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Chapter 3

Timeliness as a Measure of Lab Quality

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Abstract

Timeliness which is expressed as the turnaround time (TAT) is often used by the clinicians as the benchmark for laboratory performance. But this has not been a major focus in clinical laboratories. Improving TAT is a difficult task as it involves all the steps involved from ordering of the test till the final release of the report. In this chapter, all the aspects of TAT including causes of delayed TAT and the steps which can be taken to improve TAT have been discussed.

Keywords: Turnaround time (TAT); Pre-analytical time; Analytical time and Post-analytical time

1. Introduction

Quality can be defined as the ability of a product or service to satisfy the needs and expectations of the consumer [1]. Further, increased attention to patient's needs is demonstrated by efforts to improve the quality of the entire service provided, e.g. reduction of laboratory turnaround time (TAT). Accuracy, precision, timeliness and authenticity are the four pillars of efficient laboratory services [2]. The speed with which the laboratories are able to deliver test results is a measure by which both clinicians and laboratories judge the adequacy of laboratory service [3,4]. Indeed, one laboratory observer has opined that, in the minds of many physicians, timeliness of reporting test results may be more important than the accuracy of those results [4]. Moreover, the rapid growth in point of care testing (POCT) demonstrates that clinicians are seeking faster test results even though point- of- care tests may be more costly and less precise, subject to a variety of interferences, and less precise. For example, the cost of

point-of-care glucose testing can be many times greater than the cost in the central laboratory, and point-of-care glucose measurements are subject to variation in the patient's haematocrit [5,6,7]. Still, the POCT devices are being preferred as they deliver faster results. Clinicians depend on fast TATs to achieve early diagnosis and treatment of their patients and to achieve early discharge from emergency departments or hospital-in patient services [2]. But with limited exceptions, studies to date fail to show that decreased TAT improves the length of hospital stay or patient care [8, 9,10,11]. When the results become available in defined time, it helps the clinician to start the treatment of the patient in a single visit. Patient outcomes undoubtedly are affected by delays in diagnosis [12]. Also, delays in TAT elicit immediate complaints from users while adequate TAT goes unremarked [13].

Although, it is a difficult task to improve TAT, as it requires education of a wide variety of individuals and planning all the steps involved from ordering the test to final release of reports, yet for patient satisfaction, timeliness of results is an important task which lies with the laboratory and so, steps should be taken to improve TAT.

2. Definition of TAT

One of the most common measures of laboratory or pathological services is the turnaround time (TAT) which has frequently been used since 1980 to quantify the time for laboratory tests in an objective manner [14]. In the laboratory workflow, TAT is an important indicator of performance [15] and is even seen as a "necessary condition for trust between patient and physician" [16]. TAT can be defined in a number of ways. TAT, for example, can be defined as "time from receipt of the specimen" until "time of availability of result" (laboratory TAT) [17].

It can also be defined as the time from "physician's request" until the "time the physician views the result" (total TAT) [18]. It consists of the intervals from order placement to specimen collection as well as the time necessary for transport to the laboratory, accessioning in the laboratory, centrifugation, aliquoting, additional pre-analytic steps if necessary, transport times within and between laboratories, analysis time, the time after completion of analysis until result verification, and the time it takes for the clinical team to be informed of the result [19]. Traditionally, laboratory TAT is determined by the timely progress of 3 phases of testing: pre-analytical, analytical and post-analytical [19,20]. Some authors have introduced the "pre-pre" and "post-post" analytical phases to identify activities associated with the initial selection of tests and with interpretation by clinicians respectively, to differentiate them from the pure collection/transport activities (pre-analytical phase) and reporting (post-analytical phase) [21,22].

3. TAT Benchmarks

The Laboratory accreditation programme proposed by College of American Pathologists (CAP) has taken TAT as a quantitative quality indicator to determine the timeliness of test results [23]. Time taken from the receipt of a specimen in the laboratory to the time of reporting of test result is known as intra-laboratory TAT which is generally under the control of the laboratory and is an index of its efficiency [24]. Laboratory professionals generally believe that intra-laboratory TAT of upto 60 minutes is appropriate; clinicians do not agree [25, 26]. Expectations regarding the ideal times are different as they are based on the specificity of test ordered (electrolyte, blood gases), the type of test (stat vs urgent vs routine) and type of patient (emergency vs ICU vs ward). Turnaround time defined by the laboratory is mostly different from the one required by the physician. In CAP Q Probe study of 1993 of physicians goals and laboratory test, in the turnaround time of 722 institutions and 2763 clinicians, it was seen that physicians and laboratory consultants differed on turnaround time values for four common tests, namely haemoglobin, potassium, pO_2 and glucose. Expectations regarding TAT are different even among physicians from different fields. 40% laboratories had TAT goals between 50.1 and 60 minutes and 25% had goals between 20.1 and 30 minutes for haemoglobin, potassium and glucose [26]. While monitoring TAT, not only mean TAT should be monitored, but also results which fall outside the average TAT (i.e. outliers). Mean and median TATs are not affected significantly by outliers, and thus, they are not good statistical indicators for laboratories with good performance that want to improve further [27]. So, it is the responsibility of the lab to look for outliers, find out their root cause and take the required corrective action.

4. Benefits of Improved TAT

Assessment and improvement of turnaround time is essential for laboratory quality management as well as ensuring patient satisfaction. When the results are rapidly available, it helps the clinician in explaining the results to the patient and also starting the treatment in one meeting. This proves the efficiency of clinicians and also increases patient satisfaction [28]. Moreover, a slow TAT can lead to increased requests for tests in duplicate [13] which further increases the workload of the laboratory. Also, faster TATs have a role in curtailing general expenditure incurred by the exchequer [2].

5. Causes of delayed TAT

The commonest causes of errors in the total testing process as compiled by Plebani [29] are shown below which lead to delayed TAT.

(A). *Pre-pre analytical (46-48%)*

-Inappropriate test request

-Sample collected from infusion route

-Sample collection (haemolysis, clotting and insufficient volume)

-Inappropriate container

-Handling, storage and transportation

(B). *Pre-analytical (3-5%)*

-Sorting and routing

-Aliquoting

-Pipetting and labelling

-Centrifugation

(C). *Analytical (7-13%)*

-Equipment malfunction

-Sample mix-ups

-Interference (endogenous and exogenous)

-Undetected failure in quality control

(D). *Post-analytical (13-20%)*

-Erroneous validation of analytical data

-Failure in reporting or addressing the report

-Improper data entry

-Failure/delay in reporting critical values

(E). *Post-post analytical (25-46%)*

-Delayed/missed reaction to laboratory reporting

-Incorrect interpretation

-Inappropriate/inadequate follow up plan

6. Steps for improving TAT

Accreditation agencies are increasingly requiring laboratories to go beyond analytical quality and take responsibility for the pre and post- analytical phases where most errors arise. Otherwise, TAT can be improved by concentrating on all the phases involved in testing including pre-analytical, analytical as well as post-analytical phase. Various steps which can be taken to achieve an optimum TAT are-

6.1. Pre-analytical Phase

1. The test should be ordered via computer [30].

2. Adoption of ideal phlebotomy practices [31,32], bar coding of samples and computer generated requisition slips.

3. Use of plasma and serum separator tubes [33,34] and whole blood which will reduce the delays caused during centrifugation.

4. Steps should be taken to reduce the time between obtaining and processing of the specimen by the laboratory. This can be done by decreasing the specimen transport time from phlebotomy area to the lab. Specimen transport which is still done manually, can be improved with the help of pneumatic system, robots, or conveyer belt-type delivery systems. The pneumatic system is a path breaking innovation that has revolutionized sample transport and many studies have proven the efficiency of this mechanism in reducing inadvertent delays as a result of human courier [35].

6.2. Analytical Phase

1. The laboratories should be fully automated.

2. Evaluation of Front-end automation: This equipment centrifuges, decaps, prepares aliquots [36,37], and sorts specimens.

3. Use of machines with higher throughput.

4. To ensure adequacy of backup.

5. Adoption of efficient quality control procedures [38].

6. The staff should be trained to handle urgent samples with utmost care and expedite their processing [39,40,41].

7. Automatic dilutions with analyte remeasurements when results are beyond linearity of the method and automatic rerunning to confirm critical results in critically ill patients.

8. Prompt validation of reports

9. To consider automatic printing for locations such as intensive care unit (ICU).

6.3. Postanalytical Phase

It can be improved by adoption of Laboratory Information Management System (LIMS). The reports should be transmitted via computer, broadcast (electronic board), pager and /or internet [42].

7. Conclusions

Improving TAT is a continuous process and we need to have a wholesome approach for reducing the obstacles for optimum TAT. In addition, TAT should be kept in mind when choosing everything from blood collection procedures to instruments and computer systems. Ideally, one activity reinforces another in achieving an optimal TAT. There is a pertinent need to have increased interaction between clinicians and laboratory consultants and establish a realistic TAT which would help in achieving timeliness in the labs.

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