Factors Affecting Turnaround Time TAT in Clinical Laboratory at a Tertiary Care

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Abstract

Objectives: The present study was designed to evaluate the turnaround time (TAT) of indoor patient samples and the factors affecting TAT in the clinical laboratory at a tertiary care Hospital.

Materials and Methods: This cross-sectional, descriptive study was conducted at Farooq Hospital Westwood, Lahore. The data of TAT was collected between the period of 1st January to 31st July 2023. Requested tests were received in the Pathology laboratory along with test requisition forms. All were carefully screened for any mistakes. TAT analysis of ABGs, S/E, RFTs, Trop-I, amylase, and CBC of indoor patients was done for eight months.

Results: A total of 18282 indoor patient samples were included in this study. On analysis, it has been observed that the ABGs (n=3407, 99.5%), Trop-I (n=755, 85.40%), S/E (n=6497, 72.39%), CBC (n=16117, 88.15%), amylase (n=326, 86.47%), RFTS (n=7541, 78.07%) were reported within the defined TAT. This study also observed that the main reason for delayed TAT was hemolysed and clotted samples (14.22%), specimen dilution and re-run for the verification of result (12.96%), and incorrect patient registration (12.64%).

Conclusion: Monitoring TAT for laboratory reports is crucial and it plays a significant role in ensuring the effectiveness of the laboratory's operations. The factors influencing the TAT should be monitored and analyzed regularly for better patient care management.

Keywords: Turnaround time, hospital-based pathology laboratory, monitoring of turnaround time, factors affecting turnaround time

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Introduction

Laboratory investigations are essential for patient care and are conducted routinely in healthcare settings. These investigations play a crucial role in diagnosing, monitoring, and managing various medical conditions. They provide objective data that helps healthcare providers make accurate diagnosis, leading to appropriate treatment plans.[1] For patients with chronic conditions or undergoing treatments, laboratory investigations help monitor the progression of the disease and the effectiveness of therapies. Regular testing allows healthcare providers to adjust treatment plans as needed. Laboratory tests help identify health issues in their early stages, allowing for timely intervention and better treatment outcomes. In some cases, laboratory tests can provide prognostic information, predicting the likely course of a disease and helping clinicians plan appropriate management strategies.[2,3] Laboratory investigations provide objective data that support evidence-based medical decision-making, contributing to better patient outcomes. Routine testing, when used judiciously, can significantly contribute to providing high-quality patient care and improving overall health outcomes. Certain laboratory investigations can also assess an individual's risk of developing certain diseases or conditions, allowing healthcare providers to offer preventive measures. Laboratory tests, such as therapeutic

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drug monitoring, help ensure that patients are receiving the correct dosage of medications and that those medications are within the therapeutic range. Infections can be identified and treated promptly through laboratory tests, preventing the spread of communicable diseases and guiding appropriate antibiotic therapy.[4] Preoperative laboratory investigations help to assess the patient's overall health status and identify potential risks before surgery. Routine health check-ups often include laboratory tests to assess overall health and identify any potential health issues.[5]

Quality assurance practices ensure that laboratory processes and testing methodologies meet the highest standards. It can lead to cost savings in the long run.[6] Accurate and timely diagnosis can prevent unnecessary treatments, hospitalizations, and complications, reducing overall healthcare costs. Timely laboratory results build trust and confidence among patients and healthcare providers.[7] Clinical laboratory quality assessment did not rely solely on accuracy and precision.[8] Monitoring of turnaround time (TAT) is equally important to provide better facilities to the patients and help the physicians treat the patients in time. In a clinical laboratory setting, the TAT refers to the total time taken to complete a laboratory test from the moment the sample is collected to when the final test result is reported to the healthcare provider or the patient. It is a critical performance metric that directly impacts patient care and clinical decision-making.[9,10]

The TAT can vary significantly depending on various factors, including the type of test being performed, the complexity of the test, the laboratory's workload, the transportation time for the sample, and the efficiency of the laboratory's processes. A shorter TAT is generally desirable as it allows for faster diagnosis and treatment decisions.[11] In emergencies, rapid turnaround times are crucial for prompt and appropriate medical intervention. Efforts to improve TAT often involve optimizing laboratory workflows, using automation, enhancing sample transportation logistics, and implementing efficient information systems for result reporting. Reducing TAT without compromising accuracy is a continuous goal for clinical laboratories to provide the best possible patient care.[6] The present study was designed to evaluate the current TAT of indoor patient samples. The study also attempts to evaluate the factors affecting the TAT in the clinical laboratory of a tertiary care Hospital.

Materials and Methods

This cross-sectional, descriptive study was conducted at Farooq Hospital Westwood, Lahore. which is a 250-bed tertiary care hospital. The data of TAT was collected between the period of 1st January to 31st July 2023. Retrieved information was separated to notice current TAT and factors influencing delayed TAT. All the patient samples along with their Test Requisition Form (TRF) were analyzed which were available at the Department of Pathology laboratory at Farooq Hospital Westwood. Only indoor TRFs, prescribed arterial blood gases (ABGs), serum electrolytes (S/E), renal function tests (RFTs), troponin-I (Trop-I), amylase, and complete blood count (CBC) were included. Samples for post-prandial and fasting blood glucose measurements were excluded because there is no system to record the time of postprandial sample reception. Sudden addition or cancellation of the tests through phone calls by clinicians or nurses, outdoor patient samples, and if the calculated TAT of indoor patient tests was less than 20 minutes were also excluded. TAT refers to the total time taken to complete a laboratory test from the moment the sample is received in the Pathology laboratory to the report completion. The data was recorded and the differences were calculated. The indoor patient samples were collected by phlebotomists. After the collection of samples, the phlebotomist transported these samples to the sample management department. After that, the patient registration was done in laboratory information management system (LIMS) software. At the time of patient registration, the LIMS software automatically generates the registration time which is considered as sample arrival time. The sample receiving time entered in LIMS software is automatically printed on the patient test report as registration time. After complete enrollment of all referenced tests, the samples were transported to the Pathology laboratory by the same phlebotomist. A laboratory technician received all samples with their TRFs and checked them for any pre-analytical errors. After that, all patient samples were delivered to the respective benches for further processing. All patient samples were analyzed through different automated analyzers. After completion of the testing procedure, the observed values for the requested tests were entered into LIMS software against a unique patient registration number. Any analytical error that occurred during the total testing procedure was written on the TRFs immediately by the concerned laboratory technician. The time when the observed value was entered in LIMS software, appears as the reported time on the patient test report. Daily reports generated from the Department of Pathology laboratory at Farooq Hospital Westwood,

Lahore were analyzed for TAT, with the reasons for prolonged TAT mentioned on the TRFs. The total testing procedure of patient samples in the Pathology laboratory of Farooq Hospital Westwood is shown in Figure 1. The present study proposal was approved by the Institutional Review Board (IRB) of the Farooq Hospital Westwood, Lahore.

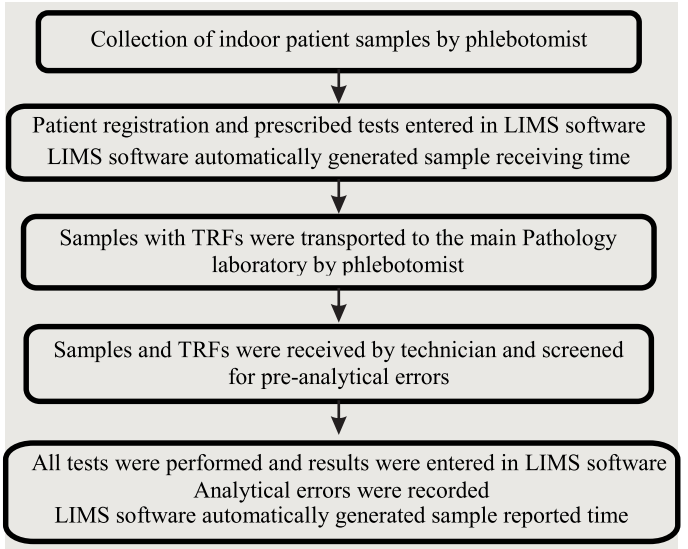

Fig-1: *Flow diagram of the total testing procedure of the Pathology laboratory of Farooq Hospital Westwood*

Results

A total of 18282 indoor patient samples and their TRFs were analyzed. In this study, we analyzed 06 urgent parameters which have an important role in patient care and treatment. From the included 18282 indoor patient samples: the number of prescribed CBC, RFTs, S/E, ABGs, Trop-I, and amylase tests were 18282, 9659, 8974, 3419, 884, and 337 respectively. The defined TAT of each parameter was different (table 1). On analysis, it has been observed that the 3407 (99.5%) ABGs, 755 (85.40%) Trop-I, 6497 (72.39%) S/E, 16117 (88.15%) CBC, 326 (86.47%) amylase, and 7541 (78.07%) RFTs were reported within the defined TAT.

During the total testing procedure, three types of main errors were recorded: pre-analytical, analytical, and post-analytical. Many factors were responsible for delayed TAT. This study observed that the main reason for delayed reporting was hemolysed and clotted samples (14.22%), specimen dilution and re-run for the verification of result (12.96%), incorrect patient registration (12.64%), and others which are described in table 2.

Discussion

Reporting within defined TAT by the Pathology labo-

Table 1: *Frequency of indoor patient samples reported within and after the defined turnaround*

	Arterial blood gases	Troponin-I	Serum electrolytes	Complete blood count	Amylase	Renal function tests
Defined TAT	30 minutes	40 minutes	45 minutes	60 minutes	60 minutes	60 minutes
Total No. of samples	3419	884	8974	18282	377	9659
Samples reported within the defined TAT	3407 (99.5%)	755 (85.40%)	6497 (72.39%)	16117 (88.15%)	326 (86.47%)	7541 (78.07%)
Samples reported after the defined TAT	12 (0.5%)	129 (14.59%)	2477 (27.60%)	2165 (11.84%)	51 (13.52%)	2118 (21.92%)

Table 2: *Frequencies of factors affecting turnaround time*

Errors	Factors	Number of samples (%)
Pre-analytical	Incorrect patients' registration	879 (12.64%)
	Hemolysis and clotted samples	989 (14.22%)
	Insufficient samples	415 (5.96%)
	Wrong barcoding of samples	621 (8.93%)
	Unsuitable sample for the test	102 (1.46%)
	Delay in transportation fromthe sample entry area to the main Pathology Laboratory	477 (6.86%)
Analytical	Delay in testing due to heavy workload	328 (4.71%)
	Troubleshooting	479 (6.89%)
	Integrity of samples	209 (3.00%)
	Need for specimen dilution and re-run for verification of result	901 (12.96%)
Post-analytical	Delay in conducting and approval of reports through LIMS software	381 (5.48%)
	Critical value reconfirmation and consultation	734 (10.55%)
	Reporting system (LIMS software) down	437 (6.28%)

ratory offers support to indoor and outdoor patients is a significant determinant factor for the best healthcare facility.[12] In this study samples with their TRFs were examined to produce important data about the TAT. TAT is defined as the time between samples received in the laboratory till the completion of the report and it varies from type and nature of tests. It also varies on the type of laboratory which may be hospital-based or independent laboratory not attached to the hospital. The meaning of the TAT is significant, but a definitive objective must be to give the right test results in a defined time. In this study, six parameters were analyzed for TAT due to their important significance.

In the present study, approximately 83.28% of samples were reported within the defined time as documented in standard operating procedures (SOPs). A study performed by K. P. Chauhan et al.[13] proposed that the per-centage of samples exceeding the TAT in 2011 was 6.4% which diminished to 4.6% by the year 2012. In the pre-sent study, the variation in TAT was primarily observed due to hemolysis and clotted samples (14.22%) followed by specimen dilution and re-run for the verification of result (12.96 %), and incorrect patient registration (12.64%).

Different factors were responsible for prolonged TAT. In the present study, errors and factors responsible for longer TAT were also analyzed. The most observed errors were pre-analytical (50.10%) followed by analytical errors (27.57%) and post-analytical errors (22.32%). A study done by KN. Desai et al.[14] proposed that 74.2% of the samples were postponed due to pre-analytical errors and another study conducted by F. Paul II et al.[15] emphasized that most delays were due to the fault in the analyzer. In the present study equipment breakdown just caused a 6.89% delay in TAT because of the avail-ability of backup instruments, and more vigilant super-vision of patient tests by the use of the LIMS dashboard. Bhattarai K et al.,[16] and Dawande PP et al.,[6] declared that the pre-analytical delays are the primary drivers of prolonged TAT. The results of these studies were consistent with the present study. The implementation of appropriate corrective measures for maintaining the TAT in the Pathology laboratory is important. Maklouf R. et al[17] revealed the utilization of the pneumatic tube diminished mean hemoglobin TAT from 43 to 33 minutes and mean potassium TAT from 72 to 64 minutes. As not all laboratories have the facility of pneumatic tubes, it is important to make proper protocols and SOPs for reporting urgent tests within in defined TAT. It can be done by the use of the LIMS dashboard and proper monitoring of technical staff by a shift in charges.

Conclusion

Monitoring TAT for laboratory reports is crucial and it plays a significant role in ensuring the effectiveness and efficiency of the laboratory's operations. There has been progress in the laboratory test result TAT lately, with additional express depictions of TAT information in the literature. The accomplishment of quality services is not just imaginable in hospital-based Pathology laboratories without tracking down the elements for delayed TAT and quick improvement of that area by the Pathology laboratory management. The factors influencing the TAT might differ from laboratory to laboratory, and their work strategies but it should be monitored and analyzed for providing timely treatment to admitted patients.

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Authors Contribution

AM: Conceptualization of Project
OF: Data Collection
ZY: Literature Search
NA: Statistical Analysis
AA: Drafting, Revision
BY: Writing of Manuscript