

# DIAGNOSTIC IMAGING TURN AROUND TIME IN RADIOLOGY: LEAN MANAGEMENT

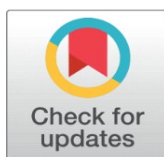
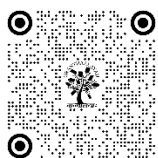
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## ABSTRACT

**BACKGROUND:** Turnaround Time can help analyze workflows in patient care. It allows us to identify waste in diagnostic services. A well-timed diagnosis result can indeed impact the patient's outcome, allow healthcare providers to make timely interventions, and plan the course of treatment. This paper presents a mapping of the TAT of X-ray and USG procedures.

**METHOD:** The study used a descriptive research design. It was carried out in one of the teaching hospitals of Gujarat. 110 procedures were taken for the study using the convenient non-random sampling method. Descriptive statistics and a one-sample t-test were applied to fulfil the objective of the study.

**RESULT:** The mean scores of the X-ray procedures and USG procedures were 40.6 and 83.56 respectively. The applied test value was 60. Both methods had a <0.05 significance level. It shows the association between the desired time and the observed time taken for the X-ray and USG procedures.

**CONCLUSION:** As the study mapped the TAT of diagnostic procedures, USG procedures need more attention to identify the waste compared to X-ray procedures from lean management perspective to improve patient satisfaction and return of beneficiaries to the care ratio.

**Keywords:** Diagnostic Procedures, Turnaround Time, Patient



## 1. INTRODUCTION

### Rational of the study

In the skyrocketing landscape of healthcare, timeliness and efficiency are the two prominent considerations to ensure patient care in an optimal way. The application of radiological imaging diagnostics i.e. USG and X-ray occupy a significant role in the prognosis and managerial point of view in numerous medical conditions. However, the effectiveness of these diagnostics prominently relies on the availability of the reports. A well-timed diagnosis can considerably impact the patient's outcomes, allow the clinician to make timely interventions, and plan of course of treatment (Verma et al., 2020). Hence, identifying and optimizing Turn Around Time (TAT) is pivotal to enhancing patient satisfaction and overall health.

In imaging diagnostics, Turn Around Time (TAT) is the interim between an examination and a confirmed report be there to the referring doctor (Onwuzu et al., 2014). There are numerous TATs which are often observed in the Radiology department from the concern of quality assurance and quality improvement perspectives (Mayer & Sebro, 2019) (Anderson et al., 2007). Despite its significance, there are numerous bottlenecks in the diagnostic procedures i.e. availability of timely equipment, personnel scheduling, and variations in the procedures. On top of it, the increased demand of imaging services with the scarcity of resources exacerbated the waiting time.

A study was conducted to assess the use of quality improvement techniques to reduce the variability of TAT for radiographic images of the emergency department. It impacted the direct effect on the patient experience and their return to care (Sharieff et al., 2013)(Towbin et al., 2013). A handful of studies pointed out the burnout of the employees, jumping off the queues by the other patients, and power blackouts as the major barriers in the mapping of the procedures. The major chunk of the service beneficiaries was dissatisfied with the USG examinations. Moreover, desirable TAT can assist in improving the financial performance of the organization (Nelson, E. C, Batalden, P. B, Godfrey, 2007). Beneficiaries believe that organizations can give inputs to understand the patient's needs by reducing downtime (M Oche & Umar, 2011). TAT varies from department to department and process to process. Sometimes it also varies from patient to patient. Technological advancement i.e. voice recognition, implementation of wide-scale picture archiving and communication systems, and other software-based aids also impact the downtime (Haruna, 2010).

This study aimed to study the TAT of X-ray and USG procedures through value stream mapping which involves a systemic examination of the stream map to spot the key areas for improvement and find opportunities to eliminate the waste.

## 1.2 THEORETICAL FOUNDATION

There are the phases on the turnaround time according to the extended model given by Lohrke, Bedeian and Palmer and developed Top Management Team (TOM) approach (Lohrke et al., 2004), are; 1. Turnaround situations (Decline phase), 2. Turn around response phase (Response initiation), 3. Turn around outcome (Transition, and Outcome). They developed the module to control the misclassification led by the type I and type II errors in process measuring state. Smith and Graves ponder the attribute of the distressed state of an enterprise to the severity of the bottleneck. They emphasize the influence of the size of the business and availability of the free resources. In the title of “decline stemming strategies”, they muse the turn around execution which aided in the stabilization and pointed to the competitive position of the business and causative factors to decline the effectiveness (Grave, 2017). Value Stream Mapping (VSM) is used to portray and analyze the logic of a production process. In comprised of five stages, 1. To determine the value stream needs to be improved, 2. To understand the current state of operation that is the foundation of the prospect state, 3. To redesign the process as per the principle of lean management, 4. To develop a plan of execution to realize enhancement (who, where, when), 5. Implementation of the improved plan is the goal of mapping (Langstrand, 2016).

## 2. RESEARCH METHODOLOGY

A descriptive research design was conducted for this study among the patients of the Outpatient Department (OPD) who were going for the diagnostic procedures of the X-ray and USG. Convenient non-random sampling was followed among 110 procedures. An observation checklist was formed to gather the data. Data was analyzed using the Statistical Package of Social Science (SPSS). Processes of procedures were mapped by the VSM that including the positioning of the patient in the examination room, the procedure done, and procedure reporting.

### 3. RESULTS

As per the handful of literature, the ideal TAT for the X-ray is one hour. The present study found that 90% of the procedures were completed within the ideal time whereas 10% of the procedures had more TAT. It states that delayed or longer TAT is usually uncommon in the procedures.

**Figure 1 Reason for delayed TAT for X-RAY**

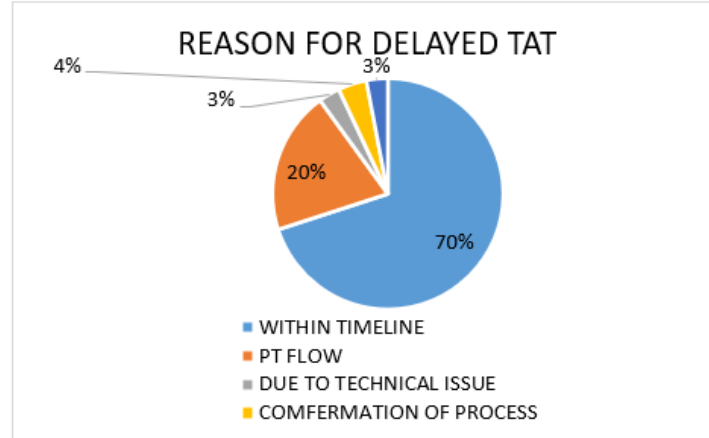


Figure 1 illustrates the reasons for the longer TAT. The majority of procedures were finished within the stipulated time. Technical issues, conformation of procedures, and unmanaged patient flow were identified as the bottleneck in the process mapping.

A significant association was tested between the ideal time and the observed time taken for the X-ray procedures.

**Table 1 One-Sample Statistics**

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
TAT	30	40.6000	14.18255	2.58937

Table 1 depicts the Thematic Apperception Test (TAT) of 30 individual procedures that range between 17-66. The mean score for the TAT is 40.6. The standard deviation (SD) is 14.18. that states the variability in the responses because the dispersion of SD is more out of the mean. The standard error that shows the variation between the sample mean and population mean is 2.589. This statistic helps to understand the central tendency and variability of the scores in the sample. Further analysis is needed to draw precise conclusions.

**Table 2 One sample Test**

One-Sample Test for USG Procedures.						
	Test Value = 60					
	T	Df	Sig. (2tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
TAT	-7.492	29	.000	-19.40000	-24.6959	-14.1041

Table 2 states the value of the significance level which is  $<0.05$ . it means there is a significant association between the standard X-ray procedures and the observed time taken by the procedures.

In USG procedures, 67% of procedures are done within the standard time that is in 60 minutes where 33% have delayed TAT.

**Table 3 One sample statistic for USG**

One-Sample Statistics for USG Procedures				
	N	Mean	Std. Deviation	Std. Error Mean
TAT	79	83.5696	43.73307	4.92036

Table 1 depicts the Thematic Apperception Test (TAT) of 79 individual procedures that range between 25-252. The mean score for the TAT is 83.56. The standard deviation (SD) is 43.73 which states the variability in the responses because the dispersion of SD is more out from the mean. The standard error that shows the variation between the sample mean and population mean is 4.92.

**Table 4 One sample test for USG procedures**

One-Sample Test						
	Test Value = 60					
	T	Df	Sig. (2tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
TAT	4.790	78	.000	23.56962	13.7739	33.3653

Table 4 states the value of significance level and that is  $<0.05$ . it means there is a significant association between the standard USG procedures and the observed time taken by the procedures.

The altitude of the TAT among X-ray and USG was observed in the present study. It exhibits that both procedures need to identify the waste during the process. In addition, there is more TAT was found in USG procedures compared to X-ray. To date, a handful of the studies mentioned the definition of the TAT (Breil et al., 2011). Out of those 10 studies, four definitions were concerned with dictation, typing, and signing the process, which ranged from X-ray completion to delivery of the reports. Another six studies narrated the TAT ranging from radiology request to X-ray completion. None of the studies mentioned the analysis of the intervals.

#### 4. CONCLUSION

Diagnostic imaging procedures have become an integral attribute to the quality of the services that focus on the patient-centric care i.e. early and timely diagnosis, treatment selection, plan of care, follow-up needs and patients' willingness to revisit the organisation. From an employer's perspective, desirable TAT grants financial benefits, patient satisfaction, and more efficiency to the process outcome. As a coin has two sides, some non-value-added services can't be ignored i.e. requirement for the fullness of the bladder, preference for the female clinician for female patients, electricity blackout, technological challenges, and confirmation for the diagnostic procedures.

To sum up, the outcome is linked to finding out the TAT of the diagnostic imaging procedures. The theory of lean management that focuses the value stream mapping can be applied to more samples which can help to find out the non-value added services that can be eliminated from the process.

## 5. LIMITATION OF THE STUDY

This present study has included a limited imaging diagnostic procedure which is one of the most significant limitations of the study. To generalize the result of the study, the sample size and the extent of the procedures could be enlarged. More study is suggested for technology-aided imaging services.

## ACKNOWLEDGEMENT

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## CONFLICT OF INTEREST

None.

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