Determination of Laboratory STAT Investigation Turnaround Time in Monilek Hospital and Research Centre, Jaipur

By

Priyambi Agarwal

Dissertation submitted for the partial fulfillment of the

MBA Hospital and Health Management

Academic year, 2016-2018

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TO WHOMSOEVERMAY CONCERN

This is to certify that Ms. Priyambi Agarwal student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at Monilek Hospital & Research Centre, Jaipur from 1st Feb to 4th May .

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish her all success in all his future endeavors.

Dean, Academics and Student Affairs
The IIHMR University, Jaipur

Col. (Dr) Ashok Kaushik
The IIHMR University, Jaipur

Monilek Hospital & RESEARCH CENTRE

(A Wing Of Smt. Mohinidevi Lekhraj Odhrani Charitable Trust)

The certificate is awarded to

PRIYAMBI AGARWAL

In recognition of having successfully completed her

Internship in the department of

QUALITY

and has successfully completed her Project on

Determination of laboratory STAT Investigation turnaround time in Monilek Hospital & Research Centre, Jaipur

1st Feb 2018 to 4th May 2018

Monilek Hospital and Research Centre, Jaipur

She comes across as a committed, sincere & diligent person who has a strong drive and zeal for learning

We wish her all the best for future endeavors

Mrs. Kavita Kaushik

(Director Operations)

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled Determination of Laboratory STAT Investigation Turnaround Time in Monilek Hospital & Research Centre, Jaipur submitted by Priyambi Agarwal Enrollment No. IIHMR-U/01/2016-18/0472 under the supervision of Col. (Dr) Ashok Kaushik for award of MBA in Hospital and Health Management in Health and Hospitals of the University carried out during the period from 1st Feb to 4th May embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Priyambi

Signature

ACKNOWLEDGMENT

At the outset, I would like to articulate this project as small journey which was a remarkable learning experience for me. The successful completion of this project is only because of the extraordinary support, guidance, counseling and motivation from my respectable staff, of IIHMR University and my organization Monilek Hospital and Research Centre, Jaipur.

This journey could not be completed without support of my family and friends. I express my deep gratitude to Col. (Dr) Ashok Kaushik (Retd.)(Professor and Dean) mentor for this project. Through the support provided by him, I have imparted knowledge on the avenues which this project have opened and explored. His directions in making me think about unique conceptual and practical aspects of Health & Safety which has lifted this project at this stage of successful completion.

I extend my gratitude to my Manager and all my colleagues, friends for their encouragement, support, guidance and assistance for undergoing industrial training and for preparing the project report.

DECLARATION

I do hereby declare that I am a student of 2nd year, MBA in Hospital and Healthcare Management, IIHMR University, Jaipur Rajasthan session 2016-2018. I would like to state that I have carried out my Dissertation on the topic **"A Study on Determination of Laboratory STAT Investigations Turnaround Time in Monilek Hospital & Research Centre, Jaipur".** This project work is my own and has not been submitted to any of the other Institute or University for the purpose of award of any degree or diploma.

Priyambi Agarwal

MBA- HM 21

2016-2018

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INTRODUCTION

STAT: It is a common medical abbreviation for urgent or rush derived from the Latin word statum, meaning "immediately."

Laboratory STAT TAT is defined as the time from collection of the specimen to the time the results are verified in the computer and the reports are given to the patient. The total TAT for laboratory assays includes the entire interval from ordering of the test to the clinician's awareness of the result (i.e., "brain-to-brain"). 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, liquating, 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. The effects of TAT have been studied to a high extent, with correlations being drawn between emergency department treatment and length of stay. As a result, TAT is often considered the most significant measure of a laboratory's service and is used by many clinicians to judge its quality. Along with accuracy and reliability, timely reporting of laboratory test results is now considered an important aspect of the services provided by the clinical laboratory. Whether or not, faster turnaround time can make any medical difference, patients and their physicians want reports as rapidly as possible. It has also been shown that outcomes in certain situations such as operation theaters and in emergency departments have been affected by timely reporting of lab tests results. Hence, rapid laboratory turnaround times is important both from a medical and commercial point of view. The study was conducted to evaluate the delay and reasons of delay of turnaround time (TAT) of stat tests in the section of clinical chemistry of the clinical laboratory.

LITERATURE REVIEW

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 the activities included. This last area is the greatest source of variation in reporting of TAT. The steps in performing a laboratory test were outlined by Lundberg, who described the brain to brain TAT or "total testing cycle" as a series of nine steps: ordering, collection, identification, transportation, preparation, analysis, reporting, interpretation and action.[1,2] The term "therapeutic TAT" is sometimes used to describe the interval between when a test is requested to the time a treatment decision is made.[3–5]Although the laboratory can and perhaps should be involved in all these steps, many laboratories restrict their definition of TAT to intra-laboratory activities, arguing that other factors are outside their direct control and that timing data for extra-laboratory activities are not readily available.[6] Such an approach will necessarily underestimate TAT since non-analytical delays may be responsible for up to 96% of total TAT.[7.8] In the ED, delay in review of results by clinicians is the greatest component of perceived TAT. [6]

Intra-laboratory TAT can also vary in its definition with possible start points of sample receipt time, registration time, or analytical sampling time and end points of analytical completion time, result verification time, result transfer to electronic medical record time and report printing time.

Another classification of time periods separates the steps into the pre-analytical (order to preparation), analytical (analysis) and post-analytical (reporting to action) phases.[9.10] These divisions have often been used when classifying errors and delays and are sometimes used for description of TAT.

There are differences between clinicians and laboratories in their definitions of TAT. In the 1998 CAP Q-Probes program, 41% of laboratories defined ED TAT as time of receipt in the laboratory until time of report, 27% as ordering of test to result reporting and 18% as specimen collection to reporting.[11] However over 40% of physicians defined ED TAT as starting at physician request and only 9% at laboratory receipt. There was better agreement between laboratories and physicians in the choice of endpoint with over 40% of physicians choosing when the physician gets the results as the end point and 50% when the ED gets the results. Similar results were seen earlier in the 1990 CAP Q-Probes survey with test ordering or phlebotomy the preferred start point and laboratory reporting or physician receipt the preferred endpoint for the majority of physicians. [12]

Use of different measures to describe TAT also complicates comparisons. It is important to examine a frequency histogram of data before deciding on appropriate descriptive measures. In the case of TAT, the overall process is composed of multiple sequential steps, each with a minimum or fastest time possible. For example, if a centrifuge is set to 10 minutes spinning time, centrifugation can take no less than 10 minutes and may take longer if there are delays (e.g. balance problems). This means that Gaussian distributions for each of the individual steps or for the total TAT are not

expected. It is thus inappropriate to use means and standard deviations as descriptors of TAT distributions.

A non-Gaussian distribution with a positive skew (or tail to the right) is seen for TAT distributions, meaning that median and tail size are the preferred measures.[13] Tail size can be quantified as the percentage exceeding a defined time (outlier rate) or as the time corresponding to a defined percentile of the distribution (e.g. 90^{th}). This last measure is increasingly common in the literature and is referred to as the 90% completion time. Valenstein and Emancipator studied the performance of four measures of laboratory TAT: the mean, median, 90^{th} percentile, and outlier rate.[14] For tests with long TATs, the most important quality of a TAT measure is high reproducibility, so that improvement in reporting speed can be distinguished from random variation resulting from sampling. The mean was found to be the most reproducible of the four measures, followed by the median. The mean achieved acceptable precision with sample sizes of 100–500 tests. For tests with normally rapid TATs, the most important quality of a measure is high sensitivity and specificity for detecting whether TAT has dropped below standards. The outlier rate was found to be the best measure of TAT in this setting but required sample sizes of at least 500 tests to achieve acceptable accuracy.

Use of outlier rates has been recently promoted but use of dual measures is useful in providing information on the norm (the median) as well as the exception (the tail size).[15.16] This allows a more balanced appreciation of TAT and avoids excessive attention to a single parameter. An alternative single measure is the use of the mean as this will be sensitive to outliers as well as the bulk of the population.[17].

Unfortunately the variety of different approaches in the literature creates difficulties when searching for benchmarking or state-of-art data. Inspection of journal abstracts is sometimes insufficient to allow clear identification of how TAT was measured and study of the original text does not always clarify the details. The descriptions in external quality assurance programs of TAT (e.g. CAP Q-Probes, Q-Tracks) often provide the clearest and most easily understood procedures. Howanitz, who has published widely on the CAP survey results, has suggested that TAT be defined from the time the test is ordered to the time that results are available to the caregiver and that TAT goals be expressed as a percentage of all results completed within the time interval (e.g. 90% or 95% of results completed within the time interval).[18.19] However laboratories without electronic order entry systems may have difficulty collecting accurate ordering times and may find intra-laboratory TAT a more feasible option at present.

Satisfaction is an important element of the quality of services, including health services: a high quality organization meets customer's needs. One approach assumes that, in the clinical laboratory, managers know what customers want and directly set out measures of laboratory performance in each specific area. Another approach considers that quality measurement is the assessment of customer satisfaction with the services provided by the laboratory. Each approach has its advantages for assessing quality. Direct assessment of local performance helps managers understand whether it is improving and how it compares to published norms. On the other hand, customer satisfaction assessment helps

to better define the real expectations of the ordinary customers of a particular laboratory. [20.21]

Physicians are the primary external customers of laboratory services and their opinions are essential components in providing laboratory managers with opportunities to identify areas for improvement. Nowadays, assessing customer satisfaction with laboratory services is considered an important component of a laboratory quality assurance programme. [22]

Aim

To evaluate the delay and reasons for delay in turnaround time (TAT) of STAT Investigations.

Research Question

a) What is the actual turnaround time of the reports for the STAT Investigation?
b) What are the possible reasons for delays, if any

Objectives

1. To study the laboratory turnaround time.
2. To evaluate delay of turnaround time.
3. To find out reasons for delay in turnaround time.
4. To suggest measures to reduce turnaround time, if possible.

METHODOLOGY

Study type: Cross sectional and observational study.

Study Area: Laboratory, Monilek Hospital & Research Centre.

Sample size: 100% (383) sample size of STAT investigations except the exclusions.

Inclusion criteria

1. All the samples from OPD, IPD and Emergency of stat investigations.

Exclusion criteria

1. Samples having abnormal results.
2. Rare tests which are not having standard turnaround time.

3. Samples which are part of master health checkups.
4. Oncology samples which are checked by pathologists.
5. Samples collected after 5:00 pm.

Duration of study: 1st February 2018 to 4th May 2018

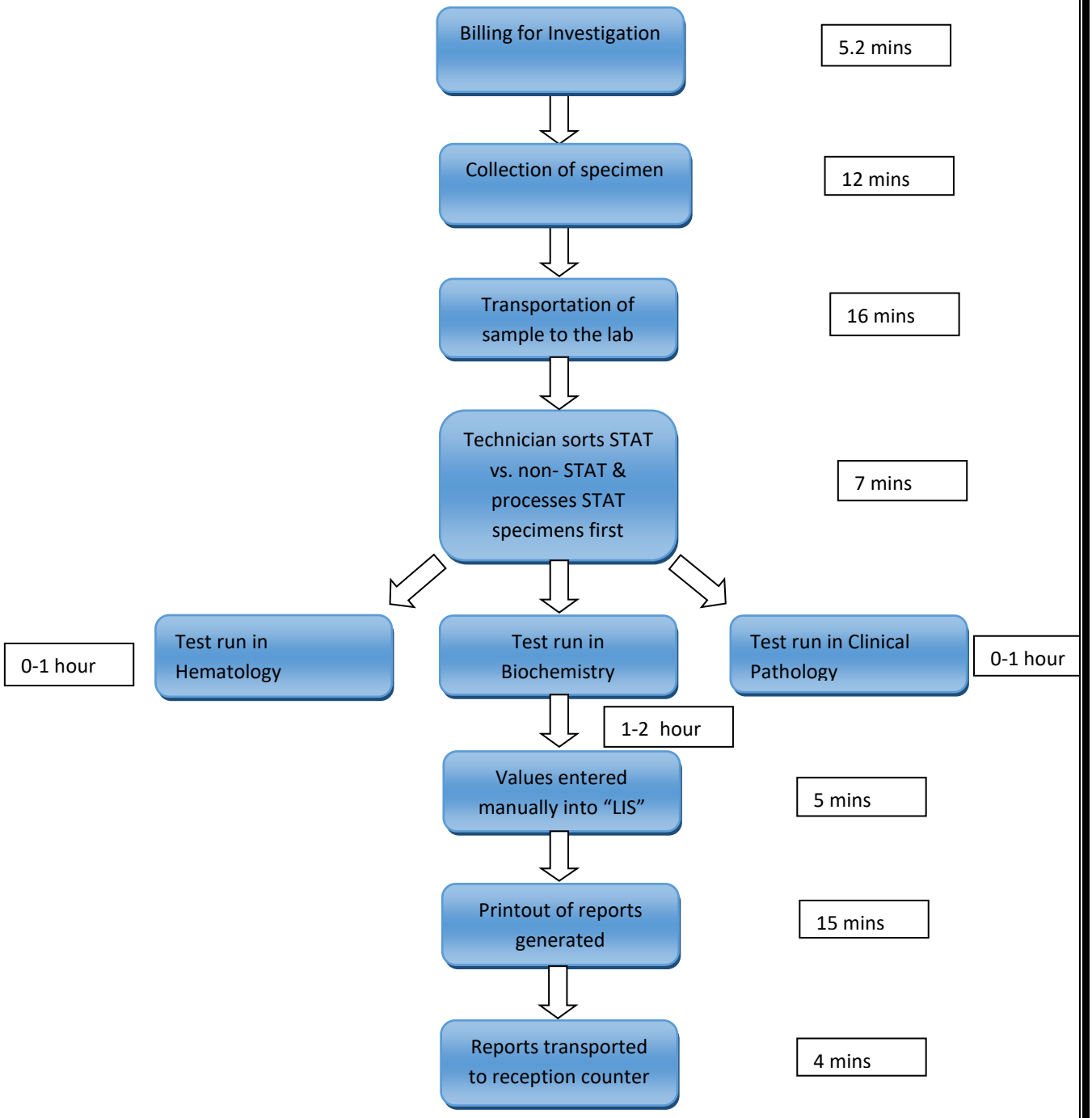
Data Collection

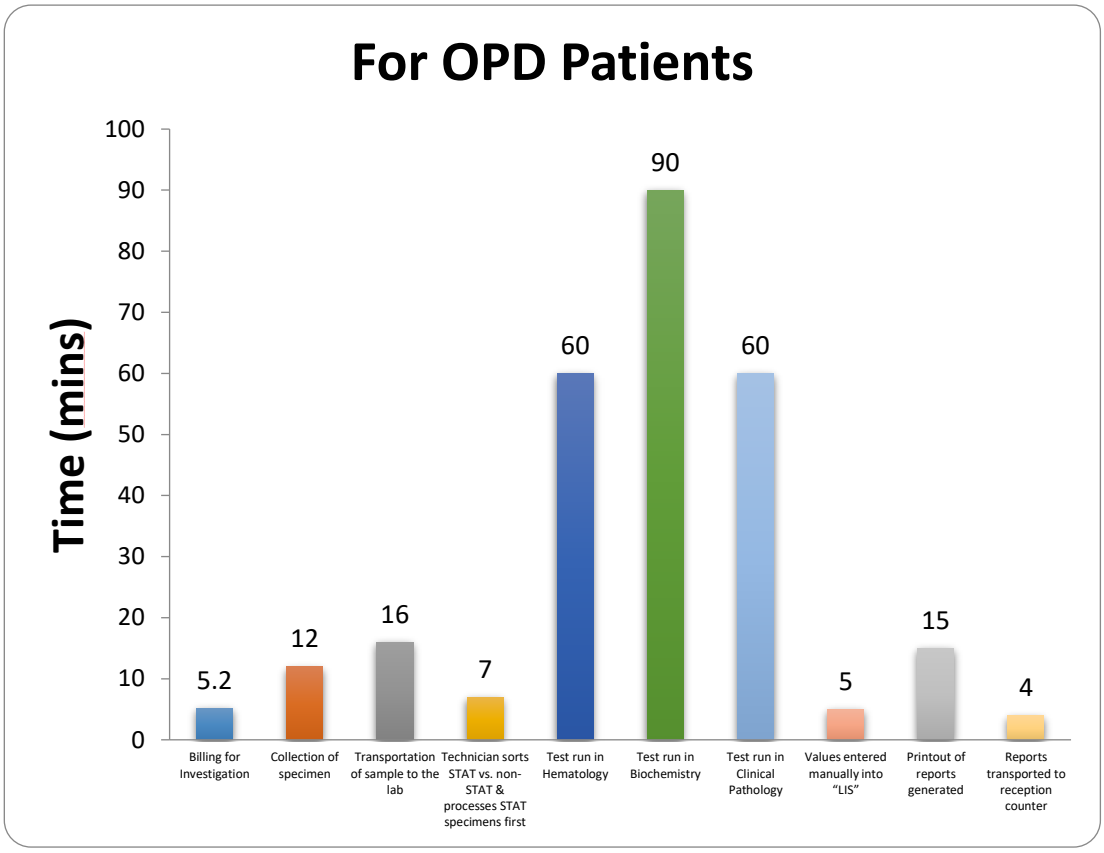
Primary data: Direct Observation, Conversation with the Laboratory department staff
Secondary data: Laboratory information system, Printed Reports of the Patients

DATA ANALYSIS& INTERPRETATION

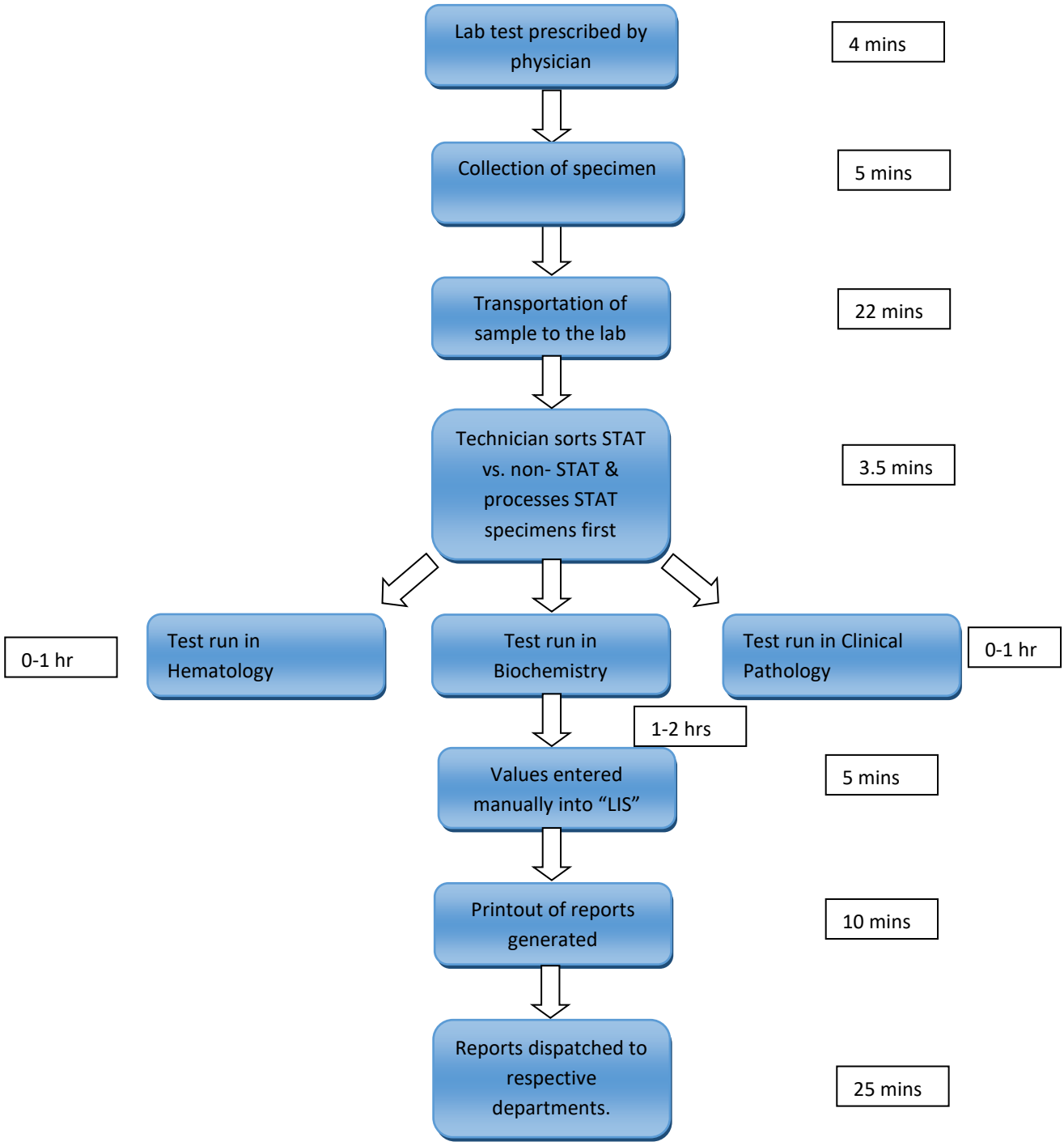
1. **Process flow showing average time taken for the steps is as follows:**

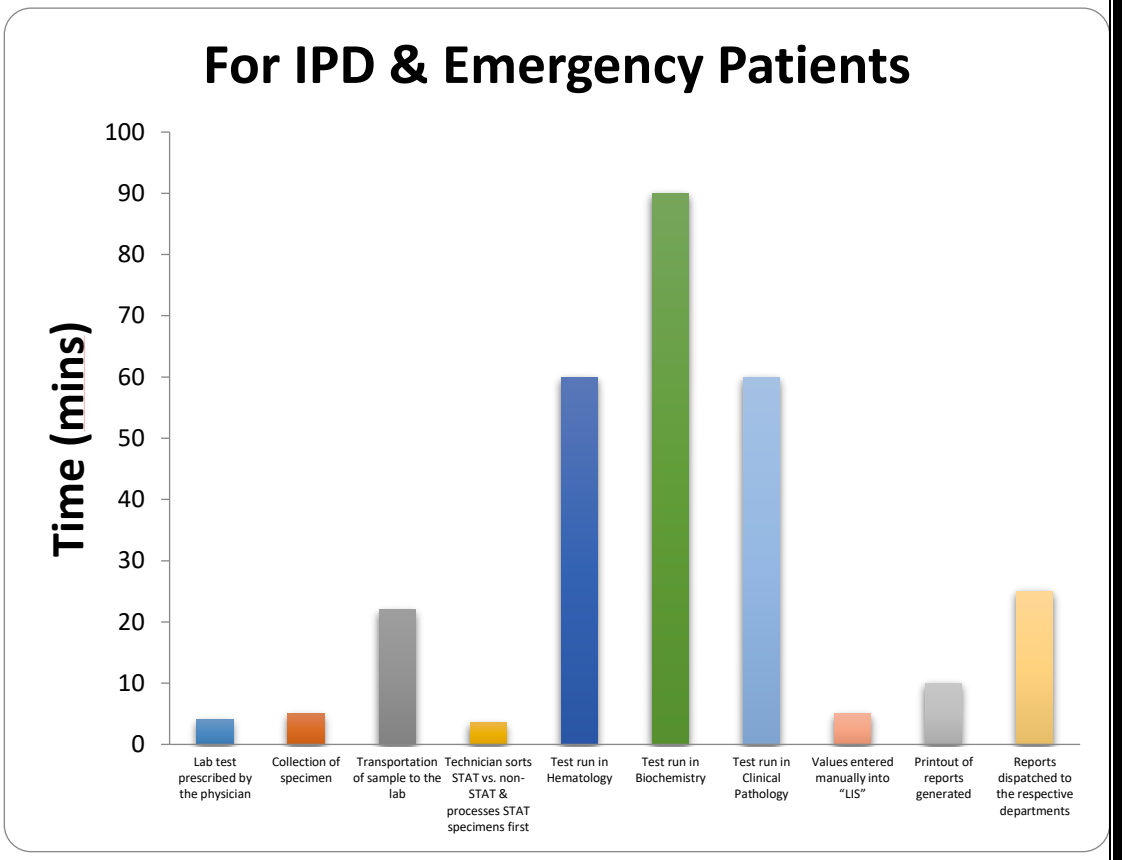
i) For OPD Patients:




For OPD Patients
Time (mins)
100
90
80
70
60
50
40
30
20
10
0
5.2
12
16
7
60
90
60
5
15
4
Billing for Investigation
Collection of specimen
Transportation of sample to the lab
Technician sorts STAT vs. non-STAT & processes STAT specimens first
Test run in Hematology
Test run in Biochemistry
Test run in Clinical Pathology
Values entered manually into "LIS"
Printout of reports generated
Reports transported to reception counter

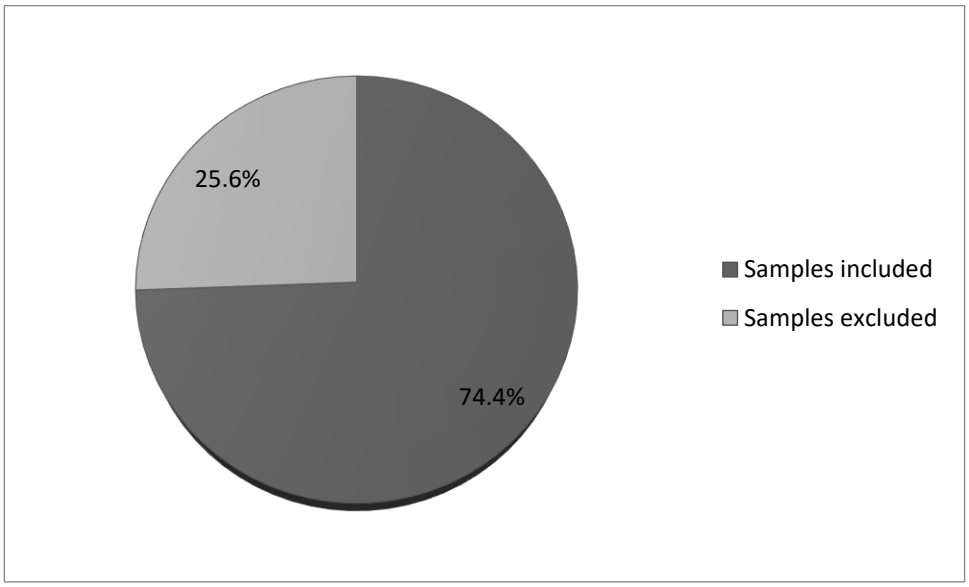
ii) For IPD & Emergency Patients:





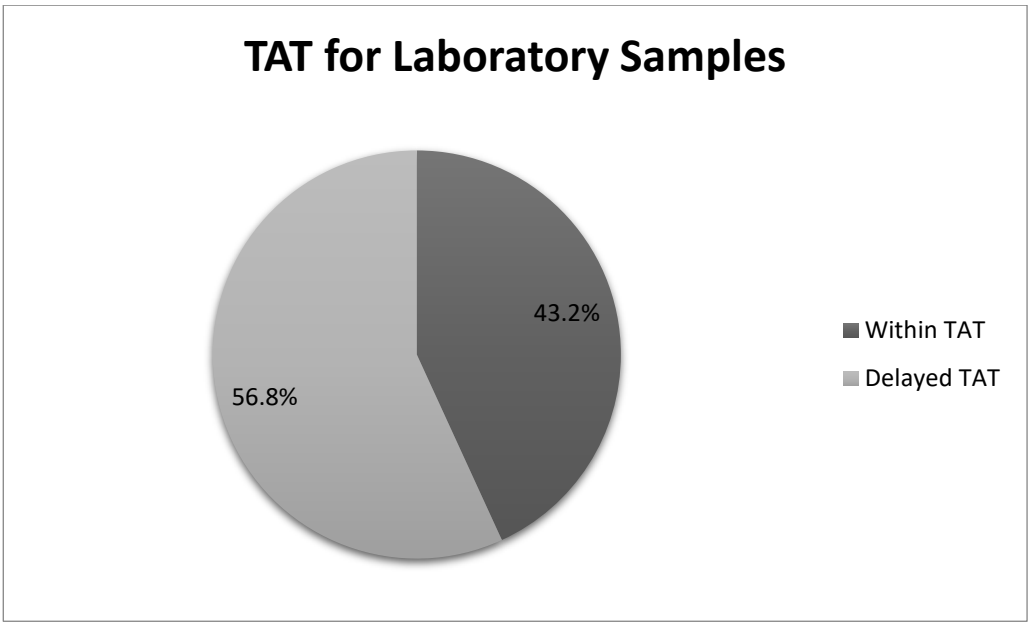
2. Observation of diagnostic samples

Total 383 diagnostic samples were observed. Out of 383, 285 samples (74.4%) were taken for analysis. Rest 98 samples (25.6%) were under exclusion criteria.



3. TAT for laboratory samples

Out of total 285 samples included for study, 123 (43.2%) samples were within TAT time and 162 (56.8%) samples were delayed.



4. Distribution of delayed TAT timings

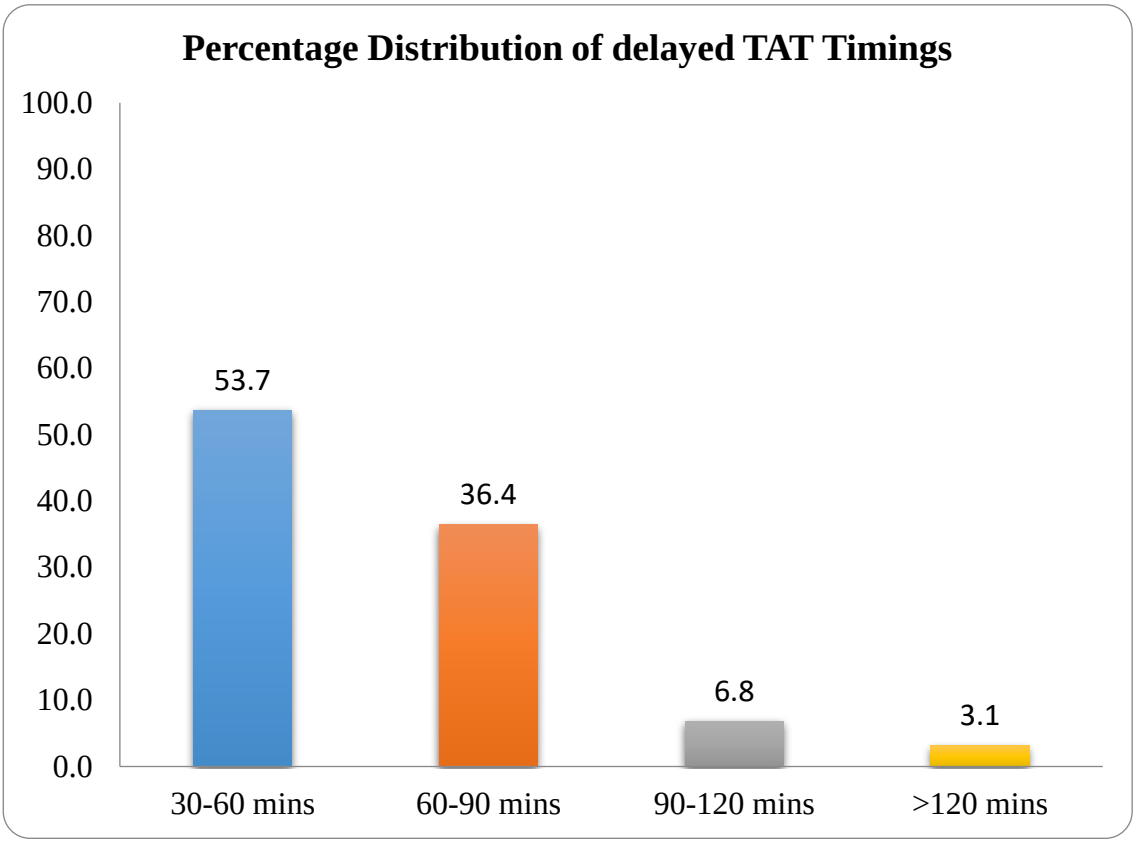
The specimens were divided into 5 groups:

1. TAT within 30 min
2. TAT between 30 and 60 min
3. TAT between 60 and 90 min
4. TAT between 90 min and 120 min
5. TAT over 120 min

The average time taken for each step was measured.

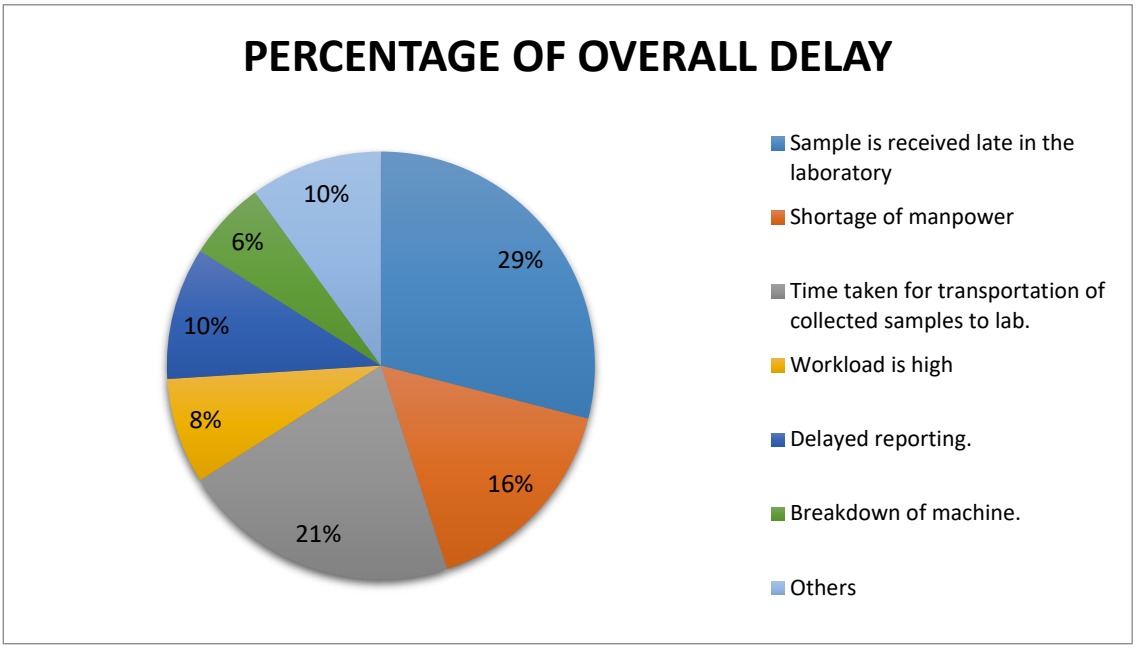
When specimen results were reported after 30 min, each phase was investigated to determine the underlying reason for the lack of timeliness.

Out of total 162 samples which were delayed, 87 (53.7%) samples had TAT between 30 minutes to 60 minutes, 59 (36.4%) samples had TAT between 60 minutes to 90 minutes, 11 (6.8%) samples had TAT between 90 minutes to 120 minutes and 5 (3.1%) samples had TAT over 120 minutes.



5. REASONS OF DELAY

REASONS FOR DELAY IN REPORTS OF STAT INVESTIGATIONS	PERCENTAGE OF OVERALL DELAY
Sample is received late in the laboratory	29%
Shortage of manpower	16%
Time taken for transportation of collected samples to lab.	21%
Workload is high	8%
Delayed reporting.	10%
Breakdown of machine.	6%
Others	10%



It is evident from the above pie chart that out of 100% stat investigations, 29% patients faced delay in reports as sample was received late in the laboratory, 16% due to shortage of manpower, 21% faced delay as transport personnel carrying samples to lab stuck in lift, 8% delays were due to high workload, 10% delays were due to delay in reporting, 6% due to breakdown of machine, and 10% delays were due to other reasons.

DISCUSSION

Defined TAT for STAT investigation is: 30min.

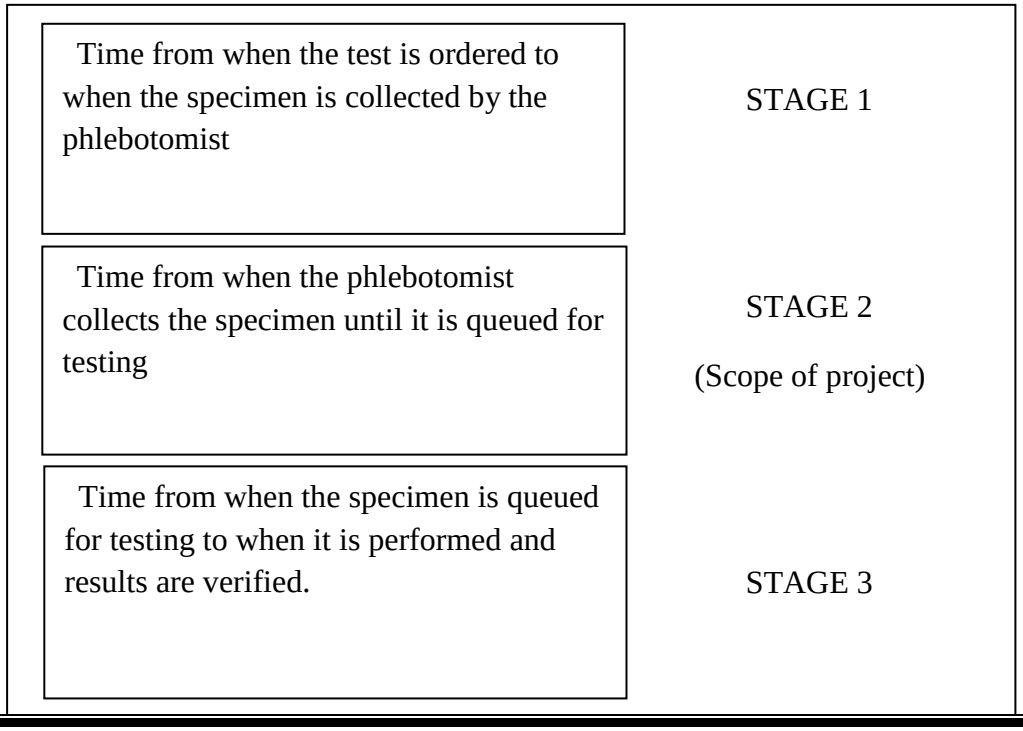
This study utilized 383 specimens that were received from 8:00 am until 5:00 pm at Monilek Hospital & Research Centre for routine STAT tests. A total of 383 tests were performed, the routine analysis were hematology, glucose, urea, creatinine, uric acid, cholesterol, protein, albumin, total bilirubin, direct bilirubin, phosphorous, sodium, potassium, chloride, amylase, lipid profile, routine urine examination, lipase, etc.

During laboratory test processing, 4 points were noted i.e., "labeling of sample" when the barcode was generated in software and the specimen was accessed simultaneously, labeling on sample was done which included Patient's name and registration number; "scanning" when the barcode was scanned in the auto analyzer; "result to LIS" when the result was transmitted manually from the instrument to the LIS by the technician after the analysis; and "report to patient" when the result was out and the reports were sent to the patients.

In this study, the TAT was classified into 3 phases on the basis of these 4 points, i.e., pre analytical phase (barcode printing-scanning), analytical phase (scanning-result to LIS) and post analytical phase (result to LIS- report to patient).

The pre analytical phase consists of the following steps: Barcode generation with simultaneous specimen accession; the wait for phlebotomist; transport of the specimen from sample collection room to laboratory; manual centrifugation; manual specimen loading on auto analyzer. The analytic phase consists of following steps: barcode scanning; tests run in the machine; analysis; result entered manually into LIS. The post analytical phase consists of following steps: the result entered into LIS manually; verification (manually); the printed report sent to the patient.

The total lab TAT is broken down into three main stages. The portion of total TAT that lab management targeted as the main issue includes the time from when the specimen is collected by the phlebotomist until the specimen is queued for testing.



After documenting the process flow, time studies were performed in order to determine the composition of process times and potential areas of improvement.

The hourly trends in the number of specimens processed were analyzed over one week. Total specimens processed were analyzed over one week. Total specimens processed are highest at the beginning of the week and gradually decline until the end of the week. Peak hours are between 9am to 2pm.

A steep drop off is seen during the weekend (Saturday and Sunday) as a result of limited patient appointments.

Average time between sample collection and lab reach was observed to be 10 min. Ideal permissible time for sample to reach laboratory from collection should be between 5-7 minutes. So there was a transport delay.

Instrumentation failure

1. Biochemistry: 2 times

It was found that most of the delay in TAT of stat test was more than 30 minutes.

Most common reason for this delay was found to be transport delay followed by shortage of manpower, machine breakdown, problems in machine maintenance and high workload.

Another finding in my study was that most of the delay in TAT of stat tests occurred in the morning shift, while maximum staff strength is available. Increase in workload at this time could be a reason for delay in TAT at this time of the day.

RECOMMENDATIONS

- Transport personnel coming from the IPD and Emergency should be restriction free to use the lift while coming to the lab.
- Additional transport personnel can be given during peak hours in lab.
- Pneumatic shoot can drastically reduce the sample carrying time.
- TAT should be specified as per the investigations as few tests have very less TAT and others have more TAT. For instance, the need to centrifuge Potassium specimens prior to biochemical analysis causes the laboratory TAT interval for this test to be longer than those of hemoglobin and prothrombin.
- The reports should be made available online in all the departments of the hospital.

CONCLUSION

- The study shows that there are various reasons of delay.
- Such as time taken in transportation of collected sample to the lab etc.
- Therefore management of staff and new technology could be used to overcome these issues

REFERENCES

1. Lundberg GD. Acting on significant laboratory results. JAMA. 1981;245:1762–3.
2. Crook MA. Near patient testing and pathology in the new millennium. J Clin Pathol. 2000;53:27–30.
3. Fermann GJ, Suyama J. Point of care testing in the emergency department. J Emerg Med. 2002;22:393–404.
4. . Seamonds B. Medical, economic, and regulatory factors affecting point-of-care testing. A report of the conference on factors affecting point-of-care testing, Philadelphia, PA 6–7 May 1994. Clin Chim Acta.1996;249:1–19.
5. Hicks JM, Haeckel R, Price CP, Lewandrowski K, Wu AH. Recommendations and opinions for the use of point-of-care testing for hospitals and primary care: summary of a 1999 symposium. Clin Chim Acta.2001;303:1–17.
6. Saxena S, Wong ET. Does the emergency department need a dedicated stat laboratory? Continuous quality improvement as a management tool for the clinical laboratory. Am J Clin Pathol. 1993;100:606–10
7. Manor PG. Turnaround times in the laboratory: a review of the literature. Clin Lab Sci. 1999;12:85–9.
8. Rollo JL, Fauser BA. Computers in total quality management. Statistical process control to expedite stats.Arch Pathol Lab Med. 1993;117:900–5.
9. Valenstein P. Turnaround time. Can we satisfy clinicians' demands for faster service? Should we try? Am J Clin Pathol. 1989;92:705–6.
10. Truchaud A, Le Neel T, Brochard H, Malvaux S, Moyon M, Cazaubiel M. New tools for laboratory design and management. Clin Chem. 1997;43:1709–15.
11. Steindel SJ, Howanitz PJ. Physician satisfaction and emergency department laboratory test turnaround time. Arch Pathol Lab Med. 2001;125:863–71.
12. Howanitz PJ, Cembrowski GS, Steindel SJ, Long TA. Physician goals and laboratory test turnaround times. A College of American Pathologists Q-Probes study of 2763 clinicians and 722 institutions. Arch Pathol Lab Med. 1993;117:22–8.
13. Valenstein PN, Emancipator K. Sensitivity, specificity, and reproducibility of four measures of laboratory turnaround time. Am J Clin Pathol. 1989;91:452–7.
14. Holland LL, Smith LL, Blick KE. Reducing laboratory turnaround time outliers can reduce emergency department patient length of stay: an 11-hospital study. Am J Clin Pathol. 2005;124:672–4.
15. Steindel SJ, Novis DA. Using outlier events to monitor test turnaround time. Arch Pathol Lab Med.1999;123:607–14.
16. Howanitz PJ, Steindel SJ. Intralaboratory performance and laboratorians' expectations for stat turnaround times. A College of American Pathologists Q-Probes study of four cerebrospinal fluid determinations. Arch Pathol Lab Med. 1991;115:977–83.
17. Howanitz PJ. Errors in laboratory medicine: practical lessons to improve patient safety. Arch Pathol Lab Med. 2005;129:1252–61.
18. Mfinanga SG et al. Patient's dissatisfaction with the public and private laboratory services in conducting HIV related testing in Tanzania. BMC Health Services Research, 2008, 8:167–171.

19. Workbook 6. Client Satisfaction Evaluations. Geneva, World Health Organization, 2000 (WHO/MSD/MSB 00.2g) (http://whqlibdoc.who.int/hq/2000/WHO_MSD_MSB_00.2g.pdf, accessed 2 April 2013).
20. Jones BA et al.; College of American Pathologists. Physician satisfaction with clinical laboratory services: a College of American Pathologists Q-probes study of 138 institutions. Archives of Pathology & Laboratory Medicine, 2009, 133:38–43.