

Optimizing laboratory work flow and performance by Implementing Lean Management techniques

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Under the guidance of:

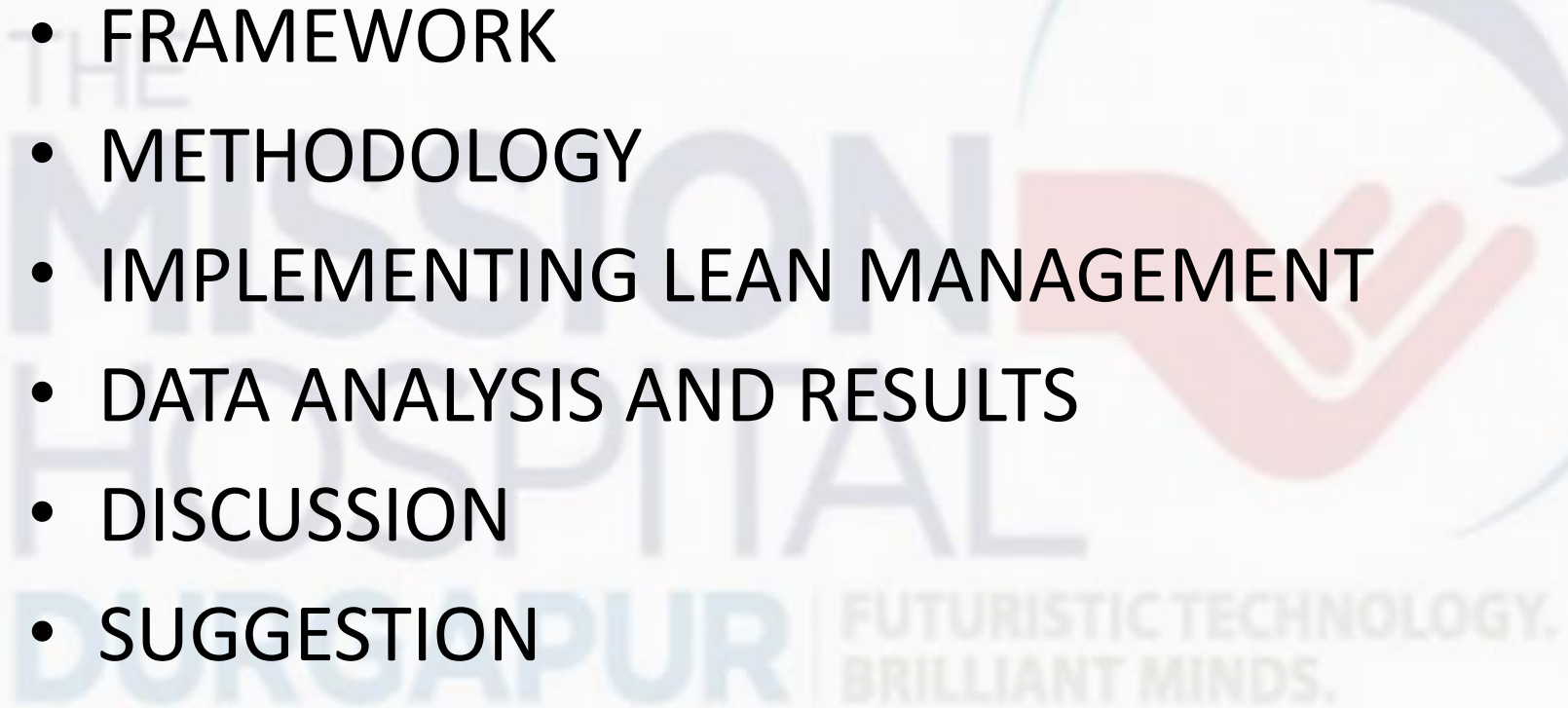
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Project Setting:

The Mission Hospital
Durgapur

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- FRAMEWORK
- METHODOLOGY
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- DATA ANALYSIS AND RESULTS
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1.

Introduction to the project

THE
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FUTURISTIC TECHNOLOGY.
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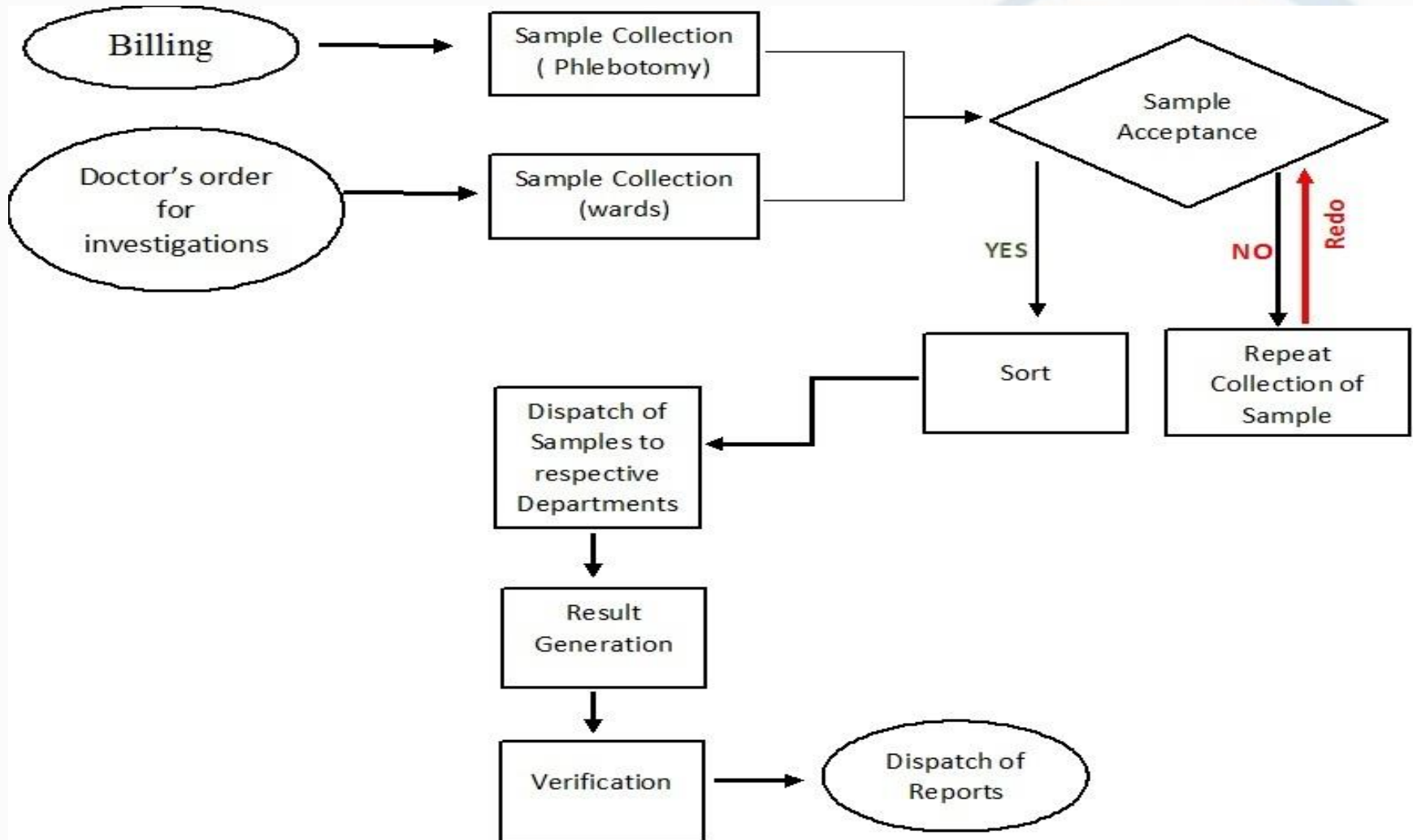
Introduction

- Lean is focused on the elimination of waste, or non-value-added activities, from the process. Non-value-added activities can be defined as those activities the customer is not willing 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

Practical Implications of the study:

- As technology has integrated in our lives we expect our results to be fast and efficient.
- Laboratory professionals also experience this fast-paced way of life and feel pressured to meet demands .Haste can lead to mistakes which is not affordable when it comes to life altering laboratory result . Lab optimization and proven techniques of lean management will ultimately result in increased efficiency, quality, productivity, labour utilization and decreased TAT, error, waste and cost

LABORATORY WORKFLOW



Meaning of Lean Laboratory:

- A “Lean Laboratory” is focused on testing products and materials to deliver results in the most efficient way in terms of cost or speed or both.
- In an effort to eliminate or reduce these laboratory service wastes, several tools can be used in the application of Lean in healthcare settings. These tools include fishbone (cause –effect) analysis, 5S methodology and value stream mapping.

2. FRAMEWORK

OBJECTIVE	TOOLS	SOURCE OF DATA COLLECTION
1. To understand the current situation of the laboratory performance	Fishbone Analysis	Primary Data
2. To improve the laboratory performance by implementing lean management tools	Workplace Organisation (5S) Value stream mapping Standardization	Primary Data
3.To estimate the impact of lean management tools in reducing TAT	Operational score card	Secondary Data (Laboratory Information System)

3. 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:
- **Research area:** Medical laboratory and phlebotomy room of the mission hospital, Durgapur
- **Research design:** An Observational cross-sectional study design was used for this study.

Research duration:

The study was carried out for a periods of 2.5 months. The distribution of the work is described in the Gantt chart below:

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

- **Sampling technique:** Convenient sampling was done
- **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 450IPD and 450OPD 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.

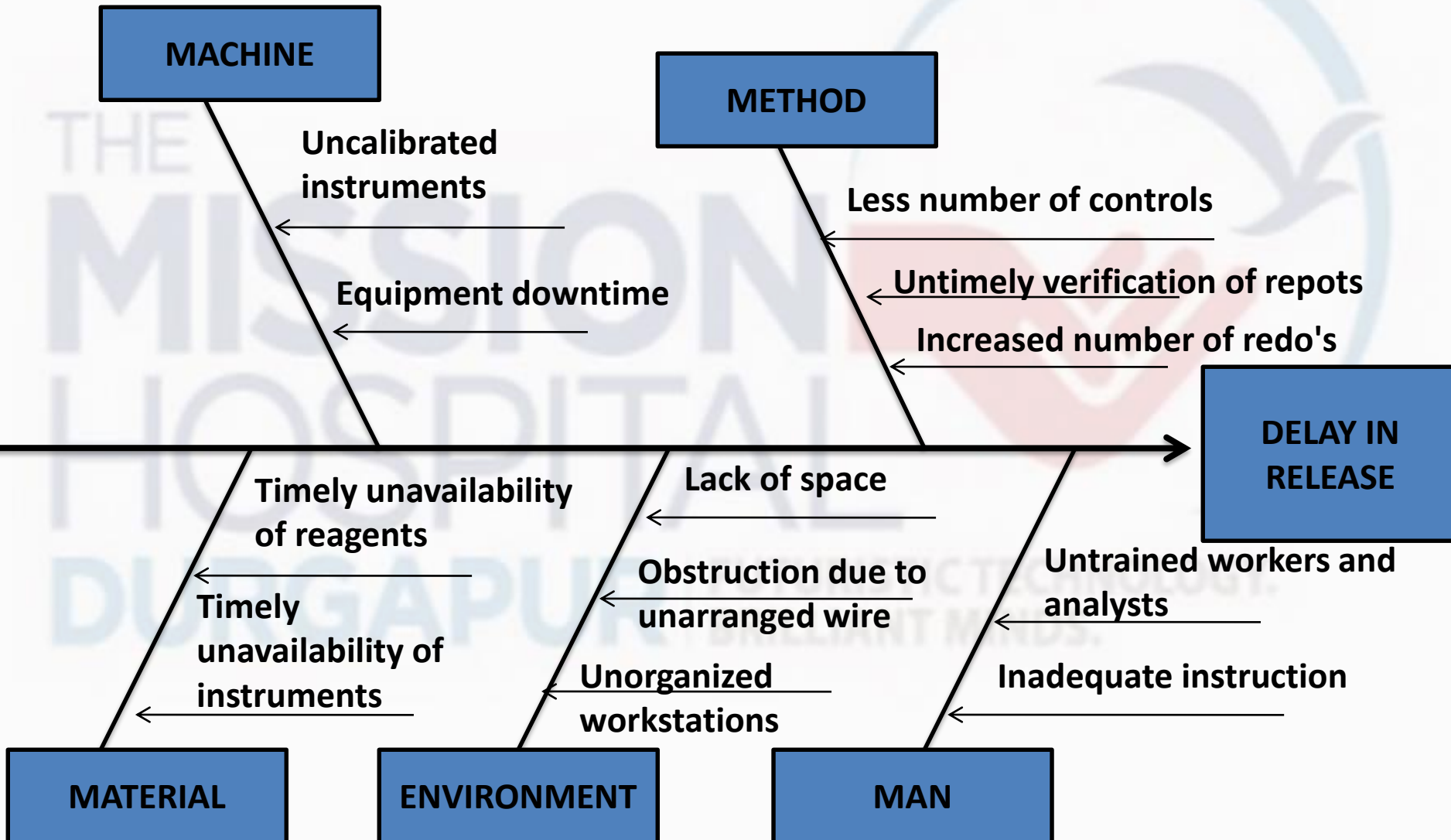
- **Data collection tools used:**
- Operational score card
- Lean management tools

IMPLEMENTING LEAN MANAGEMENT

- **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:
 1. Machine
 2. Method
 3. Man
 4. Material
 5. and Environment

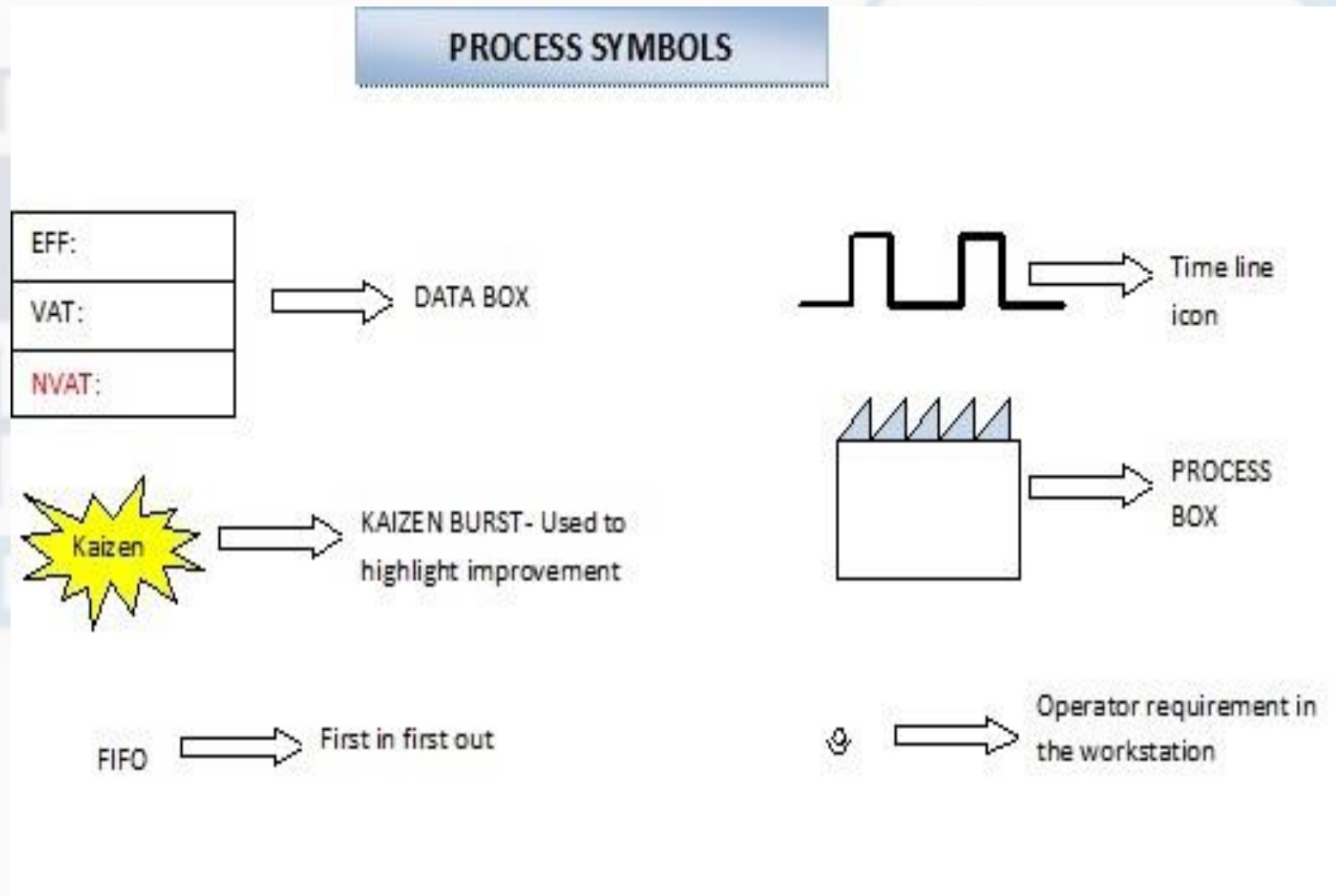
FISHBONE ANALYSIS



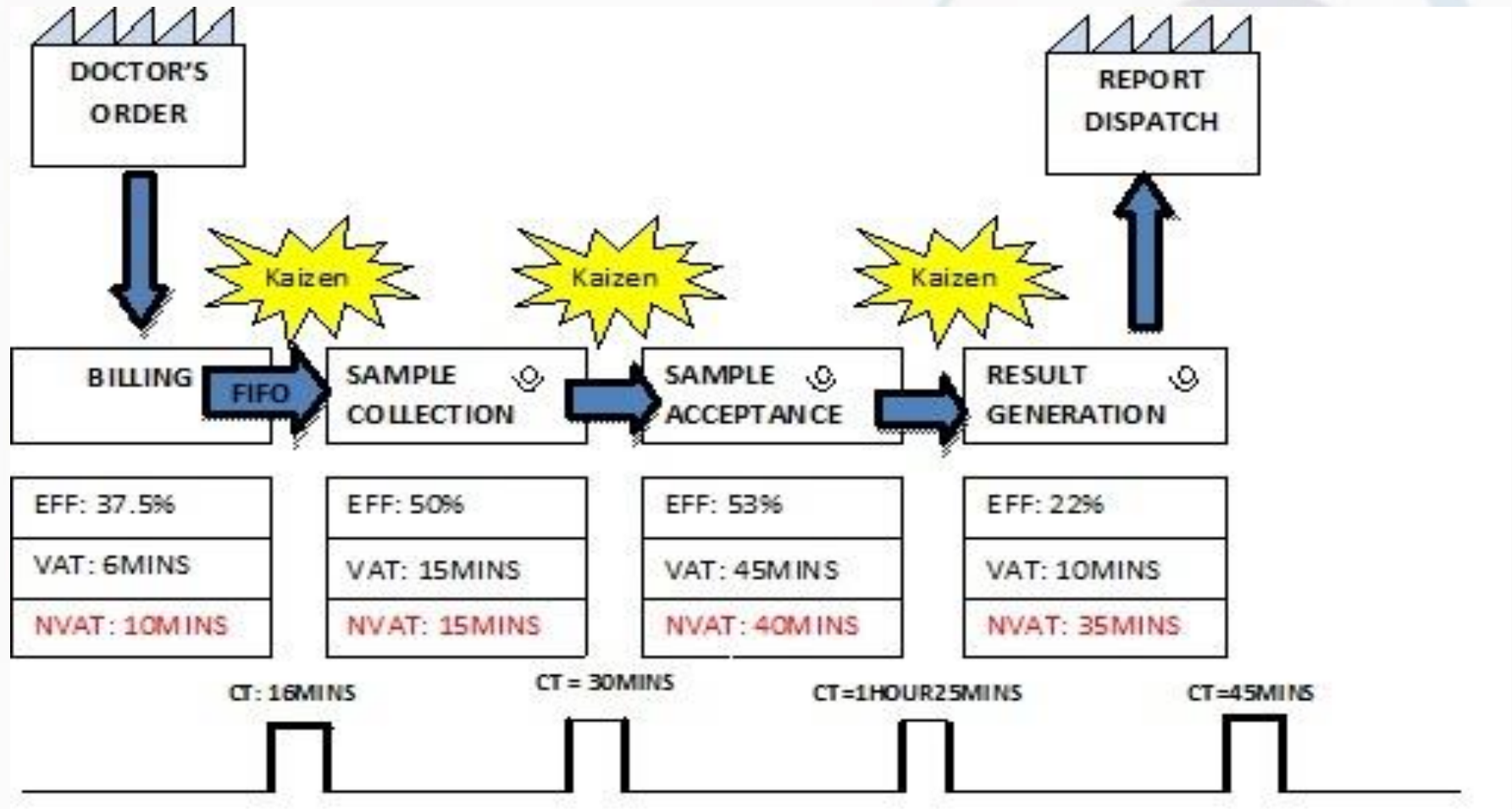
- **2 Value Stream Mapping:**
- After the current scenario of the laboratory situation was depicted another lean management tool i.e. Value stream mapping was done in the medical laboratory. This tool helped in identifying the **value added and non value added** service time spend in the laboratory and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

- APPLICATION OF VALUE STREAM MAPPING
- Identified 5 steps in the laboratory operations process: (1) Billing/order initiation, (2) Sample collection, (3) sample acceptance, (4) result generation, (5) report verification.
- Measurement criteria were determined for each step in order to quantify the flow of information. These included: cycle time, wait time, lead time, value added services, and non value added services.

Symbols used in value stream mapping:



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



WORKPLACE ORGANISATION(5S)

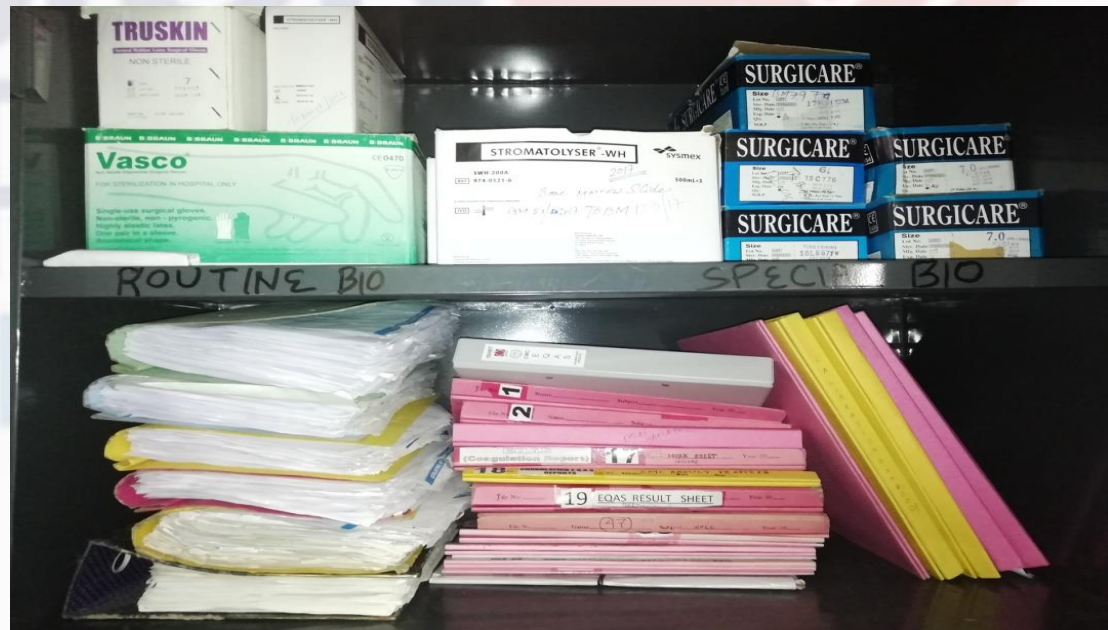
- After the situational analysis with the help of fishbone analysis and value stream mapping by observing at each step the shortcomings of the laboratory were found out.
- So the next step towards lean management was taken which was rectifying those short coming as much as possible.
- This was done with 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

IMPLEMENTING 5S IN THE LABORATORY

STEP-1 SORT THE LABORATORY	• a red tag was established to all unneeded items and were moved to a temporary holding area. • Items that were not required at a particular location were indentified. • Dispose of items not required after team approval
STEP-2 SET LABORATORY IN ORDER	• Made sure all items have a home using signs and labels • Clearly define work areas
STEP – 3 MAKE LABORATORY SHINE	• Cleaned thoroughly- made it literally shine • Frequency of cleaning was checked. • A list of items was made that need routine cleaning to assist with the standardisation step. • Checklist for housekeeping
STEP 4- STANDARDISE THE LABORATORY	• Standard Operating Procedure(SOP) were developed • Documentation of equipment and processes • Operational Score Card
STEP 5- MAKE YOUR PROGRAME SUSTAINABLE	Sustain , develop long- lasting habits



BEFORE SORTING



AFTER SORTING



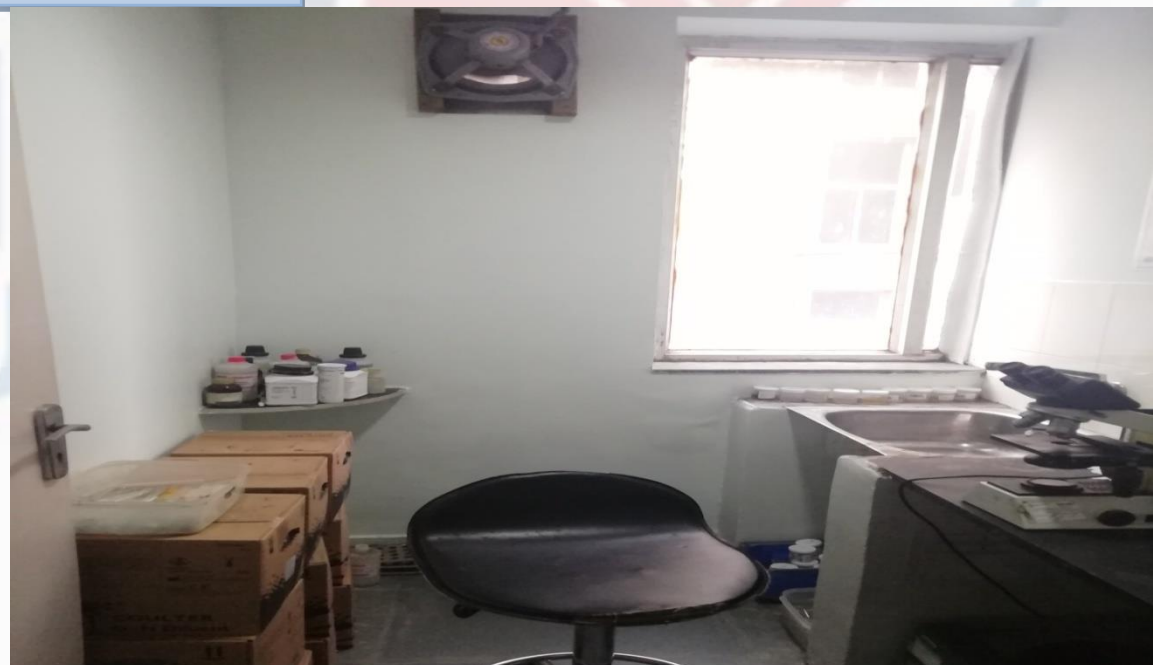
BEFORE WORKSTATION WAS SET IN ORDER



BEFORE WORKSTATION WAS SET IN ORDER



BEFORE SHINE



AFTER SHINE

DATA ANALYSIS AND RESULT

- 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

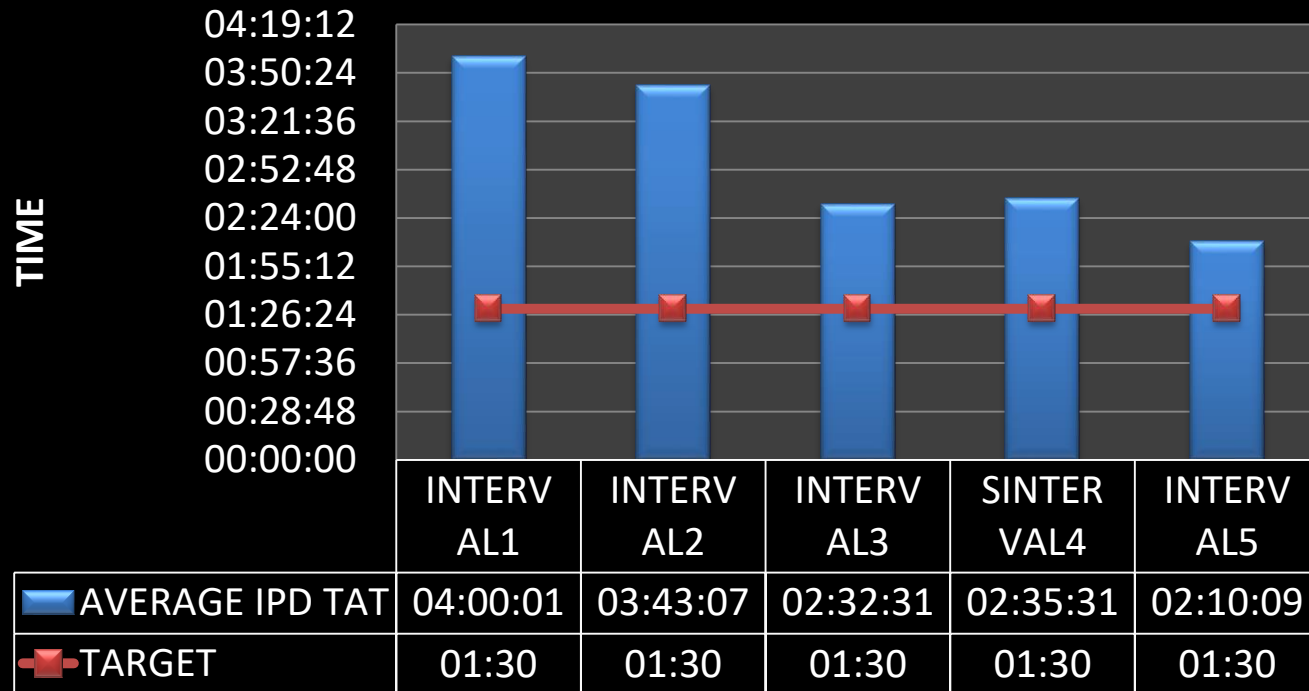
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OPERATIONAL SCORE CARD

Metrics	Interval 1	Interval 2	Interval 3	Interval 4	Interval 5	Target
% Of short lead time tests delayed beyond defined time (IPD)	87.5%	88%	65%	54%	48%	01:30:00
(OPD)	92.31%	90.6%	73%	75%	33%	
% Of long lead time tests delayed beyond defined time (IPD)	21%	15%	16.6%	10%	0.5%	
(OPD)	20.4%	21.43%	20%	9.4%	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.	14567	14980	15350	14093	10185	
% 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%	

IPD TAT

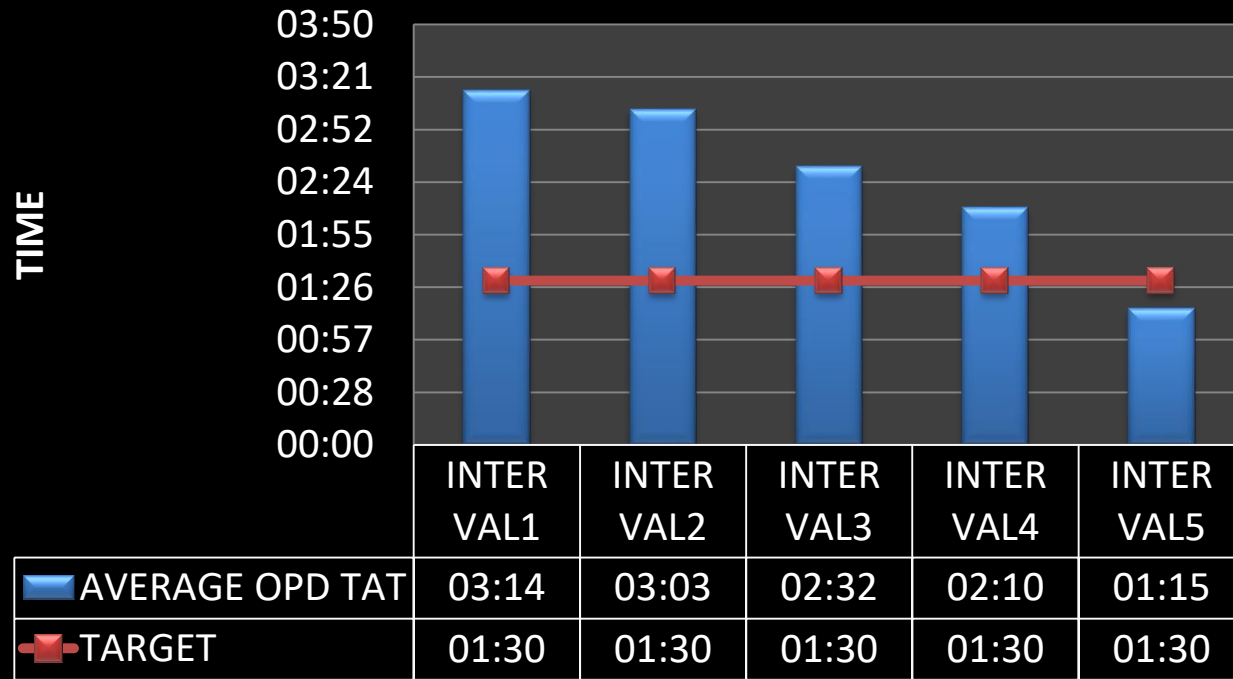


This graph compares the average IPD TAT of each interval. At interval 1 the average IPD TAT was 4hours, which was decreased to 3hour43minutes in the second interval, 2hourand 32minutes in the third interval , 2hour 35minutes in the fourth interval and 2hour 10 minutes at the last interval. The TAT was significantly reduced by 1hour 50 minutes.

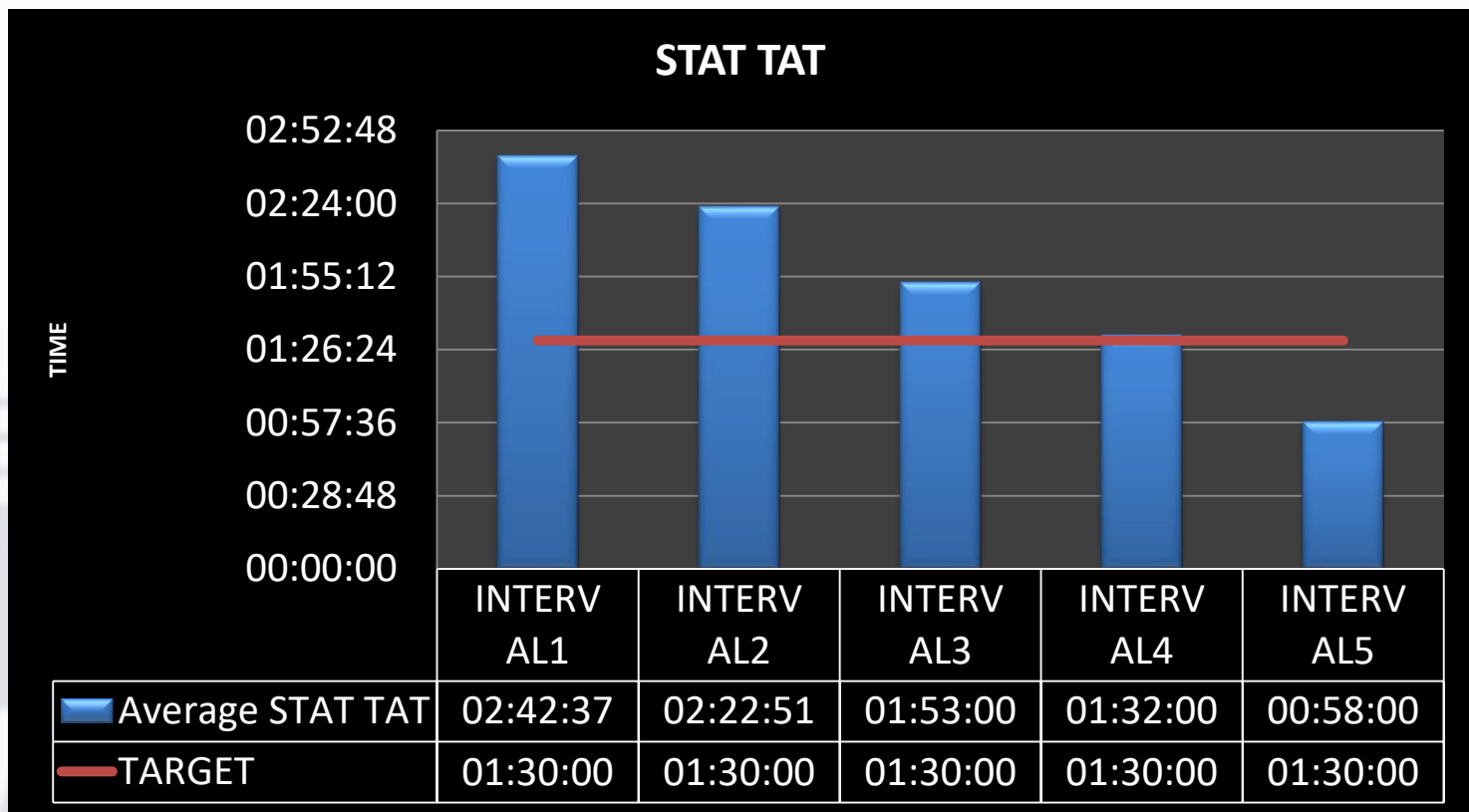
Beside the reduction of 1hour 50 minutes it could not reach the target value of 1hour30 minutes.

48% of samples were still delayed beyond the target time of 1hour30minutes at the last interval

OPD TAT

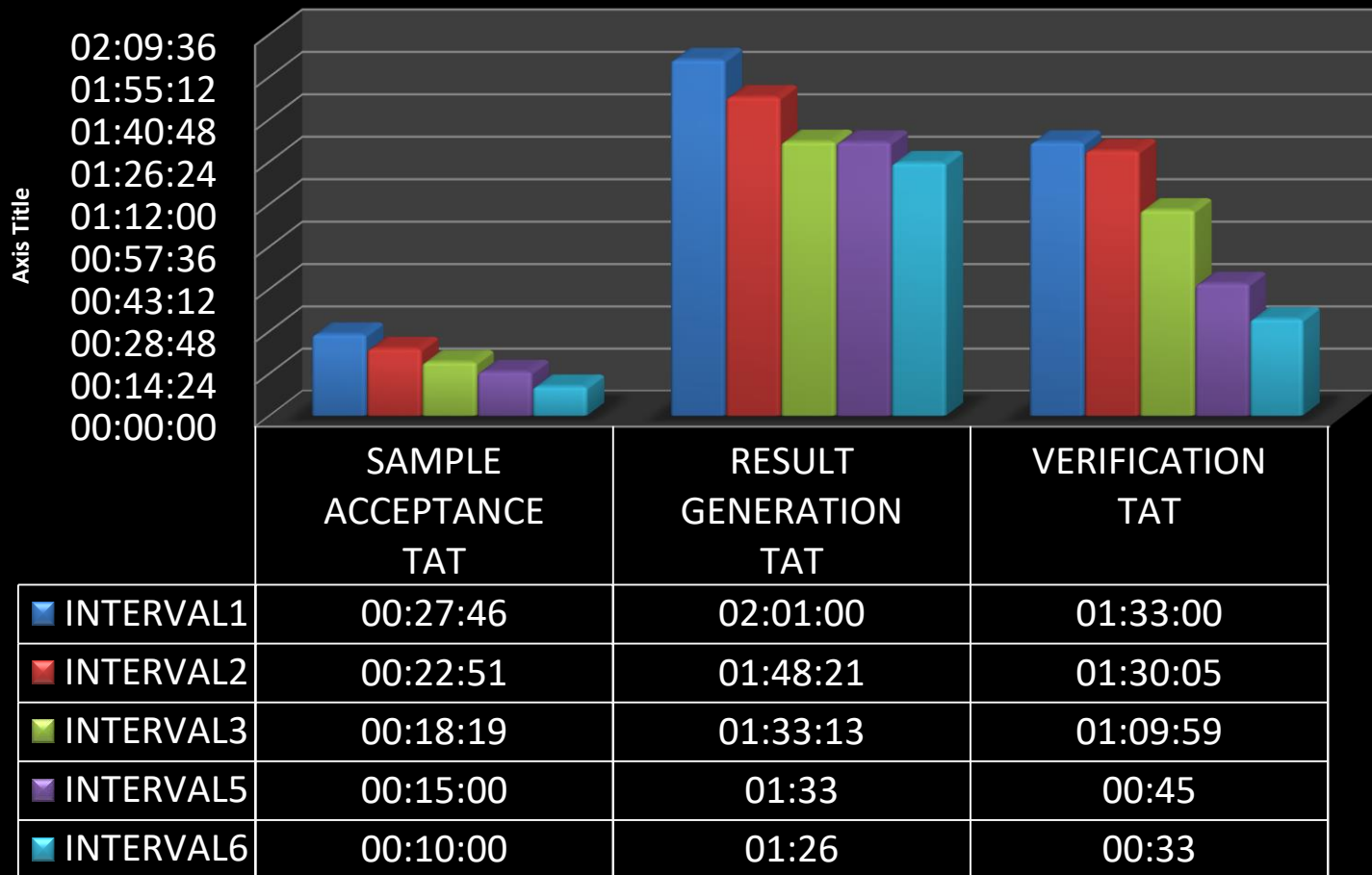


Similarly, this graph compares the average OPD TAT of each interval. At interval 1 the average OPD TAT was 3hour14minutes, which was decreased to 3hour3minutes in the second interval, 2hourand 32minutes in the third interval, 2hour 10minutes in the fourth interval and 1hour 15minutes at the last interval.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



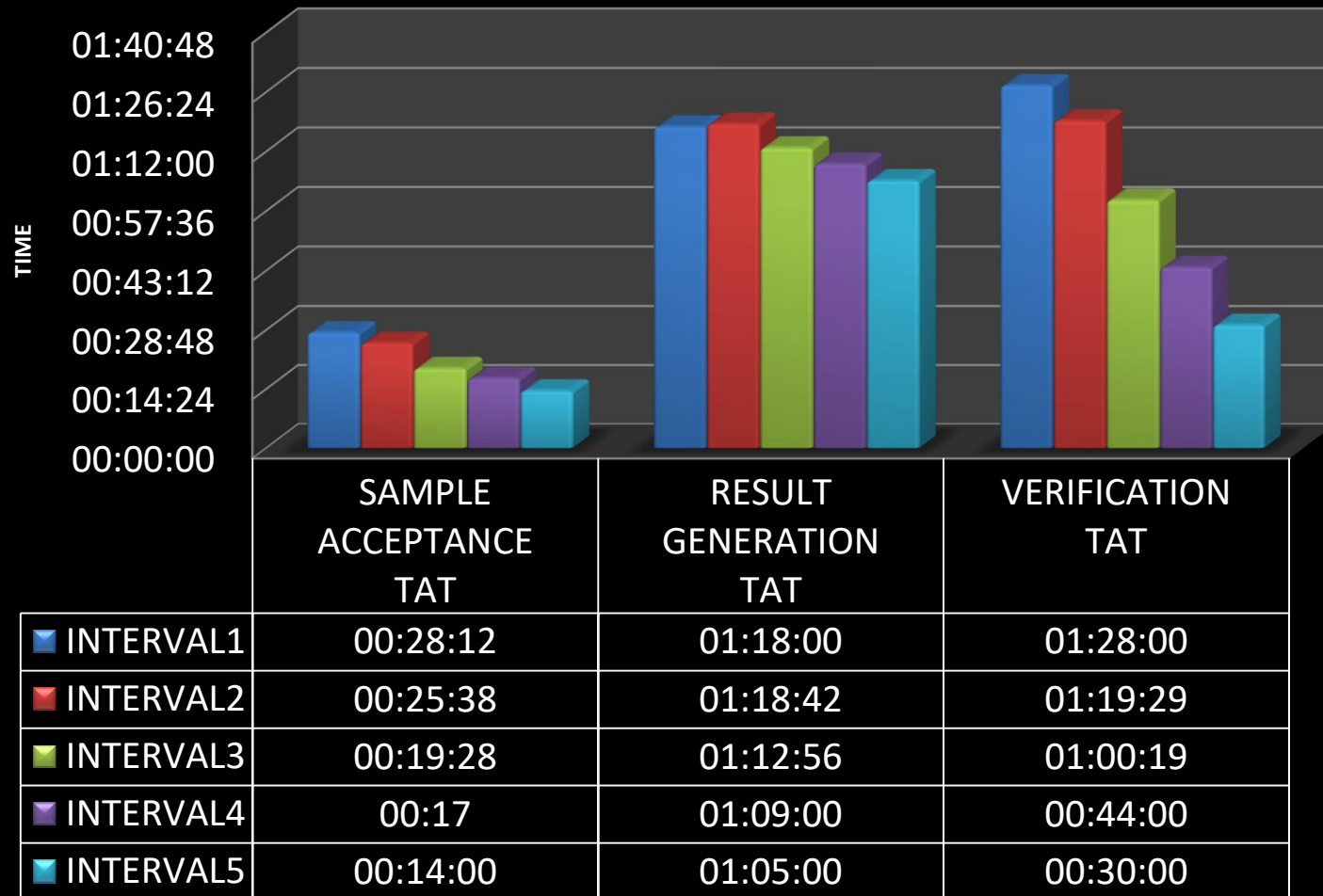
Just like the other two graphs this graph compares the average STAT TAT of each interval. At interval 1 the average STAT TAT was 2hour42minutes, which was decreased to 2hour22minutes in the second interval, 1hourand 53minutes in the third interval, 1hour 32minutes in the fourth interval and 58minutes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

IPD TAT COMPARISON



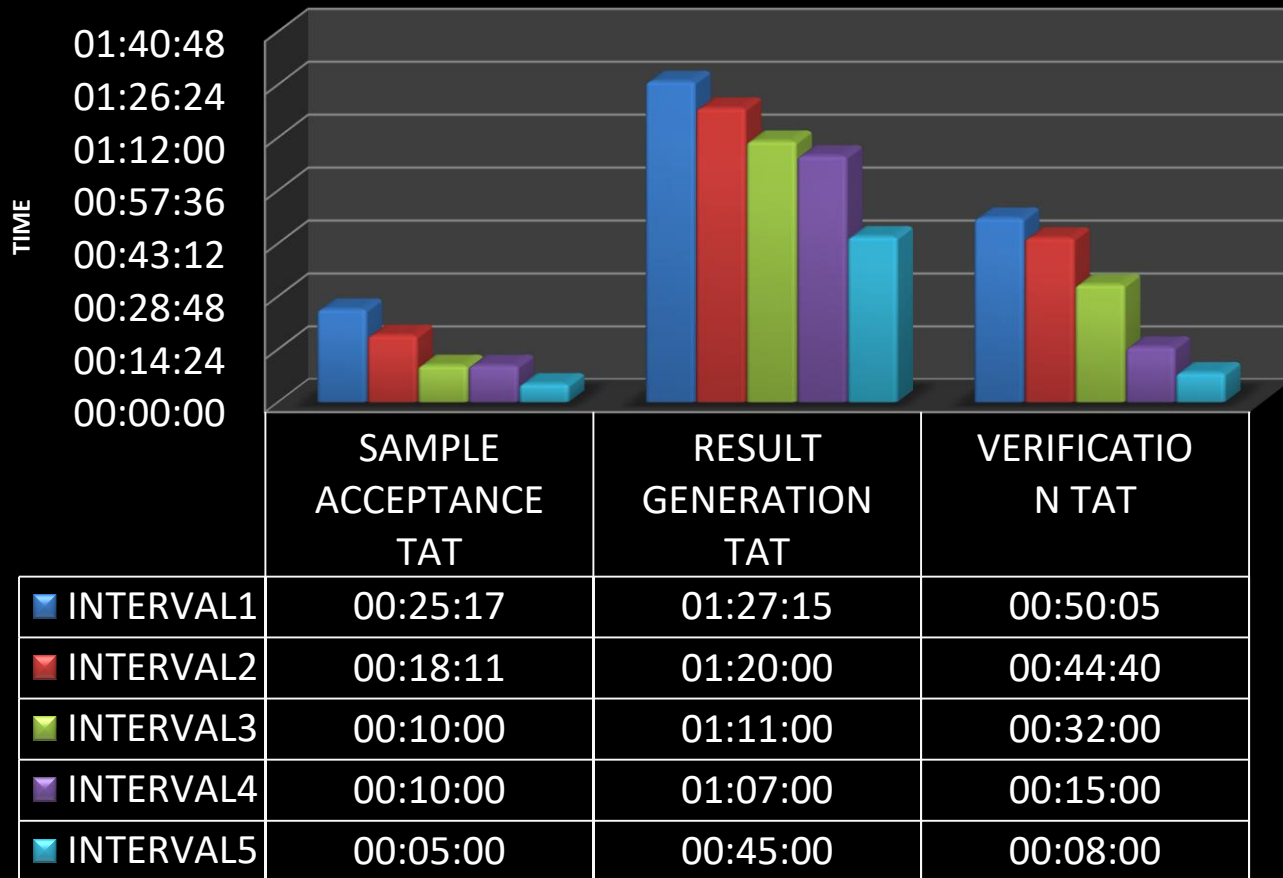
In this graph IPD TAT comparison at each step of the sample processing was done. The sample acceptance , result generation TAT and result verification TAT showed a steady decrease

OPD TAT COMPARISION



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

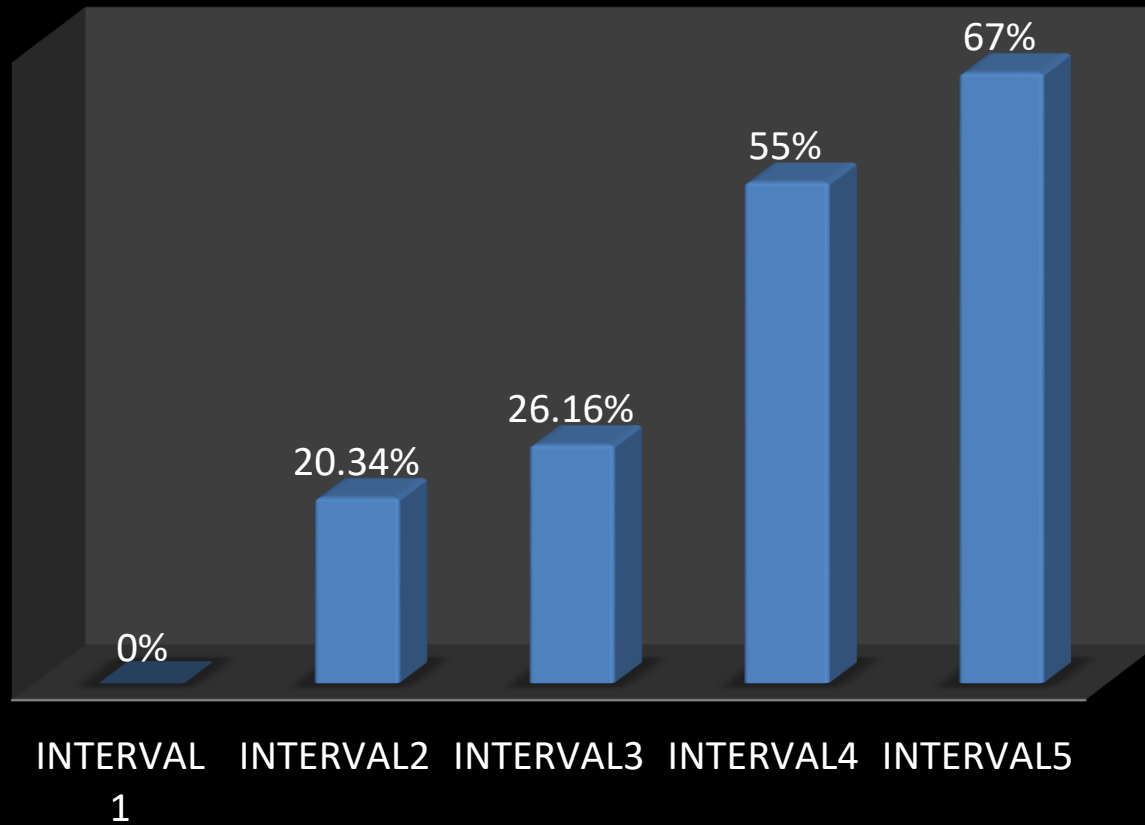
STAT TAT COMPARISION



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Percentage of Reports Verified Before 9AM

■ 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 INTERVAL	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

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

SUGGESTIONS

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

- The key performance indicators that are not meeting the laboratory requirements should be identified. Along with the non value added services or wastes that will cause the delay in the laboratory reports.
- Once the waste activities are being identified they should be eliminated by using various lean management techniques and tools suitable for that activity.
- 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.
- 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.
- Sustaining the process is very crucial in order to see long term results in the process. Therefore continuous quality improvement is must.
- The laboratory consultants must be trained in lean management so that a better monitor and implementation can be assured.

CONCLUSION

- There were many reasons for the delay of laboratory reports, which included untrained workers, ineffective communication among staff, improper space management, uncalibrated 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.
- Previously, the laboratory was a 10am-to-5pm operation without weekend coverage. Now, staffs is present weekdays from 8am till 8pm, and on Saturdays, allowing for more prompt response to customer needs and increased time for analyses. Excess transportation 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.



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