appointment counters and Report dispatch counter.
High Waiting Time is observed in the 2D echo Test in case any TEE or DSE investigation is scheduled.	Room no. 54 (Used for Pacemaker only on Wednesdays) can be utilized as a buffer 2D echo room in case of TEE and DSE Investigations. ‘OR’ Giving appointments for DSE and TEE on lesser rush days like Saturday and in the 2nd half of the day
No information regarding the generation of the report is promptly provided to the patient.	Patients must be informed regarding collection of their reports of 2D-Echo as they keep waiting even after completion of their reports.

Table-2.1

2. IP Patients

Problems Faced in Cardiology Department	Suggested solutions
Sometimes nurses send the patient to the floor without raising an indent for investigation.	Nurses must always raise an indent to dr. secretary before sending the patient for investigation.
The nurse sends the emergency patient without informing the doctor's secretary, which delays the Patient's investigation.	Nurses must inform the Dr. secretary about the emergency case and get the earliest slot confirmed.
Dr. Secretary does not accept the indent raised by the nurses until the nurse comes to the floor.	Dr. Secretary must accept the indent and give the earliest slot (If it is between 10-11 am and 3-4 pm).

Table-2.2

6. CONCLUSION

Finally, the development of the queue management system and the execution of operational modifications have greatly reduced the Turnaround Time (TAT) for cardiology investigations. A more effective and streamlined procedure was built by analyzing the inadequacies of the old system and finding opportunities for improvement, resulting in faster and more accurate diagnosis and treatment for patients.

The new queue management system has improved resource allocation, ensuring that patients are seen promptly and in a systematic manner. The system can identify possible bottlenecks and distribute resources, minimizing waiting times and optimizing the workflow, by utilizing modern technology and data-driven approaches such as predictive analytics and real-time monitoring.

The efficiency of the cardiology investigation process has been improved further by operational adjustments such as Bifurcating OP-IP investigation timings, Monitoring the I-porter app to avoid delay in the arrival of the porter, and implementing standardized standards. The overall TAT has been greatly decreased by optimizing resource utilization and enhancing coordination among diverse healthcare providers. This not only benefits patients by providing faster access to critical studies, but it also increases the cardiology department's capacity to handle a higher volume of cases.

The better patient outcomes and increased satisfaction levels demonstrate the positive impact of the new queue management system and operational modifications. Patients can receive timely diagnoses with shorter TAT, allowing for early interventions and therapies. As a result, heart diseases are better managed, patients are happier, and healthcare expenses may be reduced.

It is critical to remember that the success of the redesigned system and operational modifications is dependent on ongoing monitoring, evaluation, and refining. The queue management system will stay successful and responsive to changing needs through regular evaluation of key performance indicators, feedback from patients and employees, and the adoption of emerging technology and best practices.

To summarize, the redesign of the queue management system, as well as the execution of operational modifications, have proven to be effective in reducing the TAT for cardiology examinations. The increased resource allocation and coordination among healthcare experts, as well as the optimized workflow, have resulted in faster and more efficient cardiac care, eventually benefiting both patients and the healthcare system.

7. REFERENCES: -

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