



## **Implementation of Six Sigma to Improve the Discharge Process**

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### **Abstract**

**Abstract:** This article describes the Discharge process in a tertiary care hospital with a define, measure, analyze, improve, and control (DMAIC) approach. For this study we have used process mapping, Ishikawa Analysis to make decisions. The findings suggested that focusing on physician preparation for discharge order writing would have the greatest impact. A significant reduction in the average discharge time from 4.15 to 3.14h.

**Keywords:** Ishikawa Analysis, Process Flow.

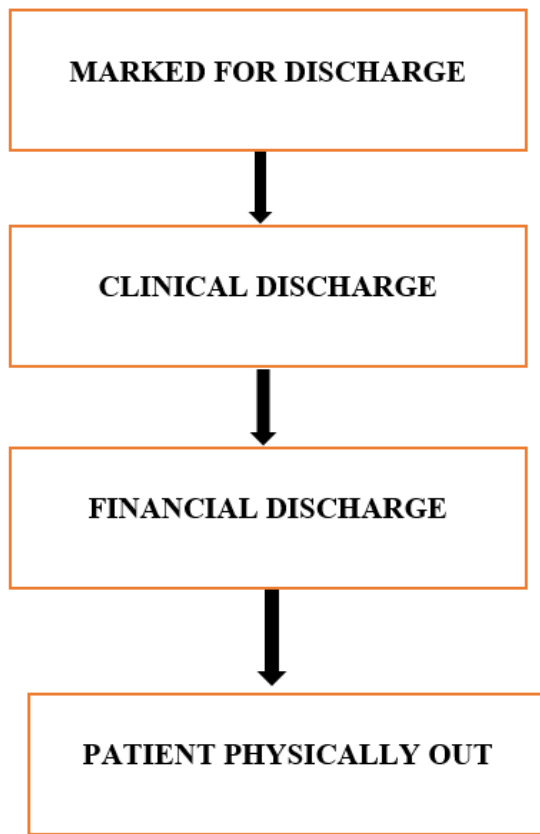
### **Introduction**

Nowadays the healthcare industry is growing day by day with the help of advance technology and healthcare professionals. Hospital is a point where the patients come at the difficult time of their life, struggling with the pain. So, for the healthcare professional it is compulsory to provide the best quality of healthcare facility with minimum cost. Hospital is a social and medical care center which provide the curative and preventive care for the inpatient and outpatient but sometime not provide the long patient stay. Once the patient reaches the hospital, all the hospital staff co- ordinate with each other to achieve a common goal by observing and maintaining the good health of patient to relief them from pain and diseases.

Inpatient care is provided to those patients who are admitted in hospital. Patients are referred to inpatient department from various sources like family doctor, Emergency and trauma center, etc. Patient are admitted in inpatient department when they need special care by healthcare professionals. In inpatient department medical staff provide all the medical facility and special care. When the patient recovers or back to normal functioning then consultant plan to discharge the patient.

Discharge is point where the patient leaves from the hospital or transfer to home, other healthcare center, or rehabilitations center. Discharge is a last process in hospital, so it fixes it into patient mind and it reflects the hospital Image. This process starts when the doctors decides that the patient is physically fit, and he / she is able to take care of him / herself. Patients are discharged in 3 conditions when they are physically fit, or they take DAMA (Discharge Against Medical Advice) and Death. In this paper study the discharge process by applying the DIMAC (Define, Implement, Measure Analysis and control) Tool. DIMAC is quality tool which is to reduce time in discharge process and improve good quality of work. Discharge leads to patient satisfaction, decreasing time in discharge process increases the patient satisfaction.

The hospital discharge process studied in the project is divided into 4 stages:



**Figure .1**

Study of Six Sigma Approach on Discharge Process Turnaround time, by L. Kalyan Viswanath Reddy, Fares Al Shammari (February 2014). This study was done to stream line the current discharge process of King Khalid hospital and suggested solution in such a way that maximum output can be attained from minimum input of man power and resources for the best results. This study helps the organization to know the deficiency and more over find out the difficulties faced by the patients at various levels for getting discharge from the hospital.

In the analysis phase of DMAIC, 32 defects are found in the turnaround time of discharge process and the Defect Per Million Opportunity (DPMO) is calculated as 91428.57 in which defect is 9.14%, yield is 90.86% and Process Sigma level is 2.83. After the improvement phase, the defects reduced from 32 to 2. So, DPMO reduced to

5390.83 in which defect is decreased to 0.54%, yield is increased to 99.46% and Process Sigma level increased to 4.05. Conclusion: Six sigma approach saved the money of organizations, by reducing errors, increased customer service and satisfaction and improved productivity.

Another study Using Six Sigma DMAIC Methodology and Discrete Event Simulation to Reduce Patient Discharge Time in a Cancer Treatment Hospital, by Mazen Arafeha Mahmoud A. Barghasha , NirminHaddada, Nadeem Musharbasha, Dana Nashawatib , Adnan Al-Bashirc , and FatinaAss

This study was done for Six Sigma process improvement methodology was applied to reduce patients' discharge time in a cancer treatment hospital. Data on the duration of all activities, from the physician signing the discharge form to the patient leaving the treatment room, were collected through patient shadowing. These data were analyzed using detailed process maps and cause-and effect diagrams. "Fragmented and unstandardized processes and procedures and a lack of communication among the stakeholders were among the leading causes of long discharge times. Categorizing patients by their needs enabled better design of the discharge processes. Discrete event simulation was utilized as a decision support tool to test the effect of the improvements under different scenarios. Simplified and standardized processes, improved communications, and system-wide management are among the proposed improvements, which reduced patient discharge time by 54% from 216 minutes. Cultivating the necessary ownership through stakeholder analysis is an essential ingredient of sustainable improvement efforts.

#### **Implementation of Dmaic**

The study was conducted in Multi-specialty hospital which has good image in Maharashtra, India. To maintain this good image, the management tries every effort to provide a high-quality health care, and to guarantee

customer satisfaction. The discharge process is one of the factors which reflect hospital image. The DIMAC process is explain in below.

**PHASE 1 - Defining the Problem**

The problem was clearly defined by the administrative head of the hospital based on the following criteria:

- 1) Patient satisfaction index survey
- 2) Past patient complaints
- 3) Through internal audit process.

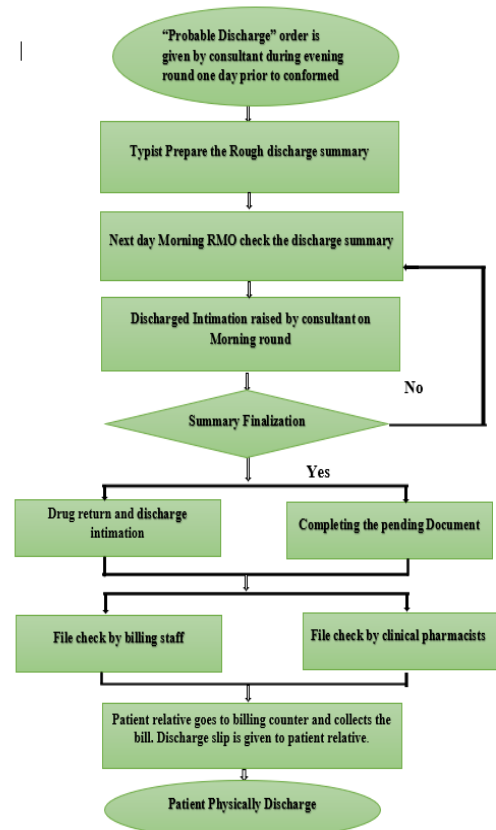
This helped to define the scope of the problem. The main aim of the phase is:

- 1) Describe the problem quantifiably.
- 2) Defining the process to determine how the performance will be measured.

The current process was documented involving the discharge of a patient from the time doctor decides the patient should be discharge to the time patient leave the room. To understand the current process discharge Process Mapping tool was used. It is the technique used to follow the detailed flow of product through a manufacturing cycle. A process map is a pictorial representation of the sequence of action that compromises a process. The resulting process map depict the input, the performance, the sequence of action the Performance take, and the output of work process in a matrix or flow chart, usually combining both words and simple graphics. Process mapping is typically knowledge about process.

The primary objective of the project is to improve and optimize the patient discharging process and the initial target was fixed to hand over the discharge summary to the patients within three hours (i.e. 180 minutes) of the discharge decision was taken by the attending Physician or Surgeon.

**Discharge Process**



**Figure 2**

The above process map depicts that there are various phase or sub – process involved in the discharge process. These sub- Process were described as follows:

**Discharge Summary Finalization**

Discharge orders given by the consultant during the rounds which is informed to the staff and in charge nurse. The duty doctors start typing the discharge summary along with file completion by the doctor and nursing staff. After completion of rough summary, the summary s sent to consultant to finalize the summary.

**Pharmacy Clearance**

Once the discharge is finalized and file is taken to the pharmacy to all the medicines disposable are returned to the pharmacy one the request of return is put in the HIS system by the nursing staff. The unused medicine is labelled, packed and then sent to IPD pharmacy and then

the discharge intimation is being raised by the assigned nurse.

**File preparation:** Discharge file is completed by RMO and assigned nurse.

**File check-up:** The file is checked by billing department. The status in the HIS is updated as bill ready.

**Summary check:** After updating of bill, the clinical pharmacists check the summary.

**Bill Clearance:** After the bill is updated the patient is informed about the same and asked to clear the bill.

**Physically out:** Once the discharge slip is submitted to the nursing counter, RMO explains the discharge summary to the relatives and the patient is left at the ground floor with help of wheelchair.

### PHASE 2-Measure

This phase is marked as the **Data Collection** Phase for the study.

The main aim of this phase is to measure the problem by describing it with process and performance, fact, data.

This phase will determine the baseline before making any changes. The determined baseline will become the standard against which any improvement after the implementation will be measured.

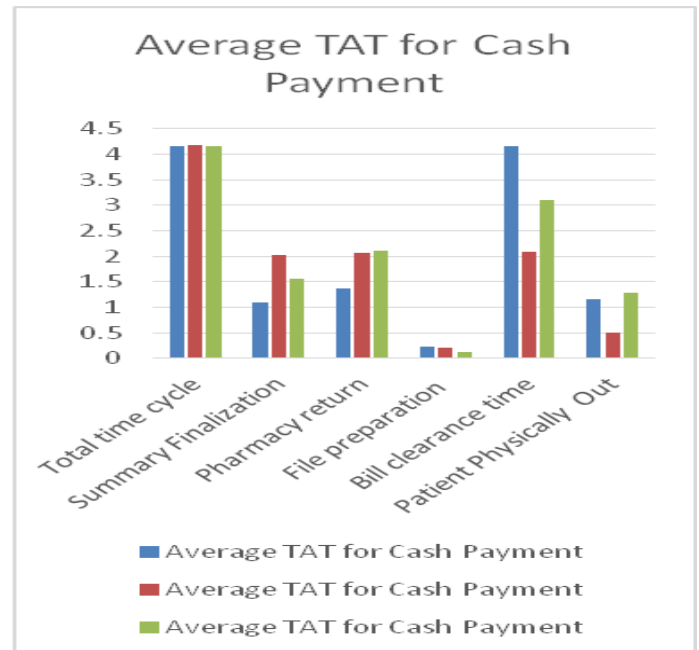
The baseline of measurement was defined as the turn-around time for the entire discharge process starting from the time physician decide that the patient can be discharged till the time the room was vacated by the patient. This time was defined as the Total Cycle Time.

The benchmark time was taken as 180minutes since this was the desired turnaround time were defined after studying the process map which despite the various sub-process.

### Data Collection

**Primary Data:** Data was collected for the 4 parameter - Summary Finalization, Pharmacy Return, File Preparation, Bill clearance, Patient Physical out sample for 160 patient discharges from IPD Floor as per convince

Sampling technique. The investigation recorded the start time and end time of every sub parameter for the daily discharge.



**Figure .3**

As the above data shows, the mean TAT for the discharge process is 4hr 35 minutes which is more the than the benchmark.

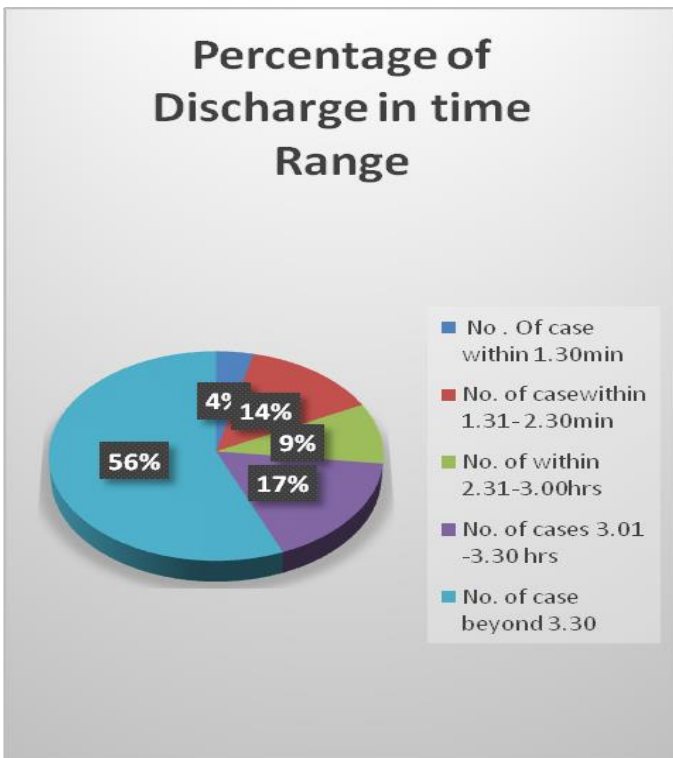
The Maximum time taken for completing the process is to finalize the summary and Pharmacy clearance.

### Phase 3- Analyze

In this phase analyses of current performance are calculating to identify the problem and root cause is formulated.

The following steps are undertaken to formulate the root cause:

1. Calculating the percentages of discharges above those were within the benchmark TAT of 180minutes.
2. Cause and Effect Analysis was done using the concept of cause and Effect of diagram.
3. Analysis of the Mean Cycle Time for each parameter to rate the problem areas a per their contribution to the total cycle time.



**Figure .4**

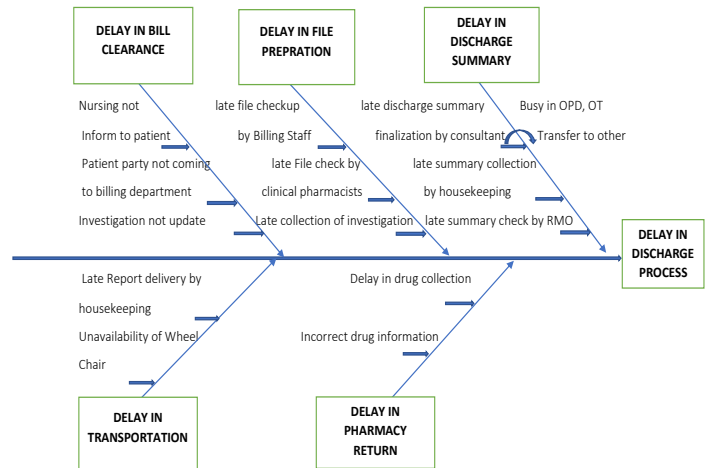
As the above data shows, the discharge completing within the benchmark time of 180minutes was only 44%, near the negligible. Maximum percentage of discharge look more than 180minutes.

**• Ishikawa Analysis**

A Cause -and -Effect Diagram is a tool that help identify, sort, and display possible cause of a specific problem or quality characteristic. It graphically illustrates the relationship between a given outcome and all the factors that influence the outcome. This type of diagram is sometime called an” Ishikawa Diagram” because it was invented by Kaoru Ishikawa, or a “Fishbone diagram” because of it looks. A cause-and-Effect Diagram is a tool that is useful for identifying and organizing the known or possible cause of quality, or the lack of it. The structure provided by the diagram helps team member think in a very systematic way. Some of the constructing a cause-and-Effect Diagram are:

It helps to determine the root cause of a problem or quality characteristic using a structured approach. It is easy-to-

read format to diagram to diagram cause-and effect relationship. Indicates knowledge of the process by helping everyone to learn more about the factors at work and how they relate. It helps to identify areas where data should be collected for further study. From the below diagram.



It was observed that the following were the major cause of delay in the discharge process is:

**• Delay in Discharge Summary:**

This cause could be further an effect of one or more of the following reasons

**Delay by Typist**

In completing the tentative discharge summary, after the decision of discharge by the doctors on morning round.

**Delay by consultant**

In finalizing the made by the resident and the typist, due to being occupied in the morning rounds of patient process.

**Delay in Transporting Finalized Discharge Summary**

After the discharge summary in finalized by the consultant, the delay is caused due to non-availability transport summary to nursing station.

### Delay in Summary Finalized

After completion of rough discharge summary, the summary is delay is caused to consultant busy in OT, OPD, and in emergency.

### Delay in Pharmacy Return

The sub- cause of this effect could be:

- Incomplete Return is sent by the Nurse and is not accepted in the pharmacy.
- Pharmacy department taking too long time in acknowledging the return sent from the ward and updating the clearance in the HIS.
- Housekeeping department taking too much time to collecting drug from Nursing station and returning to pharmacy department.

### Delay in File Preparation

- Housekeeping not available on the floor.
- Documents in the file not updated in the routing. All the reports updated in the file at the time of discharge preparation.
- Incomplete Notes by RMO

### Delay in Bill Clearance

- Delay in informing the patient relative to clear the bill.
- Delay caused by the attendant in reaching the billing desk for bill clearance due to delay in arranging money or waiting for relatives.
- Wrong billing identified by the relative at the time of bill clearance, as the detailed provisional bill is given to the relative prior the final payment, this further leads to confirmation of the doubles in billing regarding wrong entries from the ward and cancellation of services wrongly changed in the bill.

### Delay in Patient Physically Out

- Delay by Nurse in removing the cannula or doing dressing before relieving the patient and explaining the summary to the patient.

- Delay in availability of Wheel chair to transport the patient from the ward to the hospital exit.
- Wait for pending investigation report the need to be given to the patient.
- Wait for Discharge Summary.

### 4. Analysis of the percentage contribution of various MEAN CYCLE TIME of the sub process to the discharge process.

For all the cause identified in the identified in the diagram, the sub- Process were divided into 2 categories:

- **Correctable Factor-** are the factor which can be not controlled by intervention and are dependent on the situation or the external factor.
- **Non – Correctable Factor** – are those which can be controlled by introducing intervention as these are independent of the external factor.

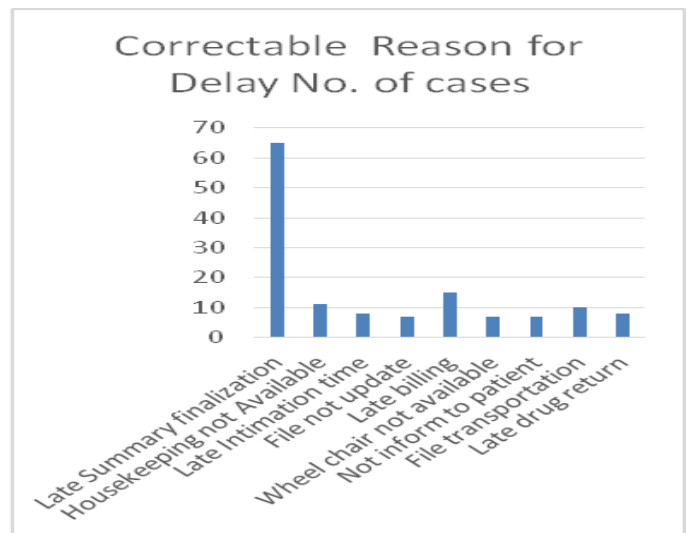
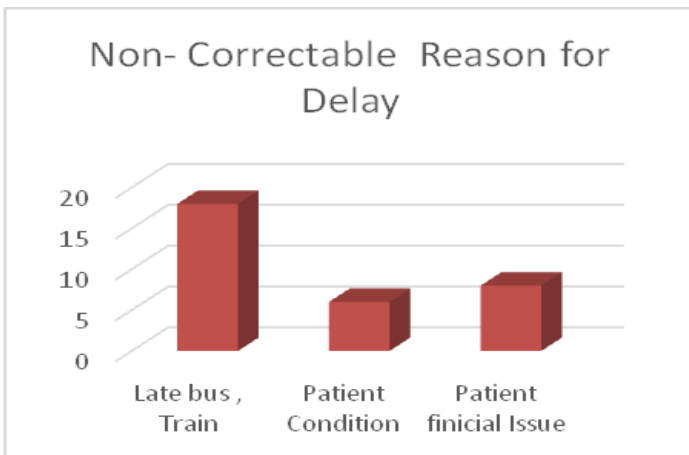


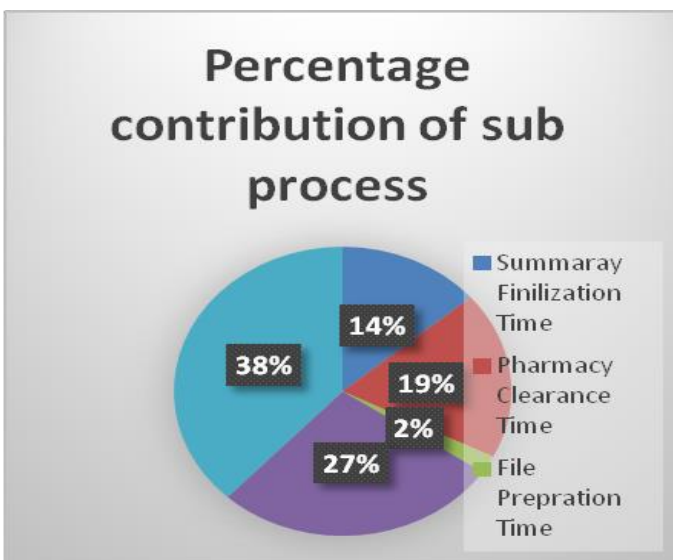
Figure.6

As the above data shows, the discharge process was mostly delay because of late summary finalization. Another main reason for delay is late bill clearance.



**Figure.7**

As the above data shows, the discharge process was delay because of patient personal issues like unavailability of vehicle. This reason is not considered because it is from patient side.



**Figure.8**

The above graph depicted that a major percentage (38%) of the cycle time is constituted by the time taken by summary finalization.

The next is pharmacy clearance time which contribute significance large percentage (19%) of total cycle time.

**Phase 4 – Improve**

In the implementing phase, the result of the analyses phase is used to make tentative design change recommendations. These recommendations are then piloted, confirmed, and institutionalized in the control phase.

**Discussions**

- The discharge summary should be updated a day prior to the expected date by the doctor and typist, such that when the doctor go on rounds they are able to complete the process of discharge summary and Sign it in the nursing station, immediately after the rounds.
- After the assigned nurse has finalized the pharmacy to be returned, the in charge should counter check and sign the return material. This will decrease the waste of time in returning medicine several times due to minor error such as coming.
- The suggestion is on this after requesting for drug return the housekeeping go collect the drug from the Nursing station.
- The daily updating the service not performed by the assigned nurse and processing the cancellation was put forward.
- The documents were recommendation to be update in the file n daily basis by typist.
- Another suggestion is doctors should file investigation and treatment on daily routine.
- The attendant should be provided with a printed provisional bill a day prior to the expected date of exchange, so that the verification at the consumers end are done and any correction to be done can be completed before the time for final bill clearance.
- The assigned nurse should take responsibility to coordinate with Patient and billing department.

**PHASE 6- Control**

In the control phase the interventions suggested as recommendation in the improve phase can be applied to the existing process. Control phase focused on the Lope hole of the problem. The Control process was done on 56 patients because of time duration.

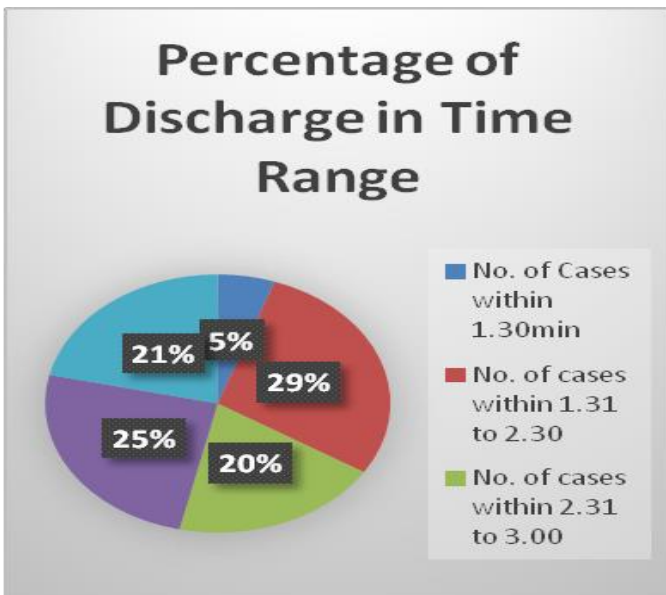


Figure.9

As the above data shows, the discharge completing within the benchmark time of 180minutes 75%. Maximum percentage of discharge look within 180minutes

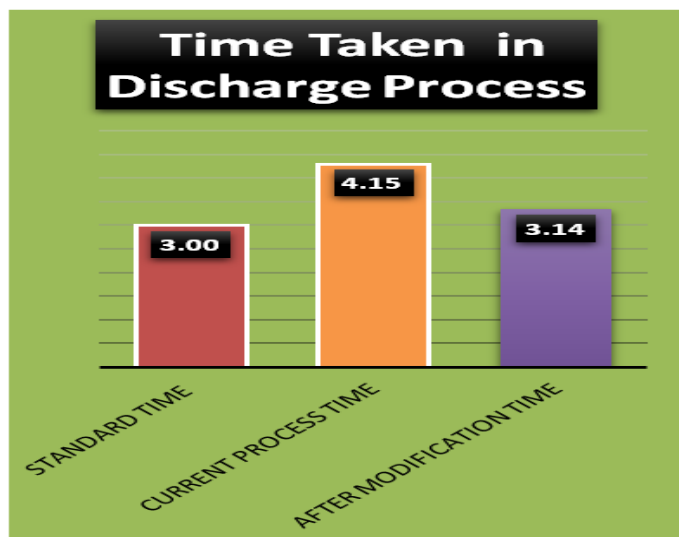


Figure .10

As the above data shows the standard time of discharge process in Hospital is **3 hrs. i.e. 180minutes** but actual time taken for completing the process is **4 hrs. 15min i.e. 255 minutes**. After implementing the recommendation in the discharge process the time taken for completing the discharge process is **3hrs 14minutes i.e. 294 min**. The difference between pre -analysis and post analysis is **55minutes**.

### Conclusion

The standard time of discharge process in Hospital is **3 hrs.** but actual time taken for completing the process is **4 hrs. 15min**. After implementing the DMAIC in the discharge process the time taken for completing the discharge process is **3hrs 14minutes**. The difference between pre -analysis and post analysis is **55minutes**. Measure should be taken to improve the discharge process.

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