REDUCTION OF TURNAROUND TIME OF IN-PATIENTS IN A PRIVATE HOSPITAL, CHENNAI: A SIX SIGMA APPROACH

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ABSTRACT

The study aims in reducing the average length of stay of in-patient. Average length of stay (ALS) is the average period in hospital (in days) per patient admitted, i.e. the average number of days of service rendered to each in-patient. ALS is calculated dividing the number of in-patient day's care (excluding healthy newborn) during the year by total number of discharges and deaths. Applying this formula is quite satisfactory in acute general hospitals with quick patient turnover, but is unsatisfactory where there is considerable difference between the number of patient admitted and those discharged during the year, e.g. in chronic disease hospitals.

In most acute care general hospitals; the ALS varies from 8 days to 15 days, which is not acceptable to many patients. The study covers the time taken from physical admission to physical discharge. Methodology adopted in this study is Six Sigma. Six Sigma is a structured problem solving tool, which deploys Brainstorming & Statistical tools to identify the vital root causes, and finding a solution so as to optimize the Output. It follows DMAIC (Define, Measure, Analyze, Implement and Control) approach for problem solving. The vital fews are found to be the orthopedic surgery, PTCA (Percutaneous transluminal coronary angioplasty), LSCS (Lower segment cesarian section), which shows longer period of stay. The major root causes are there are no standards for working procedure and timeframe is not available for every process in in-patient areas, shortage of manpower and lack of communication & co-ordination. The run chart reveals that there are certain cases, which shows continuous 6 points above the average length of stay of the patients. The actual importance of in-patient procedure is not properly understood by most of the staffs. Significant reduction in waiting time, leading to a substantial improvement in quality of service at the Ultrasound Unit of the hospital can be achieved through six-sigma approach. Total quality management concepts and methodologies would help in standardizing the medical care activities across hospitals.

Keywords: *Average length of stay, DMAIC, In-patient admission and discharge, Six sigma*

INTRODUCTION

PURPOSE

This document contains the Six Sigma Project Report for the project titled **Reduction of turnaround time of in-patients** for the private Hospital, Chennai.

DEFINITIONS, ACRONYMS AND ABBREVIATIONS

- **IP** – In-Patient
- **IPD** – In-Patient Department
- **FOA** – Front Office Assistant
- **OT** – Operation Theatre
- **ICU** – Intensive Care Unit

OVERVIEW

This document is divided into sections describe the various phases of DMAIC methodology. Each section describes the tools and methodology applied in each of the phases. The annexure section contains the referenced formats and documents used in this project.

SIX SIGMA

6σ

Six Sigma stands for Six Standard Deviations (Sigma is the Greek letter used to represent standard deviation of population parameter) from mean. Six Sigma methodology provides the tools and techniques to improve the process capability by reducing defects by reducing variation in any process.

It was started in Motorola, in its manufacturing division where millions of parts are made using the same process repeatedly. Eventually, Six Sigma evolved and applied to other non manufacturing processes. Today you can apply Six Sigma to many fields such as Services, Medical and Insurance Procedures and Call Centers.

Six Sigma is a problem solving methodology that improves any existing business process by constantly reviewing and re-tuning the process. To achieve this, Six Sigma uses a methodology known as DMAIC.

- **D**efine the problem
- **M**easure the current performance
- **A**nalyze the performance
- **I**mprove the performance
- **C**ontrol the improved performance

Six Sigma methodology can also be used to create a brand new business process from ground up using DFSS (Design For Six Sigma) principles. Six Sigma strives for

perfection. It allows for only 3.4 defects per million opportunities for each product or service transaction. Six Sigma relies heavily on statistical techniques to reduce defects and measure quality objectively based on data.

Six Sigma incorporates the basic principles and techniques used in Business, Statistics, and Engineering. These three form the core elements of Six Sigma. Six Sigma improves the process performance, decreases variation and maintains consistent quality of the process output. This leads to defect reduction and improvement in profits, product quality and customer satisfaction.

DMAIC Methodology

Six Sigma process improvement is carried out as a project. The most common type is the "DMAIC" method (Define, Measure, Analyze, Improve and Control). First, the project and the process targeted to be improved are defined, after which the performance of the process is measured. The data is then analyzed and bottlenecks and problems are identified. After analysis, improvement ideas are evaluated/implemented and defects are removed. A management group controls this development program.

The DMAIC methodology consists of the following five steps:

- Define process improvement goals that are consistent with customer's demands and the enterprise strategy.
- Measure key aspects of the current process and collect relevant data.
- Analyze the data to verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered.
- Improve or optimize the process based upon data analysis using techniques like Design of Experiments.
- Control to ensure that any deviations from target are corrected before they result in defects. Set up pilot runs to establish process capability, move on to production, set up control mechanisms and continuously monitor the process.

DEFINE PHASE

The primary objectives of the define phase are:

- To identify the focus areas or key performance measures
- To setup a project and deploy a project team

PROJECT CHARTER

The following project charter defines the project **Reduction of turnaround time of in-patients** and its goals, objectives and scope.

Name of the Organization	PRIVATE HOSPITAL, Chennai.
Name of the Project	Reduction of turnaround time of in-patients
Problem Statement	There is delay on the services to the in-patients that subsequently delay the turnaround time of in-patients. It is observed that the delay is by 40%. The current performance stands at 13 days as against customer's expectation of 9 days.
Goal Statement	Turnaround time to be reduced by 4-5 days. A reduction of 40% is targeted.
Project Scope	Limited to in-patients only, In-patient treatment time takes 4-13 days, which is not acceptable to many patients. Study covers the time taken from physical admission to physical discharge.
Project Objectives	To make the significant improvement in the in-patient process thus reducing the turnaround time.
Project Team	Mr. O. Arivazhagan, Project Guide, Black Belt Mrs. Bhooma Devi, Project Leader, Green Belt Mr. G. Gunasundaram, Assistant Project Leader, Green Belt Ms. Shobana, Team Member, Yellow Belt
Team Guidelines	1st meeting – initial discussion about data collection 2nd meeting – review of project charter, flow chart and SIPOC 3rd meeting – measurements 4th meeting – analysis

5th meeting – improvement & control and final report.

PROJECT SCHEDULE

The following project scheduled prepared for various activities of the project:

SNo	Activity	Responsibility	Completion Date
1	Data collection	Ms. Shobana	25-Apr-2009
2	Data analysis with various tools	Team	30-May-2009
3	Discussion on results of data analysis	Team	30-May-2009
4	Identifying and selecting improvement ideas	Team	30-Jul-2009
5	Final Report	Team	30-Jul-2009

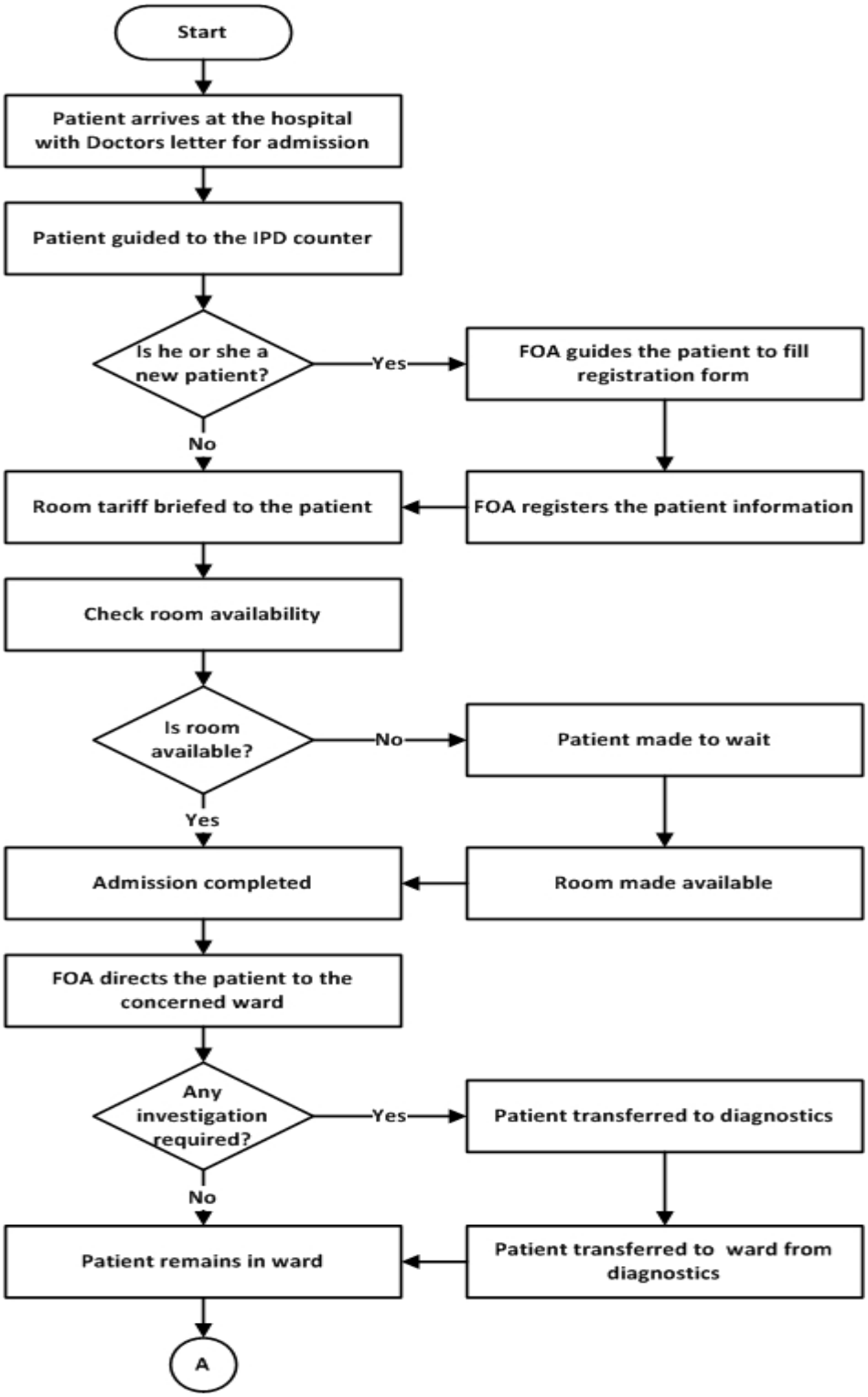
SIPOC

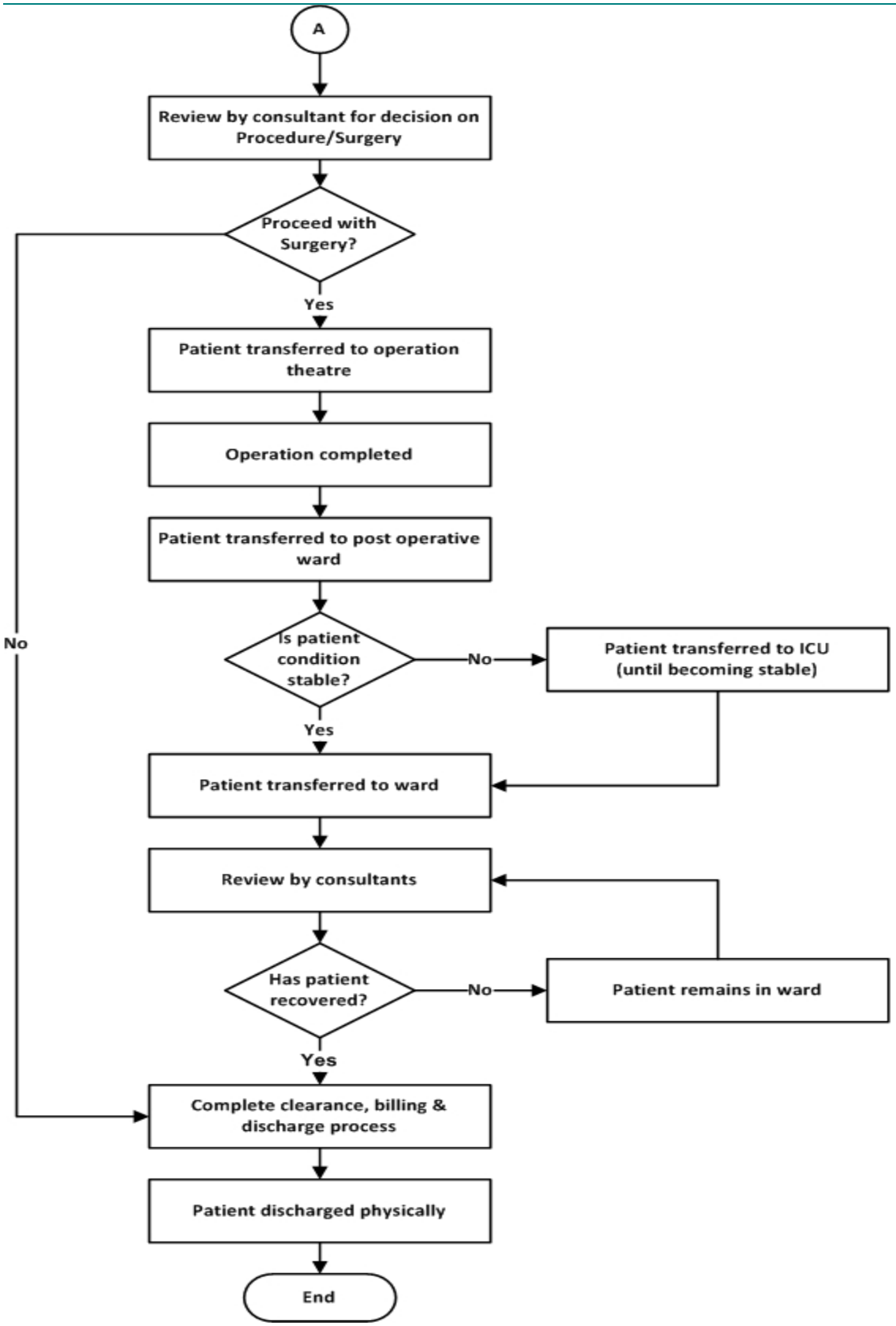
The following SIPOC diagram describes the in-patient process.

Supplier	**Input**	**Process**	**Output**	**Customer**
Patient	Admission card	Admission	Case sheet	Patient
Front office assistant	Ward register	Diagnosis	Patient is admitted	Patient's relatives
Nurse	Case sheet	Operation	Investigation Report	
Diagnostic staff	OT register	Post operation	Preparation done before surgery	
Surgeons	Post operation log	Intensive care	Operation/Surgery done	
Anesthetist	ICU log	Treatment in the ward	Postoperative observation done	
OT staff	Discharge advise	Billing	Intensive care provided	
Technician	No dues receipt	Discharge	Re-admitted in the ward	
Ward boys			Discharge advice given by the doctors	
Billing staff			Clearance given by other departments	
			Payment of bills	
			Patient discharged	

Flow Chart

The following flow chart describes the in-patient process flow:




A
Review by consultant for decision on Procedure/Surgery
Proceed with Surgery?
No
Yes
Patient transferred to operation theatre
Operation completed
Patient transferred to post operative ward
Is patient condition stable?
No
Patient transferred to ICU (until becoming stable)
Yes
Patient transferred to ward
Review by consultants
Has patient recovered?
No
Patient remains in ward
Yes
Complete clearance, billing & discharge process
Patient discharged physically
End

VOICE OF CUSTOMER

Voice of Customer was determined by feedback from the in-patients using a Questionnaire as per **Annexure B**. Based on the feedback the acceptable length of stay or USL – Upper Specification Limit was determined as 9 days. LSL was determined as 1 day.

The following is the summary of Voice of Customer prepared from the questionnaire answered by various patients.

Voice of Customer							
SNo	Patient Name	Procedure	Length of Stay	Delayed?	How many days delayed?	Which process got delayed?	How much delay? (in hours)
1	Mrs Jaya Perumal	Cystoscopy	13	yes	4	Admission	3 hours
2	Mr Haroon Rashied A	CABG	12	yes	3	Diagnosis	4 hours
3	Dr. Mukhopadhyay B	TURP (Urology)	10	yes	1	Diagnosis	3 hours
4	Baby Thrisha Palanisamy	Angiography	12	yes	2	Billing	2 hours
5	Mr Mohan K	PTCA	6	yes	2	Diagnosis	2 hours
6	Miss Ramadevi J	Angiography	9	yes	3	Clearance	1 hour
7	Mr Balaji Subramaniam	Lap Cholecystectomy	6	yes	2	Discharge	4 hours
8	Mr Aditya Balakrisnan	Neuro surgery	10	yes	3	Billing	4 hours
9	Mr Ramachandran S	TURBT	6	yes	2	Diagnosis	2 hours
10	Mrs Aarthi Kuppuswamy	LSCS	4	no	0	Billing	2 hours
11	Mrs Arockiamary	Myomectomy	4	yes	1	Diagnosis	1 hour

MEASURE PHASE

The primary objectives of the measure phase are:

- To define the KPOV - Key Process Output Variables that need to be measured
- To develop data collection plan
- To collect data
- To determine current performance (baseline performance)

CTQ

CTQ (Critical To Quality) is an important factor in measuring the customer satisfaction against the product or service offered by the organization.

CTQ – Turnaround time of in-patients

CTQ Measure – Days

OPERATIONAL DEFINITIONS

Patient – A patient or an in-patient is any person who receives medical attention, care, or treatment within the hospital premises. For this project, any patient admitted into the in-patient department is considered an in-patient who receives the services from the hospital.

Turnaround time – Turnaround time is the time taken from physical admission to physical discharge of an in-patient after the treatment. The terms turnaround time or length of stay are interchangeable.

Investigation – The terms investigation and diagnosis are interchangeable. The patient is asked to undergo various medical investigations in order to identify or confirm the health conditions.

Procedure – A medical procedure is a course of action intended to achieve a result in the care of patients with health problems.

Admission – The procedure of admitting the patient into the in-patient ward.

Discharge – The procedure of discharging the patient from the hospital after final review by the consultant, clearance from other departments and payment of bills.

Defect – If the turnaround time is above 9 days it is considered as a defect.

IP – In-patient

IPD – In-patient department

FOA – Front Office Assistant

OT – Operation Theatre

ICU – Intensive Care Unit

Data collection Plan

- **Measurement Method** – The physical admission time and physical discharge time of in-patients was recorded using the data collection sheet as per Annexure A. One of the team members was assigned with the responsibility for data collection.
- **Measurement System Analysis** – The chances of repeatability error are avoided by using a standard data collection sheet by one operator/data collector.
- **Sampling Method** – A simple random sampling method is used for the data collection. Patients are picked up randomly as patient enters the hospital premises, the patient or the attender who accompanies the patient are provided with the data collection sheet to fill the data such as Patient Name, Procedure, etc. All the other information such as the process time, etc. were collected from the system.
- **Sampling Timeframe** – A period of 4-5 weeks time from 01-March-2009 was targeted for the data collection and completed by 5 weeks.
- **Sample Size** – 80-90 samples were targeted and 89 samples were collected.

Baseline Performance

The following are the baseline performance statistics regarding the turnaround time:

- Sample Size – 89

- **Minimum** – 1 day
- **Maximum** – 13 days
- **Range** – 12 days
- **Mean** – 6.73 days
- Standard Deviation – 2.63 days
- **USL** – 9 days (as per the voice of customer)
- **LSL** – 1 day (as per the voice of customer)

DPMO AND CURRENT SIGMA LEVEL

DPMO is the defect per million opportunities. DPMO for this project is arrived based on the following:

- **Number of Units** – 89 (every patient is considered a unit)
- **Defect** – if turnaround time or length of stay is more than 9 days
- **Number of Defects** – 11 (as per the data collected)
- **Defect Opportunity** – 1 opportunity per patient

DPMO = (Number of Defects X 1,000,000)/(Number of Defect Opportunities/Unit) Number of Units*

DPMO = (11 X 1,000,000) / (1/1) * 89
= (11,000,000) / 1 * 89
= 123595.5

CURRENT SIGMA LEVEL = 2.6

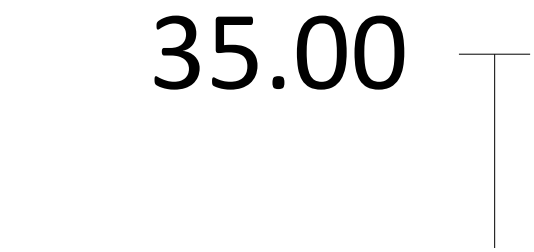
PROCESS CAPABILITY - CP

- **USL - LSL** – 8 days [9 – 1]

Cp = (USL-LSL)/6 Sigma

Cp = 8/(6x 2.63)
= 0.5069

Histogram



Interpretation

Cp < 1 means the process variation is too much as indicated by range also, and a significant number of defects are being made. In other words, the process is not capable and doesn't meet the customer specifications, resulting in customer dissatisfaction.

1. ANALYSIS PHASE

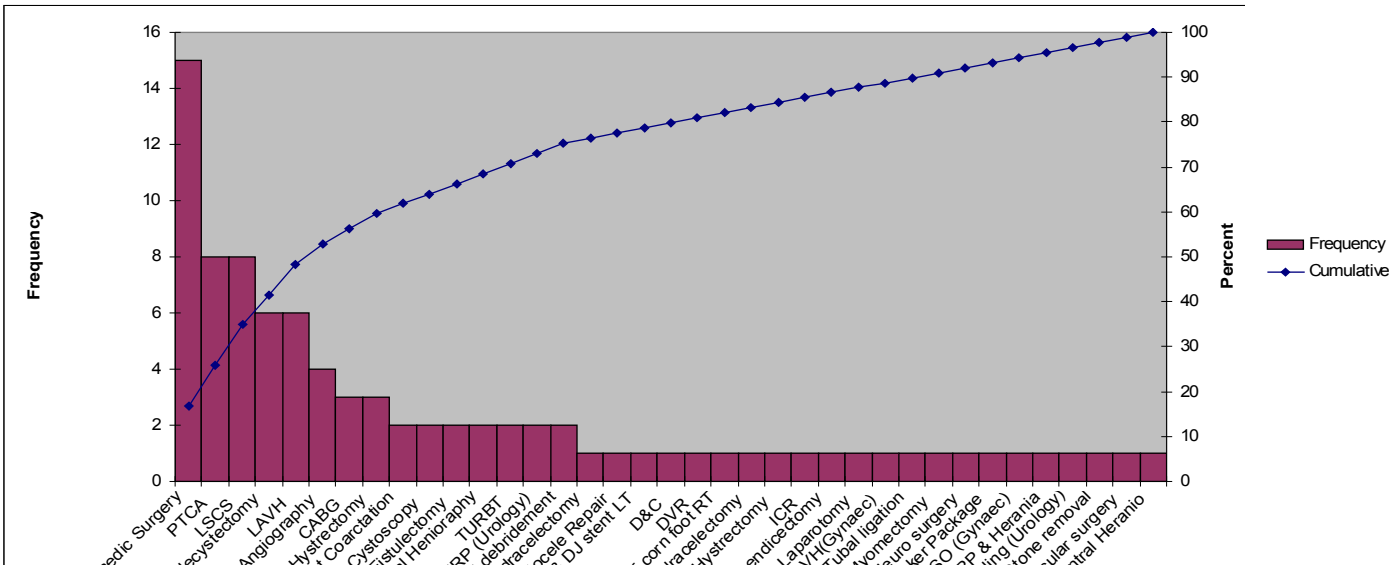
The primary objectives of the analysis phase are:

- To analyze all possible causes
- To shortlist major suspected causes (vital few)
- To verify root causes
-

PARETO CHART

The following Pareto chart was constructed using the measured turnaround time shows

that the few procedures take longer turnaround time.



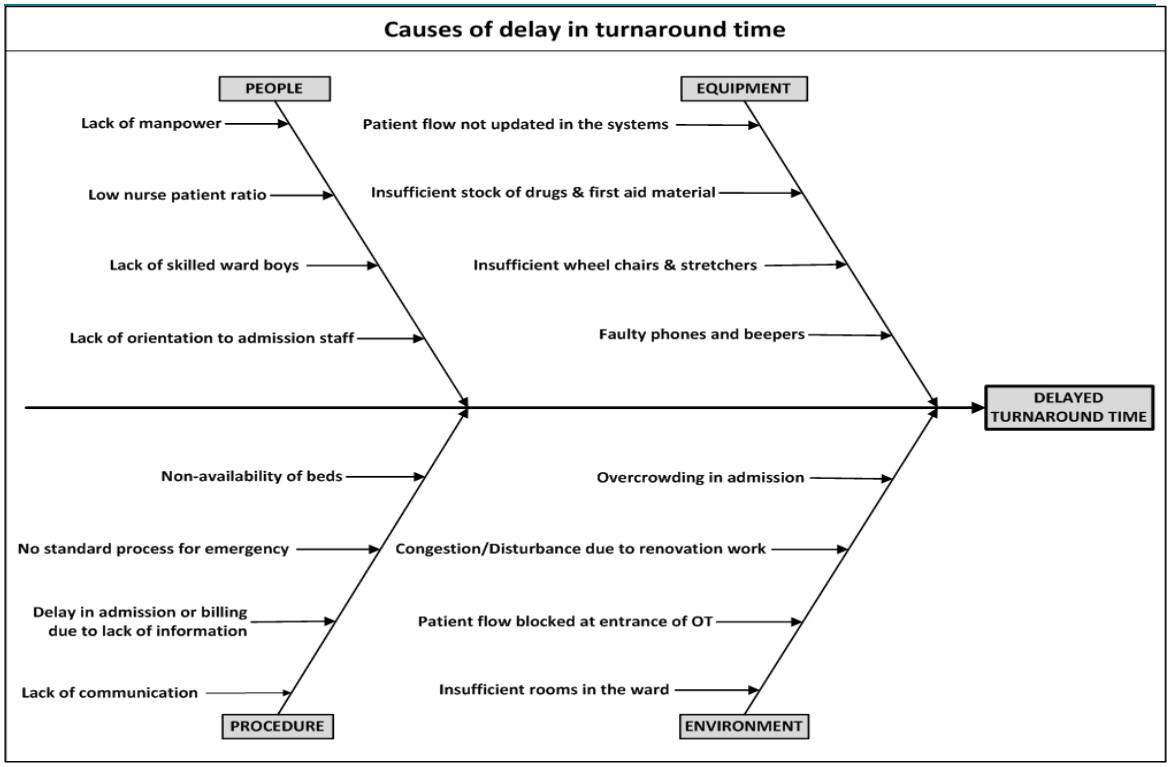
Interpretation

The following procedures (vital few) take longer turnaround time:

- Orthopedic surgery
- PTCA
- LSCS

Cause and Effect Diagram

The following cause and effect diagram describes the possible causes for the delay in turnaround time.



Interpretation

- **People** – Lack of manpower, Low nurse patient ratio, Lack of skilled ward boys, Lack of orientation to admission staff
- **Equipment** – Patient flow or status information not regularly updated in the systems, Insufficient stock of drugs and first aid material, Insufficient wheel chairs and stretchers, Faulty phones and beepers
- **Procedure** – Non availability of beds, No standard process for emergency, Delay in admission or billing due to lack of information, Lack of communication
- **Environment** – Overcrowding in admission, Congestion/disturbance due to renovation work, Patient flow blocked at the entrance of operation theatre, insufficient rooms in the ward.

IMPROVE PHASE

The primary objectives of the improvement phase are:

- To identify and evaluate possible improvement solutions
- To confirm possible improvement solutions towards optimized performance

The implemented solution also needs to be measured in order to ensure there is an improvement. If not the measure and analyze phases need to be repeated.

POSSIBLE IMPROVEMENT SOLUTIONS

Brainstorming sessions were conducted and all the team members proposed the ideas for improvement and possible solutions.

- Establish standard operating procedure for in-patient treatment process; provide training to all staff and implement across the in-patient department.
- Provide training and orientation to admission staff.
- Print and provide in-patient information to the patients arriving for admission. The printed material can include information regarding admission process, tariff, frequently asked questions, etc.
- Appoint new junior level staff for handling enquiries to reduce the load on admission staff thus reducing the delay in admission time.
- Increase nurse patient ratio by recruiting more nurses.
- Recruit new ward boys and train all the ward boys.
- Train the staff responsible for updating the patient status information on the computer systems. Insist on timely update of patient status information on the computer systems.
- Maintain right level of drug and first aid material.
- Add sufficient number of wheel chairs and stretchers.
- Maintain good phones and beepers.
- Improve the operation theatre scheduling process to reduce the congestion-waiting period near the operation theatre entrance.
- Implement computerized system for communicating or updating the status, admission or discharge information to other departments so that the information can be passed on quickly thus reducing the delay at admission and discharge process.
- Prepare and implement checklist for various processes as applicable in order to reduce defects and reduced turnaround time.

CONTROL PHASE

The primary objectives of the control phase are:

- To standardize improvement plan to sustain the gains of the improvement
- To close this improvement project

RECOMMENDATIONS

A standard operating procedure, training and implementation plan to be prepared and implemented. It is recommended to implement the standard operating procedure across the in-patient department in order to reduce the turnaround time.

It is also believed that if the suggested improvements are implemented, the defect level would be reduced thus sigma level and customer satisfaction could be improved.

It is also proposed that the post implementation performance shall be measured to evaluate and sustain the improved performance.

The project report was submitted to the management and the management is considering the implementation.

ANNEXURE A - Data Collection Sheet

Data Collection Sheet

SNo	Patient No	Patient Name	Procedure	Date of Admission	Date of Discharge	Length of stay

ANNEXURE B - VOICE OF CUSTOMER

Voice of the Customer to determine the acceptable length of stay in the hospital.

Voice of Customer		
Questionnaire		
Date		
Patient Name		
Procedure		
Date of Admission		
Date of Discharge		
What is your total length of stay?		
Do you think you could have got discharged earlier?		
If yes, how many days earlier?		
Do you feel any delay happened at any stage during your stay?		
If yes, please tick the process that got delayed and specify the delay in hours	✓ Process	Delay in Hours
	Admission	
	Diagnosis	
	Operation	
	Post Operation	
	Ward	
	Billing	
	Clearance	
	Discharge	

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