IMPLEMENTING SIX SIGMA METHODOLOGIES FOR QUALITY ASSURANCE IN THE DEPARTMENT OF RADIOLOGY

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CONTENTS

- Study Place
- Aim of the Study
- Objective of the Study
- Methodology
- Findings
- Analysis
- Recommendation
- Conclusion

STUDY PLACE

- The project was done at Metro Manas Arogya Sadan Heart Care & Multi Speciality Hospital, Jaipur which is one of the first flagship hospital in Jaipur made on Public Private Parternship (PPP) mode with State of art infrastructure supported by Rajasthan Government. Multi Speciality Hospital of 220 bedded catering to patients from all over the state of Rajasthan.

AIM OF THE STUDY

- To develop a standardized methodology to decrease the report turnaround time.
- To improve patient satisfaction.

OBJECTIVE OF THE STUDY

- To study the current process flow of radiology department, find out the gaps, modify and streamline the same in such a way that maximum efficiency can be achieved by reducing the turnaround time of reports.
- To measure the data in order to identify the extent of problem.
- To analyse the data and comparing it with the standard process.
- Provide a project roadmap to improve the process flow and develop appropriate solutions.
- Proper training of nursing & technician staff to improve the quality of documentation required for maintaining record for turnaround time.
- Proper monitoring for sustainability of results.

METHODOLOGY

The study is Prospective cum Retrospective Analytical Study. A Comprehensive study has been conducted to assess the overall existing performance of Radiology Department.

- To analyze Patient Perception towards various components of care and support services like clinical care, quality of service, infrastructure facilities availing from Radiology Department.
- To analyze overall satisfaction level considering factors affecting performance of job responsibilities of all the health care providers engaged in the Radiology Department

Study Area:

Radiology Department at Metro MAS Hospital, Jaipur.

Method of Data Collection:

(a) Primary Data: Patient feedback forms.

- Self administered Interview Schedule for Patients Perspective.
- Questionnaire for Patients Perspective.

(b) Secondary Data:

- Obtained from HIS (system & records).
- Records from registers: Various records will be viewed for collection of data.

Sample size:

(a) Customer Feedback: 70 patients were interviewed. The sampling for each investigations is done on random basis.

(b) CT Scan: 161
(c) USG: 931
(d) X-Ray: 1630

} Data for 30 days

Study Framework:

Six Sigma approach was used in the study framework. Here DMAIC theory was applied.

Study Tools:

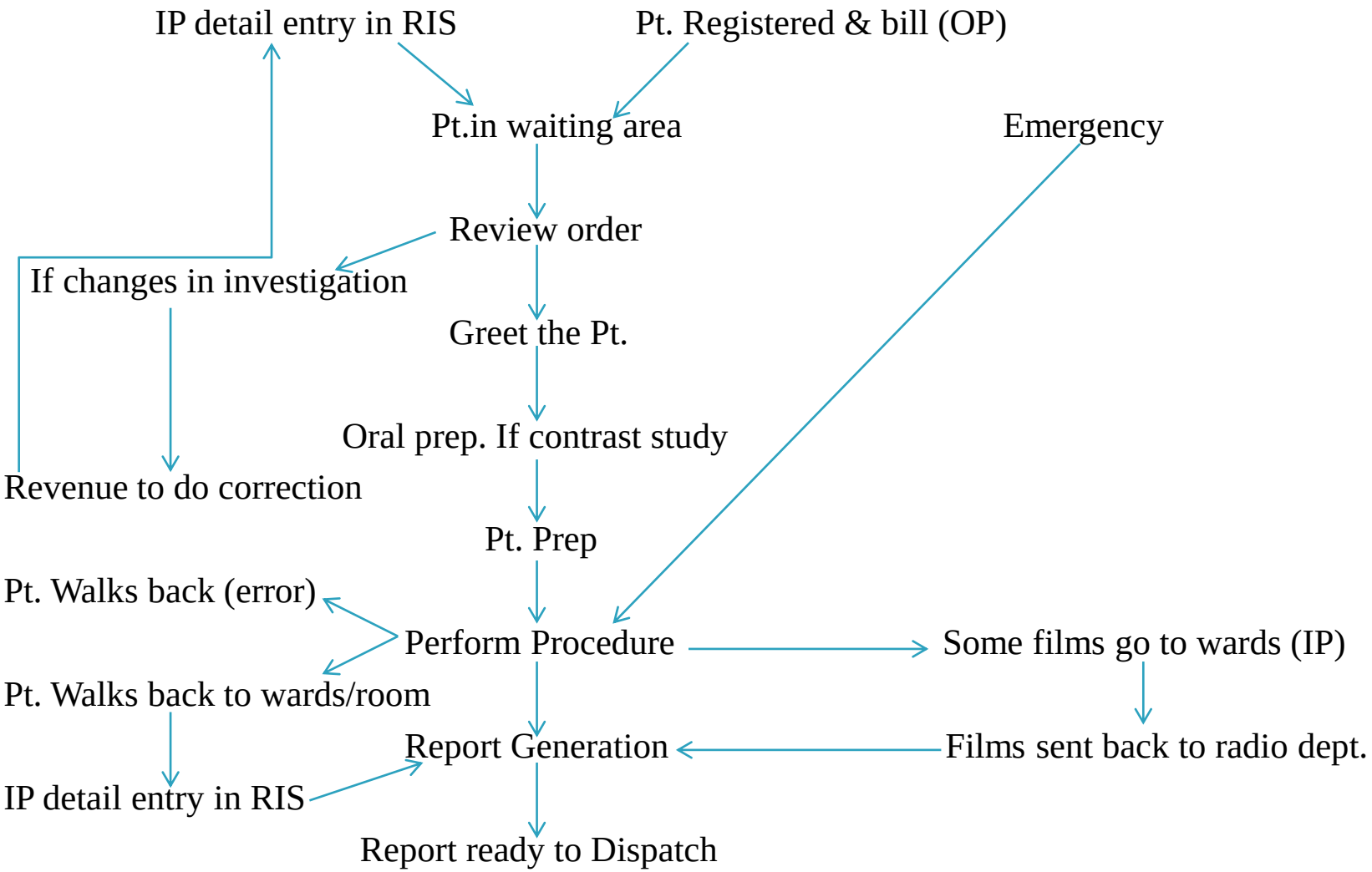
SIPOC diagram, Process Mapping, Voice of Customers, CTQ Prioritization Matrix, Process Analysis, Fishbone Analysis, and Process Redesigning.

FINDINGS: DEFINE PHASE

SIPOC Diagram (Supplier-Input-Process-Output-Customer *Diagram)*

SUPPLIER	INPUT	PROCESS	OUTPUT	CUSTOMER
Inpatient Dept/wards	1.Inpatient staff, Complete information related to patient 2.Housekeeping staff 3.Revenue dept. For billing of inpatients 4.Outpatient staff	Test Performed	Report Delivered	Doctors Nursing staff
OPD Counter	5. BME for machine calibration. 6. IT dept. For maintaining RIS.	Report Printed	On time	Technician staff
Emergency	7. Report transcriptionist.	Report Delivered		

Process Mapping



Voice of Customers (Patient Feedback)

- Voice of customers was obtained in order to identify the major areas of concerns in the department.
- **Sample size**: 70

Voice of customers showing patient Feedback

Sr. No.	Quality Indicator	Excellent	Good	Average	Poor
1	Waiting Time	20	41	8	1
2	Quality of HK. services	19	40	9	2
3	Report on time	9	25	30	6
4	Common Skills of staff	26	35	9	0
5	Billing services	22	39	9	0
6	Competency of Doctors & staff	28	35	7	0
7	Courtesy of staff	24	42	4	0

Factors Critical to Quality (CTQ)

- From the Voice of Customer's, 5 factors critical to quality were derived on the basis of performance.

Factors Critical to Quality

Sr. No.	Factors
1	Waiting Time
2	Quality of HK. services
3	Report on time
4	Comm. Skills of staff
5	Billing services

From the 5 factors critical to quality, prioritization matrix was done in order to identify the critical factor on which six sigma has to be applied.

CTQ Prioritization Matrix

- This matrix cannot be used for more than 5 variables.
- Rating of importance to customers is done on the scale of 1-5-9.

  Scale 1 – No impact

  Scale 5 – Medium impact

  Scale 9 – High impact
- Relationship Rating is the relationship between variables and the impact of variables and is done on the scale of 1-5-9.

  Scale 1 – Low/Week

  Scale 5 – Medium

  Scale 9 – High/Strong

CTQ Prioritization Matrix

Sr. No.	Factors Critical to Quality	Impact of 1 on custo.(9)	Impact of 2 on custo.(5)	Impact of 3 on custo.(5)	Impact of 4 on custo.(5)	Impact of 5 on cust.(5)	Total
1	Report on time	9	5	5	1	1	141
2	Quality of HK. service	5	9	1	1	1	105
3	Comm. Skills of staff	5	1	9	1	1	105
4	Waiting Time	1	1	1	9	5	89
5	Billing services	1	1	1	5	9	89

MEASURE PHASE

- A total of 30 days was collected for the three different investigations. Analysis of the current process showed that average turnaround time for various investigations calculated was as follows:

Average Turnaround time for CT scan, USG, and X-Ray

Investigation	CT Scan	USG	X-Ray
Calculated Average TAT	3.17 hours	2.71 hours	4.97 hours

- **Data Measurement for CT Scan**

CT scan showing average TAT

Category	Size	Mean TAT(hrs)
OP	60	2.73
IP	101	3.43
Critical	11	1.96
Total(OP+IP)	161	3.17

Showing TAT Ranges for OP and IP cases of CT Scan

Range in Hours for Average TAT	OP Cases	OP Av.TAT	IP Cases	IP Av. TAT
0-1	6	2.73 hrs	3	3.43 hrs
1-2	31		32	
2-3	8		26	
3-4	6		14	
4-5	2		14	
5-6	0		0	
6-7	0		0	
7-8	2		2	
8-9	0		0	
9-10	2		2	
10-15	3		8	

DPMO (Defects Per Million Opportunity)

- DPMO = (1,000,000*No. Of Defects)/No. Of Units*No. Of opportunity

Showing DPMO for CT scan as per SOP

Category	Units	Defects	No. Of Opportunity	DPMO
CT Scan(OP)	61	22	2	180327
CT Scan(IP)	100	39	2	195000
CT Scan(Critical)	11	10	2	454545
Total(OP+IP)	161	61	2	189440

Defects indicate the number of patients who failed to follow the SOP for TAT. 61 cases of 161 cases show a defect of 38%.

Showing DPMO for CT scan as per policy at Metro MAS Hospital

Investigation	9-11am by 2pm	11am-5pm by 7.30pm	5pm-9am by 12pm	Total Defects	No. Of Opportunity	DPMO
CT(OP)	6/12	0/38	6/10	12/60	2	100000
CT(IP)	13/27	5/46	14/28	32/101	2	158415
Total	19/39	5/84	20/38	44/161	2	136645

ANALYSIS PHASE

Divide into 3 parts

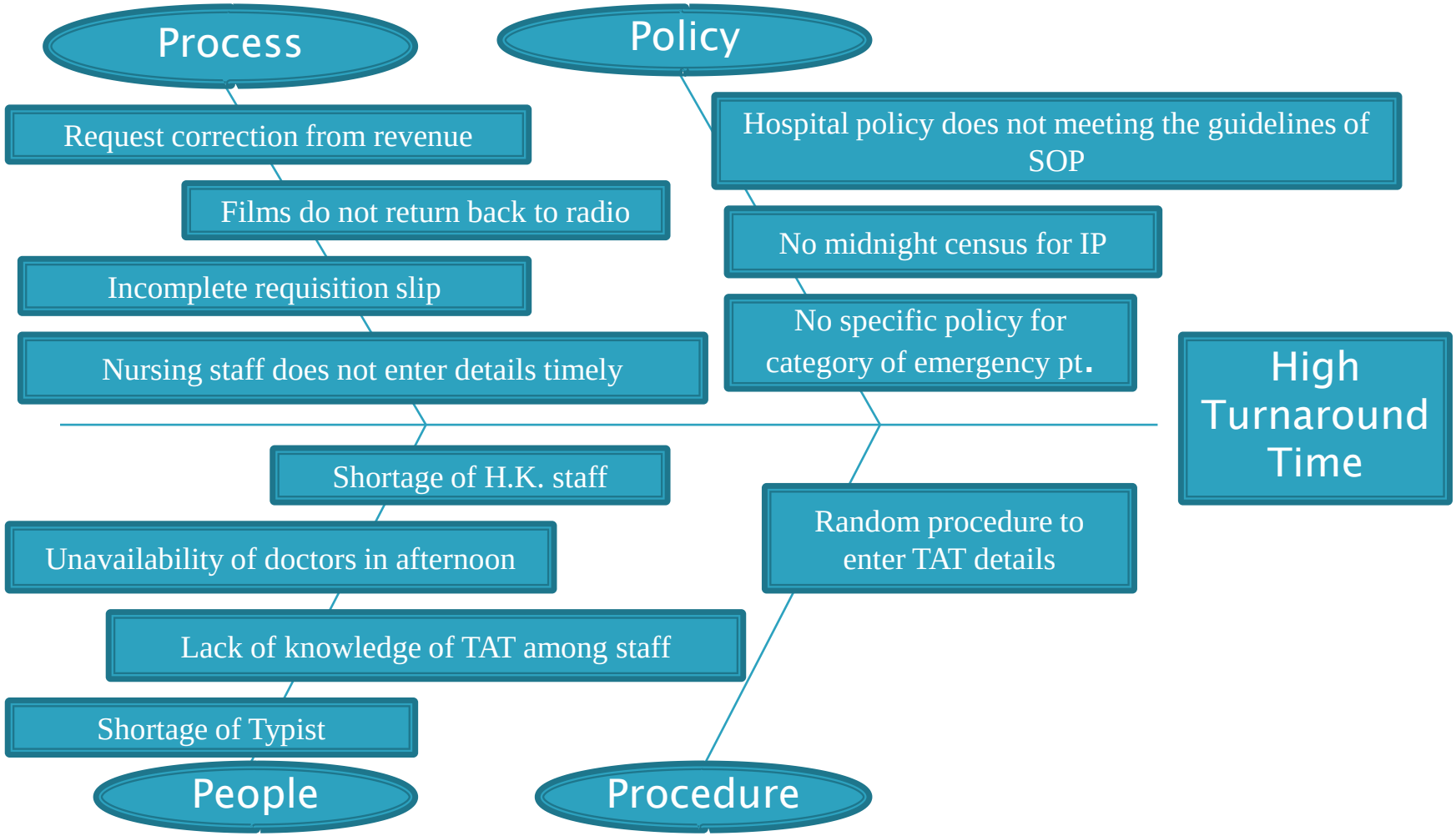
- Process Analysis
- Fishbone Analysis
- Data Analysis

Showing Process Analysis

Steps	Process Flow	Analysis
1	Patient Registration	(OP)Outpatient gets the registration done. (IP)In patient comes to radiology from ward/room. There is no specific protocol for taking a mid night census & handover to radiology department for the next day investigations. So radiology staff is unaware about the patient load on daily basis. In some of the cases, investigation requisition details are not entered into HIS before the test & entry is done only after investigation part is over. Without the entry, report cannot be prepared. At times this gets delayed & affects TAT. (Critical)Patient from emergency may be an outpatient or may be admitted so a confusion always remain regarding the registration(OP/IP) as without registration investigation can be done in some cases but report cannot be generated. This causes increase in report turnaround time.
2	Patient walks to waiting room	(OP)Outpatient after getting the registration done wait for some time till their number comes. (IP)For Inpatients, prior phone call is done whether the staff is free or not. (Critical)Emergency patients are attended immediately.

3	Greet the patient with review of order.	In case of Inpatients, review order takes more time in some cases, as the requisition forms are not fully filled. Due to this the radiologist has to confirm from the sending department regarding the type of investigation. This allows patient to wait more in the department. In some cases, the radiologist demands some different investigation to be done. For this the nursing staff sends a correction mail to revenue. After correction a fresh entry is made in HIS. Delay in entry causes delay in report preparation.
4	Oral preparation in case any contrast study.	-
5	Patient preparation	-
6	Procedure preparation	Time takes for different investigations varies. Especially in contrast studies, it takes more time for the procedure.
7	Report preparation with consultant signature.	Only one transcriptionist is available for report preparation. This creates a chaos situation especially in the morning hours when the patient load is more. It affects & takes more time in report preparation. In IP/Emergency cases, sometimes films are sent to consultant for review.
8	Report dispatch	In IP cases, at times due to shortage of the housekeeping staff reports are not been sent to wards though they are ready for dispatch.

Fishbone Analysis



- **Showing Six Sigma Performances Level as per SOP**

Category	DPMO	Sigma Level
CT Scan(OP)	180327	Between 2-3
CT Scan(IP)	195000	Between 2-3
CT Scan (Critical)	454545	Between 1-2
USG(OP)	177137	Between 2-3
USG(IP)	203910	Between 2-3
USG(Critical)	443181	Between 1-2
X-Ray(OP)	451241	Between 1-2
X-Ray(IP)	407129	Between 1-2
X-Ray(Critical)	-	-

Performance of CT scan critical cases, USG Critical, X-Ray OP& IP cases is poor and showing sigma level between 1-2.

Showing Overall Performance of Radiology Department as per SOP

Category	Units	Defects	No. of Opportunity	DPMO	Sigma Level
CT Scan	161	61	2	189440	Between 2-3
USG	931	349	2	187432	Between 2-3
X-Ray	1630	1377	2	422392	Between 1-2
Total	2722	1787	2	328251	Between 1-2

- Overall performance of X-Ray is between 1-2 sigma level which is on a lower side needs to be improved.
- Overall performance shows that Radiology Department is working at nearly 2 sigma level.
- 38% cases in CT scan, 37% cases in USG & 84% cases in X-Ray do not meet customer's expectations.
- 66% cases in hospital did not meet the customer's expectations.

Improvement Phase

Recommendations

- According to a new policy, all IP investigations would be done only after the entry of patient details is made.
- All films which go towards/patient rooms should be sent back to radiology according to a specific time frame. Films which go in evening & night should be returned back in morning soon after the consultant rounds (11:30am-12:30pm) & films of the day time should come back after the rounds by evening (3:30pm-4:30pm).
- Nursing staff need not to wait for deletion of the older entry by revenue department. They can directly put a fresh entry into RIS so that transcriptionist does not have to wait long for the report making.
- Patient who comes from emergency will be considered as an Outpatient. Accordingly billing will be done at the counter & timely report will be dispatched. In case patient gets admitted then the nursing staff will ensure that repeat entry is not done in RIS for the investigations.

- Complete IP midnight census will be prepared on daily basis by the nursing staff and will be hand over to radiology department in the morning.
- Medical officers on duty will ensure that requisition slip for investigation of patients will be completely filled before coming to radiology.
- To change the policy for report dispatch as per the requirement of SOP for TAT.
- Keeping in view that patient load is more in morning hours, an additional transcriptionist to be appointed in the reporting room.
- Training to be given to nursing & technician staff in radiology department about the guidelines of SOP for TAT, also how to calculate it accurately.

Possible Improvements done:

- Complete IP midnight census preparation has been started by a staff (Emergency-team leader on duty).
- A new policy has been formulated for report dispatch as per the requirement of SOP for TAT.
- An additional transcriptionist has been appointed at reporting room (9:00am-4:00pm).
- Proper education of the technicians & nursing staff has done about the SOP for TAT. After the education, staff members have started recording the TAT details accurately.

- After the strict instructions to the nursing in charges, staff has started entering IP investigations details of all patients in RIS before the test is getting done.
- As per the previous policy, radiology films which are sent to wards/ patient rooms are returning back to radiology department on daily basis. Evening-night investigation films between 11:30am-12:30pm (next day) & morning-afternoon films by 3:30pm-4:30pm. Strict monitoring is being carried out by the nursing in charges.
- Nursing staff need not to wait for deletion of the older entry by revenue department. They can directly put a fresh entry into RIS so that transcriptionist does not have to wait long for the report making.
- Patient who comes from emergency will be considered as an Outpatient. Accordingly billing will be done at the counter & timely report will be dispatched. In case patient gets admitted then the nursing staff will ensure that repeat entry is not done in RIS for the investigations.
- Medical officers on duty will ensure that requisition slip for investigation of patients will be completely filled before coming to radiology.

Control Phase

- For ensuring sustainable results, changes were imbedded in departmental processes. Continuous monitoring would be done using control charts and it is expected that radiology turnaround time will continue to decrease as volume goes up.

Limitations

- Hospital is unable to follow accurately the standard operating procedure for report turnaround time as the consultants are unavailable for their services during 2pm-4.30pm every day.
- Due to shortage of time, patient satisfaction analysis could not be done after the improvement phase of the project & also a fresh could be collected for 7 days after the improvement.
- Due to unavailability of a proper radiology information system, there is no proper appointment system available at the radiology counter which could actually help in measuring the patient waiting time for the investigation.

Conclusion

- The project on "**Implementing Six Sigma Methodologies for Quality Assurance in the Department of Radiology at Metro MAS Hospital, Jaipur"** was started around 3 months back. In the initial phase, the main problem statement was defined using voice of customers & internal department assessment. Later data was collected for 30 days &average TAT was collected for **CT Scan(OP: 2.73hrs, IP:3.43hrs),USG(OP:2.28hrs, IP:3.27hrs),X-Ray(OP:1.83hrs, IP:6.69hrs)** . In the analysis phase calculated TAT was compared with the SOP for TAT followed at Metro MAS Hospital, which showed TAT on a significantly higher side. As a result, overall process flow was analyzed & was modified as per the need in the improvement phase. A fresh data was again collected for 7 days which was compared with the data before improvements. The results were outstanding. Average TAT for all the investigations got reduced. **(CT scan OP: 1.6hrs from 2.73hrs, CT scan IP: 3.31hrs from 3.34hrs, USG OP: 1.4hrs from 2.28hrs, USG IP: 1.95hrs from 3.27hrs, X-Ray OP: 1.3hrs from 1.83hrs, X-Ray IP: 2.41hrs from 6.69hrs).** In the control phase, continuous monitoring would be there for the various improvements done in order to have sustainability in the results.

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THANK YOU