

Study on Operation Theatre Scheduling by Using DMAIC Approach

By

Doyel Roy

*Dissertation submitted for the partial fulfillment of the
MBA Hospital and Health Management*

Academic year, 2015-2017



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TO WHOMSOEVER MAY CONCERN

This is to certify that Ms. Doyel Roy of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at Medica Superspecialty Hospital, Kolkata from 7th February, 2017 to 7th May, 2017.

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 her future endeavors.



(Col.) Dr. Ashok Kaushik
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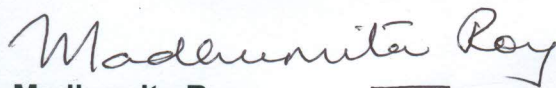
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6th May, 2017

TO WHOM IT MAY CONCERN

This is to certify that **Ms. Doyel Roy**, a student of MBA in Hospital and Health Management from Indian institute of Health Management Research (IIHMR), has successfully completed practical training at **Medica Superspecialty Hospital, Kolkata**, during **7th February 2017 to 7th May 2017**, as per her academic requirement.

She was found to be an efficient & dedicated student, and her conduct was found to be excellent.



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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **“Study on Operation Theatre Scheduling by using DMAIC Approach at Medica Superspecialty Hospital, Kolkata”**. and submitted by **Ms .Doyel Roy** Enrollment No **IIHMR-U/20/2015-17/0274** under the supervision of **Ms. Geetika Goswami** for award of MBA in Hospital and Health Management of the University carried out during the period from **FEBRUARY 2017** to **MAY 2017** 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

THE IIMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that all ethical issues have been considered while collecting data for my dissertation titled **“Study on Operation Theatre Scheduling by Using DMAIC Approach”** at **Medica Superspecialty Hospital, Kolkata”**.

Doyel Roy.

Signature of student

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Ms. Doyel Roy

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Lists of Abbreviations

OT- Operation Theatre

ITU- Intensive Treatment Unit.

ENT – Ear, Nose and Throat

CSSD- Central sterile and supply Department

HMIS –Hospital Management Information System

GDA- General Duty Assistant

RMO-Registered Medical Officer

ECG- Electrocardiogram

EEG- Electroencephalogram

SA- Spinal Anaesthesia

GA –General Anaesthesia

SE- Sedation

TPA- Third party Administrator

A&E- Accident and Emergency

HDU-High Dependency Unit

ICU- Intensive Care Unit

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1. Introduction

The operating theatre is one of the most expensive departments of any hospital and its scheduling involves an arrangement of several operating rooms to the medical surgeons in a period of time. Surgeons therefore have a responsibility to ensure that theatre facilities are utilized as fully as possible, and there should be a productive use of operating time in the theatre. In the health service sector such as government or private hospitals, the scheduling of Operating Theatre plays an important role towards achieving their goals. And their one of the main goal is to meet the patient satisfaction by minimizing his/her total waiting time before undergoing any major or minor operations. So, routine operating lists are planned in advance, so that each surgical team should be able to ensure that operating theatre time is used as fully as possible, without being exceeded more time unnecessarily.

Another objective is to reduce the costs involved with Operating Theatre such as staffing cost, or also known as overtime cost, which is greater than that of regular working hours. For example, a hospital needs to hire part-time medical specialists to perform major operations during weekends or outside office hours. As a result, the hospital has to spend more to gratify the needs of the patient. This has led to the need of optimizing the availability of the operation theatre by minimizing the under-allocation of operating room. For effective use of operating theatre it is more important for us to finding out how long common operations took, and then tried to improve the use of operating time by scheduling the operating sessions.

Operation Theatre scheduling is a major contributing factor to enhance the efficiency of Operation Theatres. Accurate and real time scheduling assist in predicting staffing needs, ensuring availability of required equipment , supplies one and of the most important concern related to patient satisfaction. Thus, contribute to a smooth running of OT. An accurate schedule must list realistically the starting and ending time of each surgery. In addition, conflicts of schedule shall be resolved by the operating theatre manager. Schedules need to be rearranged according to agreed-on principles among all surgeons, nurses and supportive staff. OT is a high revenue generating department within the hospital. Considerable resource is wasted if operating room is not used effectively.

Thus quality of care in surgical unit is a measure of timely, safe and best care to patients. The critical concern for hospitals is improving quality while simultaneously reducing cost. Different organizations use different methodologies and tools for implementing a quality management and programs for quality improvement such as seven quality tools (control chart, Pareto chart, RCA, FMEA etc). One of the methodologies used for hospital operations process is Six sigma which constitutes a number of approaches and techniques for quality improvement. One such approach of Six sigma is DMAIC (Define, measure, analyze, improve and control) and this approach can be used to streamline and improve the operation theatre scheduling process effectively and efficiently. The simplified definition of each phase of **DMAIC** is:-

Define: Define the system, the voice of the process and their requirements and the project goals.

Measure: Measure the key aspects of the current process and collection of relevant data.

Analyze: Analyze the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.

Improve: Improve or optimize the current process based upon data analysis.

Control: Control the future state process to ensure that any deviations from target are corrected before they result in defects and continuously monitor the process.

2. Review of Literature

Healthcare Expenditure comprise a meaningful portion of the gross Domestic Product in both developed and developing countries. Expenditure on healthcare in UK as a percentage of the UK Gross Domestic Product(GDP) was estimated to be 8.4%in 2007,from which the public share was 69%.Also, according to the statics released by the WHO (World Health Organisation), health care expenditure in 2007 in Iran as a developing country were estimated to be about 6.4% of its GDP, andthe portion covered by the government was about 46.8%.This fact makes health systems an important research field for industrial engineering and operations research to improve their operational efficiency.

Case Scheduling or correctly selecting the day on which to do each elective case so as to best fill the allocated hours is most important , much more so than ,for example , correcting errors in predicting how long elective or add on cases would last ,reducing variability in turnover or delays between cases ,or day to day variation in hours of add on cases . Poor scheduling is often the cause of lost OR time. To more efficiency operate a surgical setting, managers may consider centralizing all scheduling to operating room suite itself. Ideally, holding patient and surgeon preferences constant, an operating facility can identify cases and appropriately place them into predetermined time slots, or blocks

Preoperative delays hinder the optimal flow of patients and are a source of patient frustration. Several studies focused on multiple aspects of preoperative and preoperative delays in performing the surgical procedure and tried to delineate the cause for operating room delays ,so that effective intervention and planning can cut down the costs of operating rooms and increase the profit margin to the hospital

One of the factors that has a significant impact on preoperative delays is the delay in starting the first case of the day will have a ripple effect as the following cases get delayed which result in patient annoyance and disruption of operating room and staff schedules. Avoiding the delay in first case would not only be beneficial from a financial perspective but the quality of patient care ,appropriate utilization of staff time and resource available are improved. This study focused exclusively on the delay in starting the first case each day in operating rooms of Harrisburg hospital and community general hospital. The advisory committee has set the national bench

mark of 59% for the number of first cases being wheeled in on time in each operating room. This cutoff mark is for the hospitals who do not accept 5 minutes grace period policy and for those who have the 5 minutes grace period policy the bench mark has been set at 72%. In March 2009 the percentage of first cases being wheeled in on time was 13% in Harrisburg hospital and 6% in community general. Both the hospitals were significantly below the appropriate marks setup by the advisory committee. The intervention method designed to be used in the study was the lean six sigma approach i.e, DMAIC.

A study by Janice Ahlstrom, et al (2007) explains the lean methodology implications in health industry & involvement of cost, & certain factors which are critical to quality in hospital scenario. Vinukondaiah.K, AnanthaKrishnan.N, Ravishankar.M. explored the time gap between two cases i.e. end of previous case till the start of next case. This is one of the important phases in OT, where many activities are overlapped viz., information to the next case, coordination with next case surgeons, anaesthetists, nurses, technicians. A research study by Dexter F, Macario A, Traub RD. (1999) carried out at a tertiary care hospital with the objective of assessment of and identification of utilisation of OTs and identification of bottlenecks

Belien and Demeulemeester (2007) propose and evaluate models for the construction of the master surgery schedule with levelled resulting bed occupancy. Scheduling and sequencing the patients (stage three) has received much attention in the literature and has been approached in many ways.

Hans et al. (2008) introduce assigning surgeries and planned slack time to the operating room days to prevent overtime. The planned slack time on each operating room day is based on the expected variance of the surgical durations planned on that day. The problem is formulated to minimise expected overtime and planned slack time, thereby theoretically freeing up operating room capacity.

3.Rationale of the study

This study is indented to observe the scheduling of the surgeries in Medica Superspeciality hospital, Kolkata .The observation will help in understanding the process of planning a schedule for the surgery. As Operation theatre is the most important cost centre of any hospital. Operation theatre not only involves the maximum expenditure but is also the primary source of revenue generation for hospital. Thus it is a vital expenditure and revenue centre at the same time. For maximising the cost benefit ratio of operation theatre complex, hospitals needs to utilize operation rooms in most efficient manner possible.

The operation theatres are fundamental centres both for hospital as well as patients. Surgical operations are an important part of hospital acute activity. For many patients they are the sole reasons for hospital admissions. Thus it necessitates the hospital to ensure the right case at right place to right person in right time. Thus purpose of this study is to gain insight into the theatre efficiency and by the measure of incidence and reason for delays to operating theatre list.

4. Research Questions

- What are the factors responsible for delay in OT of scheduled cases?

5. Aim

The study aims at enhancing the Operation theatre efficiency as well as patient satisfaction by OT scheduling.

6. Objectives

1. To analyze the complete process of OT scheduling in the operation theatre complex.
2. To identify the gap between scheduled time and actual time of, if any.
3. To identify the reasons for ‘first –case’ delays and ‘overall case’ delays.
4. To provide recommendations to improve the operation theatre scheduling by reducing the ‘first case’ delays and ‘overall case’ delays.

7. Methodology

Study Design and approach : The study is Descriptive study.

Location of study: Medica Superspeciality Hospital, Kolkata.

Duration of study: 7thFebruary 2017-07th May 2017

Sample Size: A random sample of 400 Patients was taken.

- ☐ Cardiac cases =165
- ☐ Ortho cases = 95
- ☐ General cases =140

Study Timings: 9:00am-5:00pm

Sampling Technique: The sampling technique is Purposive sampling.

Study Approach: Six sigma methodology –DMAIC Approach

Sample Population:

Inclusion Criteria: Surgical procedures performed for a period of 3 months.

Exclusion Criteria: PHACO and Emergency Cases.

8.Study procedure

DMAIC approach is used.

Define the system through current process map.

Measure key aspect of the current process and collection of relevant data.

Analyze the data to investigate and verify cause and effect relationships. Determine what the relationships are , and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.

Improve or optimize the current process based upon data analysis

Control the future state process to ensure that any deviations from the target are corrected before they result in defects and continuously monitor the process.

8.1 Phase-1 Define

Phase –I stands for Define and in this phase we have to describe the current process which is being followed in OT at MedicasuperspecialtyHospital,Kolkata. The tool which is used to study the OT scheduling was process mapping.

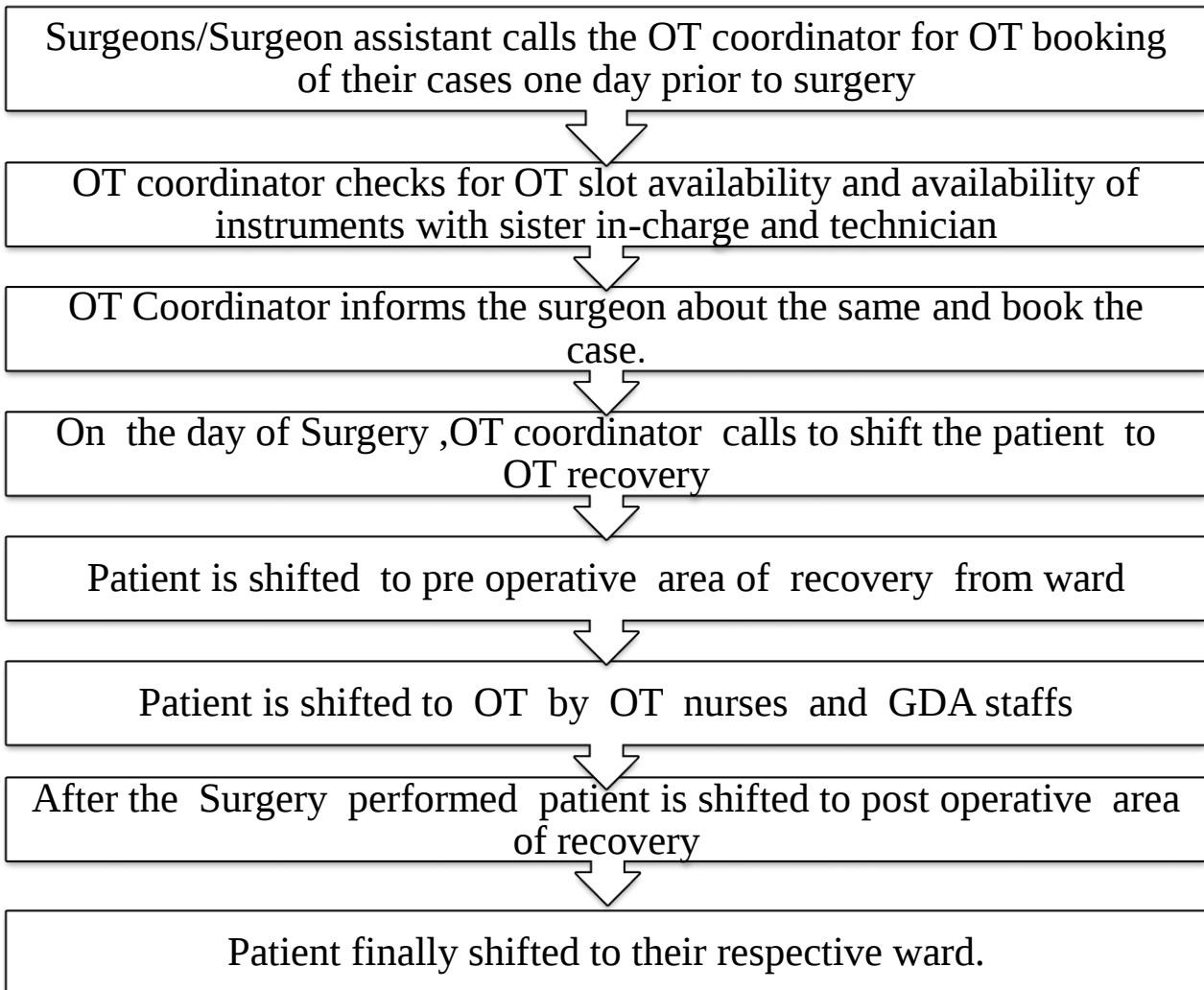
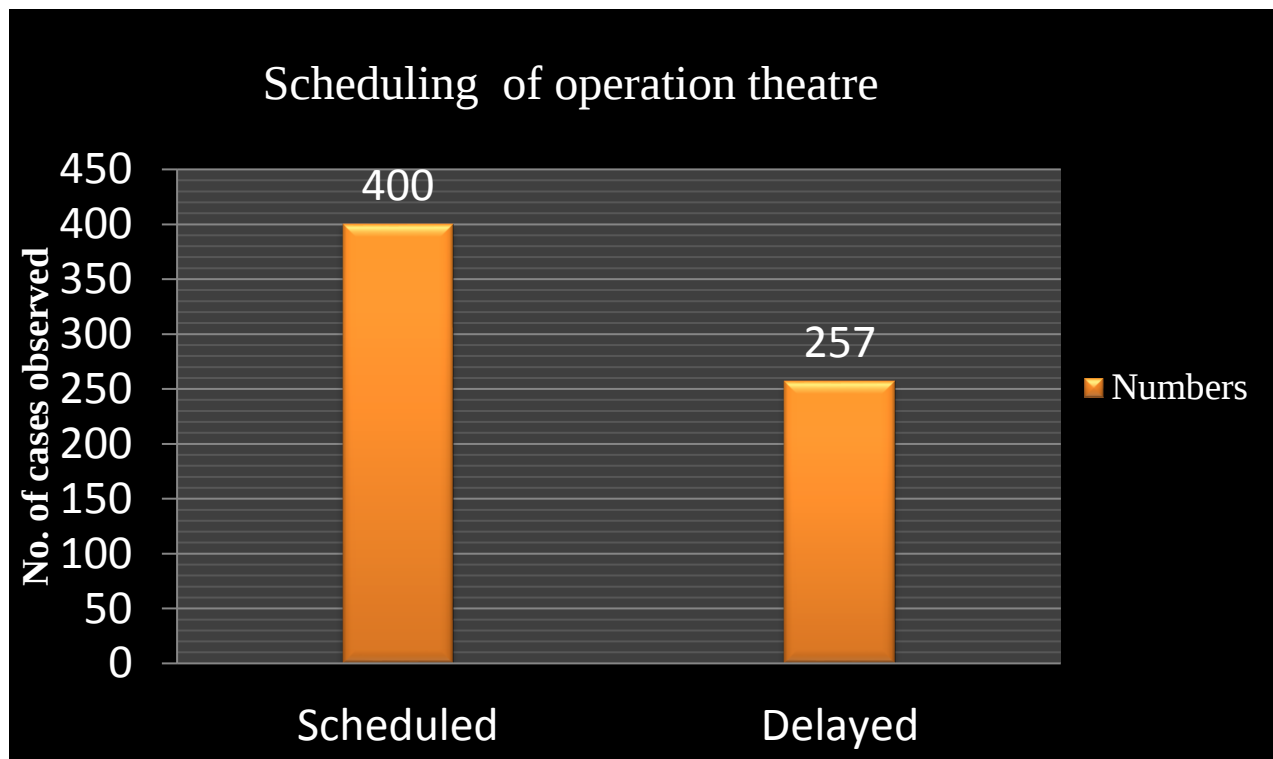


Figure-8.1

8.2 Phase –II Measure

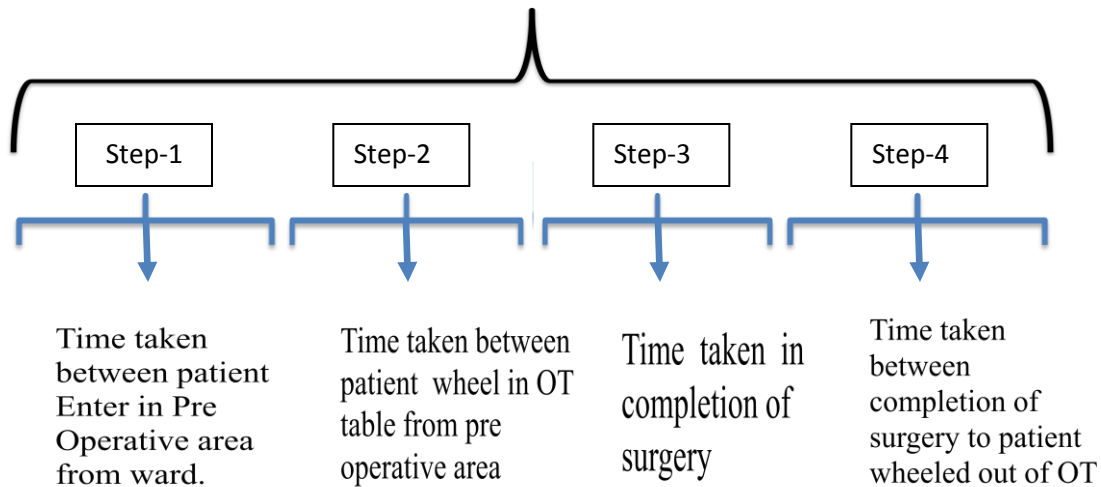
This phase is the data collection phase of the study. It aimed at measuring the problem, describe it with process and performance facts, data and metrics. The purpose of this step is to objectively establish current baselines as the basis for improvement. This is a data collection step, The purpose of which is to establish process performance baselines. The performance metric baselines from the measure phase will be compared to the performance metric at the conclusion of the project to determine objectively whether significant improvement has been made.



Graph-8.1

Interpretation- It is observed during the study that out of 400 cases scheduled for the surgery, 257 cases were delayed.

Steps to Measure the Completion of cases



To know the actual timing required for the completion of cases in OT, it is important to bifurcate the whole OT process into four steps. So that we can easily measure how much time is required to complete one single case.

Bifurcation of steps

Step-1 Time taken between patient Enter in Pre Operative area from ward

Step-2 Time taken between patient wheel in OT table from pre operative area.

Step-3 Time taken in completion of surgery

Step-4 Time taken between completion of surgery to patient wheeled out of OT

8.2.1 Speciality wise Data

Table 8.1 Cardiac cases

Measurement Parameters	Average Time taken
Case delay	52mins
Step-1 Time taken between patient Enter in Pre Operative area from ward.	23mins
Step-2 Time taken between patient wheel in OT table from pre operative area.	26mins
Step-3 Time taken in completion of surgery	4 hours 22mins
Step-4 Time taken between completion of surgery to patient wheeled out of OT	33mins

Interpretation

Out of total 165 cardiac cases ,100 cases are delay from their actual schedule time by 52minutes and the completion of whole cardiac procedure takes almost 5-6 hours.

Table 8.2 Ortho cases

Measurement Parameters	Average Time
Case delay	48mins
Time taken between patient Enter in Pre Operative area from ward.	10mins
Time taken between patient wheel in OT table from pre operative area.	20mins
Time taken in completion of surgery	1hour 15mins
Time taken between completion of surgery to patient wheeled out of OT	13mins

Interpretation

Out of total 95 cardiac cases ,61 cases are delay from their actual schedule time by 48minutes and the completion of whole cardiac procedure takes almost 2-3 hours.

Table 8.3 General Surgery cases

Measurement Parameters	Average Time
Case delay	40mins
Time taken between patient Enter in Pre Operative area from ward.	10mins
Time taken between patient wheel in OT table from pre operative area.	14mins
Time taken in completion of surgery	1hour 02mins
Time taken between completion of surgery to patient wheeled out of OT	10mins

Interpretation

Out of total 140 cardiac cases , 96 cases are delay from their actual schedule time by 40 minutes and the completion of whole cardiac procedure takes almost 2-3 hours.

8.3 PHASE III -Analysis (Speciality wise)

Figure 8.2 Cause and Effect Diagram (Fish Bone Diagram)

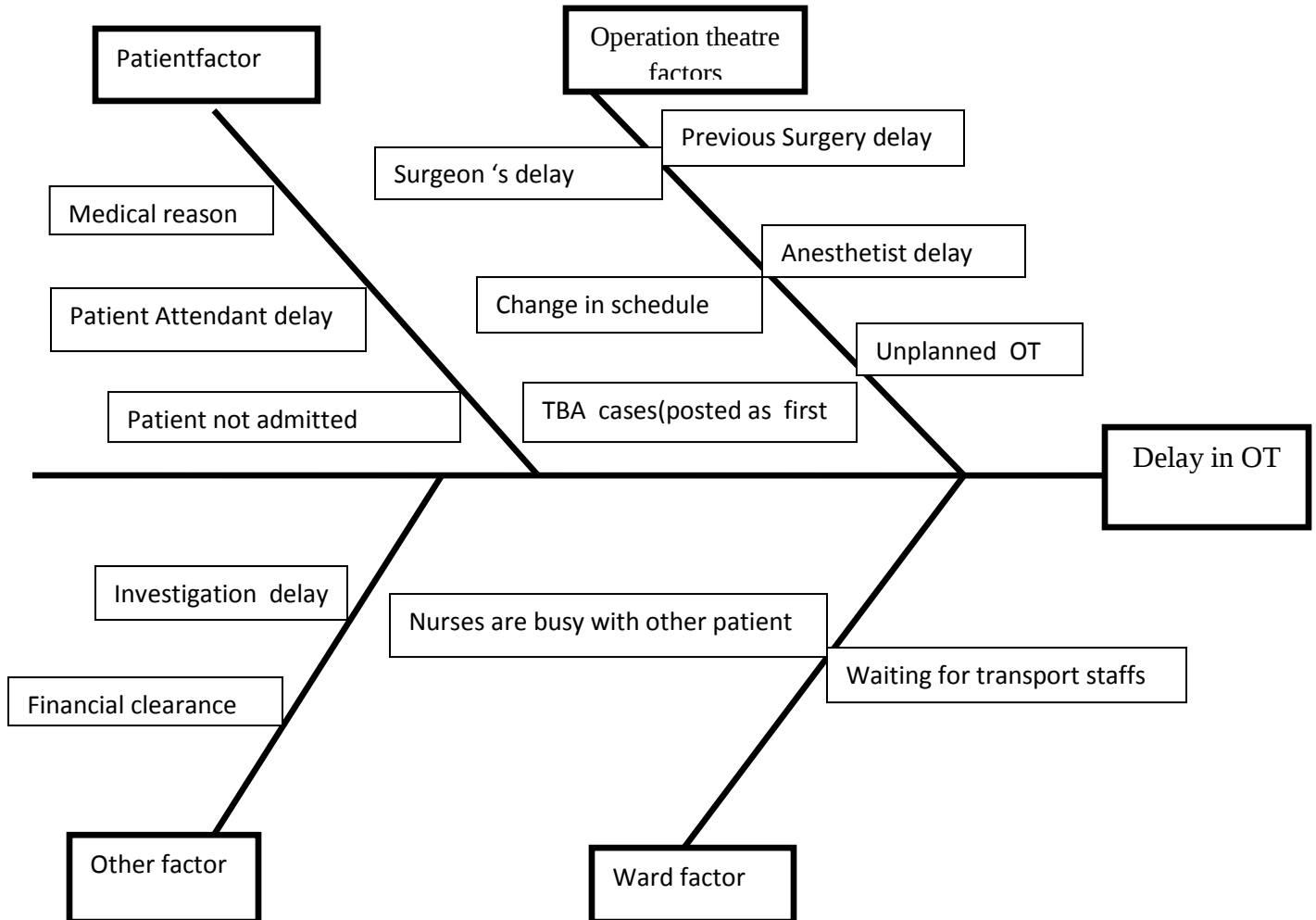


Figure-8.2

Interpretation:

During the study various factors were identified which were responsible for OT case delay. They are as follows:

❖ Operation Theatre factors

There are various factors in the operation theatre which are responsible for OT case delay and they are as follows:

- Surgeon Delay
- Anesthetist Delay
- Previous surgery delay which occurs due to following reasons:
 - Type of Surgery
 - Patient Complications
 - Ripple effect of first cases delay.
- Change in schedule of the surgery on the day of surgery which occurs due to:
 - Availability of other free Operation theatre room
 - Surgeon decision
 - Instrument unavailability for same type of surgery if scheduled one after another.
- Unplanned OT which is most commonly occurs in emergency cases
- To be admitted cases which were most commonly the day care surgeries were posted as the first case.

❖ Ward Factors:

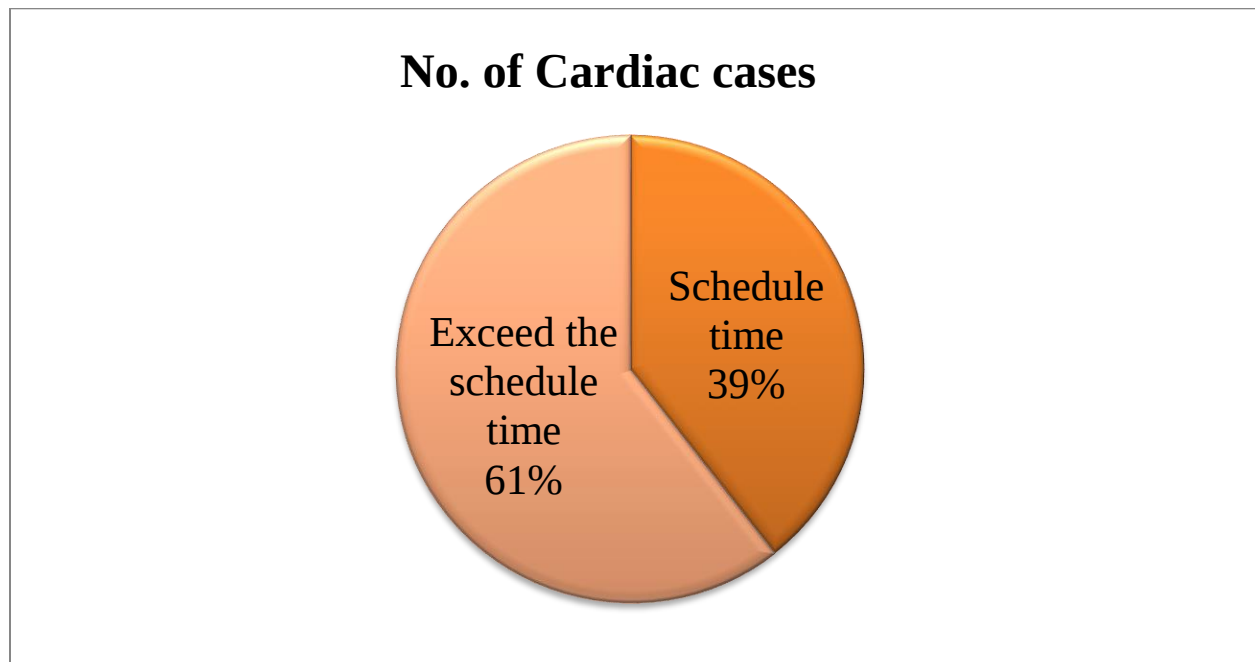
There were some ward factors which are responsible for OT case delay and they are as follows:

- Unavailability of GDA
- Infrastructural problems most commonly the lift problem

❖ Other Factors:

- Investigation Delay: Investigation delays this occurred due to delay in services of laboratory and radiological department or same day investigation of day –care surgeries.
- ❖ **Patient factors:**
- Patient factors include delay in coming of the patient party. Sometimes patient was not admitted to the hospital on actual time.

8.3.1 Cardiac Cases



Graph-8.2

Total no. of cases: 165

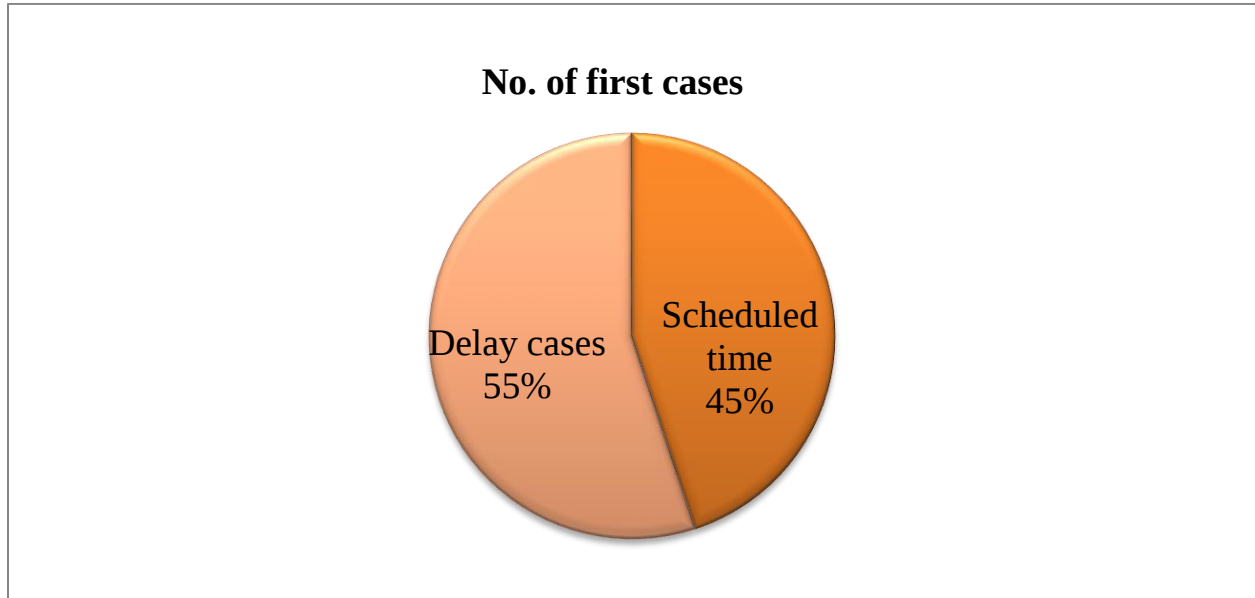
No. of cases started on scheduled time: 65

No. of cases delayed: 100

Average time of delayed cases: 52minutes

Interpretation: The total no. of cases which started at scheduled time were 65 and rest of 100 cases are delayed. It's seems that only 39% of cases started on scheduled time and 61% of the cases were delayed.

8.3.2 Cardiac First cases



Graph-8.3

Total No. of cases:89

No. of cases started on scheduled time:40

No. of cases delayed:49

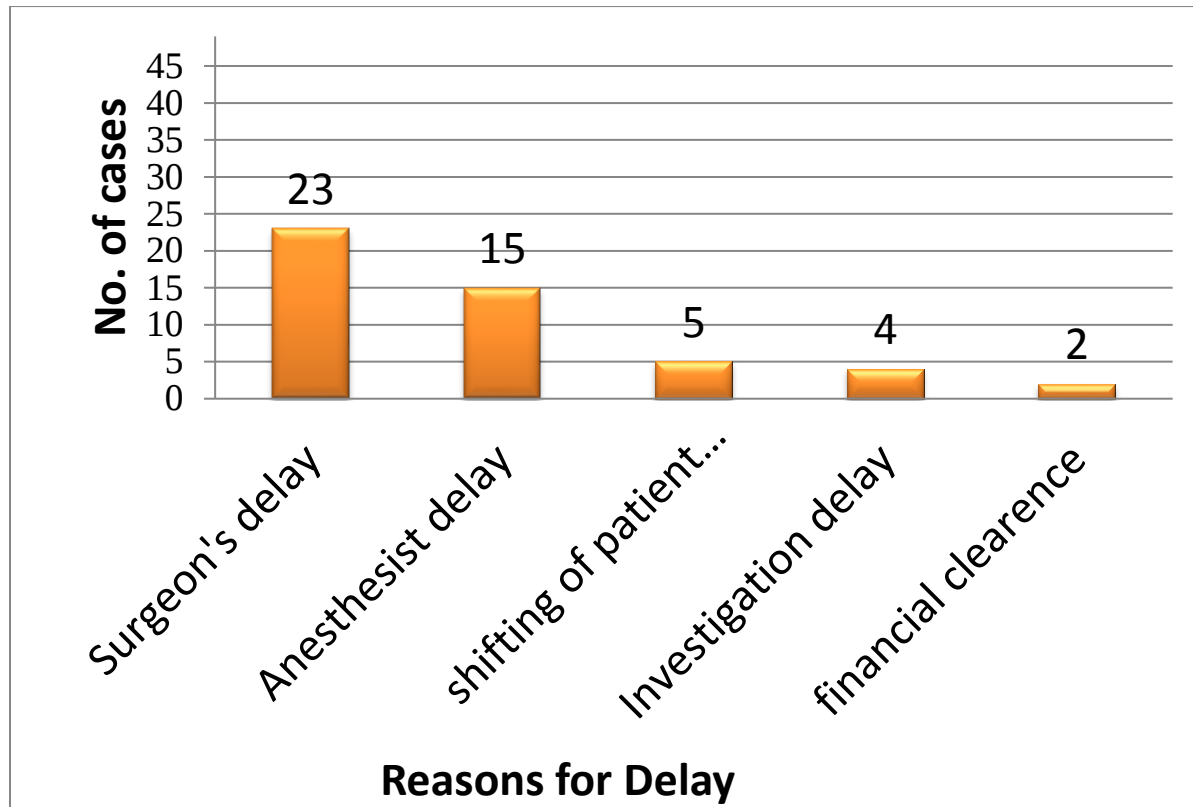
Average delay in first cases:19minutes

Interpretation:

Out of 165 cases, 89 are first cases and out of which 49cases are delayed which were started with an average delay time of 19 minutes, which means only 45% of first cases are started at schedule time and 55% of cases are delayed cases.

Reasons for Delay (Cardiac cases)

Cardiac first case delay



Graph-8.4

Reasons:-

23% of surgeries got delay due to unavailability of OT surgeon's on time.

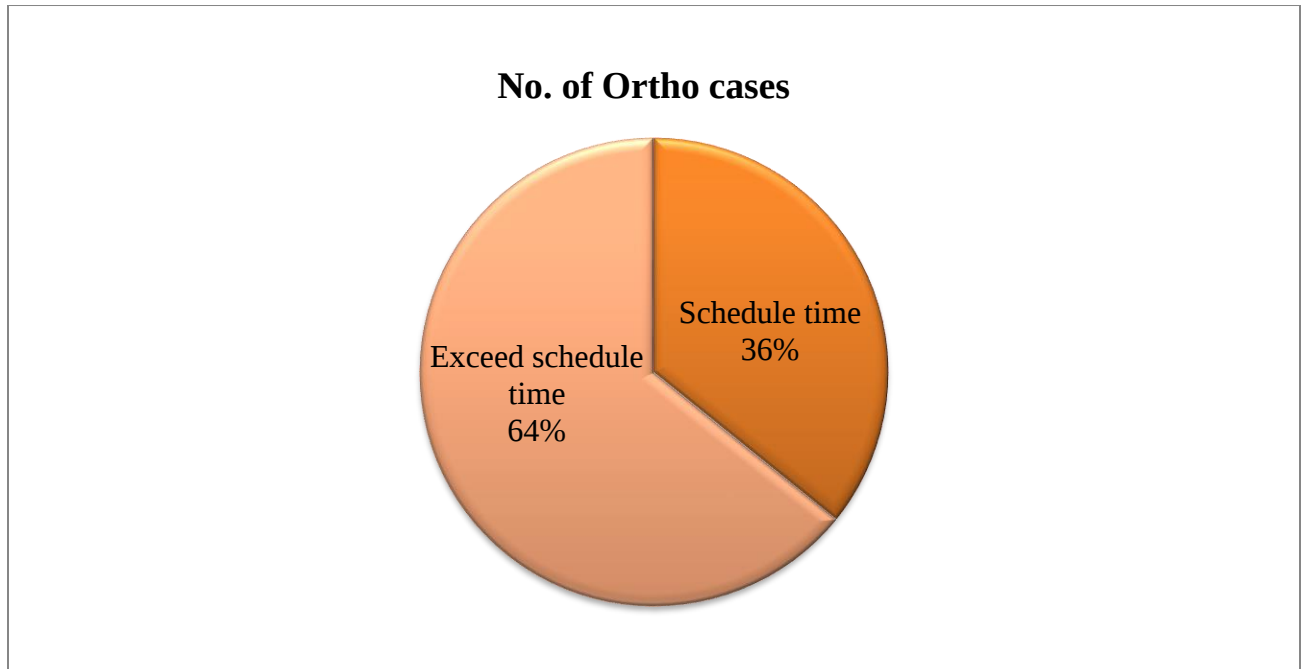
15% of surgeries are delay due to anaesthetist.

5% of Cases got delay because of delay in shifting of patient from ward to OT.

4% of cases are not on time because investigations of OT patient are not happen on time.

2% of cases are not on time because of financial clearance.

8.3.3 Ortho cases

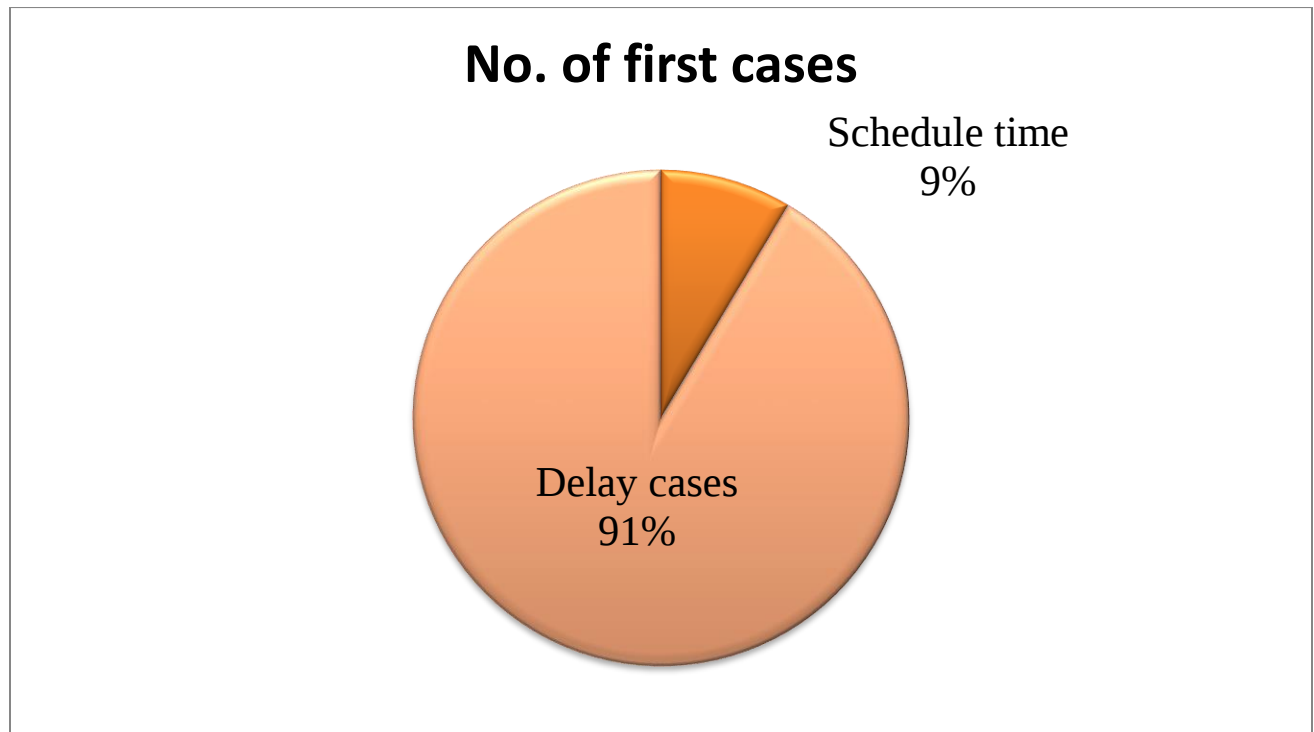


Graph-8.5

- Total no. of cases:95
- No. of cases started on scheduled time:34
- No. of cases delayed:61
- Average time of delayed cases: 48 minutes

Interpretation: The total no. of cases which started at scheduled time were 34 and rest of 61 cases are delayed. It's seems that only 36% of cases started on scheduled time and 64% of the cases were delayed.

8.3.4 Ortho first case



Graph-8.6

Total No. of cases:35

No. of cases started on scheduled time: 3

No. of cases delayed:32

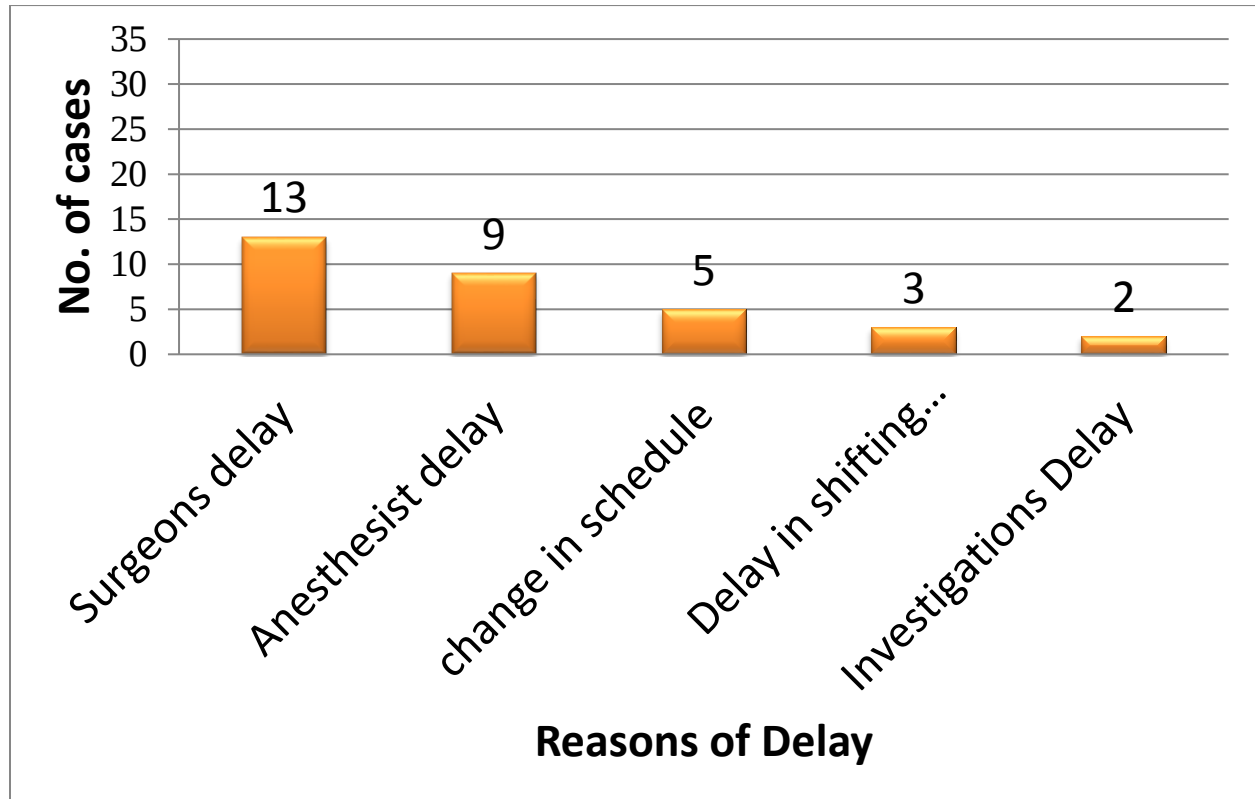
Average delay in first cases:39minutes

Interpretation:

Out of 95 cases, 35 are first cases and out of which 32 cases are delayed which were started with an average delay time of 39 minutes, which means only 9% of first cases started at schedule time and 91% of cases are delayed cases.

Reasons for Delay (Ortho cases)

Ortho First cases



Graph-8.7

Reasons:-

13% of surgeries got delay due to unavailability of OT surgeon's on time.

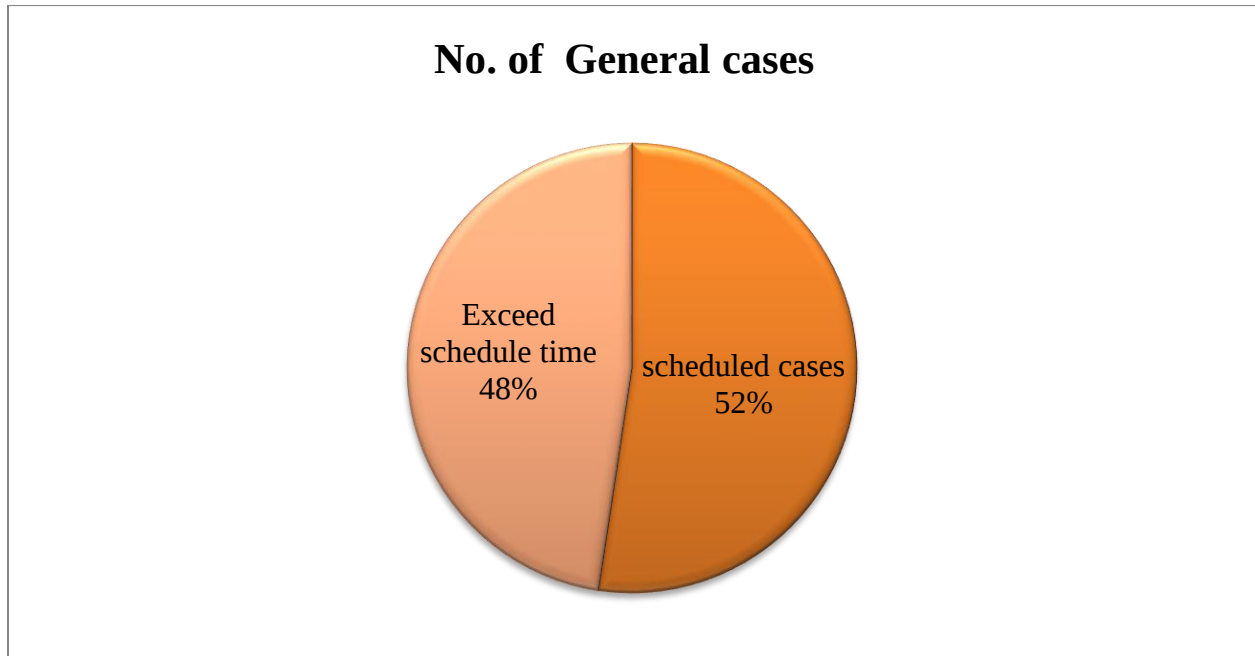
9% of surgeries are delay due to anaesthetist Delay.

3% of Cases got delay because of delay in shifting of patient from ward to OT.

2% of cases are not on time because investigations of OT patient are not happen on time.

5% of cases are not on time due to change in OT schedule.

8.3.5 General surgery cases

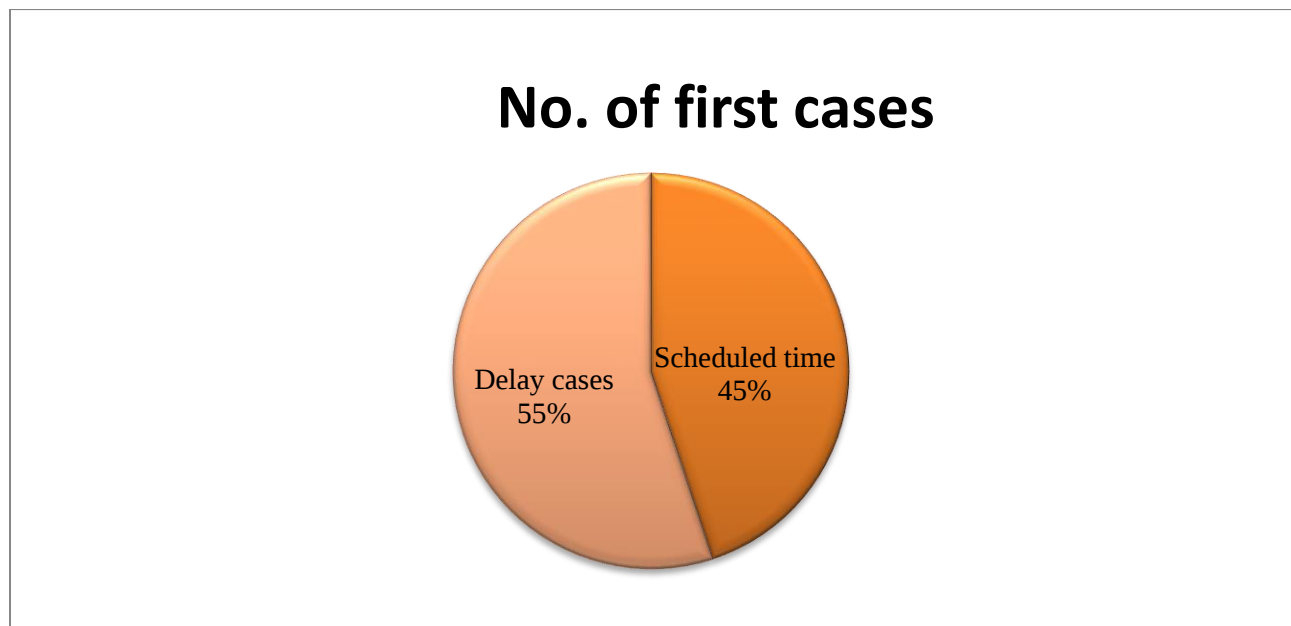


Graph-8.8

- Total no. of cases: 140
- No. of cases started on scheduled time: 44
- No. of cases delayed: 96
- Average time of delayed cases: 40minutes

Interpretation: The total no. of cases which started at scheduled time were 44 and rest of 96 cases are delayed. It's seems that only 52% of cases started on scheduled time and 48% of the cases were delayed.

8.3.6 General surgery first case



Graph-8.9

Total No. of cases:51

No. of cases started on scheduled time: 11

No. of cases delayed:40

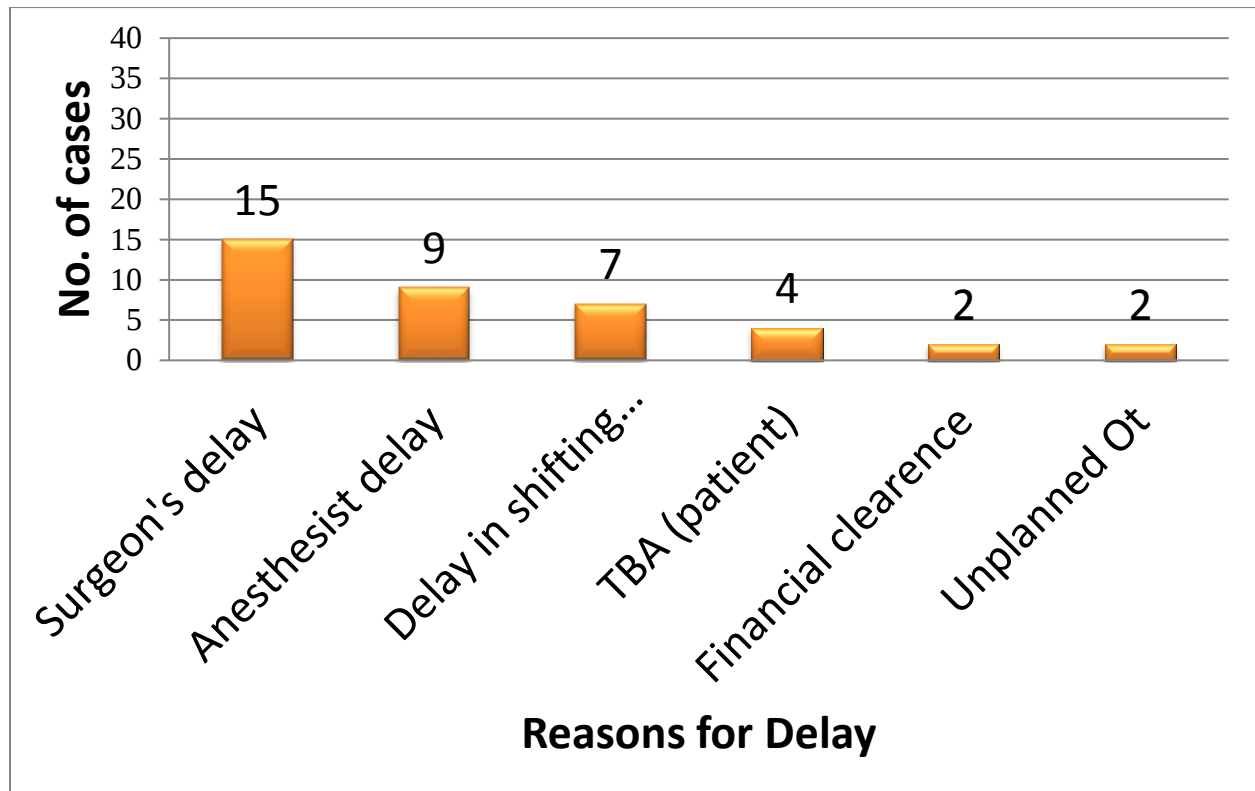
Average delay in first cases:36minutes

Interpretation:

Out of 140 cases, 51 are first cases and out of which 40 cases are delayed which were started with an average delay time of 36 minutes, which means only 22% of first cases are started at schedule time and 78% of cases are delayed cases.

Reasons for Delay (General Surgery cases)

General first cases



Graph-8.10

Reasons:-

15% of surgeries got delay due to unavailability of OT surgeon's on time.

9% of surgeries are delay due to anaesthetist.

7% of Cases got delay because of delay in shifting of patient from ward to OT.

4% of cases are not on time because of non admission of TBA patients.

2% of cases are not on time due scheduling of Unplanned cases.

2% surgeries are not on time due to not getting of financial clearance.

8.3.7 Other issues related to Operation theatre (based on direct observation)

- Pre anesthesia check up not done in 57% of cases (i.e.225 cases out of 400 cases).
- OT consent form which is being filled in operation theatre occurs in 55% of cases (i.e. 53 cases out of 95 cases)
- Allocated nurses do not accompany patients during his/her transfer to OT recovery.
- Operation theatre case list is not prepared till 6pm in the evening.

8.4 PHASE IV : Improve

After doing the analysis we have come to know about the certain factors which are responsible OT case delay. To improve the current scenario following suggestions were given:

- All the cases or surgery should be started on the scheduled time so as to reduce the frequency of previous surgery delay which occurs due to ripple effect of first cases
- A combined effort of medical team is required which includes both surgeons and anesthetists.
- Patient from the ward should be called an hour before the scheduled time of surgery
- To be admitted cases should not be posted as first case and they should be posted as second case
- All surgeons who have their OPD timings on the same day of surgery should scheduled their case with the gap of 30 minutes between the finishing time of OPD and scheduled time of the surgery so as to prevent change in schedule
- All the Investigations of the admitted cases should be done one day prior to surgery.
- In case of to be admitted patients all the investigations should be done on OPD basis.
- Operation Theatre case list should be prepared till 6pm in the evening so that it can be send to wards and other departments.

8.5 PHASE-V Control

Ideal Process for preparing OT list

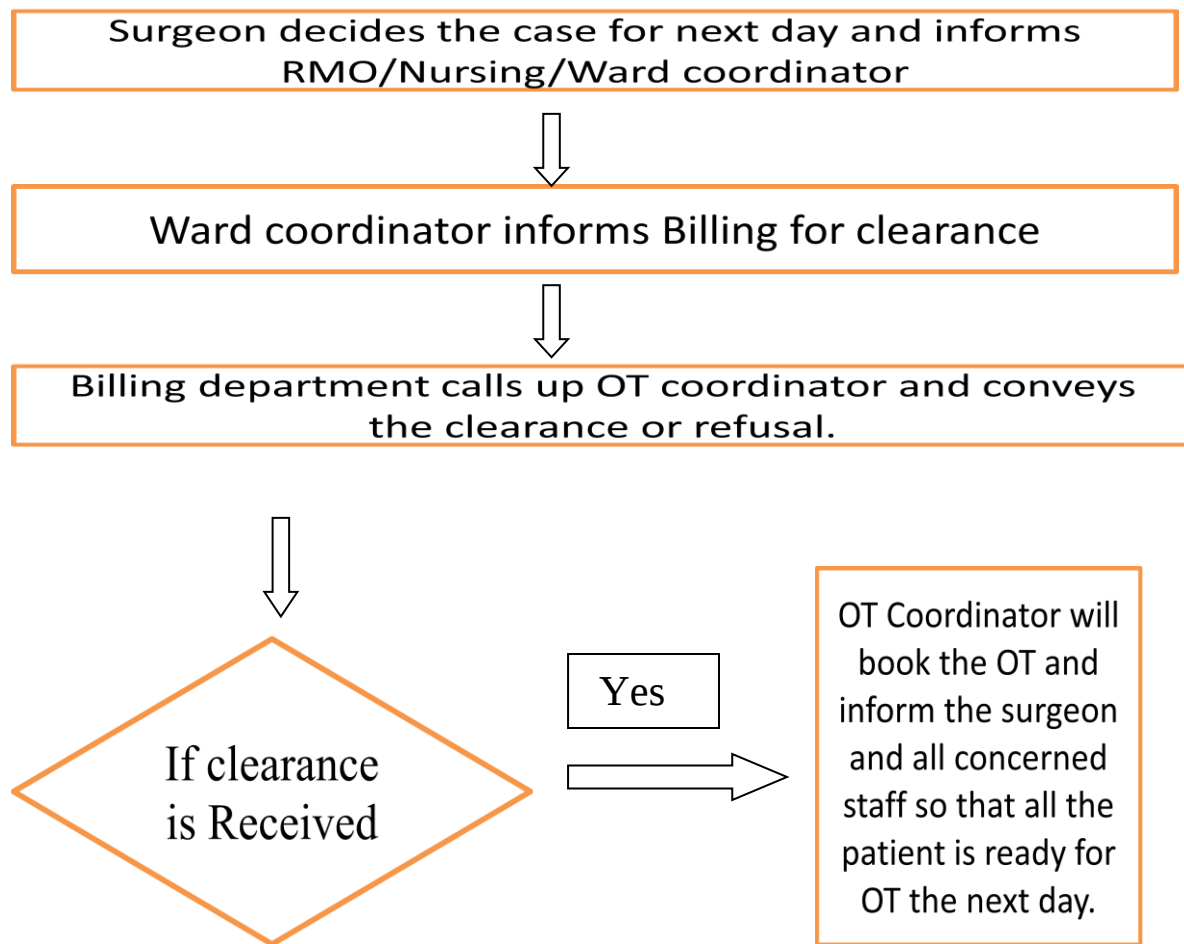


Figure-8.3

- Confirmation for the implants one day prior to surgery.
- No two surgeries which requires same kind of instruments should be scheduled back to back and should be scheduled alternatively.

Implementation done on 5th May 2017 onwards:

- All the surgeries or cases have started scheduling at 8:00am as before it was scheduled at 9:00am.
- OT coordinator have started calling the patient from respective wards one hour before the scheduled time of the surgery so that they can reach the OT recovery at least half an hour before the scheduled time of surgery.
- TBA cases are not posted as the first case of surgery in Operation theatre.
- Chairman has issued a circular on 5th May that bedside PAC should be done one day prior to surgery and OPD basis should be done before evening.
- Nursing Superintendent has addressed the nursing in-charges of all the floors regarding nursing aspects related to OT handover and has ensured that only the allocated nurse will accompany the patient to OT recovery.

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