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IMPLEMENTATION OF SIX SIGMA IN IMPROVING THE BILLING PROCESS IN A SELECT HOSPITAL

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ABSTRACT

The need to increase the efficiency of health care systems is becoming an obligation, and one of the areas of improvement is the discharge process. Delay in billing of patients leads to patient dissatisfaction, delaying further availability of beds, which all impact on ultimate revenue generation for the organization. The present study is a qualitative pre-and post-intervention study. The objectives of this study are to calculate the billing TAT, to identify the root causes for the delays in the billing process, to identify and implement administrative interventions by using six sigma approaches to reduce billing TAT. Two sets of data were structured for the purpose of attaining the objectives. The dataset was for the billing process in the discharge of the inpatient which included 408 patients in the pre-intervention phase and 376 patients in the post-intervention phase. Purposive sampling technique is used for the study. After analyzing the pre-implementation data and calculating the billing TAT, A Pre-discharge checklist is implemented and the whole discharge process is streamlined. Post-implementing there is a significant decrease of 18.42% in the turn-around time for Cash billing and 14.4% for insurance, 8.5% for corporate billing and many of the problems encountered by the billing department which lead to the delay in the billing process were reduced. Paired t-Test is also used to measure before and after implementation, variance at a significance level of 0.05% which showed that there is a significant difference in the TATs.

Keywords: *Billing, Checklist, Discharge process, HIPAA, Six Sigma, TAT*

1. INTRODUCTION

Medical Billing is the process of collecting fees for medical services provided to the patient at the hospital. A Medical bill is called a Claim. Billing is one of the contact points between healthcare organization and its patients. An orderly, effective, understandable billing and collection system is not only viewed as an essential to

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profitability but can be a positive marketing tool." women is important for understanding their financial behaviors, the barriers they face, and the impact of these factors on their long-term financial well-being.

The purpose of medical billing is to ensure that the provider receives fair payment for the patient services rendered. Billing process is the final step in hospital, which is directly proportional to patient satisfaction. Billing documents are even legally important.

Billing process in the hospital starts from when the patient enters for initial diagnosis till complete treatment.

HIPAA

HIPAA is a set of rules and regulations which hospitals, doctors, healthcare providers and health plans must follow, to provide their services aptly and ensure that there is no breach of confidence while maintaining patient records. The billing field has been challenged in recent years due to the introduction of the Health Insurance Portability and Accountability Act (HIPAA). Since 2005 medical providers are informed to electronically send their claims according to HIPAA to receive their charges. Generally, the mode of payment can be classified as

- Cash payment,
- Insurance payment,
- Corporate company payment

DISCHARGE PROCESS

Discharging a patient is an activity common to every hospital – small, large, community, intercity, teaching or corporate. The various factors that affect discharge process are, patient satisfaction, bed availability, timely tests and procedures needed for discharge, home health equipment and service availability, social worker and therapist coordination, transportation, and nursing home arrangements. No matter what type of patient is being discharged (maternity, medicine, orthopaedic, neurologic, cardiology, gastro) numerous activities must be completed for each before the patient can be released. The discharge process is a key part of patients and billing is one of the key parts of the discharge process.

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BILLING PROCESS

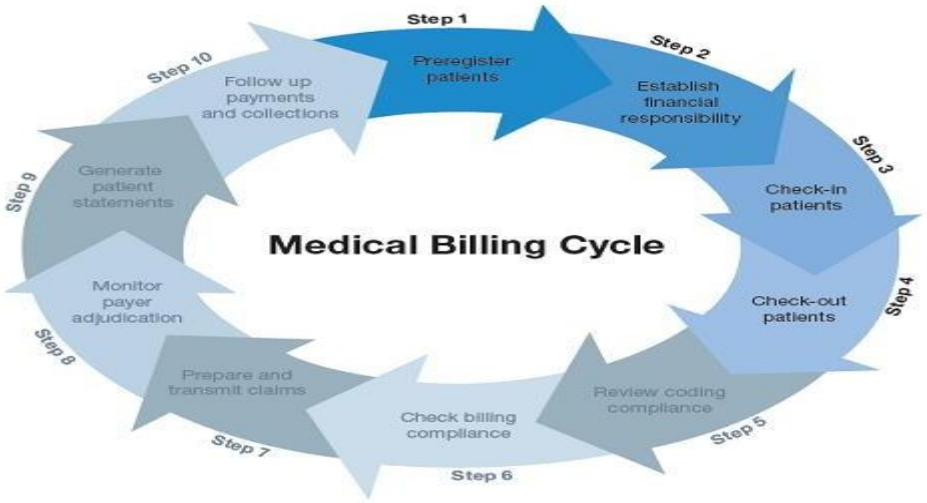

Figure: 1 Medical Billing Process

Medical billing process constitutes patient's account, bill chart, claims preparing and generating invoice of patients for submission, controlling and monitoring of patient's account. Pre-authorization of cashless claims will be permitted only when the policy is in full force and due premium has been paid.

SIX SIGMA METHODOLOGIES

High performance is essential in every healthcare process. Six Sigma projects follow two project methodologies inspired by Deming's Plan–Do–Study– Act Cycle. These methodologies, composed of five phases each, bear the acronyms DMAIC and DMADV. However, there is another third approach – DIDOV Approach.

DMAIC is a data-driven quality strategy used for improving the existing processes of the projects.
The DMAIC project methodology has five phases:

- Define the problem or goal
- Measure the performance and focus on the critical areas
- Analyse the data and determine the root causes of defects or opportunities

- Improve by finding the solutions and eliminating the root causes
- Control by monitoring the implemented action.

DMADV is a data-driven quality strategy used for designing products and processes of the projects.

SIX SIGMA TOOLS

- Value-Stream Mapping.
- Cause-and-Effect Analysis.
- The 5 Whys.
- Kanban System.
- Pareto Chart.
- Process Mapping. Types of Process Maps.
- Project Charter.
- RACI Matrix.

NEED FOR THE STUDY

Delays in discharging inpatients can cause bottlenecks in-hospital operations and impact admissions from the ED, the operating room, and the general admitting unit. It leads to patient dissatisfaction, delaying further availability of beds which all impact on ultimate revenue generation for the organization. Hence, the present study is done by using Six Sigma to reduce the billing time of cash, insurance and corporate patients and to improve the discharge process.

OBJECTIVES

- To calculate the billing TAT.
- To identify the root causes for the delays in the billing process.
- To use and measure administrative interventions by using six sigma approaches that reduce billing TAT.

METHODOLOGY

SCOPE OF THE STUDY: This is a qualitative pre- and post-intervention study. The collected data comprises of the billing process in the discharge of the inpatient which included 408 patients in the pre-intervention phase and 376 patients in the post-intervention phase.

Medical billing TAT was calculated for the first 28 days and the reasons for the delay and increased TAT were observed. Six sigma DMAIC approach is used for streamlining the process flow and implementation of the pre-discharge checklist has been done and the post-implementation data for another 28 days is collected.

SAMPLE DESIGN: Purposive sampling technique is used in this study.

SAMPLE SIZE:

- The pre-implementation sample size is 408 and
- The post-implementation sample size is 376

SOURCES OF DATA

- Primary data is collected from direct observation of patients
- Secondary data: from the hospital records, articles, journals, and websites.

ANALYTICAL TOOLS USED FOR ANALYSIS: The following tools are used for the analysis of the data

- Fish bone analysis/ Cause-and-Effect Analysis.
- Pareto analysis.

STATISTICAL TOOLS USED: In addition, Paired t-Test is also used to measure before and after implementation variance at a significance level of 0.05%.

LIMITATIONS OF THE STUDY

The limitations of the study are related to the pre, post-intervention observational design that limits ability to control for all possible confounders.

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DATA ANALYSIS

In this study a pre-implementation sample of 408 and post-implementation sample of 376 is collected for the billing process. The collected data is classified as cash, insurance and corporate billing payments made by the patients.

The analytical tools used for this are Fish-bone analysis (to find out the reasons for the delay in the billing process) and Pareto analysis (to find out those 20% causes that lead to those 80% of the delays in the billing process). After observing and collecting the data a pre-discharge checklist was implemented and again the post implementation data was collected to know. The statistical tool used in this study is paired t-test as the groups come from a single population.

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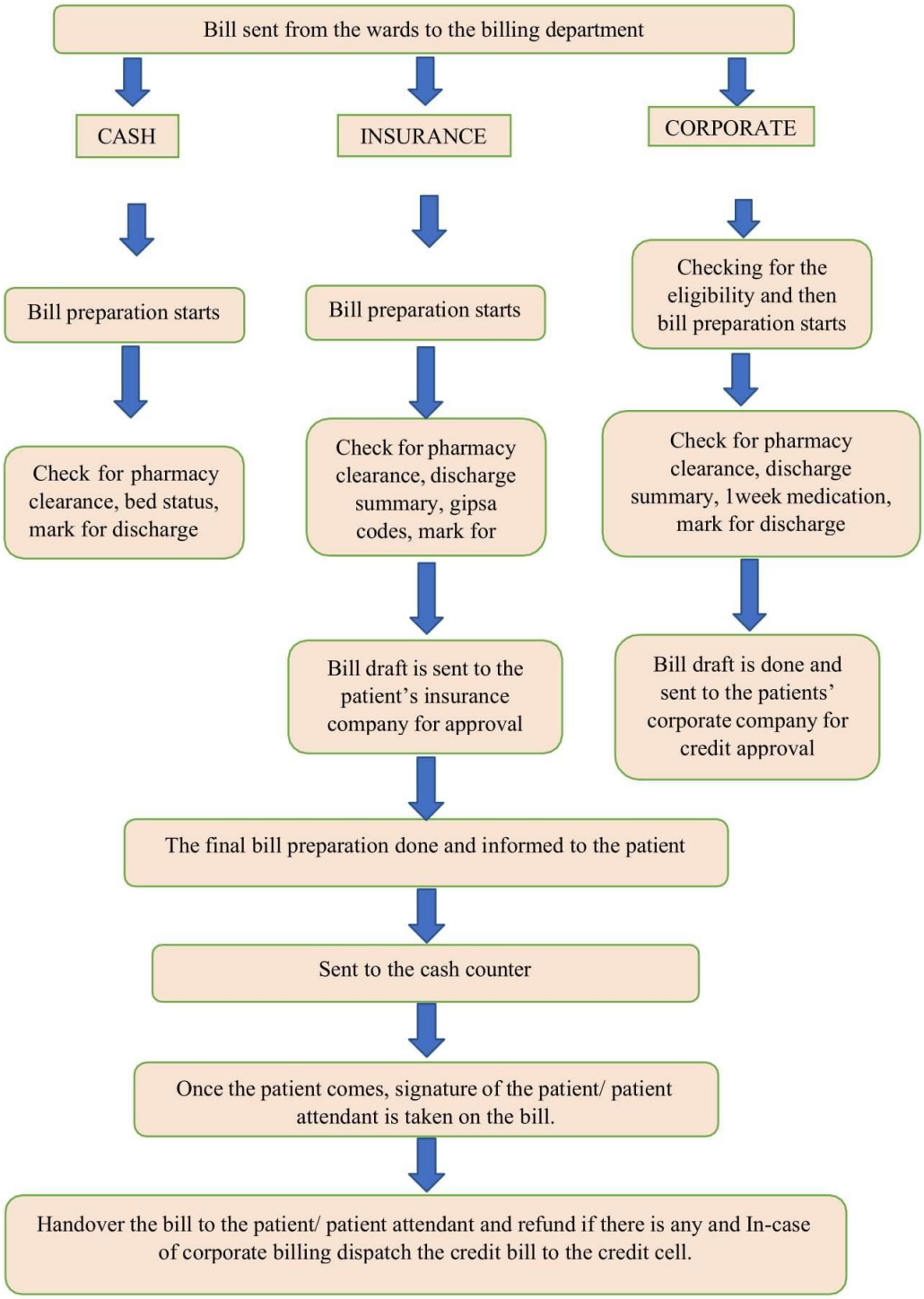
Figure 2 BILLING PROCESS



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1. PRE-IMPLEMENTATION SAMPLE

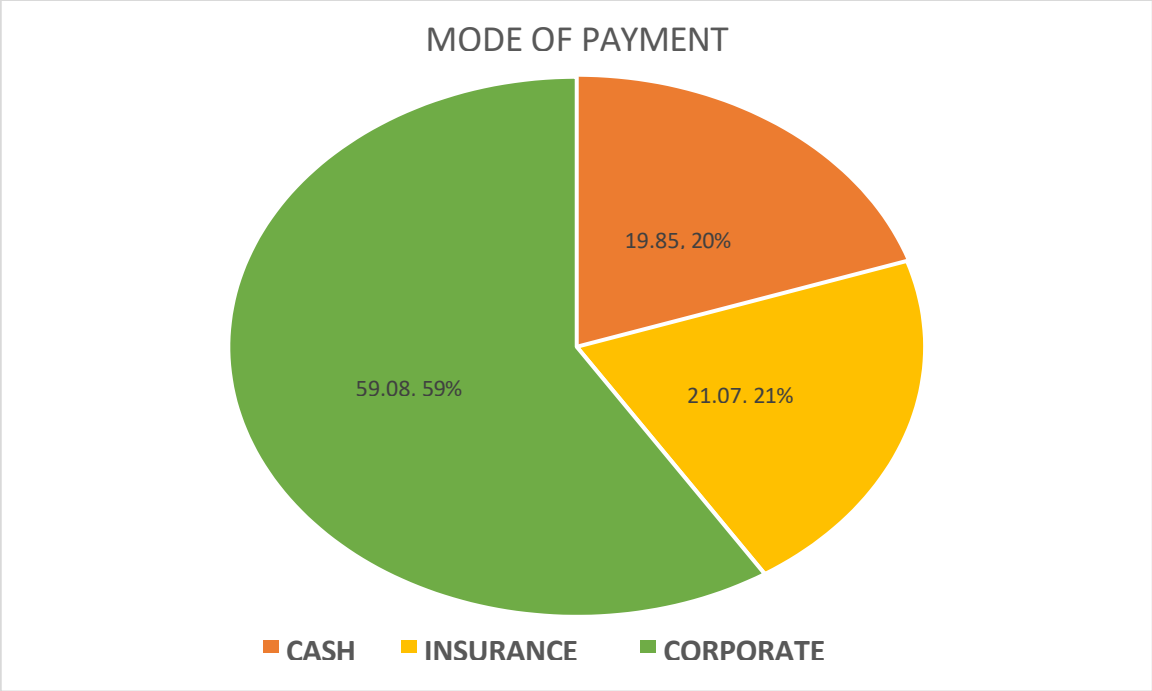

Figure 3: proportion of different modes of payments in billing

The total sample collected for the study was 408 before implementation and among the collected sample, 81 were cash patients, 86 belong to Insurance billing and the remaining 241 patients belong to corporate billing.

2. CASH BILLING TAT

	T1	T2	T3	TOTAL TAT
Min hours	15min	20min	10min	**65min**
Max hours	3hrs 55min	3hrs 43min	6hrs 50min	**7hrs 30min**
Average hours	1hr 11min	1hr 13min	1hr 24min	**3hrs 48min**
Standard Deviation	0.0472	0.0609	0.0618	**0.0792**

Table 1: cash billing TAT

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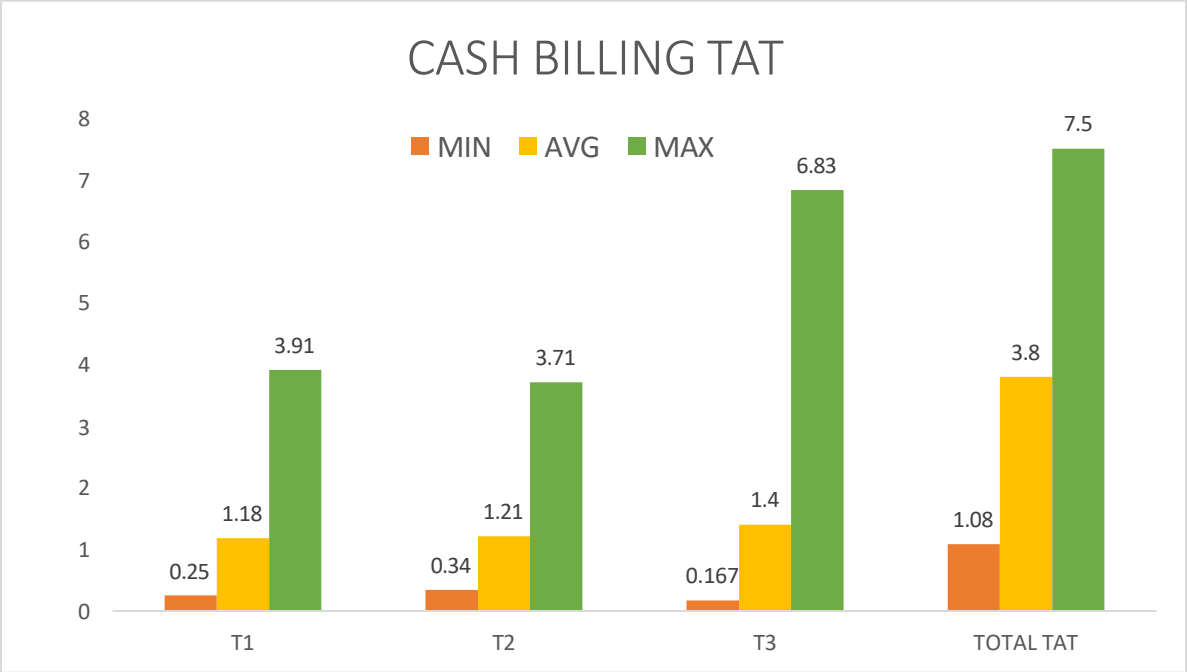

Figure 4: Minimum, Maximum and Average time taken by cash billing.

The above column graph and table shows the TAT for the cash billing, here

- T1- Bill-in to Bill start (which is the time taken by the bill after entering the billing department and the billing staff starting it)
- T2- Bill start to Bill done (starting the bill and finishing it)
- T3-Bill done to financial checkout (time taken by the patient to come and sign/pay the bill after the bill reaches the cash counter)

T1-The minimum time taken to the start the bill after it enters the billing department is 15minutes and the maximum time taken is 3hrs 55min whereas the average is 1hr 11min and standard deviation is 0.0472.

T2-the minimum time taken for the bill to be completed is 20 minutes and the maximum time taken is 223minutes whereas the average is 73minutes and standard deviation is 0.0609.

T3-the minimum time taken for the patient to reach the billing department after the bill is done is 10minutes and the maximum time taken is 414minutes whereas the average is 84minutes and standard deviation is 0.0618.

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THE TOTAL TAT FOR CASH BILLING is

- Average-3hrs 48min and standard deviation is 0.0792.
- Min-65min
- Max-7hrs 30min

3. INSURANCE BILLING TAT

	T1	T2	T3	T4	T5	TOTAL TAT
Min hours	5min	5min	51min	6min	5min	**2hrs 42min**
Max hours	2hrs 10min	4hrs 54min	7hrs 46min	2hrs 47min	9hrs 25min	**18hrs 55min**
Average hours	56min	56min	3hr 03min	21min	31min	**5hrs 47min**
Standard Deviation	0.039	0.035	0.068	0.016	0.046	**0.102**

Table 2 Insurance billing TAT

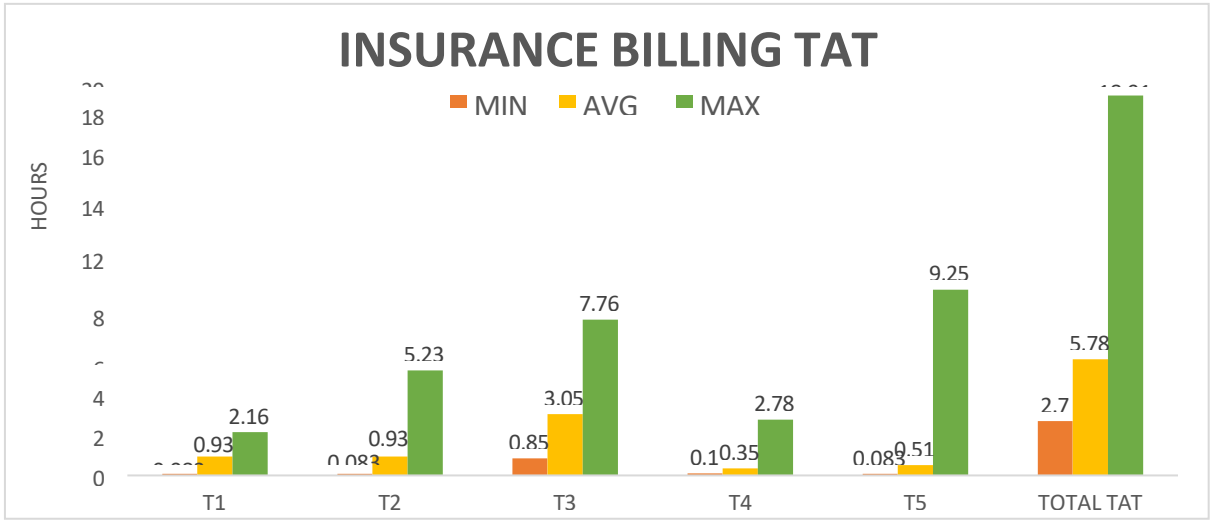

Figure 5: Minimum, Maximum and Average time taken by insurance billing.

The above column graph and table shows the TAT for the cash billing, here

- **T1- Bill-in to Bill start** (which is the time taken by the bill after entering the billing department and the billing staff starting it)
- **T2- Bill start to bill sent to insurance** (starting the bill and till it has been sent to insurance desk for approval)
- **T3-Insurance in to Insurance out** (the time taken to get the insurance approval)
- **T4-Insurance out to final bill done** (time taken by the bill to be finished after the insurance approval is received.)
- **T5-Bill done to financial checkout** (time taken by the patient to come and sign/pay the bill after the bill reaches the cash counter)

T1-The minimum time taken for the billing staff to start the bill after it reaches the billing department is 5minutes and the maximum time taken is 2hrs 10min whereas the average is 56min and standard deviation is 0.039.

T2-the minimum time taken for the bill to be updated and sent to insurance is 5minutes and the maximum time taken is 4hrs 54minutes whereas the average is 56minutes and standard deviation is 0.035.

T3-the minimum time taken to get the insurance approval is 51minutes and the maximum time taken is 7hrs 46minutes whereas the average is 3hrs 03minutes and standard deviation is 0.068.

T4-the minimum time taken is 6minutes and the maximum time taken is 2hrs 47minutes whereas the average is 21minutes and standard deviation is 0.016.

T5-the minimum time taken for the patient to reach the billing after the bill is done is 5minutes and the maximum time taken is 9hrs 25minutes whereas the average is 31minutes and standard deviation is 0.046.

THE TOTAL TAT FOR INSURANCE BILLING is

- Average-5hrs 47min and standard deviation is 0.102.
- Min-2hrs 42min
- Max-18hrs 55min

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4. CORPORATE BILLING TAT

	T1	T2	T3	T4	T5	TOTAL TAT
Min hours	17min	22min	48min	55min	13min	**1hrs 10min**
Max hours	5hrs 25min	1hrs 18min	8hrs 52min	1hrs 29min	4hrs 35min	**10hrs 56min**
Average hours	2hrs 16min	26min	1hrs 33min	52min	40min	**4hrs 30min**
Standard Deviation	0.08	0.08	0.07	0.07	0.04	**0.09**

Table 3 Corporate billing TAT

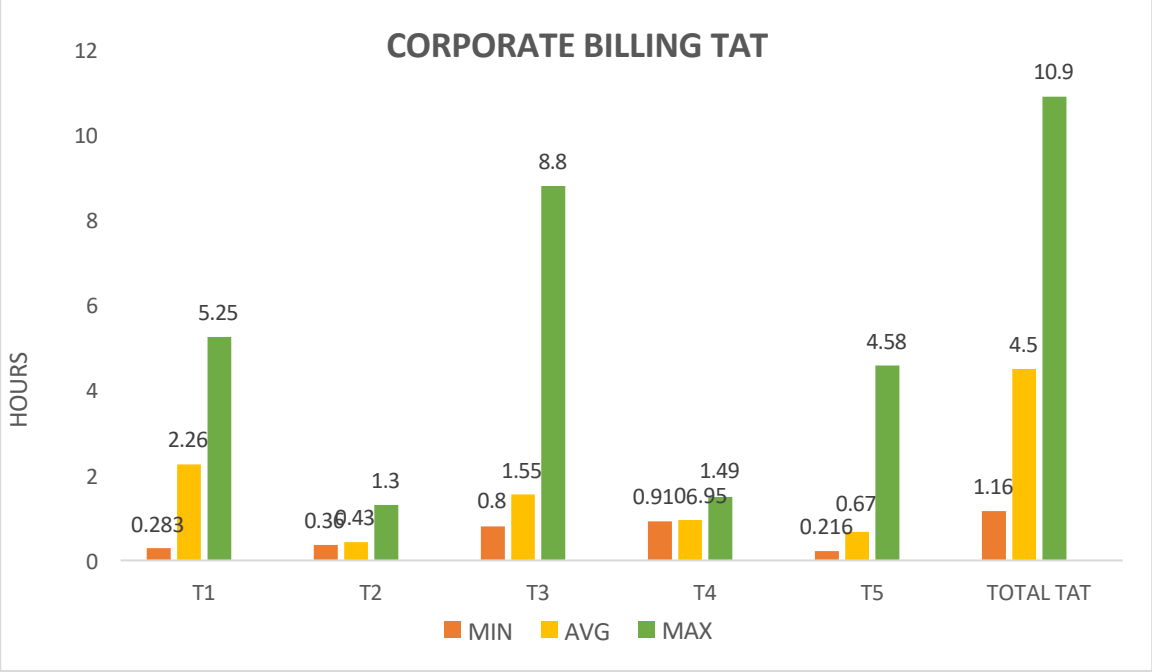

Figure 6: Minimum, Maximum and Average time taken by corporate billing.

The above column graph and table shows the TAT for the cash billing, here

- **T1- Bill-in to Bill start** (which is the time taken by the bill after entering the billing department and the billing staff starting it)
- **T2- Bill start to bill draft** (starting the bill and till its updated)
- **T3-bill draft to credit approval** (the time taken to get the credit approval from the corporate companies)
- **T4-Receiving credit approval to final bill done** (time taken by the bill to be finished after receiving the credit approval letter.)
- **T5-Bill done to financial checkout** (time taken by the patient to come and sign/pay the bill after the bill reaches the cash counter)

T1-The minimum time taken for the billing staff to start the bill after it reaches the billing department is 17minutes and the maximum time taken is 5hrs 25min whereas the average is 2hrs 26min and standard deviation is 0.08.

T2-the minimum time taken for the bill to be updated and drafted is 22minutes and the maximum time taken is 1hr 18minutes whereas the average is 26minutes and standard deviation is 0.08.

T3-the minimum time taken to get the credit approval from the corporate companies is 48minutes and the maximum time taken is 8hrs 52minutes whereas the average is 1hr 33minutes and standard deviation is 0.07.

T4-the minimum time taken is 55minutes and the maximum time taken is 1hrs 29minutes whereas the average is 57minutes and standard deviation is 0.07.

T5-the minimum time taken for the patient to reach the billing after the bill is done is 13minutes and the maximum time taken is 4hrs 35minutes whereas the average is 40minutes and standard deviation is 0.04.

THE TOTAL TAT FOR CORPORATE BILLING is

- Average-4hrs 30min and standard deviation is 0.09.
- Min-1hr 10min
- Max-10hrs 56min

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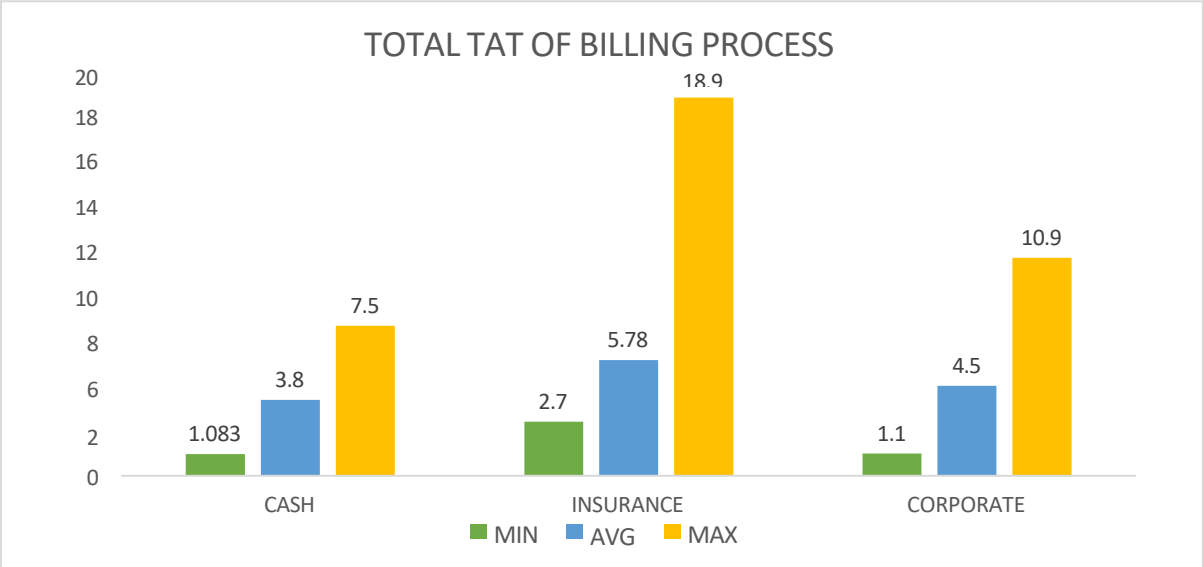

Figure 7: Total TAT of billing process before Implementation

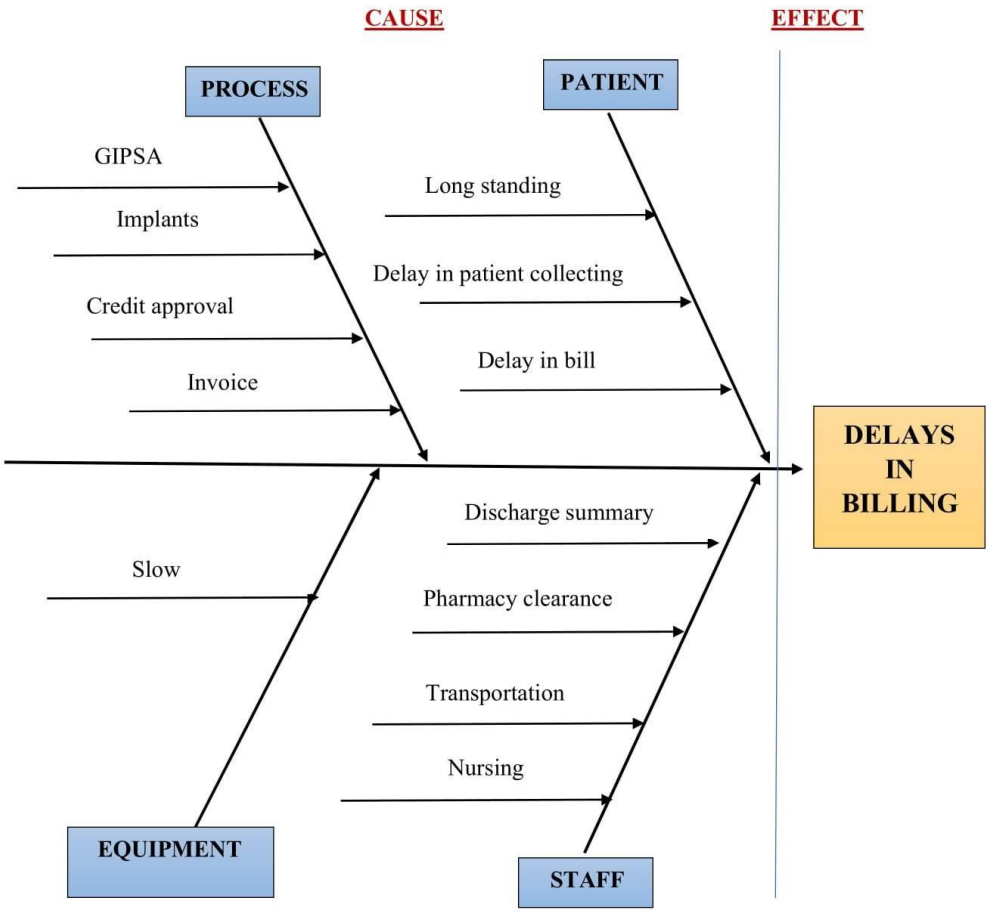

Figure 8 Fish-Bone Diagram

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Cause-and-effect diagrams (Ishikawa diagrams, fishbone diagrams, or herringbone diagrams) are causal diagrams created by Kaoru Ishikawa that show the potential causes of a specific event. The various root-causes are

CASE	TOTAL NUMBER
Nursing gap	363
Discharge summary delay	356
Surgery codes	294
Transportation delay	259
Pharmacy clearance delay	198
Credit approval pending	183
Delay in patient collecting bill	145
Long standing cases	49
GIPSA codes	18
Implants pending	9

Table 4: Root causes of delay in billing.

5. PARETO ANALYSIS

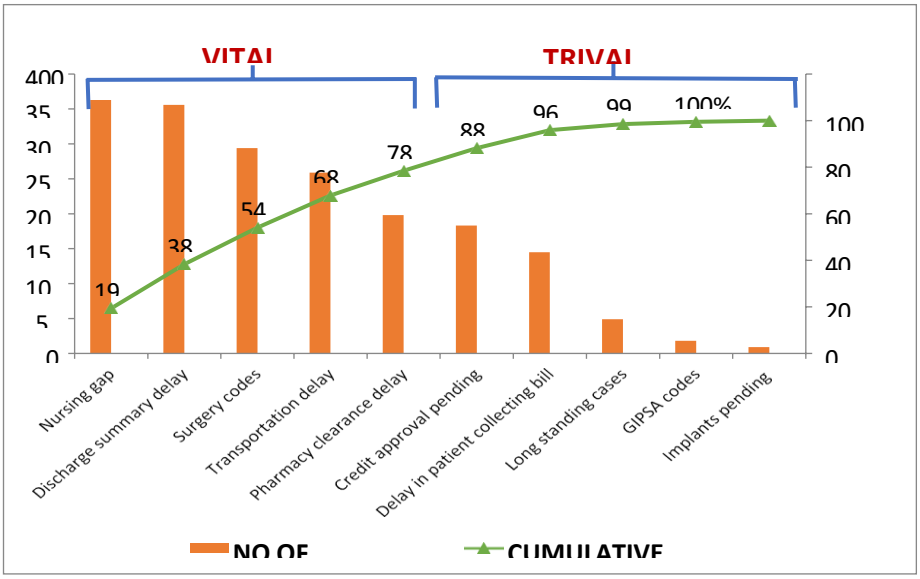

Figure 9: Pareto analysis

This technique helps to identify the top portion of causes that need to be addressed to resolve the majority of problems. This is also known as 80:20 rule. The principle is that quality problems (80%) are the result of only few causes (20%)

In the above pareto chart the 20% causes that lead to the 80% problems are

- Nursing gap
- Discharge summary delay
- Surgery codes
- Transportation delay
- Pharmacy clearance delay which are called as vital few and the remaining reasons are considered as trivial many.

IMPLEMENTATION OF PREDISCHARGE CHECKLIST AND STREAMLINING THE PROCESS FLOW

The following changes/actions were taken to streamline the existing discharge process,

- Implementation of pre-discharge checklist was done and in which the tasks were divided among the staff.
- The floor PREs/FHAs are held responsible to
  - check process services of NI lab/ radiology blood bank etc.
  - pharmacy returns were checked and updated one day prior itself.
  - cross verify with OT about all the surgical equipment codes and surgeon codes updated in the system.
  - to check the non-availability signature if present any,
  - All bedside procedures are updated from floors
  - Checking the Id proof/ approval letter availability
  - Intimating to the corporate and insurance desk for approval of any other treatment performed
  - Invoice for implants available if any are checked
  - Ensuring that the case sheet has been sent to discharge pool etc.

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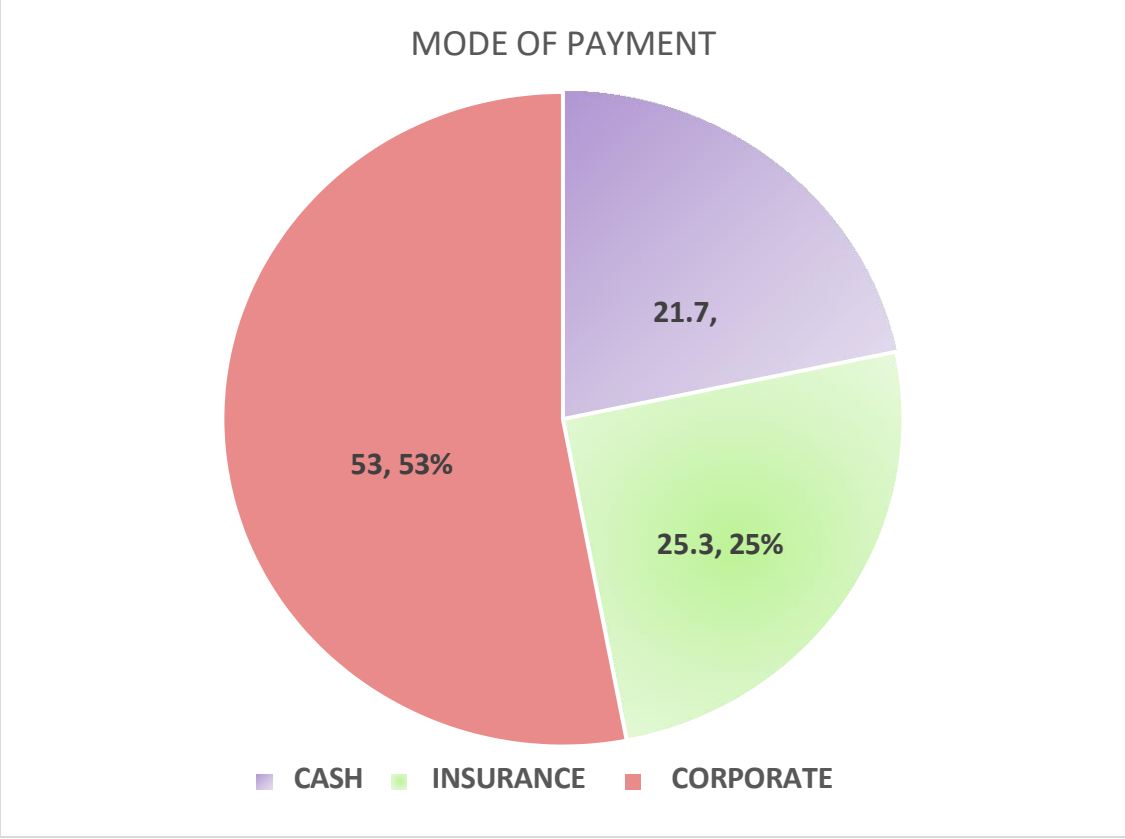
- Enhancing the number of planned discharges.
- The nursing staff are given orientation about the new implementation and the tasks were divided among them.
- The one-week medication for the corporate billing patients' task was allotted to the respective doctor/physician assistant.
- The surgery codes as per the company were updated by the corporate billing staff as soon as the surgery was done for the patient and immediately after the surgery the post- Operative area admin should communicate with corporate billing staff regarding the codes.
- The long-standing cases were updated for 2-4 days by the night shift billing staff.
- The pharmacy staff was also given orientation about the new implementation and their role in this was explained to them. And they should send the pharmacy clearance hard copy as soon as it is approved to the billing department.

7. POST-IMPLEMENTATION SAMPLE



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The total sample collected for the study was 376 after the introduction of the pre-discharge checklist and streamlining the process flow and among the collected sample, 83 were cash patients, 97 belong to Insurance and the remaining 196 belong to corporate billing.

8. TOTAL BILLING TAT AFTER IMPLEMENTING PRE-DISCHARGE CHECKLIST AND STREAMLINING THE DISCHARGE PROCESS

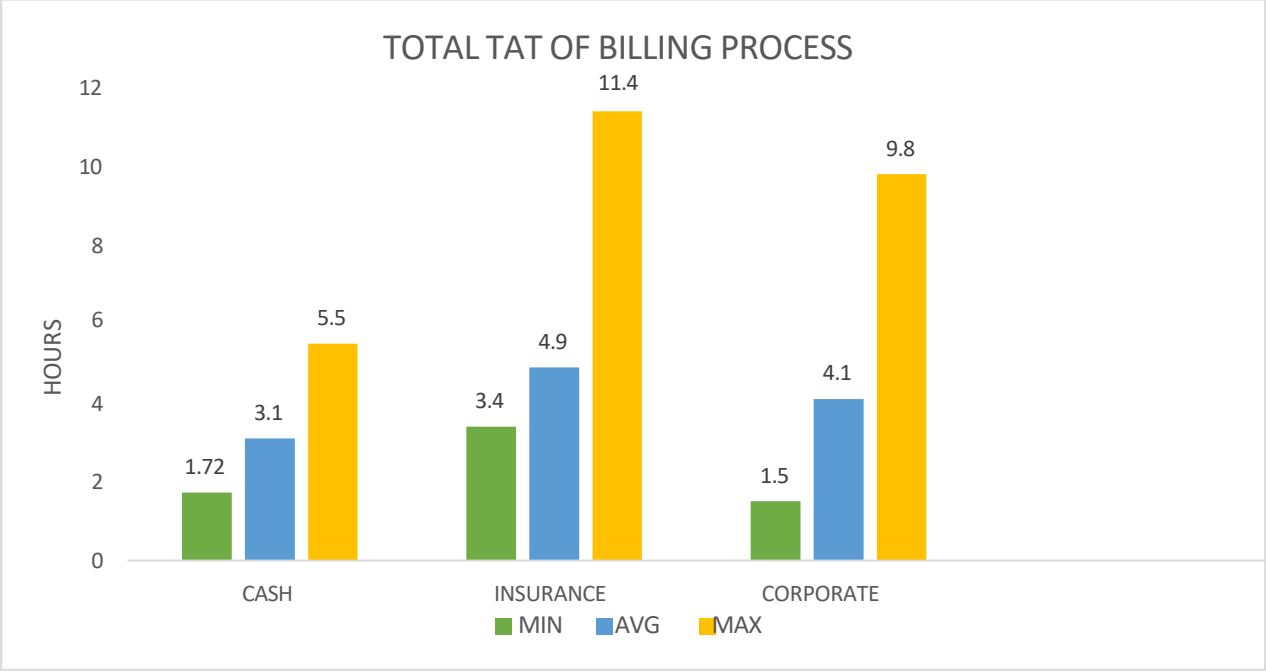

Figure 11: Total TAT of billing process after Implementation

1. THE TOTAL TAT FOR **CASH BILLING** is
    - Average-3hrs 6min.
    - Min-1hr 43min
    - Max-5hrs 30min

2. THE TOTAL TAT FOR **INSURANCE BILLING** is.
    - Average-4hrs 54min.
    - Min-3hrs 24min
    - Max-11hrs 24min

3. THE TOTAL TAT FOR **CORPORATE BILLING** is
    - Average-4hrs 7min.
    - Min-1hr 30min
    - Max-9hrs 48min

9. COMPARISON OF THE TOTAL TAT OF THE BILLING PROCESS BEFORE AND AFTER IMPLEMENTING THE PRE-DISCHARGE CHECKLIST AND STREAMLINING THE DISCHARGE PROCESS.

	PRE-IMPLEMENTATION BILLING TAT	POST-IMPLEMENTATION BILLING TAT	%DECREASE IN TAT
CASH	3hrs 48min	3hrs 6min	18.42%
INSURANCE	5hrs 47min	4hrs 54min	14.4%
CORPORATE	4hrs 30min	4hrs 7min	8.5%

Table 5 comparison of the pre and post implementation TAT

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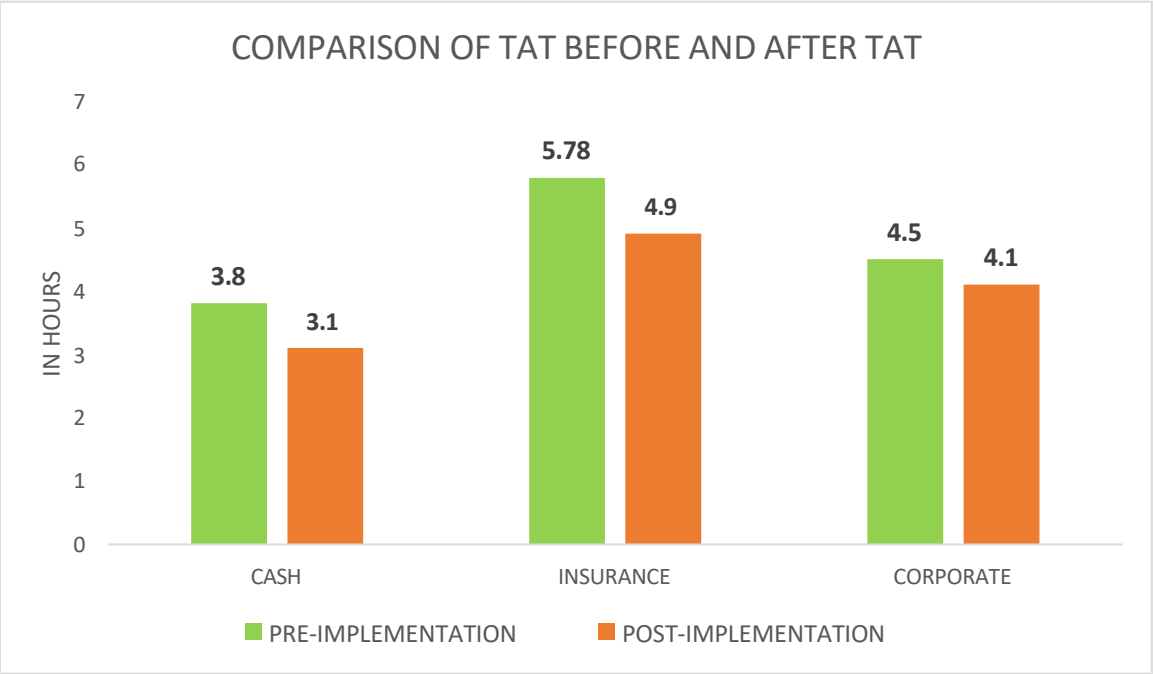

Figure 12 comparison of the pre and post implementation TAT

The above table shows the values of TAT before and after implementation of the discharge checklist and streamlining the process flow. After implementation, there is a significant decrease of 18.42% in the turn- around time for Cash billing, 14.4% for insurance, and 8.5% for corporate billing.

10. T-test

A t-test is a statistical test that is used to compare the means of two groups.

a.) HYPOTHESIS STATEMENT FOR CASH PATIENTS

Ha: There is significant difference in the Pre and Post-implementation TAT of cash billing process.

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T test		
	PRE-IMPLEMENTATION	POST-IMPLEMENTATION
Mean	228.2911392	186.0886076
Variance	13194.41415	979.0048685
Observations	79	79
Pearson Correlation	0.125270041	
Hypothesized Mean Difference	0	
D. F	78	
t Stat	3.255878443	
P(T<=t) one-tail	0.000836871	
t Critical one-tail	1.664624645	
P(T<=t) two-tail	0.001673741	
t Critical two-tail	1.990847069	

Table 6: t-test for cash billing samples

As the T calculated value > T critical value, alternative hypothesis is accepted. There is a significant difference in the Pre and Post- implementation TAT for Cash billing process.

b.) HYPOTHESIS STATEMENT FOR INSURANCE PATIENTS

Ha: There is significant difference in the Pre and Post-implementation TAT of insurance billing process.

t-Test: Paired Two Sample for Means		
	155	*375*
Mean	349.3023256	295.9302326
Variance	20076.51929	8992.159781
Observations	86	86
Pearson Correlation	-0.022330544	
Hypothesized Mean Difference	0	
D. F	85	
t Stat	2.873517232	
P(T<=t) one-tail	0.002563056	
t Critical one-tail	1.6629785	
P(T<=t) two-tail	0.005126112	
t Critical two-tail	1.988267907	

Table 7: t-test for insurance billing samples

As the T calculated value > T critical value, accept alternative hypothesis. There is a significant difference in the Pre and Post- implementation TAT for corporate billing process.

SUMMARY

The primary objective of this study is to improve medical billing process and hence reduce the delay in the billing of discharge process and to identify the root causes for the delays in the billing process which has been achieved by the fish bone analysis and calculation of the billing TAT. Administrative interventions like the pre-discharge checklist and streamlining the discharge process were implemented that reduced billing and discharge time. DMAIC six sigma approach is used to improve the whole discharge process.

CONCLUSION

It can be concluded that patient satisfaction can be improved by reducing the delays in the billing process during discharge which will enhance the overall image of the hospital.

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