

Six Sigma Applications in Reducing Cancellation of Operative Procedure in Operation Theatre of a Tertiary Care Hospital

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Abstract:

Introduction; The advancement in technology, globalization, privatization and liberalization policies have significantly changed the health care scenario all over the world, Quality operation theatres (OT) are the key area which involves huge investment, it is a high priority service area from the management point of view which requires adequate attention, willingness to improve efficiency for better return of investment. Quality is a constant concern. Surgical suite is a unique environment which is susceptible to variation and error. Six sigma can help to reduce variability and ensure that services are delivered in the safest possible manner.

Aim And Objective; The study includes increasing efficiency of operation theatre utilization and to reduce related financial loss

Methods; The study carried out for a period of six months in a tertiary care hospital, The data comprised of observational study, direct interaction with anaesthesiology HOD's (Head of department), OT incharge, HOD's of surgery, OBG, ortho, Ent, ophal and surgical super specialities, DMAIC (Define measure analyse improve control) approach, fish bone analysis model were used for analysing the data **results;** Data showed cancellation was mainly due to lack of operation room time, & lack of supportive staff, Define phase; problem statement was described as data available on OT cancellation, Measure phase; The analysis of the existing system with various measurement techniques for defects and levels of perfection was done Improvement phase; Necessary steps framed, list of solution with their respective causes done with cause and effect diagram. (fishbone diagram) control phase response plan for dealing with the enumerated problems done,

Keywords: DMAIC (Define measure analyse improve control), OT (operation theatre), Six sigma, Surgical Suite, Fish bone diagram

I. Introduction

Healthcare, as with any other service operations, requires continuous and systematic innovation to remain cost effective, efficient and provide high quality services. Evidence-based management is particularly important in the area of quality improvement (QI) [1] in healthcare because of the need to develop and assess practices for better process and outcome measurable.

There are many popular QI tools such as Six Sigma and Lean systems. [2] Lean [2] is a philosophy that intends to make business processes quick, to respond to the customer requirements as fast as possible, by helping identify delays in the value chain and helping eliminate waste. Lean Six Sigma (LSS) [3] is a philosophy and set of management techniques focused on continuous "eliminating waste" so that every process, task or work action is made "value adding" as viewed from customer. Mapping involves clarifying the customer base, listing the process steps, identifying value-add steps, and reworking the process, so the workflow is without interruption. Although, there are many QI tools in healthcare management, LSS are two new and popular tools to be used in the healthcare industry. [4],[5]

Operation theaters (OTs) are the key area which involves huge capital investment; it is highly manpower intensive too along with being a high cost center. It is a high priority service area from the management point of view, which requires adequate attention and willingness to improve efficiency for better returns on investment. [6]

The Advancement in technology, globalization, privatization and liberalization policies have significantly changed the health care scenario all over the World. Quality is the key issue of all the private, public as well corporate healthcare organizations. Corporatisation and competition in healthcare sector are forcing healthcare organisations to look for new ways and means for improving their processes. This is for improving quality of the hospital's products and services and reducing patient dissatisfaction. As healthcare sector is becoming more complex, the opportunities for errors abound.[7]

To reduce the errors and to move towards perfection, most of the corporate hospitals are now functioning at Three Sigma or Four Sigma quality levels. There is a need to breakdown the traditional boundaries that separate physicians, hospital administrators, pharmacists, technicians and nurses by shifting away from a culture of blame and by working together to systematically design safer, more effective and

efficient systems. Six Sigma methodologies can help in this and can change the face of modern hospital and healthcare delivery system. Six Sigma can reduce variability and waste, translating to fewer errors, improve customer satisfaction, provide better processes, greater patient satisfaction rates, and happier and more productive staff. The popularity of Six Sigma is growing in healthcare industry.[7]

Six Sigma is a quality control methodology that measures performance using statistical concepts and terminology. In the early 1980's, Motorola created the Six Sigma process as a strategy to generate performance excellence by improving product quality and job processes while reducing costs. Other companies such as General Electric and Hewlett Packard, adopted the Six Sigma methodology to provide a focused approach for achieving quality (Ransom, Joshi, and Nash, 2005). The Six Sigma methodology may be applied to any work activity, however, greatest results are achieved when the process directly affects return on investment and operating income (Harry, 2004).

Six Sigma is "a performance target that applies to a single critical to quality characteristic (CTQ), not to the total product" (Harry and Schroeder, Lean Six Sigma 2000) The Greek letter "Sigma," is used in statistics as a symbol for variance. A process that is Four Sigma, indicates an average process; out of a million opportunities for non-conformance, there are 6,200 non-conformities (Harry, 2004). A Six Sigma process reduces the number of opportunities for non-conformance, indicating a world-class process.

Six Sigma projects are initially defined by identifying those areas which impact costs, time, or Profit (Wellman, Box, & Saxton, 2003).

The Six Sigma approach is applicable to all facets of healthcare, both clinical and administrative. Six Sigma projects have been used in hospitals in order to improve "quality, throughout and the bottom line in the operating room" (Pexton, n.d., p. 1). Some of these process improvements include improving admissions, optimizing technologies, ensuring appropriate scheduling and improving first case start times. Successful use of the Six Sigma methodology in a hospital setting is exemplified by the Red Cross Hospital in the Netherlands. By implementing Six Sigma across all hierarchical levels, Cancellation of scheduled operations can be considered an under-utilisation and a waste of resources allocated for the maintenance of operating theatres and the availability of surgeons and theatre staff on agreed schedules for elective surgeries[8]

II. Aim And Objective

The study includes increasing efficiency of operation theatre utilization and to reduce related financial loss

III. Methods

The methodology used in this study is DMAIC, present study done for a period of six months in tertiary care hospital The primary data comprised of observational data collected from OT, Direct interaction with anaesthesiology HOD, OT manager, Survey of operating surgeons, survey of theatre staff done Secondary data gathered from the OT records, OT register Case file registers, patient files, literature reviews various tools such as mean, fish bone analysis model, Bar charts, graphical representations were used for analysing the data

Define Phase:

In the define step, a six-sigma team refines its problem statement & goals, identifies the factors which are critical to quality. In this step OT utilization of 2013 and 2014 studied, and each OT start time, end time number of cases done, OT utilization defined

Measure Phase:

Measurement process was done as per the phases pre-designed; a proper performance was developed for each phase to collect the valid data with the reasons. Here the DCP (data collection plan) was made, In this phase direct interaction with HODS of surgical broad and super specialities and OT manager, done with the preformed questionnaire to evaluate the reasons for cancellation of OT

Analyse Phase:

This phase falls into 2 categories: Data analysis & Process analysis, Fish bone diagram prepared for the controllable and non-controllable reasons, segregation of the reasons done, which directed improvements

Improve Phase:

In this study the improve stage was functioned through a strong brain storming session with all the team members & experts of the department, lead to the formation of 2 protocol designs for the smooth functioning of OT addressing major issues like; scheduling cases & schedule adherence of 1st cases, Necessary steps framed, List of solution with their respective causes done with cause and effect diagram

Control Phase:

It's the most crucial phase among all, being this project in the OT which is the vital to the hospital, still made work at this project much fundamental & trend oriented. at this phase various supervisory activities are designed for all the team members, Long term plans of goals of the project done

IV. Results

Define Phase;

Table No 1 Operation Room Utilization during Study Period

OT NO'S	DEPARTMENT	AVERAGE STARTING TIME	AVERAGE ENDING TIME	AVERAGE NO OF CASES DONE
OT1	ENT	8am	4.30pm	7-8
OT2	SURGERY	7.30am	5pm	7
OT 3	PAEDIATRIC SURGERY	9am	2pm	2
	SURGERY CASES DONE	8am	5pm	7
OT4	ORTHO	7.30am	5.15pm	4
OT5	GENERAL SURGERY	8.30am	4pm	6
OT6	OPHTHAL	8am	4.20pm	7-8
OT7	OBG	8am	5.45pm	5
OT8	PLASTIC SURGERY	2pm	3.45pm	3
OT8	PAEDIATRIC SURGERY	8.30am	3pm	3
OT9	ONCOLOGY	8.30am	7pm	2
	NEURO OT1	9.30am	7.30pm	2
	NEURO OT2(ORTHO CASES GIVEN)	8am	5am	4-5
OT9 (FEW DAYS)	UROLOGY	8.30am	4pm	4

Table No 2; Table Showing Number Average Cancelled Cases in Each Ot

	MEDIAN	MIN-MAX
NUMBER OF OPERATIONS ON THE LIST	8	4-12
CANCELLED OPERATIONS PER LIST	1	0-8

Table No 3; Assessment Of Factors Responsible For Cancellation /Rescheduling Of The Operate Procedures In Operation Theatres:

SL NO	QUESTIONS
1	Lack of operating room time
2	Cancel due to acute illness of patient
3	Cancel due to patient not fit for surgery
4	Cancel for patient not fasted
5	Patient did not turned up -scheduling error
6	Change in surgical plan
7	Autoclaved instruments not available
8	Linens not available
9	Instruments not available
10	Equipment failure
11	Non availability of surgeon for the case
12	Refusal of consent by patient
13	Postponement of cases due to non – clearance of insurance/no billing clearance
14	Icu bed not available
15	Ventilator not available
16	Adequate blood products not available
17	Cancel mainly due to non-availability of supportive staff
18	Cancel mainly due to non-availability of attenders to stay with patient.

Table No 4; Response from Head of Departments, Reasons For Cancellation Of Operations In Operation Theatre Complex.

SL NO	YES	NO	NO COMMENTS
Q1	83.3%	16.6%	
Q2	50%	50%	
Q3	66.6%	33.3%	
Q4	16.6%	83.3%	
Q5	0	100%	
Q6	0	100%	
Q7	16.6%	83.3%	
Q8	33.3%	66.6%	
Q9	33.3%	66.6%	
Q10	33.3%	66.6%	
Q11	0	100%	
Q12	0	100%	
Q13	33.3%	33.3%	16.6%
Q14	0	83.3%	16.6%
Q15	0	83.3%	16.6%
Q16	0	100%	
Q17	16.6%	83.3%	
Q18	16.6%	83.3%	

most of them had opinion that cancellation is mainly due to lack of operating room time ,secondly its due to patient not fit for surgery.

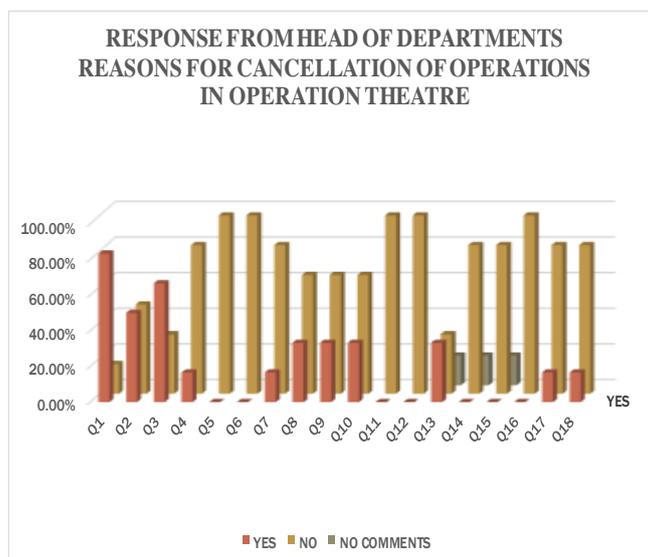


Figure No 1; Response from Head of Surgical Departments

Table No 5; Response From Assistant Professor, Reasons For Cancellation Of Operations In Operation Theatre Complex.

SL NO	YES	NO	NO COMMENTS
Q1	83.3%	16.6%	
Q2	58%	41.6%	
Q3	91.6%	8.3%	
Q4	50%	50%	
Q5	16.6%	83.3%	
Q6	8.3%	91.6%	
Q7	50%	50%	
Q8	50%	50%	
Q9	25%	75%	
Q10	41.6%	58.3%	
Q11	0	100%	
Q12	25%	75%	
Q13	33.3%	66.6%	
Q14	16.6%	83.3%	
Q15	25%	75%	
Q16	8.3%	91.6%	
Q17	25%	75%	

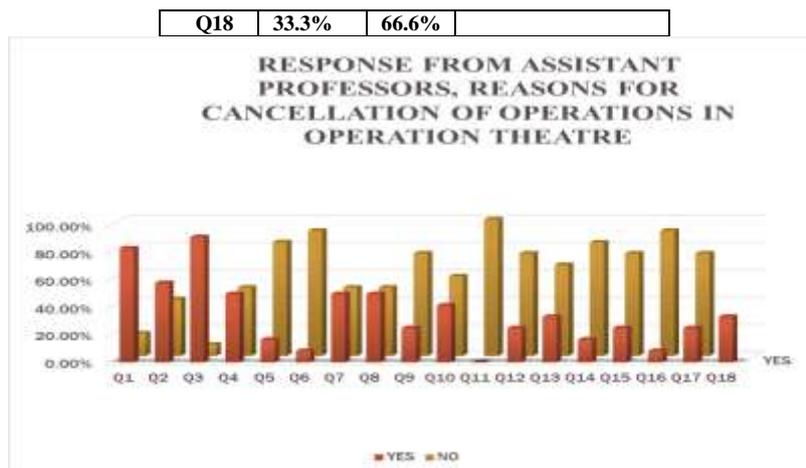


Figure No 2; Response from Assistant Professors of Surgical Departments

Table No 6; Assessment of Factors Responsible For Cancellation /Rescheduling Of the Operative Procedures in Operation Theatres for Response from Theatre Staff

SL NO	QUESTIONS
1	Delay in cleaning work
2	Delay due to non-arrangement of equipment
3	Postponement of cases due to no insurance clearance, consumables not available, no billing clearance
4	Surgeon late
5	Surgeon unwillingness to perform surgery
6	Anaesthetist late
7	Implants /stunts coming late to operation theatre
8	Incomplete assessment of patients
9	Patients not brought on time
10	Lack of co-ordination among physicians and surgeons

Table No 7, Response from Nursing Staff

SL NO	YES	NO
Q1	57%	43%
Q2	16%	83%
Q3	16%	83%
Q4	0	100%
Q5	16%	83%
Q6	16%	83%
Q7	16%	83%
Q8	0	100%
Q9	0	100%
Q10	16%	83%

Nursing Staff Had Opinion That Cancellation Is Due To Delay in Cleaning Work

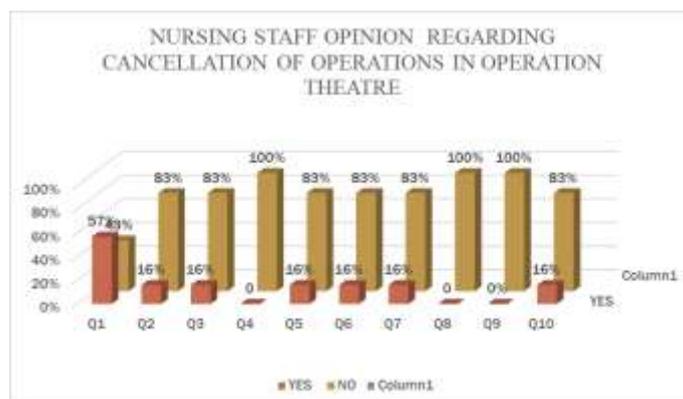


Figure No 3; Response from Theatre Staff
GRAPHICAL REPRESENTATION

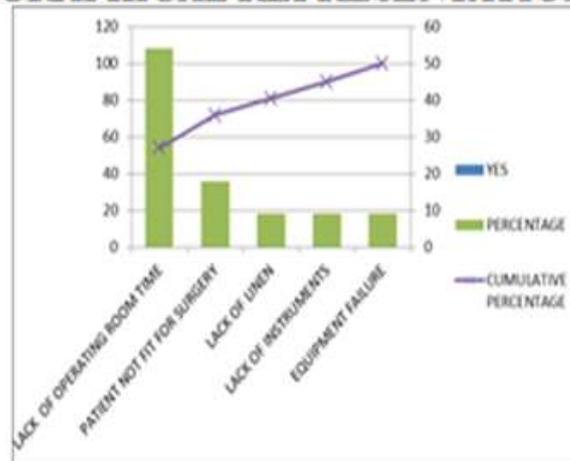
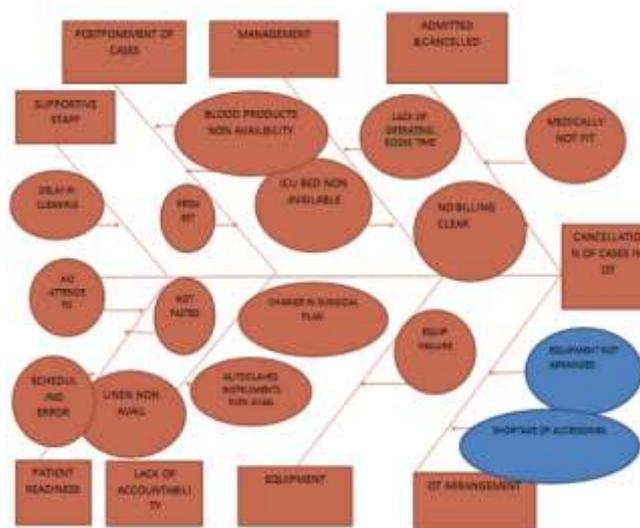


Figure No 4; Graphical Representation of Reasons for Cancellation



Analysis Phase Fish Bone Diagram;
Figure No 5; Cause and Effect Diagram

Improve Phase:

Necessary steps framed, list of solution with their respective causes done with cause and effect diagram.

CAUSES	SOLUTIONS
LACK OF OPERATING ROOM TIME	STRESSING ON IMPORTANCE OF TIME, PROPER PLANNING,
DELAY DUE TO CLEANING WORK BETWEEN CASES	PROVIDING MORE HOSEKEEPING STAFF
EQUIPMENT FAILURE	BETTER HANDLING RESOURCES STRATEGY
LINEN NOT AVAILABLE	MADE AVAILABLE
NON AVAILABILITY OF AUTOCLAVED INSTRUMENTS	IMPROVE CO ORDINATION BETWEEN OT AND CSSD
NON AVAILABILITY OF SUPPORTIVE STAFF	INCREASING NUMBER OF STAFF IN OT

Control Phase;

Long term plans were made; In this phase management support was also built up for logistic response and sustaining the achievement of the long term goals of the project, all efforts made to maintain motivational levels of the staff.

Advantages and Limitations of the Study;

In this study appreciation of usual reasons for cancellation of surgeries made, and factors help in improving theatre utilization. control phase was limited due to non-availability of time

V. Discussion

During the study organization were able to provide back up for the accessories which have multiple uses, because of improved efficiency and engagement of all staff ,the number of cases being done in the theatre improved by 1 to 2 case per day, it increased to overall performance of cases per day ,which is compared to last year similar months, there was an evident direct and indirect cost savings with application of DMAIC method, cost saving was approximately 2,70,000rs,because to ability to do more case in control phase,

VI. Conclusion

The overall cancellation rate of operations can be reduced by providing accessories, ready availability of cleaning staff, proper OT scheduling, monitoring postponement and cancellation of surgeries and its evaluation, which in turn lead to saving time and prevent financial loss to organization.

VII. Recommendations

We can recommend a team approach ensuring presence of policies and procedures for improving and ensuring realistic scheduling of theatre lists, reducing time spent preparing and cleaning and better handling resources, with monthly reports sent to Director, Administrator, teams to monitor causes of cancelled operation, taking into consideration the distinction between avoidable and unavoidable causes. Also we recommend the implementation of control charts for monitoring cancellation of operations.

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