Study on Optimizing Laboratory Workflow and Performance by Implementing Lean Management Techniques at The Mission Hospital Durgapur

By

Mahima Sambyal

Dissertation submitted in partial fulfillment of the requirements of the degree

MBA Hospital and Health Management

Academic year, 2017-2019

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IIHMR UNIVERSITY

TO WHOMSOEVER MAY CONCERN

This is to certify that **Dr. Mahima Sambyal** student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at **The Mission Hospital, Durgapur** from **4th Feb 2019 to 30th April 2019.**

The Candidate has successfully carried out the study on **Optimizing Laboratory Workflow and Performance by Implementing Lean Management Techniques** assigned 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 her future endeavors.

Col (Dr.) Ashok Kaushik
Dean, Academics and Student Affairs
The IIHMR University,Jaipur

Piyusha 15/5/19 on behalf of V.N.S.

for Prof. Veena Nair
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THE MISSION HOSPITAL DURGAPUR | FUTURISTIC TECHNOLOGY. BRILLIANT MINDS.

Ref: TMH/HRD/OG/April/19/82 **Date: 01/05/19**

TO WHOM IT MAY CONCERN

This is to certify that **Dr. Mahima Sambyal** has done three months dissertation on **A Study on Optimizing Laboratory Workflow and Performance by Implementing Lean Management Techniques at The Mission Hospital, Durgapur, West Bengal** from 04/02/2019 to 30/04/2019.

During the period of dissertation **Dr. Mahima Sambyal** has been found sincere, hard working & having an attitude to learn.

We wish her a successful future and brilliant professional career ahead.

For The Mission Hospital, Durgapur

Ramesh Lall
Sr. General Manager - HR

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **Optimizing Laboratory Workflow and Performance by Implementing Lean Management Techniques** and submitted by **Dr. Mahima Sambyal** Enrollment No**595** under the supervision of **Prof. Veena Nair** for award of **MBA Hospital and Health Management** in Health and Hospitals of the University carried out during the period from **4th February to 30th April** 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.

Signature

ABSTARCT

Background: This article highlights some key concepts of Lean and the elements of beginning a Lean journey within the clinical laboratory. It explores Lean tools that can be implemented within the healthcare setting of The Mission Hospital, Durgapur for a period of 2.5months.

Objective: The objective of the study included to estimate the impact of lean management techniques in optimizing laboratory workflow and performance and to derive managerial implications from the findings.

Methodology: The study performed is a descriptive cross- sectional study and both primary and secondary research was used for data collection. Primary data was collected with the help of lean tools developed and secondary a data was collected with the help of laboratory information system (LIS). **Data Analysis**: After data analysis it was clearly evident that TAT was reduced by implementing lean in laboratory.

Conclusion: It was concluded that if appropriate resources and training provided better results can be seen in terms of reduction in Turnaround time for laboratory reports.

ACKNOWLEDGEMENT

I would like to extend my heartfelt gratitude to Dr. Parthapal, Chief Medical Superintendent of The Mission Hospital Durgapur, for providing me the opportunity to undergo my dissertation in the esteemed organisation. Words fall less for the guidance he has provided at each step and the opportunities given for judicious learning by allotting the department and always being open for constructive discussions.

My sincere gratitude to Dr. Taraknath Taraphdar, Assistant Medical Superintendent (Quality and audit) and senior consultant Emergency Medicine for being a constant source of knowledge, support and guidance throughout the span of time.

The completion of this undertaking would not have been possible without the wholehearted support and pearls of wisdom shared by Mr. Priyanath Mukherjee, Quality manager of Laboratory Medicines.

I would also like to extend a note of thanks to my guide at The IIHMR University, Prof. Veena Nair, Associate Professor for being available whenever i needed her guidance and support.

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LIST OF FIGURES

LABORATORY SERVICES OF HOSPITAL

Laboratory services of the Mission hospital, Durgapur has department as follow:

1. Biochemistry
2. Haematology
3. Microbiology
4. Serology
5. Clinical Pathology

And 6. Histopathology

The sample flow occurs from both IPD and OPD. The following are the services provided by various departments.

HEMATOLOGY

- Complete Blood Count
- Bone marrow aspiration
- Biopsy
- Fibrinogen
- Haemoglobin analysis by HPLC
- MP antigen
- Sickling test
- PT
- APTT
- Factor VIII assay
- Inhibitor screen assay
- Clot solubility
- DIC profile

CLINICAL PATHOLOGY

- Routine examination – Urine and stool, Cell type and cell count- body fluids, semen analysis,
- Cytopathology –Malignant cell analysis, FNAC (guided and unguided), Excision biopsy, CT/USG (guided and unguided)
- Histopathology – Biopsy of all small and large specimens

SEROLOGY

- CRP, RA, ASO
- Hepatitis Markers ELISA
- Allergy screening,
- Dengue ELISA
- Autoimmune disease (ANA Panel, Liver Panel, Anti CCP, ANA ELISA)

BIOCHEMISTRY

(Routine biochemistry)

- LFT
- Renal Function Test
- Lipid Profile
- Glycosylated haemoglobin
- Serum electrolyte
- Blood sugar
- Lipase
- Amylase
- Magnesium

(Special biochemistry)

- LH
- FSH
- Prolactin
- Cancer Markers (CA125, CEA, CA19.9)
- Beta. HCG
- THYROID PROFILE
- VIT B12
- VIT D

MICROBIOLOGY

- Culture and sensitivity – Blood, Urine, Sputum, Wound, CSF, Body fluids
- Throat swab for diphtheria
- Fungal culture
- Gram stain
- Acid fast bacilli smear

The following is the depiction of the laboratory workflow and performance:

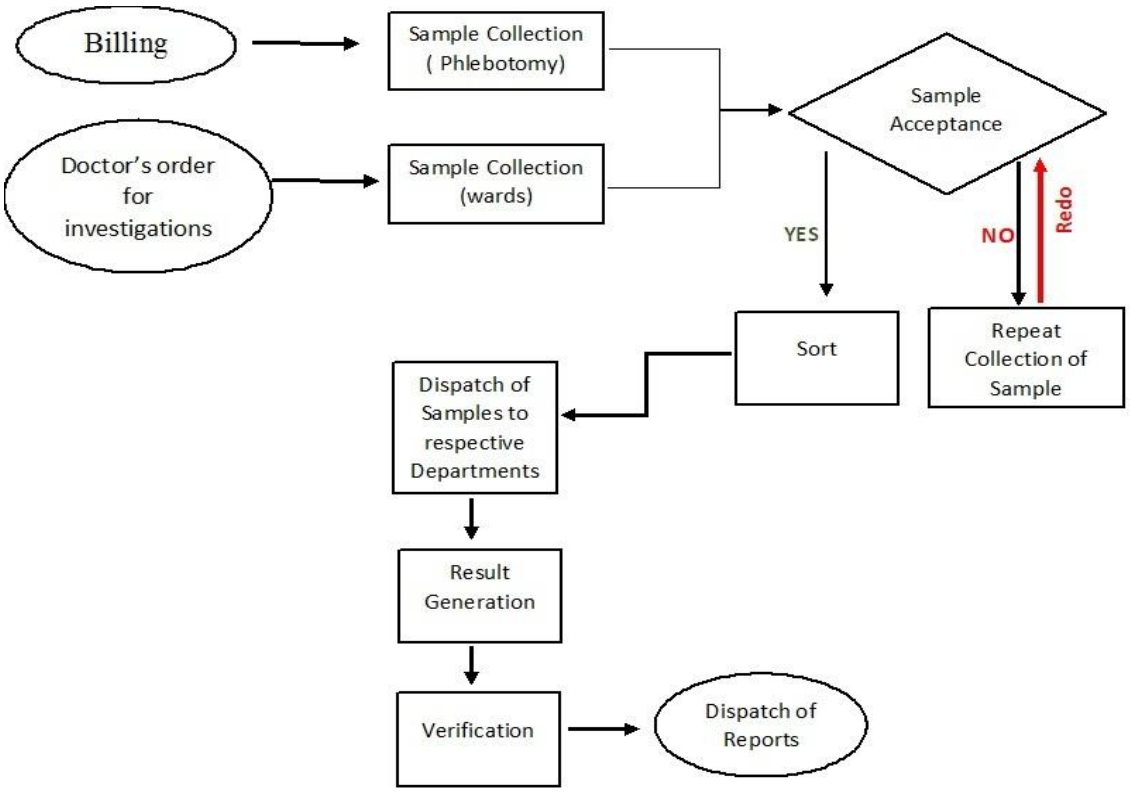

Fig:2

Collectively all of the interrelated laboratory steps in the testing process describe its workflow.

Sample collection: The doctor will order a laboratory report on a patient, a phlebotomist will draw the specimens needed for testing. Each test ordered has different draw needs. Each type of collection tube or method has different qualities that affect the integrity of the specimen. For example, a CBC must be drawn in EDTA tube to avoid the blood from clotting.

Sample reception: If accepted the sample is sort at the laboratory and send to various departments for further process. The sample may either be accepted or rejected from this point.

Sample processing: Once the samples are received in the laboratory, they are processes based on the orders associated with each sample. Some blood and urine specimens are spun down, some are poured off into separate tubes and some are left to be tested as it is. The samples are checked for labelling accuracy as well before they are approved for testing.

Result generation: After sample processing result is generate and send to the respective consultant for verification

Report dispatch: Once the reports are verified the reports will be dispatch to the patient.

DISSERTATION

TITLE: A study on optimizing laboratory work flow and performance by Implementing Lean Management techniques at The Mission Hospital Durgapur

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

Lean management tools have a crucial role to play in the health care industry when it comes to increasing the efficiency and effectiveness the laboratory. Similarly, medical laboratory has a crucial impact on the TAT reduction with the help of lean management tools. To adopt the lean management tool healthcare provider must be aware of which lean management tool will better be suitable for their TAT reduction.

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1.1Background of study

In simple terms lean management is the elimination of non-value-added services in order to increase the efficiency. Non value-added services are those for which the customer is unwilling to pay for (i.e., it does not affect the service or outcome). These activities typically account for 75-95% of the total time needed to provide a service – the lead time (Figure 1). Similarly, value added services are those for which the customer pays the organisation thus adding the value.

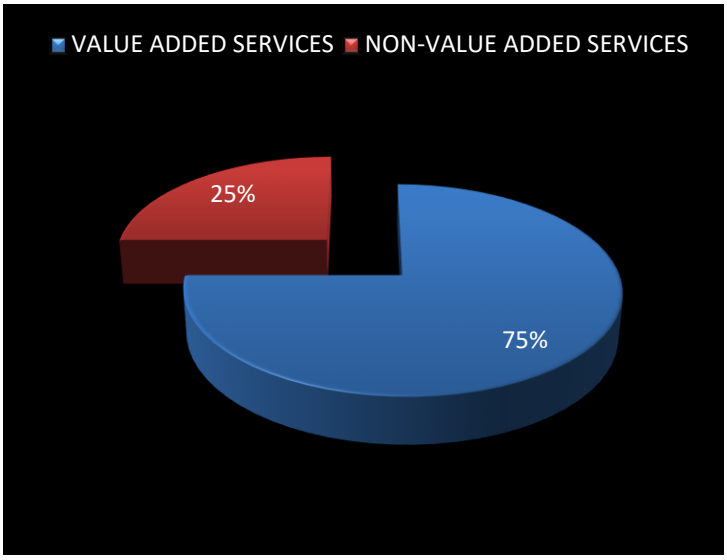


Fig:1

1.2Aim of the study

The aim of the study is to examine the impact of implementation of lean management tools on the performance of the laboratory. TAT is the most significant measure of performance of laboratory services. TAT is defined as the length of time from which the test is ordered to the time when the result is received by the clinicians. The study mainly focuses on benefiting the laboratory, clinicians and patients. When patients receive their laboratory test results on time and receive treatment on time it will enhance the satisfaction of the patient.

1.4 Limitations of the study

The time period of the study is limited to three months only.

CHAPTER 2

FRAMEWORK

FRAMEWORK:

OBJECTIVE	TOOLS	INDICATOR	SOURCE OF DATA COLLECTION
1. To understand the current situation of the laboratory performance.	Fishbone Analysis	1. % Of short lead time tests delayed beyond defined time (IPD) (OPD) 2. % Of long lead time tests delayed beyond defined time	Primary Data
2. To improve the laboratory performance by implementing lean management tools	Workplace Organisation (5S) Value stream mapping Standardization	3. Cycle time 4. Takt Time 5. EFF 6. Non value added time 7. Value added time	Primary Data
3. To estimate the impact of lean management tools in reducing TAT.	Operational score card	8.Average TAT for short lead time 9. Average TAT for the STAT sample 10. % of samples repeated 11. %Of reports verified before 9am	Secondary Data (Laboratory Information System)

CHAPTER 3

REVIEW OF LITERATURE

LITERATURE REVIEW:

H. D. Isack et al, 2017 in their study on 'Exploring the Adoption of Lean Principles in Medical Laboratory Industry' stated that as the demand for efficiency and quality in the healthcare industry has increased over the past few years, adoption of Lean principles and tools in the medical laboratory industry has become increasingly crucial. Healthcare organisations are under excessive pressure to improve operational performance in medical laboratories. The demand for laboratory services has continued to rise every year, as countries increasingly require evidence-based decision making for healthcare interventions. Laboratory services are mostly tasked to address clinical diagnosis and interventions. An efficient laboratory system is critical for the correct diagnosis of clinical conditions in the shortest possible time.

Nicola.E. Dundas et al, 2011 in their study on 'Lean Laboratory' sated that Lean principles have been applied successfully to various industries and processes, increasingly within the health care community. Although hindered by challenges including staunch adherence to traditional laboratory practices, complexity of workflow, and marked variability in sample numbers, hospital laboratories can still adapt the basic Lean principles to maximize productivity, reduce cost, and ensure quality results. The processes involved in creating a Lean laboratory environment vary greatly due to individual laboratory differences in testing menus and sample numbers, but the basic tools remain the same and include observation and documentation of the current environment and workflow, identification of waste in both materials and activity, redesign of the process to best facilitate a continuous flow of work that involves the least waste, implementation of the new design, and, finally, ongoing re-assessment and improvement.

Gabriele Halwachs Baumann,2010 in his study on 'Concept of Lean Laboratory Organisation' stated that laboratory management is required to decrease costs, increase efficiency, and promote customer satisfaction under the consideration of quality to be of primary importance. Beside the main task of a laboratory (i.e. the analysing of patient specimens, interpretation of results, and expert advice for clinicians), quality management, education of technicians and medical staff, research and development, and development of economic strategies are important duties and responsibilities. A lean laboratory organisation is an important condition to cope these duties. Lean laboratory concepts have to include the pre-analytical, analytical and post analytical period. Strategic planning decisions have to be based primarily on information derived from the external environment and have to be long-term.

Lisa .M Yerian et al, 2012 in their study on 'A Collaborative Approach to Lean Laboratory Workstation Design Reduces Wasted Technologist Travel' stated that lean is a quality and process improvement method that emphasizes consideration of the customer's needs, employee involvement, and continuous improvement. Central to the Lean method is the identification and elimination of waste in all its forms. In this context waste is defined as elements of a process that either interfere with people doing their work effectively or do not provide value for the customer .Another important aspect of Lean is respect for the individuals performing the work. Lean tools have been applied across manufacturing industries and various healthcare settings to improve efficiency, productivity, and service. Several laboratories have documented improvements in report turnaround times, specimen flow, technologist productivity, quality, and other performance measures using these methods.

Alhmodeus et al, 2018, in their study ' Lean management tools' stated that laboratories stand to gain the most from trimming down their operations to be as lean as possible, and also to embody the ideal of leanness as much as possible.5 Labs also have the best chance at actually implementing lean laboratory concepts because their mandates, inputs and outputs are narrowly defined. Inventory is expected to be expended at a certain rate, protocols are operated exactly the same each time, and the on018ly potential point of extra weight is a glut of unexpected samples.6 For these labs, practicing lean principles allows them to handle unexpectedly large volumes of work gracefully and waste as little as possible while accommodating the needs of whoever is next in the chain of sample custody.

CHAPTER 4

METHODOLOGY

4. METHODOLOGY:

The study was conducted as a part of dissertation programme at The Mission Hospital, Durgapur. The various methods and materials used are described as under:

4.1 Research area: Medical laboratory and phlebotomy room of the mission hospital, Durgapur

4.2 Research design: A descriptive cross- sectional study design was used for this study.

4.3 Research duration: 2.5 Months

- Understanding the project needs: 10 days
- Current TAT: 50days
- Fishbone analysis: 10days

S.NO	TASK NAME	10th Feb-20th Feb	21st Feb-2nd March	3rd March-12th March	13th March-22nd March	23March-1st April	1st April-11th April	12th April-21st April	22nd April-31st April
1.	Understanding the project needs								
2.	Current state TAT								
3.	Fishbone analysis								
4.	VSM								
5.	5S								
6.	Standardization								
7.	Data analysis								
8.	Report writing and presentation								

- Value Stream Mapping: 20 days
- 5S:10 days
- Standardisation:10days
- Data Analysis: 10 days
- Report writing:10days

Gantt chart: Activity chart

4.4 Sampling technique: Convenient sampling was done

4.5 Data collection

The study included both primary and secondary data followed by comprehensive analysis

The source of secondary data is Laboratory Information System. A sample size of 900 samples was collected over a period of 1.5months to analyse the impact of lean management tools on the TAT.

Primary data is collected for value stream mapping. A sample size of 50 samples were followed and observed at each step. Out of which value added and non-value-added services were identified.

Data collection tool used:

- Operational score card
- Lean management tools

(Appendix)

CHAPTER 5

DATA ANALYSIS AND RESULT

5. DATA ANALYSIS AND RESULTS

The following lean management tools were applied in the medical laboratory of the mission hospital, Durgapur.

5.1 Fishbone Analysis

As the initial step towards lean management in the laboratory a **situational analysis** depicting the current scenario of the laboratory was done. The tool used for the situational analysis was Fishbone analysis. It was done in the initial month from 21st Feb to 2nd March in order to identify the cause of delay of the TAT reports in the laboratory of The Mission Hospital, Durgapur. The following were the causes identified that contributed to the delay in the TAT and was divided into the followings:

- Machine
- Method
- Man
- Material
- and Environment

Those lead to the effect of delay in the laboratory result.

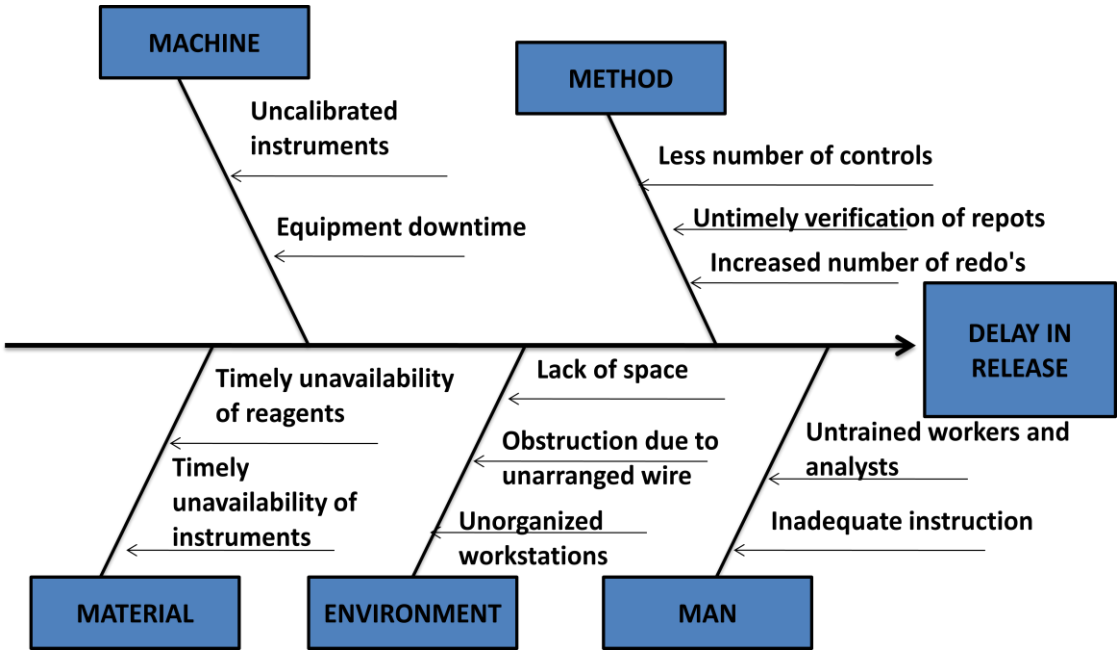


Fig 4: Fishbone Analysis

.5.2 Value Stream Mapping:

After the current scenario of the laboratory situation was depicted another lean management tool i.e. Value stream mapping was done in the medical laboratory. This tool helped in identifying the value added and non-value-added service time spend in the laboratory and helped eliminating the later.

APPLICATION OF VALUE STREAM MAPPING

There are following 5 steps required for the entire process of sample processing and report generation. (1) Order initiation, (2) Sample collection, (3) sample acceptance, (4) result generation, (5) report verification. Following are given some definitions about the same.

Cycle time: It is the time from when an operation begins to the point of time at which operation ends.

Lead time: Time taken by one unit of the thing to be transformed to go through every step of the process.

A value-added activity time – it is the time for which the customer will pay for, or anything that changes the form, fit, or function of the sample.

Non-**value added activity time** - It is the time for which the customer does not pay for, or a form of waste (defects, over-production, waiting, non-utilized resources/talent, transportation, inventory, motion, and excess processing).

Symbols used in value stream mapping:

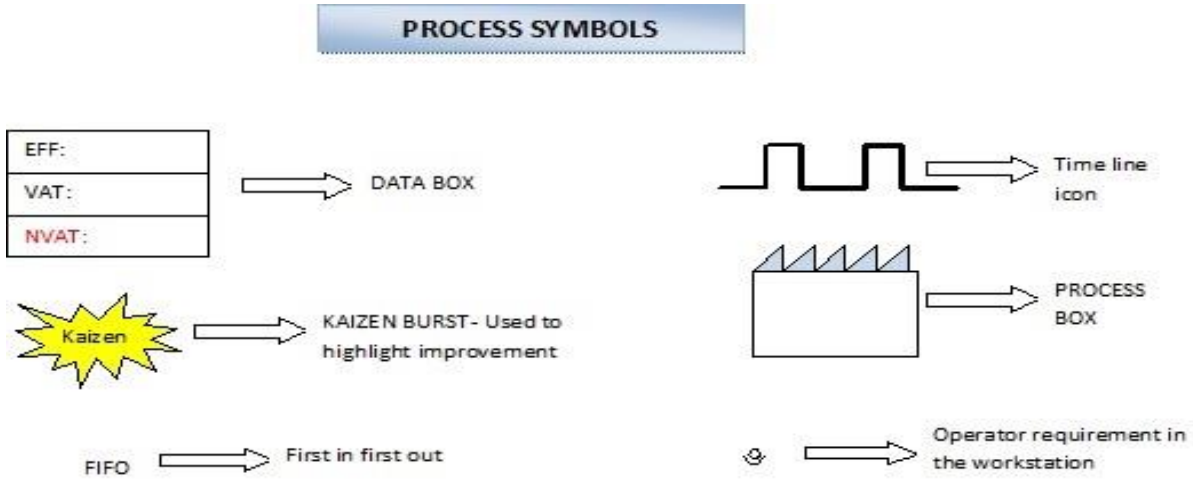


Fig:3

Value Stream Map of The Laboratory at The Mission Hospital, Durgapur

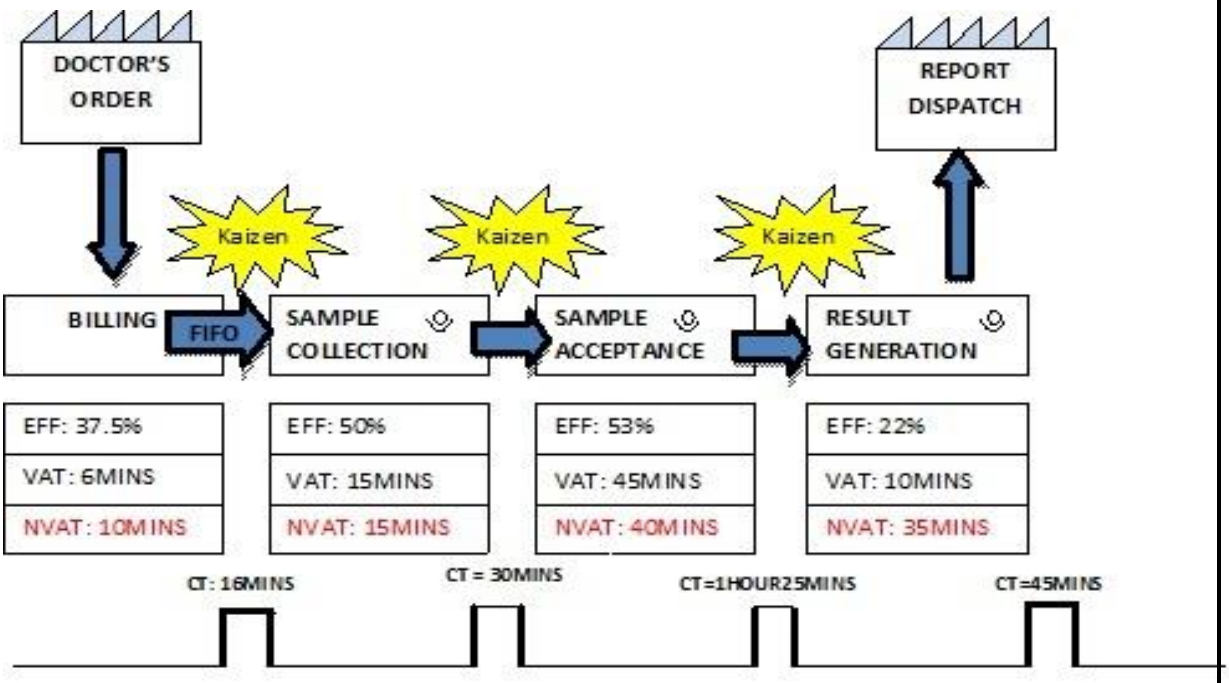


Fig:8: Value Stream Mapping

The following observations were noticed in the value stream mapping:

- From **billing to sample collection,** the cycle time was 16mins out of which 10mins non value added activities were performed. The non-value-added activities noted at this step was: excess waiting and underutilized HR. The efficiency of this step activities was 37.5%
- From **sample collection to sample acceptance** the value added activities of 15mins were done out of total cycle time of 30mins. In this the efficiency was 50%. The non value added activities seen at this stage were: excess transportation, the batch size of the samples was large and excess motion.
- From **sample acceptance to result generation** the cycle time was 1hour 25 minutes out of which there were 40mins of non value added activities. These non value added activities included: Copying and filling, manual archiving, excess motion and defects
- From **result generation to report dispatch** the cycle time of 45mins were noted out of which 35mins of non value added activities were noted which included: underutilized HR

5.3 Workplace Organisation (5S)

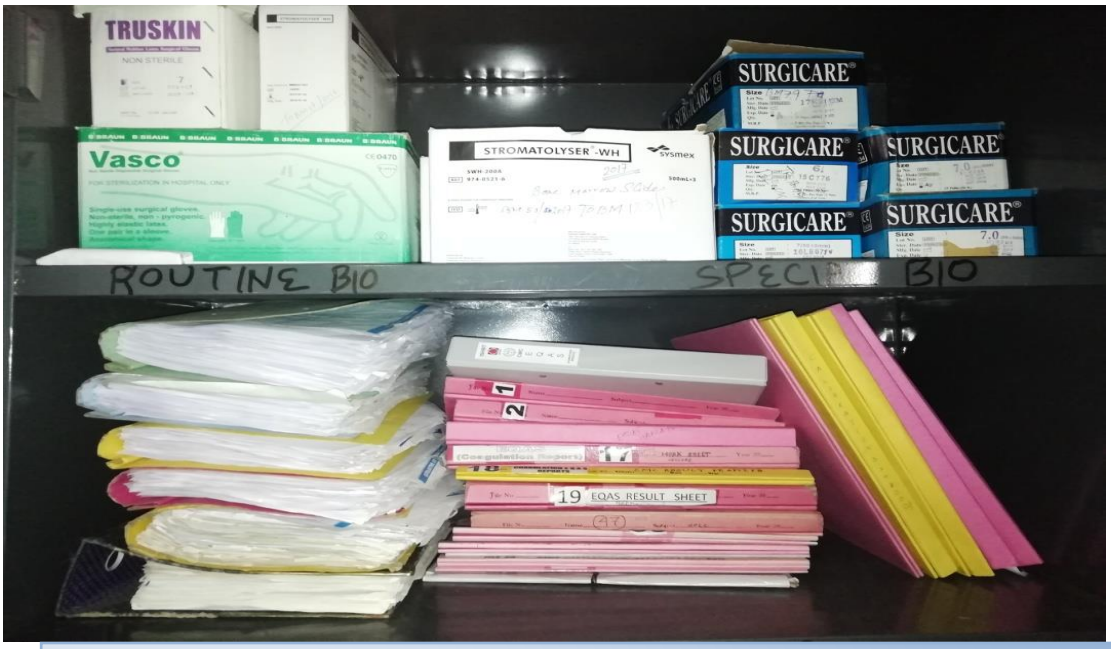
After the situational analysis with the help of fishbone analysis and value stream mapping by observing at each step the shortcomings of the laboratory were found out. So the next step towards lean management was taken which was rectifying those short coming as much as possible. This was done with the help of workplace organisation implementing 5S in the laboratory area. It helped to identify and remove what was not needed from the workplace to achieve a given task. This allowed management and staff to quickly determine when something is out of place or if a problem exists.

The following steps were implemented:

The following change was observed after the implementation of the 5S.

Sort –All the items in the given place were sort, placing a red tag / sticker on all unneeded items and moving them to a temporary holding area. All the items that were no longer needed were removed from the laboratory so that space can be formed for new improvements

BEFORE SORTING



AFTER SORTING

Fig: 5 : Sort

2. **Set in Order** – For the remaining items that were needed appropriate locations was found and a definite place was made.

BEFORE WORKSTATION WAS SET IN ORDER

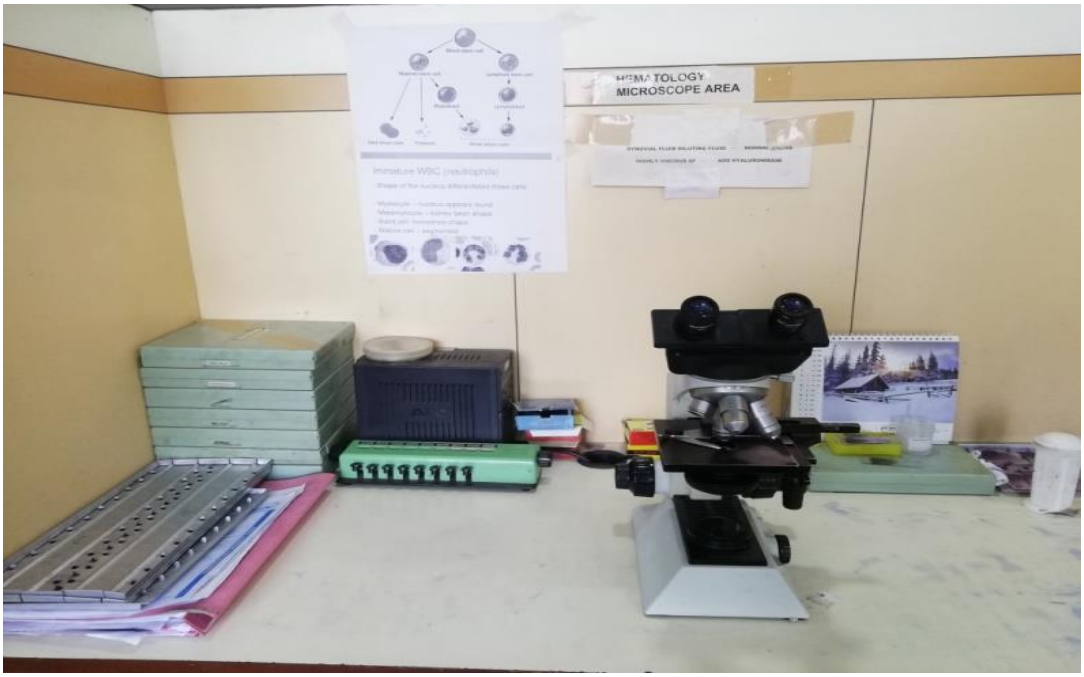
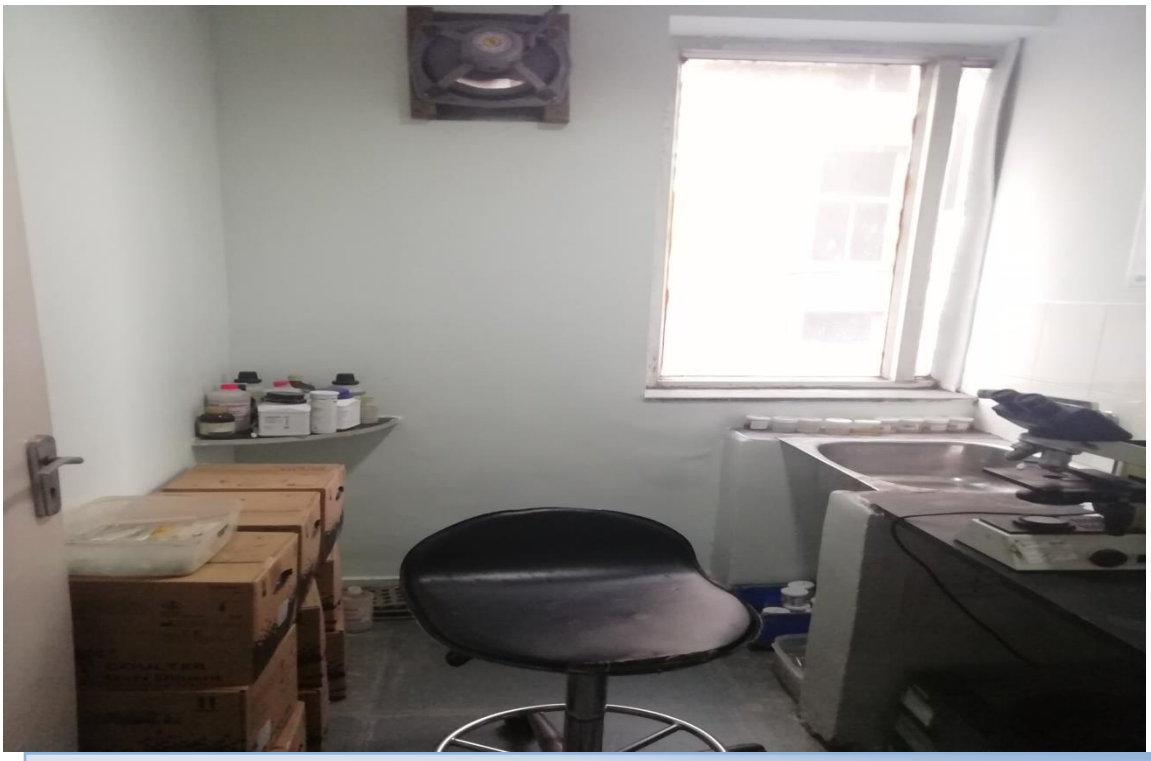


Fig6: Set in Order

3. **Shine** – Everything was cleaned inside out. Any opportunity for contamination, dirt and dust was prevented.

BEFORE SHINE



AFTER SHINE

Fig 7: Shine

4. **Standardize** - Rules were created for maintaining and controlling the first three steps was made and visual controls were used.

5 **Sustain -** Adherence to the 5S standards was ensured through communication, training, and self-discipline

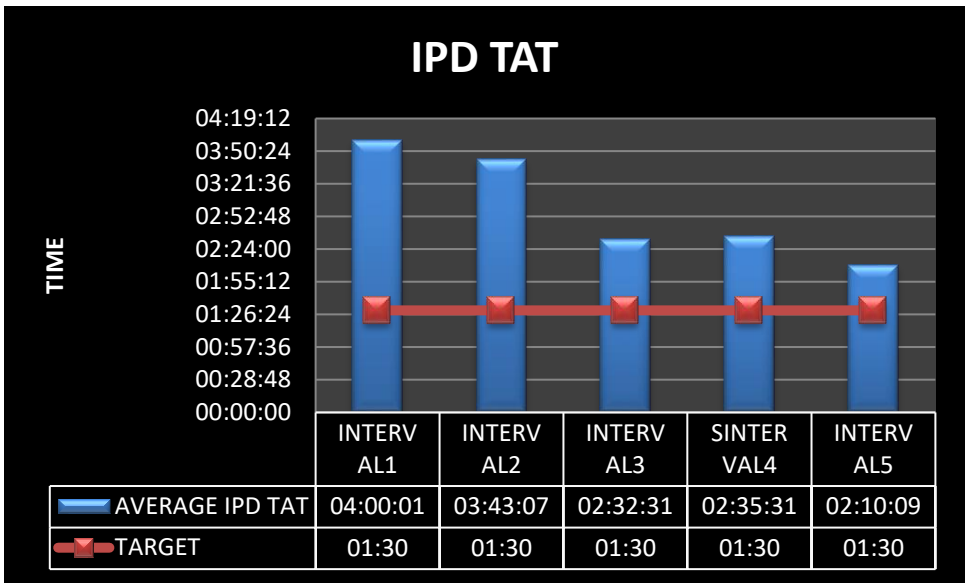
5.4 Operational Score Card

An operational score card was maintained throughout the study in order to understand the impact of lean tools on the efficiency of laboratory performance. Also it gave them a standardized target to reach up to.

Turnaround time was calculated from the sample acceptance to the result verification. IPD, OPD and STAT TAT were separately calculated. TAT for each time interval of 10 days were calculated and compared.

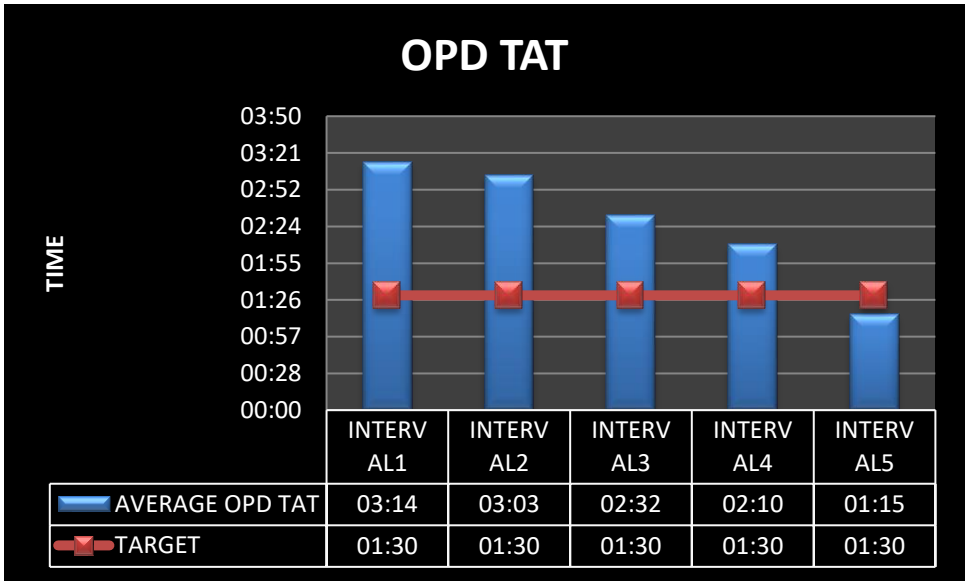
OPERATIONAL SCORE CARD

METRICS	INTERVAL1	INTERVAL 2	INTERVAL 3	INTERVAL 4	INTERVAL 5	TARGET
% Of short lead time tests delayed beyond defined time (IPD) (OPD)	87.5% 92.31%	88% 90.6%	65% 73%	54% 75%	48% 33%	01:30:00
% Of long lead time tests delayed beyond defined time (IPD) (OPD)	21% 20.4%	15% 21.43%	16.6% 20%	10% 9.4%	0.5% 0.6%	
Average OPD TAT	03:14:00	03:03:00	02:32:00	02:10:00	01:49:00	01:30:00
Average IPD TAT	04:00:00	03:43:07	02:32:31	02:35:31	02:10:09	01:30:00
Average TAT for the STAT sample	2:42:37	2:28:51	02:16:00	02:00:00	01:40:00	01:00:00
Total investigation done.	1456	1498	1535	1409	1018	
% of critical alerts informed to nurses/clinicians	100%	100%	100%	100%	100%	
% of samples repeated	5.4%	5.1%	3.4%	0.5%	0.51%	<5%
%Of reports verified before 9am	0%	20.34%	26.16%	55%	67%	



GRAPH1: IPD TAT

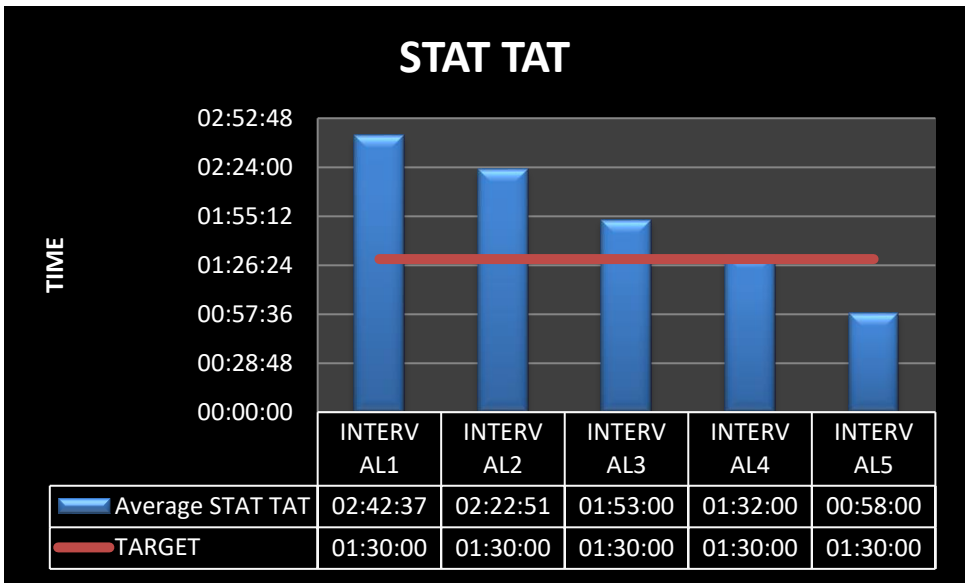
This graph compares the average IPD TAT of each interval. At interval 1 the average IPD TAT was 4hours, which was decreased to 3hour 43minutes in the second interval, 2hourand 32minutes in the third interval , 2hour 35minutes in the fourth interval and 2hour 10 minutes at the last interval. The TAT was significantly reduced by 1hour 50 minutes. Beside the reduction of 1hour 50 minutes it could not reach the target value of 1hour30 minutes. 48% of samples were still delayed beyond the target time of 1hour30minutes at the last interval.



GRAPHS2: OPD TAT

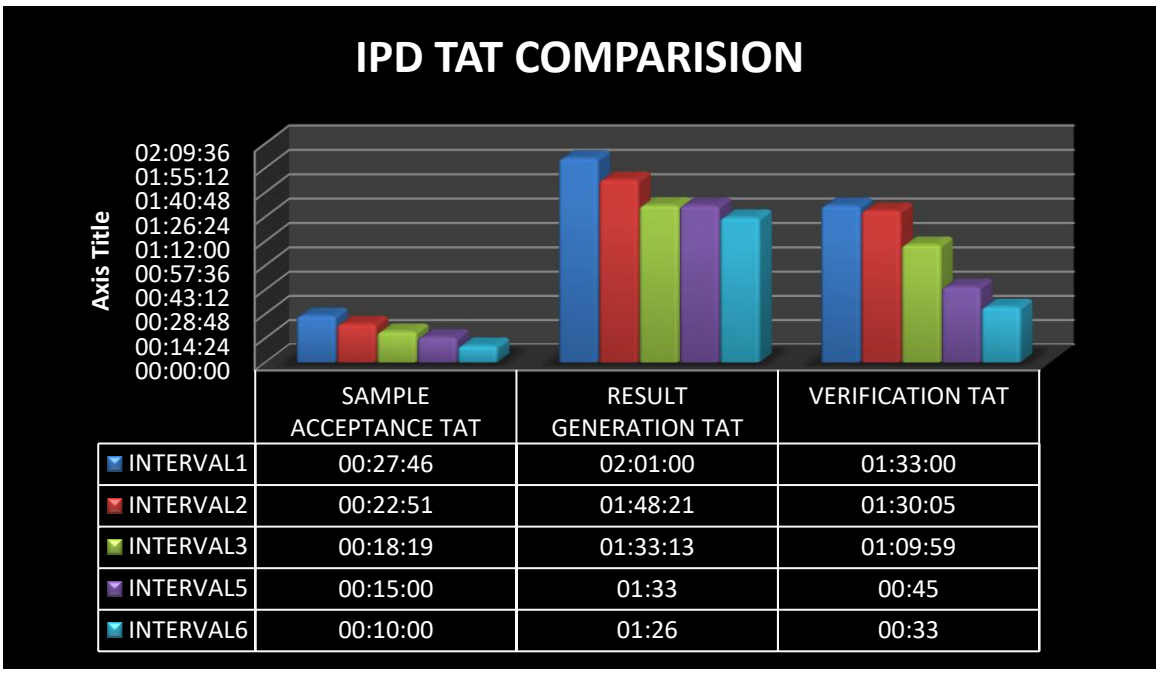
Similarly, this graph compares the average OPD TAT of each interval. At interval 1 the average OPDTAT was 3hour14minutes, which was decreased to 3hour3minutes in the second interval, 2hourand 32minutes in the third interval, 2hour 10minutes in the fourth interval and 1hour 15minutes at the last interval. The TAT was significantly reduced by 1hour 50 minutes. But

unlike average IPD TAT, average OPD TAT reached the target value of 1hour 30minutes. 33%of samples were still delayed beyond the target time of 1hour30minutes at the last interval.



GRAPHS 3: STAT TAT

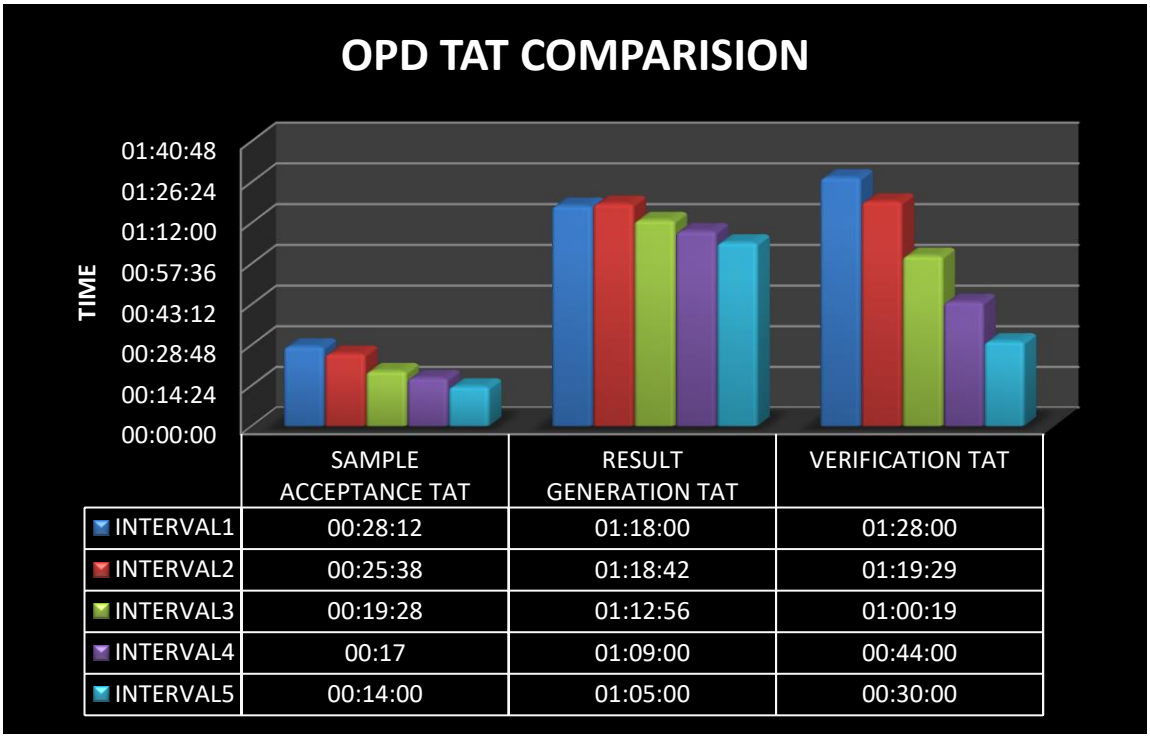
Just like the other two graphs this graph compares the average STAT TAT of each interval. At interval 1 the average STAT TAT was 2hour42minutes, which was decreased to 2hour22minutes in the second interval, 1hourand 53minutes in the third interval, 1hour 32minutes in the fourth interval and 58minutes at the last interval. The TAT was significantly reduced by 1hour 44 minutes. Average STAT TAT reached the target value of 1hour.



	SAMPLE ACCEPTANCE TAT	RESULT GENERATION TAT	VERIFICATION TAT
INTERVAL1	00:27:46	02:01:00	01:33:00
INTERVAL2	00:22:51	01:48:21	01:30:05
INTERVAL3	00:18:19	01:33:13	01:09:59
INTERVAL5	00:15:00	01:33	00:45
INTERVAL6	00:10:00	01:26	00:33

GRAPH 4: IPD TAT COMPARISION

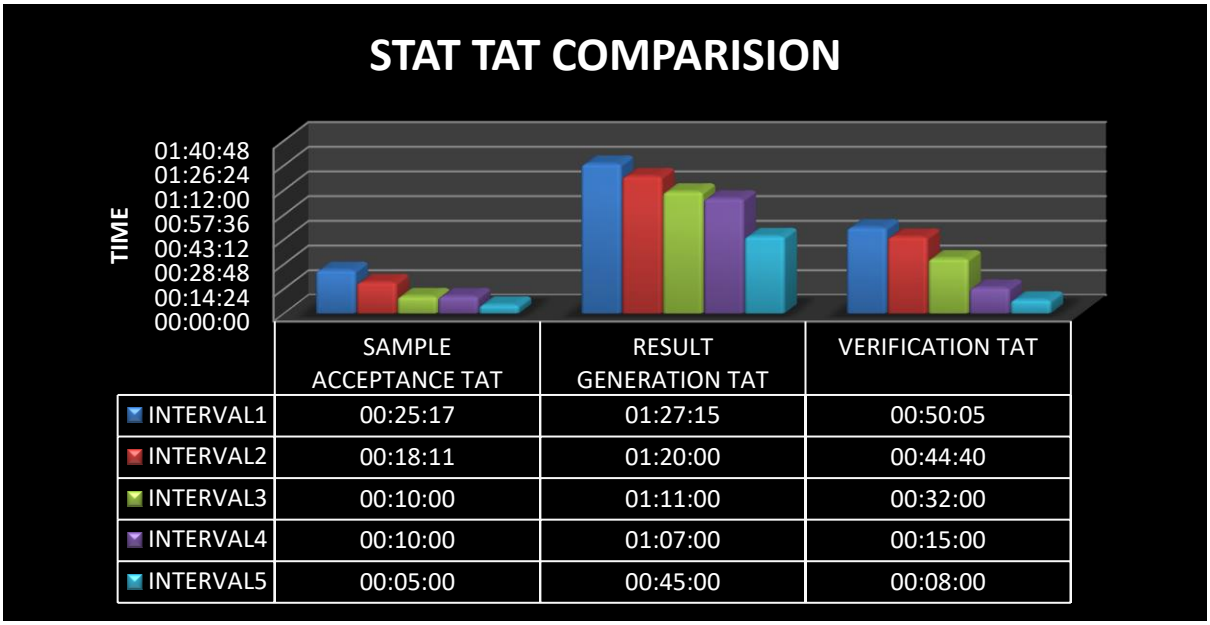
In this graph IPD TAT comparison at each step of the sample processing was done. The sample acceptance, result generation TAT and result verification TAT showed a steady decrease.



	SAMPLE ACCEPTANCE TAT	RESULT GENERATION TAT	VERIFICATION TAT
INTERVAL1	00:28:12	01:18:00	01:28:00
INTERVAL2	00:25:38	01:18:42	01:19:29
INTERVAL3	00:19:28	01:12:56	01:00:19
INTERVAL4	00:17	01:09:00	00:44:00
INTERVAL5	00:14:00	01:05:00	00:30:00

GRAPH 5: OPD TAT COMPARISION

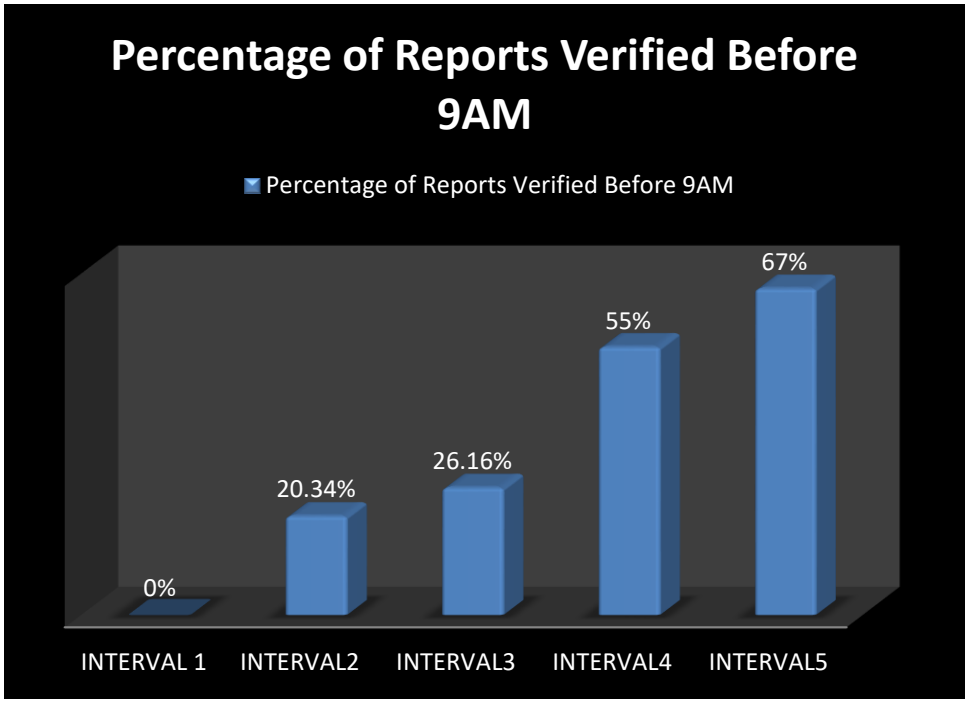
Similarly, in this graph OPDTAT comparison at each step of the sample processing was done. The sample acceptance, result generation TAT and result verification TAT showed a steady decrease.



	SAMPLE ACCEPTANCE TAT	RESULT GENERATION TAT	VERIFICATION TAT
INTERVAL1	00:25:17	01:27:15	00:50:05
INTERVAL2	00:18:11	01:20:00	00:44:40
INTERVAL3	00:10:00	01:11:00	00:32:00
INTERVAL4	00:10:00	01:07:00	00:15:00
INTERVAL5	00:05:00	00:45:00	00:08:00

GRAPH 6: STAT TAT

Just like the above-mentioned graph this graph average STAT TAT showed a steady decrease in the sample processing.



GRAPH 7: PERCENTAGE OF REPORTS VERIFIED BEFORE 9AM

The above graph shows the percentage of reports verified before 9AM at The Mission Hospital, Durgapur. There was a steady increase in the percentage of reports verification from 1st interval to 3rd interval followed by a sudden increase of 55% in 4th interval and 67% in the last interval.

PRELEAN AND POSTLEAN COMPARISION:

The following table describes the overall change in the TAT before and after implementing lean management techniques. For this the data from first interval is compared to the data from the last interval.

TYPE OF SAMPLE	FIRST INERVAL	LAST INTERVAL	IMPROVEMENT	TRAGET TIME
Inpatient sample (IPD)	**04:00:01**	**02:10:09**	**01:49:52**	**01:30:00**
Outpatient Sample (OPD)	**03:14**	**01:15**	**01:59:00**	**01:30:00**
Emergency sample (STAT)	**02:42:37**	**00:58:00**	**01:44:37**	**01:00:00**

The table shows a decrease in IPD TAT from 4hours to 2hours 10minutes, but still couldn't reach the targeted time of 1hour30minutes the OPD TAT depicts an improvement of 2hours and reached its target time. Similarly STAT TAT was improved by 1hour44minutes and was exactly its targeted time of 1hour.

CHAPTER 6

DISCUSSION

6. DISCUSSION

“Studies have shown that implementation of lean management in laboratory has a positive impact in building the laboratory towards being more efficient. In my study I found the same holding true. On in depth analysis of the data gathered through the means of operational score card there are few important points that have come in the picture. The data clearly depicts a trend in which the turnaround time of the laboratory results have reduced. From the first interval to the fifth interval (last interval) the TAT was reduced by 1hour50 minutes for IPD samples. Thus a huge improvement was seen in the laboratory workflow and performance. Besides the improvement the IPD TAT could still not reach the target turnaround time of 1hour 30minutes. The reason for this was because of two main factors: one was the duration of the study was small to reach the target and secondly the sample collection for the IPD patients was done in the wards not by phlebotomists but by nurses. Thus laboratory had no control over the collection of samples from the wards. And thus the delay was seen.

The study shows that lean implementation has a direct impact in improving the TAT of the laboratory workflow thus increasing the efficiency of the laboratory.

CHAPTER 7

SUGGESTIONS AND CONCLUSION

7.1 SUGGESTIONS

Implementing lean is an ongoing process. Thus i would like to contribute the following suggestions in implementing the same.

1. The key performance indicators that are not meeting the laboratory requirements are identified. Along with the non value added services or wastes that will cause the delay in the laboratory reports.
2. Once the waste activities are being identified they should be eliminated by using various lean management techniques and tools suitable for that activity.
3. These improvements must not only be followed by the Quality manager of the department but should be in corporate in all the members of the laboratory including housekeeping and GDA. For the very same weekly induction and training towards lean management techniques should be given to the staff. Along with that the improvements occurring should be delivered to them in order to keep them motivated.
4. If the improvement is being seeing or the waste is being successfully eliminated one should keep monitoring the process often to see if the wastes are re-appearing.
5. Sustaining the process is very crucial in order to see long term results in the process. Therefore, continuous quality improvement is must.
6. The laboratory consultants must be trained in lean management so that a better monitor and implementation can be assured.

7.2 CONCLUSION

There were many reasons for the delay of laboratory reports, which included untrained workers, ineffective communication among staff, improper space management, uncelebrated instruments, and equipment downtime, unorganised workstation, unavailability of instruments, excess of transportation, excess motion and underutilized HR. These causes were identified and eliminated with the help of lean management tools. Earlier, the laboratory was a 10am-to-5pm process without weekend coverage. Now, staffs is present weekdays from 8am till 8pm, and on Saturdays, allowing for more punctual response to customer needs and increased time for analyses. Excess moving of samples was reduced by enabling the pneumatic shoot system at different wards to send the samples to the laboratory. 5S was implemented in the laboratory which increased the efficiency of laboratory by making it more organised, clean and best utilizing the space avoiding excess of motion.

Although the study had limitation in terms of resources, time and appropriate training towards making the laboratory lean, still many improvements were evident. This shows that if implemented with the right amount of resources and in right direction huge improvement can be seen increasing the overall patient and physician satisfaction by making timely ease of use of reports from the laboratories possible.

CHAPTER 8

ANNEXURE

ANNEXURE

ANNEXURE1

VALUE STREAM MAPPING					
		PATIENT NAME:			
		MRD NO:			
PROCESS	BILLING	SAMPLE COLLECTION	SAMPLE ACCEPTANCE	RESULT GENERATION	VERIFICATION
TIME					
CYCLE TIME					
NVAT					
VAT					

ANNEXURE 2: *Source: NABL 4th edition*

OPERATIONAL SCORE CARD

METRICS	TARGET	UNIT
% Of short lead time tests delayed beyond defined time (IPD) (OPD)	1hour 30mins	
% Of long lead time tests delayed beyond defined time	4Hours 72Hours 7days	
Average TAT for short lead time	1hour30mins	
Average TAT for the STAT sample	1hour	
Total investigation done		
% of critical alerts informed to nurses/clinicians	100%	
% of samples repeated	<5%	
%Of reports verified before 9am		

CHAPTER9

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