

A Study On Laboratory Services Turn Around Time Process At Private Hospitals In Coimbatore City

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1. INTRODUCTION

Turnaround Time (TAT) is referred as the time of sample received in sample receiving area of the laboratory and the final report time of the test given. The TAT is commonly said that the time of sample collected and the report dispatched to the end customer within the laboratory of the hospital. TAT is classified as Pre – analytical, Analytical and Post – analytical. Pre – Analytical is the processes starts from the test acknowledge and segregation of sample to department from sample receiving area of laboratory. Analytical is the processes starts from transfer of sample to concern department of the laboratory till provisional report generation. Post – Analytical is the processes starts from doctor's assessment to report delivery to the end customer. Among these three classified phases, pre-analytical and post-analytical phases contribute to nearly 96% of the TAT and factors may vary depending upon the infrastructures of the laboratories, degree of automation, and experience and attribution of the employee. Laboratory personal gives more important to the quality of the report and sample report efficiency and analytical accuracy. But, the service of the hospital is always assessed by the rapidity of result or report delivered to the patients. The average processing time of blood samples are 20 to 30 mins but it draws up to 1 to 2 hrs. Hospitals always focus to reduce the total TAT which witness to extreme reduction in TAT for the test results. Most of the medical decisions are made on the basis of laboratory findings. So, the clinical laboratory findings must be accurate and well-timed. Waiting for laboratory reports for long time is often disappointing for patients and clinicians too. Hence, it is better for each laboratory to have its own turnaround time (TAT) 2-5. Accuracy, reproducibility and punctuality have their own grounds in the field of clinical laboratory. Assessment and improvement of turnaround time is essential for laboratory quality management as well as ensuring patient satisfaction. delivered at low cost. Of these characteristics, timeliness is perhaps the most important to the clinician, who may be prepared to sacrifice analytical quality for faster turnaround time (TAT) Laboratories may disagree with such a priority, arguing that unless analytical quality can be achieved, none of the other characteristics matter. Nevertheless, TAT is one of the most noticeable signs of a laboratory service and is used by many clinicians to judge the quality of the laboratory. Delays in TAT elicit immediate complaints from users while adequate TAT goes unremarked. Unsatisfactory TAT is a major source of complaints to the laboratory regarding poor service and consumes much time and effort from laboratory staff in complaint resolution and service improvement. Despite advances in analytical technology, transport systems and computerisation, many laboratories have had difficulties improving their TATs. Emergency department (ED) TATs have not improved over several decades. Inspection of the literature reveals a variety of different approaches to definition of TAT. TAT can be classified by test (e.g., potassium), priority (e.g., urgent or routine), population served (e.g., inpatient, outpatient, ED and MHC) and the activities included. This last area is the greatest source of variation in reporting of TAT.

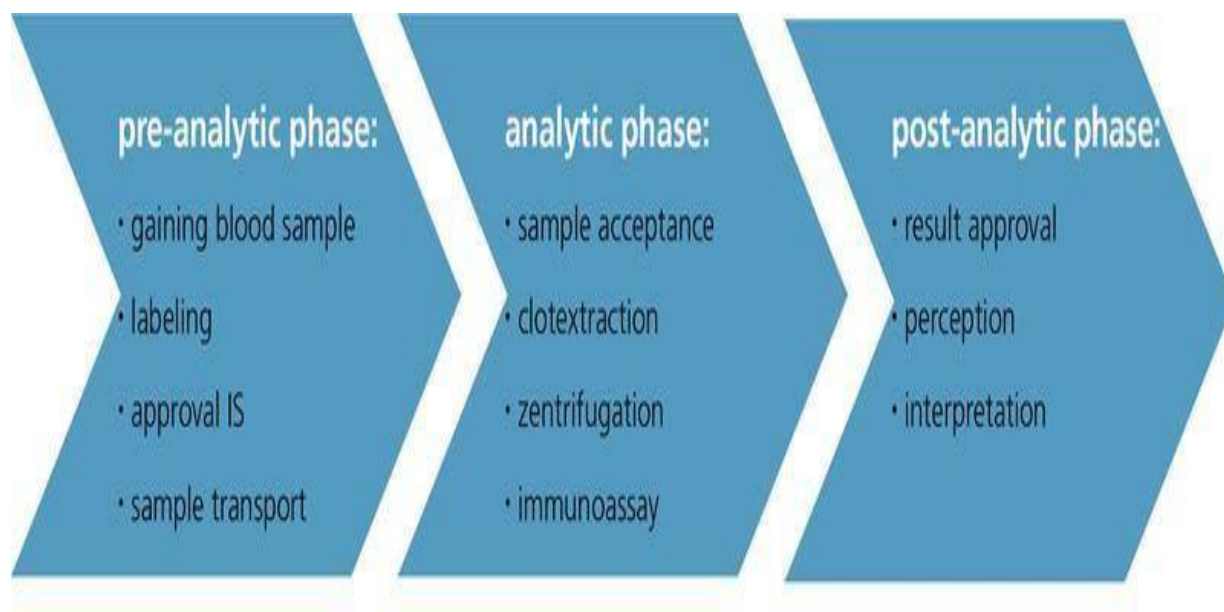


Fig.1.0 Three Phases of TAT

The turnaround time (TAT) as defined by most of the laboratories is the time interval between the specimens received in the laboratory to the time of reports dispatched with verification. Nearly 80% of hospital-attached clinical laboratories receive complaints about delayed TAT. Reporting in time is a crucial indicator of quality services along with accurate, precise and reliable reports, thus each clinical laboratory should identify affecting factors to eliminate them for the enhancement of quality services

2. INDUSTRY PROFILE:

The health care industry, or medical industry, is a main sector that provides goods and services to treat patients with curative, preventive, rehabilitative, or palliative care. The modern health care sector is divided into many sub-sectors and depends on interdisciplinary teams of trained professionals and paraprofessionals to meet the health needs of individuals and populations. This section is an attempt to understand the definitions, cultural, political, organizational, and disciplinary perspectives of this industry. It will identify the main sectors of the health care industry and its business drivers, and review the key aspects of the industry business model, its competitive environment, and the current trends in the industry. The target audience for these tutorials is IT professionals working on the healthcare domain, consulting houses, industry investors, and all size companies that sell products or services to healthcare sectors and allied industries. This section will be useful for organizations and professionals looking for knowledge and key business information in the health care industry. Health care is the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in humans. Health care is delivered by practitioners in medicine, chiropractic, dentistry, nursing, pharmacy, allied health, and other care providers. It refers to the work done in providing primary care, secondary care, and tertiary care, as well as in public health. The health care industry, or medical industry, is a sector that provides goods and services to treat patients with curative, preventive, rehabilitative, or palliative care.

The Global Industry Classification Standard and the Industry Classification Benchmark further distinguish the industry as two main groups:

Health care equipment and services

Health care equipment and services comprise companies and entities that provide medical equipment, medical supplies, and health care services, such as hospitals, home health care providers, and nursing homes.

Pharmaceuticals, biotechnology, and related life sciences

The second industry group comprises sector companies that produce biotechnology, pharmaceuticals, and miscellaneous scientific services.

Healthcare Providers and Professionals:

A health care provider is an institution (such as a hospital or clinic) or person (such as a physician, nurse, allied health professional, or community health worker) that provides preventive, curative, promotional, rehabilitative, or palliative care

services in a systematic way to individuals, families or communities.

3. AI IN HEALTHCARE:

The adoption of Artificial Intelligence in healthcare is projected to cross \$400 million by the end of 2020. This means those start-ups and innovators who are still apprehensive of integrating AI will be forced to rethink data use, training, validation, implementation practices to win the trust of more and more users. A day is near when more trust will increase and faster AI will develop.

The usage to acquire, collect, and organize data, medical images of patient's history, the reach of AI is by far has reached to genetics, labs, pathology, and other healthcare areas. Right from

optimizing monetary transactions to predicting the fastest possible route, helping doctors follow the best treatment and procedure to reducing the burdens put upon them by being more precise with treatments and their decisions, AI and digitalization in healthcare go hand in hand.

COMPONENTS OF INDIAN HEALTHCARE INDUSTRY

The significant constituents of the Indian medicinal services industry are hospitals, clinical trials, outsourcing, telemedicine, therapeutic tourism, health care coverage and medical equipment. The Indian medicinal services conveyance framework comprises of two noteworthy segments - open and private. The general population, that is, Government health care services framework incorporates restricted optional and tertiary consideration foundations in key urban communities and spotlights on giving fundamental human services offices as essential Primary Healthcare Centers (PHCs) in provincial regions.

4. OBJECTIVE OF THE STUDY:

To study the turnaround time of the laboratory at private hospitals in coimbatore

To evaluate the delay of turnaround time for Laboratory test.

To find out the reasons for the delay in turnaround time.

To suggest measures to reduce the turnaround time for laboratory test.

5. SCOPE OF THE STUDY:

Turnaround time (TAT) is the universally accepted method of describing the efficiency of laboratory services, often described as the time between a test being requested and the result of the said test being available to the clinician. Always remember higher volume, higher efficiency and fastest report delivery. Result delivery is important but timing is paramount especially when it comes to healthcare. So, improve your TAT to improve your revenues. TAT important aspect of lab management, With faster and reliable report delivery time, you have more credibility from patients, referrals, and business partners as well. Thus, reviewing TAT can help reduce delivery time, customer satisfaction & reduce costs in a significant manner.

1.4 LIMITATIONS OF THE STUDY:

The opinion study is confined only to private hospital laboratory

The sample size complicates comparisons.

Duration of sample processing of Microbiology and Histopathology are quite long also varies for each sample.

Rejection sample comments and reasons are not updated in systems gives some changes in data.

2.0 REVIEW OF LITERATURE

Bhattacharya, S., & Bansal, R.(2024) A systematic review found that implementing Lean methodology across various laboratory workflows achieved an average 76.1% reduction in TAT, addressing inefficiencies such as sample transport delays, manual data entry, and workflow bottlenecks. Interventions included barcode systems, process redesign, and optimized staffing to streamline operations.

S Kamath, S Belurkar, GS Reshma - 2021 - Quantification of Pre-Analytical Quality Indicator in a Clinical Laboratory - Pre-analytical quality indicators analysed for sample collections were clotted sample, hemolyzed sample, incompletely filled form, wrong labelled sample, insufficient sample volume and patient waiting for sample collection after registration in the laboratory- turnaround time (TAT). Turnaround time for patient waiting for sample collection is 15 minutes from the registration of the request form.

SG Christian, BW Moore-Igwe, RB Jacob- 2021 - Quality Indicator Measures as It Affects Turnaround Time (TAT) in A Molecular Laboratory in Port Harcourt, Rivers State - It involves the assessment of samples delivered to the RSUTH PCR Laboratory from January 2019 to March 2020. A baseline rate of sample rejection was established from January to July 2019. Interventional measures were put in place such as introducing the national algorithm for rejection and acceptance of samples,

training was also done for EID sample collectors and a final assessment of changes in the rate of sample rejection was determined at the final period of January to March 2020.

D.S.Blancab e.tal (2020) Evaluation of the performance of rapid tests for screening carriers of acquired ESBL- producing Enterobacterales and their impact on turnaround time - To evaluate the impact of rapid ESBL tests on the turnaround time (TAT) of screening. The two rapid ESBL tests showed good performance and allowed a reduction in TAT for screening protocols to identify patients carrying ESBL-producing Enterobacterales.

Silvia Angeletti, e.tal (2015) - The aim of the present study was to evaluate the intra-laboratory TAT after laboratory automation implementation intra-laboratory TAT was evaluated both as the mean TAT registered and the percentage of outlier (OP) exams. The mean TAT was 36, 38, and 34 min during the study periods, respectively. These values respected the goal TAT established at 45 min. The OP, calculated at 45 min as well as at 60 min, decreased from 26 to 21 and from 11 to 5, respectively. From a focused analysis on blood count cell, troponin I, and prothrombin (PT) test, TAT improvement was more evident for tests requiring longer preanalytical process.

6. RESEARCH METHODOLOGY

Methodology is defined as the analysis of the principles of method, rules and postulates patients by a discipline of the development of the methods to be applied within a discipline. Research methodology is a way of systematically solving the research problem.

7. RESEARCH DESIGN:

The research design is **Descriptive** as it is based on a survey conducted among employees in the hospital like Lab Technicians, Consultants, Nurses and Guest Relation Officer.

SOURCE OF DATA:

The primary data and secondary data were used for the study.

PRIMARY DATA:

Primary data may be described as those data that have been observed and recorded by the researcher for the time to their knowledge. A questionnaire was prepared and with the help of which the primary data been collected.

SECONDARY DATA:

Secondary data is the data that have been already collected by and readily available from other sources. One of the most popular ways of collecting secondary data is using the internet. Using the Kranium software of an organisation the secondary data are collected.

DATA COLLECTION INSTRUMENT:

The instrument used for data collection is questionnaire, experiment and observation. A questionnaire is simply formalized set of questions for eliciting information. An Interview schedule was administered to collect the primary data. The instrument used in this study is self – administered schedule for collecting primary data. Conducted interviews with the laboratory technicians, laboratory consultants, chief operative officer and with nursing staffs.

MODE OF DATA COLLECTION:

The mode of data collection is observation method and experiment method.

SAMPLING METHOD:

Primary data – A simple random sample method which is a subset of individuals chosen from a larger set in which a subset of individuals are chosen randomly, all with the same probability. It requires using randomly generated numbers to choose a sample.

Secondary data- systematic random sampling is a very common technique in which you sample every k'th element. This is a type of probability sampling method in which sample members from a larger population are selected according to a random starting point but with a fixed periodic interval.

SAMPLE UNIT:

Primary data sample unit are Nursing staffs, Lab technicians and guest relation officers in the hospital.

Secondary data sample unit are in-patients and out- patients.

SAMPLE SIZE:

Primary Data sampling size – 70

Secondary data sampling size – 226

4.0 DATA ANALYSIS AND INTERPRETATION

TABLE 4.1 ANALYSIS OF SD AND AVG ON BIOCHEMISTRY DEPARTMENT

DEPARTMENT	STANDARD DEVIATION(SD) LAB [HRS]	AVERAGE OF LAB TAT [in Hrs]
Biochemistry	5.0	4.3
Clinical Pathology	5.6	3.9
Coagulation	12.6	6.6
Cytology	10.0	7.9
Hematology	30.5	10.3
Histopathology	43.7	83.4
Immunology	53.5	61.2
Molecular Biology	21.5	13.9
Serology	20.3	9.7

8. INTERPRETATION:

The above table 4.1 indicates the analysis of standard deviation and average of laboratory turnaround time in hours of biochemistry department of the laboratory. The standard deviation of laboratory were (5.0 hrs) and (4.3 hrs) were the average lab TAT. The standard deviation of laboratory were (5.6 hrs) and (3.9 hrs) were the average lab TAT. The standard deviation of laboratory were (12.6 hrs) and (6.6 hrs) were the average lab TAT. The standard deviation of laboratory were (10.0 hrs) and (7.9 hrs) were the average lab TAT. The standard deviation of laboratory were (30.5 hrs) and (10.3 hrs) were the average lab TAT. The standard deviation of laboratory was (43.7 hrs) and (83.4hrs) were the average lab TAT. The standard deviations of laboratory were (53.5 hrs) and (61.2hrs) were the average lab TAT. The standard deviations of laboratory were (21.5hrs) and (13.9hrs) were the average lab TAT. The standard deviation of laboratory were (20.3 hrs) and (9.7 hrs) were the average lab TAT.

TABLE 4.2ANALYSIS OF SD AND AVG COMPARISON ON LABORATORY DEPARTMENT

DEPARTMENT	STANDARD DEVIATION(SD) LAB [Hrs]	AVERAGE OF LAB TAT [in Hrs]
Biochemistry	5.0	4.3
Clinical Pathology	5.6	3.9
Coagulation	12.6	6.6
Cytology	10.0	7.9
Hematology	30.5	10.3

Histopathology	43.7	83.4
Immunology	53.5	61.2
Molecular Biology	21.5	13.9
Serology	20.3	9.7
Total average	17.3	6.9

INTERPRETATION: The above table 4.10 indicates the analysis of standard deviation and average comparison of all laboratory departments in hours. The total average standard deviations of laboratory departments were (17.3 hrs) and (6.9hrs) were the total average lab TAT.

TABLE 4.3 ANALYSIS OF AVG OF PRELIMINARY AND INTERIM TAT ON LABORATORY DEPARTMENT

DEPARTMENT	Average of PRELIMINARY TAT (D-A) [in Hrs]	Average of LAB TAT (D-B) [in Hrs]	Average of INTERIM TAT (C-B) [in Hrs]
Biochemistry	4.8	4.3	1.6
Clinical Pathology	5.4	3.9	1.4
Coagulation	6.8	6.6	2.1
Cytology	9.7	7.9	7.4
Hematology	10.7	10.3	3.9
Histopathology	83.6	83.4	83.4
Immunology	61.5	61.2	49.0
Molecular Biology	14.1	13.9	12.6
Serology	10.1	9.8	7.5
Total Average	7.4	6.9	3.7

Table 4.4 ANOVA TEST USING AGE AND EXPECTED LEVEL OF LABORATORY SERVICE OF HOSPITAL.

ANOVA							
Particulars		Sum Squares	df	Mean Square	F	Sig.	REMARK
1.The Laboratory check-out of In-Patients discharge are on time	Between Groups	16.434	2	8.217	10.147	.001	SIGNIFICANT
	Within Groups	13.766	17	.810			
	Total	30.200	19				

4. Dispatching patients lab reports are on time to the front desk	Between Groups	6.018	2	3.009	6.252	.009	SIGNIFICANT
	Within Groups	8.182	17	.481			
	Total	14.200	19				
5. Authorization of lab results are on time	Between Groups	9.177	2	4.588	7.342	.005	SIGNIFICANT
	Within Groups	10.623	17	.625			
	Total	19.800	19				

H0: Respondent belonging to different age on an average has a same expected level of laboratory service of hospital.

H1: Respondent belonging to different age on an average doesn't have same expected level of laboratory service of hospital

9. INTERPRETATION:

The above indicates the analysis variance of age and expected level of laboratory hospital services of employees. The significant value of laboratory check-out, reports dispatch and authorization of results of hospital lab are found to be 0.001, 0.009, 0.005 in which it is lesser than

0.05. Hence for all these statements the alternate hypothesis can be accepted. This means that respondent belonging to different age on an average don't have same expected level of laboratory service of hospital.

Table 4.5 ANOVA TEST USING AGE AND EXPECTED LEVEL OF LABORATORY EMPLOYEE SATISFACTION IN HOSPITAL

ANOVA							
Particulars		Sum Squares	of Df	Mean Square	F	Sig.	REMARKSS
4. Work load influencing the laboratory turnaround time	Between Groups	15.178	3	5.059	5.597	.006	SIGNIFICANT
	Within Groups	18.982	21	.904			
	Total	34.160	24				
5. Service of In Patient nursing staff are good	Between Groups	9.365	3	3.122	3.709	.028	SIGNIFICANT
	Within Groups	17.675	21	.842			
	Total	27.040	24				

H0: Respondent belonging to different age on an average has a same expected level of laboratory employee satisfaction in hospital.

H1: Respondent belonging to different age on an average doesn't have same expected level of laboratory employee

satisfaction in hospital.

INTERPRETATION:

The significant value of work load of laboratory employees and response of inpatient nursing staff to laboratory employees are found to be 0.06 and 0.028 in which it is lesser than 0.05. Hence for all these statements the alternate hypothesis can be accepted. This means that respondent belonging to different age on an average don't have same expected level of laboratory employee satisfaction in hospital

Table 4.6 ANOVA TEST USING AGE AND EXPECTED LEVEL OF LABORATORY EMPLOYEE RESPONSE IN HOSPITAL

ANOVA							
Particulars		Sum Squares	of Df	Mean Square	F	Sig.	REMARK
1. Lab employees are attending the calls regularly	Between Groups	21.333	2	10.667	12.571	.000	SIGNIFICANT
	Within Groups	18.667	22	.848			
	Total	40.000	24				
2. Lab employees responds to queries properly and correctly	Between Groups	12.160	2	6.080	6.080	.008	SIGNIFICANT
	Within Groups	22.000	22	1.000			
	Total	34.160	24				
3. Sample collection by the phlebotomist with IP patients are on time	Between Groups	15.310	2	7.655	9.763	.001	SIGNIFICANT
	Within Groups	17.250	22	.784			
	Total	32.560	24				

H0: Respondent belonging to different age on an average has a same expected level of laboratory employee response in hospital.

H1: Respondent belonging to different age on an average doesn't have same expected level of laboratory employee response in hospital

INTERPRETATION:

The table indicates the analysis variance of age and expected level of laboratory employees' response in hospital. The significant value of laboratory employee's response to calls, queries and sample collection by phlebotomist for inpatients are found to be 0.000, 0.008, 0.001 in which it is lesser than 0.05. Hence for all these statements the alternate hypothesis can be accepted. This means that respondent belonging to different age on an average don't have same expected level of laboratory employee's response in hospital.

10. SUGGESTIONS:

The laboratory space can be increased which helps to extend the lab in future.

Updating of Kranium for nursing station will reduce the call to lab.

Some of the access can be approved for nursing staffs like sample processing status, sample in acknowledged state and the result is authorized

Outsourcing, lab purchase, outsource report dispatch can be taken care by lab secretary or any specific person.

Regulating the employee insufficiency in lab will also reduce TAT.

A regular study on Lab TAT can improve regular errors in lab.

Rejection of sample can be reduced by providing regular training for nurses.

By providing access to one more barcode machine in lab will help to acknowledge soon.

The laboratory accession can be organized well and with sufficient space for samples will improve the efficiency of lab service employees.

Appointing consultants for concern department helps to reduce the work load of the existing consultant and also helps to reduce TAT in authorization.

Reduced outsourcing of samples will also improve the TAT of laboratory.

11. CONCLUSION:

This study examined the turnaround time (TAT) process in laboratory services across private hospitals in Coimbatore, focusing on operational efficiency, factors influencing delays, and the impact on patient care and satisfaction. The findings highlight that while several hospitals have adopted modern equipment and Laboratory Information Systems (LIS), challenges such as pre-analytical delays, understaffing, inefficient sample handling, and lack of continuous performance monitoring continue to affect timely delivery of reports.

Data analysis revealed that **automation, Lean process improvements, effective coordination between departments, and proper staff training** significantly reduce TAT and enhance service quality. Furthermore, hospitals with active tracking of quality indicators and Root Cause Analysis (RCA) mechanisms showed better performance in terms of timely reporting and patient satisfaction.

In conclusion, optimizing laboratory turnaround time is not only a technical necessity but also a strategic component in enhancing the overall quality of healthcare services. Private hospitals in Coimbatore have the opportunity to improve their laboratory efficiency by embracing process reengineering, adopting automation where feasible, and fostering a culture of continuous quality improvement. Implementing these measures will lead to better diagnostic accuracy, timely clinical decisions, and increased patient trust and satisfaction.

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