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Research Paper

Operation Theatre Manpower Optimization, an Initiative Towards Process Improvement -A Case Study

Dr Rashmi M [1&2*], Fr George Jeevan Sequeira[2], Dr Linus Benedicta Dsouza[3]
Dr Sucharitha Suresh[3]

[1]*Assistant Professor, Father Muller Medical College, Department of Hospital administration. Mangalore. Rajiv Gandhi University for Health Sciences. Karnataka. India*
Orcid:0000-0003-4569-2277; E-mail:drrashmim18@gmail.com
[2]*Research scholar, Srinivas Institute ofManagement&Commerce,Srinivas University. Mangalore. Karnataka. India.*
Orcid:0000-0003-4569-2277; E-mail:drrashmim18@gmail.com
[2]*Lecturer, Father Muller Medical College, Department of Hospital administration. Mangalore. Rajiv Gandhi University for Health Sciences. Bangalore. India*
Orcid:0000-0002-3005-6289; E-mail: georgesequeira10@gmail.com
[3]*Research Professor, Srinivas Institute ofManagement&Commerce,Srinivas University. Mangalore. Karnataka. India.*
Orcid: 0000-0002-1353-7363; E-mail: linusbenedictapinto@gmail.com
[3]*Associate professor, Father Muller Medical College, Department of Community Medicine. Mangalore. Rajiv Gandhi University for Health Sciences. Bangalore. Karnataka. India*
Orcid:0000-0002-1189-3436; E-mail: sureshsucha@fathermuller.in

ABSTRACT
Purpose: Operation theatre management has always been a challenging aspect for any hospital administrator because it includes staff from various categories, a large amount of infrastructure, maintenance work, the importance of risk management, infection control priorities, and, most importantly, patient safety. This paper presents a study conducted in a hospital operation theatre. In the study, the existing system in the operation theatre was assessed; a gap analysis was performed on the job descriptions of various categories of staff in the operation theatre, and improvements were suggested and implemented. The study also assessed the outcome of the achieved improvements.
Methodology/Approach: This study was conducted in two phases. In the first phase, the statistics, shift wise and OT wise, were studied and peak hour cases scheduled were analysed. The staff allocations in OT were studied for shift wise and gap analysis of the job descriptions of the OT staff was performed. Also, suggestions for the closure of gaps identified were made. In Phase 2 of the study, a re-audit of the process after six months was performed to assess the closures implemented for process improvement and manpower optimization in OT derived from the phase 1 study.
Findings/Results: The manpower optimization process in the operation theatre unit of a multispecialty tertiary care hospital was performed successfully using the quality improvement tools. The desired outcomes from the suggested improvement points were observed in the phase 2 study, thus achieving the implications of the study.
Originality/Value: The result of the study will help in deriving a complete quality improvement procedure which can be applied for manpower optimization in operation theatre and managing the staff crisis without remodelling the staffing structure.
Paper Type: Case study.
Keywords: *operation theatre, manpower optimization, process improvement, PDSA tool, fish bone analysis, Donabedian model.*

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I . INTRODUCTION

All major and minor surgical procedures are carried out in the hospital's operation theater. The preoperative area, the operation theater, and the postoperative care unit are the three primary components of an operation theater. To ensure quality, a sterilized atmosphere, and standard of care, the operation theatre is staffed separately. The number of operating rooms in a surgical unit depends on the hospital's bed capacity and the number of specialties it offers. Operation theater management has always been a challenging aspect for any hospital administrator because it includes staff from various categories, a large amount of infrastructure, maintenance work, the importance of risk management, infection control priorities, and, most importantly, patient safety.The DMAIC (Define, measure, analyze, improve and control) technique demonstrated how the healthcare organization may obtain competitive advantages, effective decision-making, and problem-solving abilities in a wider range of situations in business context.To enhance the Operation Theatre Process in hospitals, a Design DMAIC Model is suggested that may be utilized as a model. [1]Numerous operational flaws, such as long case turnaround times and disregard for case scheduling, were discovered after analysis of the "As-Is" scenario. The lean program improved operational processes and made sure that all patients received continuous care, which benefited both the personnel and the patients. Operation theatres where Lean was implemented demonstrated significantly increased performance coupled with a rise in patient satisfaction regarding the services rendered and enhanced staff involvement and complacency.[2]

II. LITERATURE REVIEW

According to a study conducted by Zheng, Q. et.al, (2011, September).they discussed that, in hospitals, the operating theatre has a crucial function. Resources needed for the surgical procedure include both manpower and tangible assets. A judicious use of resources may result in a high level of operating theatre effectiveness and patient satisfaction. A discrete event system simulation model of hospital operating rooms was built under SIMIO. Based on existing patient flow and operational data gathered from a large hospital in Ningbo, the case study is explored. The usage of the available resources and the surgical flow time are examined through simulation. The simulation's evidence points to managerial issues in the current Operation theatre. Based on resource allocation simulation, some recommendations are made to boost the OR's effectiveness. [3]In 1999, Ozcan, S., & Hornby, P. in their study mentioned that if any nations are forced to explore employing more stringent methods for calculating staffing levels in the healthcare facilities due to the challenges of providing an adequate and suitable distribution of health services and increasing financial pressures on the public sector. One such strategy is the Workload Indicators of Staffing Need (WISN) approach. To assess the number of employees needed, it employs activity standards, measures of workload and utilisation, and a type of activity analysis. The approach offers a reasonable means of determining localised staffing demands while also being significantly distinct from earlier approaches. This paper explores hospital applications of this strategy in Turkey. Manpower levels must be maximized. [4] Wong, J., et. al, in 2010. in their study, discussed that in the operating room, delays regularly happen and have a significant impact on patient flow and resource usage. The concepts underlying the causes of operating room delays across surgical disciplines are illustrated by thorough documenting of perioperative delays, which serves as a foundation for the creation of solutions to increase operating room efficiency. This study reveals that perioperative system delays are a frequent form of error in the neurosurgical operating room and that other surgical disciplines can learn from investigations of perioperative delays in neurosurgery. Furthermore, a first delay is followed by multiple second delays, creating a vicious cycle. Equipment malfunctions and delays in getting the patient into the operating room were the most frequent types of delays, therefore strategies developed to reduce inefficiency in the operating room must focus on these areas. A thorough analysis of the reasons of perioperative delays in various surgical subspecialties could be a perfect way to start when developing ways to increase operating room efficiency. [5]In 2021, Apornak, A. et.al, in their study mentioned that optimizing human resources (HR) is essential for good hospital management. Due to optimization, the cost of emergency departments is typically used as the objective function to find the best possible set of HR operational options. It is incredibly tough to assess these kinds of problems in ambiguous situations. It was concentrated on the cost evaluation approach and the path to HR optimization in an emergency department during the current research. They made a novel contribution by using a flexible method built on the Bat algorithm, which can distinguish between and forecast the necessary employments. Therefore, during the optimization method, salary cost, penalties for damages that may result from improper performance, and hospital performance were all examined as three simultaneous objective functions. The amount of personnel with the necessary skills to maximise all objective functions were shown by the results. The hospital's application of the suggested strategy demonstrated a predicted reduction in emergency human resources costs of more than 24.3%.[6]Bahranifard. A et.al, in 2017, in their study explained that for hospitals to be successful in offering high-quality care, their ability to handle clinical hazards in the emergency rooms is crucial. The goal of this study is to offer an optimization technique and apply management performance in medical and health emergency on the rate of emergency readiness of the suburb city hospitals. Data were gathered using interviews,

observational evidence, and, if necessary, a numerical analysis, as well as the World Health Organization-recognized standard checklist of hospital emergency responsiveness exam to WHO disasters, which consists of 90 questions in 9 domains. The situation was initially evaluated using the checklist. The second stage involved developing a set of solutions, which were then put into practise in accordance with the knowledge gained. To increase the quality of health management performance and emergency readiness, data analysis before and after proposing the technique and its application was carried out using central indices, and tables and graphs were utilised to describe and display the survey results. According to research findings and statistics on accidents and disasters in suburban cities, the importance of emergency departments in interurban hospitals in preventing accidents, and the need for planning and implementing practical measures like holding training sessions on health management in disasters and emergencies, having an estimate of critical and essential resources, altering the structure, and providing manpower (emergency management).[7]Roland, B. et. al, in their study in 2010, discussed that the operating room is seen as a crucial function in the management of health care in the current economic environment. The operating room is one of the major sources of hospital expenses due to the significant amount of human and material resources it consumes. A more logical use of resources and more in-depth planning of the surgical units are required for a less expensive operating room setup. In addition to these factors, we also have the medical staff's wellbeing in mind. By emphasising the human resources' availability in the schedule design, we incorporate this human aspect into the optimization process. A planning step is usually followed by a scheduling stage, which together make up this planning process. The solutions that are produced because of this decomposition might not be ideal. In this research, it is suggested to formulate both the scheduling and planning of the surgical procedures. In addition, it suggests a heuristic solution method based on evolutionary algorithms to address the lengthy running times involved in solving this challenging optimization problem.[8]

III. NEED FOR THE STUDY

Operation theatre management has always been a challenging aspect for any hospital administrator because it includes staff from various categories, a large amount of infrastructure, maintenance work, the importance of risk management, infection control priorities, and, most importantly, patient safety. This paper presents a study conducted in a hospital operation theatre. In the study, the existing system in the operation theatre was assessed; a gap analysis was performed on the job descriptions of various categories of staff in the operation theatre, and improvements were suggested and implemented. The study also assessed the outcome of the achieved improvements.The gap analysis appeared to have a useful diagnostic function to play in identifying, measuring, analyzing, and calculating the performance of the operating room. It was important to routinely monitor and evaluate the process quality from the viewpoints of the hospital staff and patients [9]By studying operating room data on causes of delays, developing plans for cutting down on the most frequent delays, and then monitoring delay data, a significant increase in operating room efficiency was observed. Personal responsibility, procedure simplification, cross-disciplinary teamwork, and precise data gathering were all significant factors in increased effectiveness. [10] A plan was prepared to study the existing system in operation theatre for process flow and manpower allocation was assessed; a gap analysis was performed on the job descriptions of various categories of staff in operation theater; and improvements were suggested and implemented. The study also assessed the outcome of the improvements suggested and implemented.Thus, this study was conducted to optimize the manpower in the operation theatre unit of a multispecialty tertiary care hospital using the quality improvement tools.

IV. OBJECTIVES

(1) To study the existing system for process flow and manpower allocation.
(2) To perform a gap analysis for the job descriptions of various staff categories in the operation theatre of a multispecialty teaching hospital.
(3) To implement corrective actions for the gaps identified and restructure the process flow and manpower allocation.
(4) To assess the outcome of the implemented corrections.

V. METHODOLOGY

This study is an observationalstudy performed in the operation theatre unit of a multispecialty teaching hospital with seven dedicated operation theaters. The OT manuals and registers were studied. The study was conducted in two phases. As all the OT cases performed in the study duration are considered and all the staff categories working in the OT (excluding the doctors) are considered for the study, the sample size calculation is not applicable in this study.The compiled data for process flow, gap analysis, and outcome of the implemented corrective actions will be analyzed by applying various quality improvement tools. The process flow and gap analysis of the job descriptions of various categories of staffing in the operation theatre are

analyzed by applying the PDSA.[11]and Fishbone analysis [12]as quality improvement tools. The outcome of the implemented corrective actions and the improvements observed will be analyzed by applying the Donabedian structure, process, and outcome model.[13]

The statistical data for a month with specificity to the shift wise cases scheduled and the number of cases scheduled in a specific time range and OT wise data was collected from the operation theatre unit in phase 1 (Before implementation of corrective actions—August 2021) and phase 2 (After implementation of corrective actions—April 2022) respectively, through retrospective audits. The study results from phase 1 wereanalyzed for the gaps in process flow in OT scheduling during the peak hours and necessary arrangements were made with appropriate corrective actions. The corrections were decided to be implemented and, after six months of the implementation, the Phase 2 study on the improvement's outcome was conducted.The gap analysis for the job descriptions mentioned in the operation theatre manual of the technicians, nurses, nursing aides, and nursing orderlies was performed in phase 1 (Before implementation of Corrective Actions-August 2021) to find compliance, partial compliance, and non-compliances. The same categories of staff in phase 2 (after implementation of corrective actions—April 2022) were audited to find the outcomes of the improvements implemented after the phase 1 study. The necessary training and development programs, as well as staff restructuring, were implemented. In this study,the qualitative data is converted into quantitative data and descriptive statistic technique is applied and hence, all data compiledanalyzed in percentage and interpreted to conclude both in phase 1 (Before implementation of corrective actions—August 2021) and phase 2 (After implementation of corrective actions—April 2022) of the complete study.

VI. FINDINGS, RESULT AND ANALYSIS

Phase 1: Before implementation of Corrective actions-Aug-21.

Section 1 of the study*:*

Process flow in the operation theatre Unit:The study in detail explored the existing process flow in the operation theatre unit with 7 operating rooms. The operation theatre manual was studied in detail to understand the existing policy on case scheduling, duty shifts of various categories of staff (technicians, Nursing staff, nursing aides and nursing orderly) and their job descriptions explained in the manual. The statistical data of total number of cases performed in the study area were compiled for the study period with specificity to each shift in section 1 of the study.

The percentage of cases analysed in each shift, with 54% in shift 2, 38% in shift 1 and the least of 9% in shift 3. From the existing shift hours of the OT staff, the peak hours were derived: 7:30 am to 10:00am and 4:00pm to 6:00pm, when there would be lack of manpower but increase in number of cases being scheduled.7:30am to 10:00am and 4:00pm to 6:00pm had staff only pertaining to one shift and the percentage of cases posted were comparatively high, i.e., 164 cases out of 393 and that led to one of the reasons for manpower crisis in the operation theatre unit. 42% of the 162 cases in shift 1 were conducted during the peak hour period and in shift 2 only 18% of the 231 cases were observed to be conducted in peak hour which was comparatively less when compared to the morning peak hour cases.It was observed that in all OTs, cases were posted both for elective and emergency cases. With the available statistics of Aug-21, it was observed that maximum cases were conducted in OT-6, OT-1, OT-2, and OT-5. Among these cases most of the cases were performed during the shift-2 followed by second highest in shift-1 and very minimal in Shift-3 on daily basis.

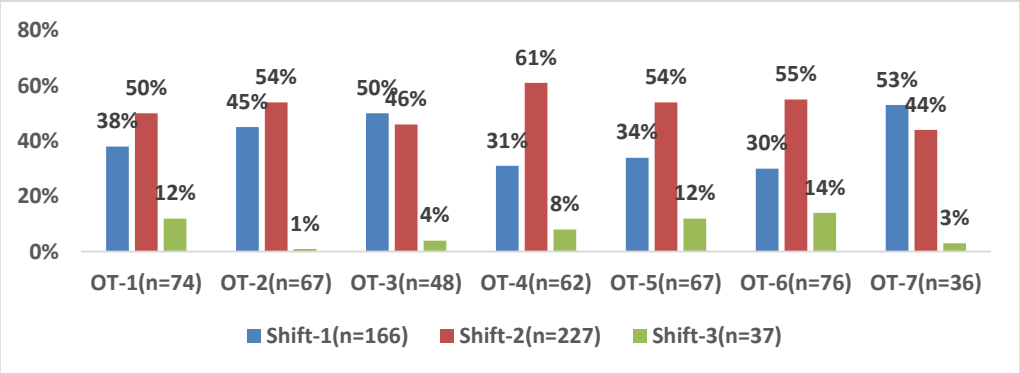

Figure1: OT wise shift wise Percentage of cases Aug-2021

Figure1 explains the OT wise case distribution in percentage for August 2021 which shows that maximum (61%) of cases is performed in OT-4 during Aug-21.

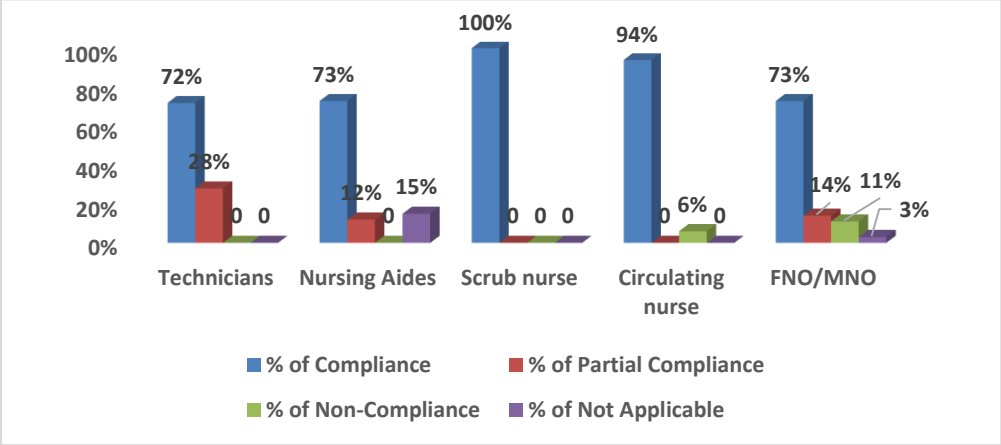

Figure2: Staff category wise Gap analysis report in percentage

Figure2 shows that compliance rate to gap analysis of the Job description was 72% among technicians, 73% among the Nursing aides, 94% among circulating nurses and 73% among FNO/MNO. It was observed that 100% compliance rate noted for Scrub nurse. It also indicated that partial compliance rate of 28% among technicians, 12% among nursing aides and 14% among the FNO/MNO and 6% among Circulating nurses and 11% among FNO/MNO of the Non-compliance rate needed to be addressed with corrective actions.

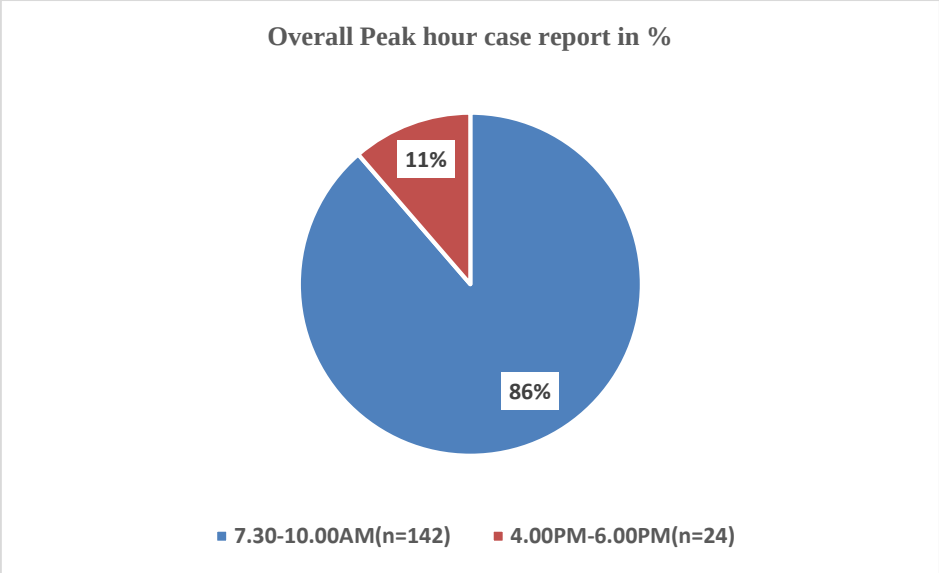

Figure3: Overall Percentage of cases in Peak hours- Aug-2021

Figure3 explains that, on an average 86% of the cases were posted in peak hour of the shift-1 and 11% of the cases in peak hour during shift-3. Hence addressing the 86% of cases getting posted in morning peak hour was important to optimize the manpower issues in OT unit.

Table1: Details of NC & PC noted of each category in Gap analysis

JD of OT Technicians as in Manual	**PC/NC**	**Remarks**
Maintains and keeps the operating room and ensures everything is running smoothly before the conduct of surgery	PC	Only anaesthesia room maintained
Maintains and keeps all equipment clean and functional	PC	Only anaesthesia room maintained
Order and maintain adequate necessary supplies in the operating room	PC	Only anaesthesia room maintained
Clean and disinfect operating room area after each procedure/surgeries	PC	Only anaesthesia room maintained
Reports any defective equipment and instrument for repair or replacement to the incharge	PC	Only anaesthesia room maintained
JD of Hospital Assistants/Nursing Aids as in Manual	**PC/NC**	**Remarks**

Maintains the cleanliness of the ward	PC	As applicable
Takes care of the C.S.S.D articles and maintains sterilization of articles	PC	Assists nursing team only
Cleaning of the suction and oxygen bottles, catheters and other utensils of the ward.	PC	Performed by MNO mostly only Oxygen bottles are cleaned by HA
JD of Circulating Nurse as in Manual	**PC/NC**	**Remarks**
Direct or complete the placement of the electrosurgical grounding pad.	NC	MNO is performing this duty
JD of FNO/MNO	**PC/NC**	**Remarks**
All horizontal surfaces within the OR are damp dusted before the first scheduled surgical procedure of the day, with a clean lint free cloth moistened in 5% Silvicide disinfectant solution	NC	During dusting performed by staff nurse
All the non-critical items are washed and disinfected.	PC	Washing only buckets, Basins & suction bottles
Surface disinfection of all high touch surfaces with 5% silvicide eg; table, light, trolley etc	NC	Performed by Staff Nurse
Respiratory tubing's are washed and sent for sterilization.	NC	Performed by OT Technicians
Terminal disinfection of the equipment used inside the OR should be with 10% Silvicide	PC	Performed by Staff nurse/ OT Technician/Hospital Assistants/MNO
Transport vehicles should be disinfected with 10% Silvicide	PC	Only once a week
Remove all movable equipment and furniture from the OR	NC	Performed on OT shut down day only not on all sunday
Disinfection of the OR is done with 10% Silvicide	PC	Performed once in 3months
Floor cleaning to be done with scrubbing and moping using disinfect	PC	Performed once in 3months

In Table1, the details of partial compliance and non-compliance of the gap analysis are explained for each of the category of staff.

Table2: Comparison of the Statistics details

	Statistics	Aug-21	April-22
1	**Total cases**	430	622
2	**Shift wise No. of cases**		
Shift-1	7: 30am- 4:00pm	166	197
Shift-2	10:00am-6:00pm	227	358
Shift-3	6:00pm-7:30am	37	67

In Table 2, on observation of the phase 2 statistics data and comparing the phase 1, it was noted that there was an increase in number of cases, also there was almost similar kind of case distribution in all three shift duties of the OT unit.

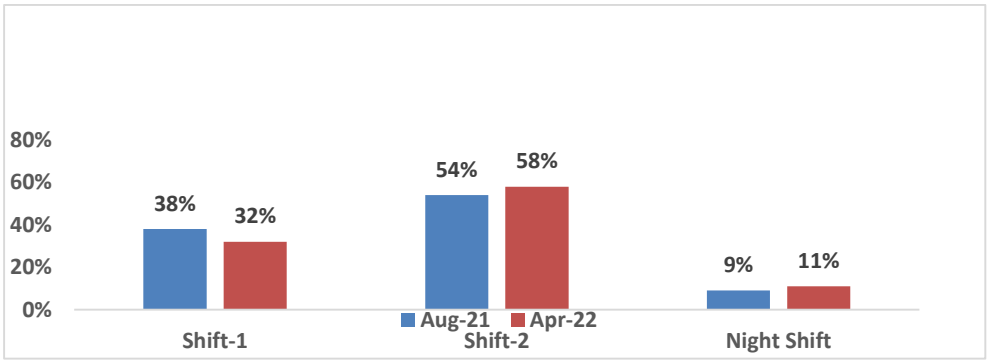

Figure4: Comparison of the Percentage of cases shift wise in Aug-2021& April-22

In figure 4, the comparison of the percentage of cases based on shift wise category for Aug-21 and April-22 are explained. In shift-1, it was seen that 38% cases in Aug-21 and in April -22, 32% were performed. In shift-2, 54% in Aug-21 and 58% cases were performed in April-22.In the night shift 9% in Aug-21 and 11% in April-22.It was clearly evident that with the implementation of improvement points from Phase-1 of this study, the most of the cases being posted in shift-1 had reduced to certain extent and the preference to shift-2 case posting had been given priority.

Table3: Comparison of Peak hour Statistics details		
Peak Hour Statistics	**Aug-21**	**April-22**
Total cases (Shift 1&2)	**393**	**555**
7:30am-10:00am	**164**	**197**
4:00pm-6:00pm	**30**	**59**

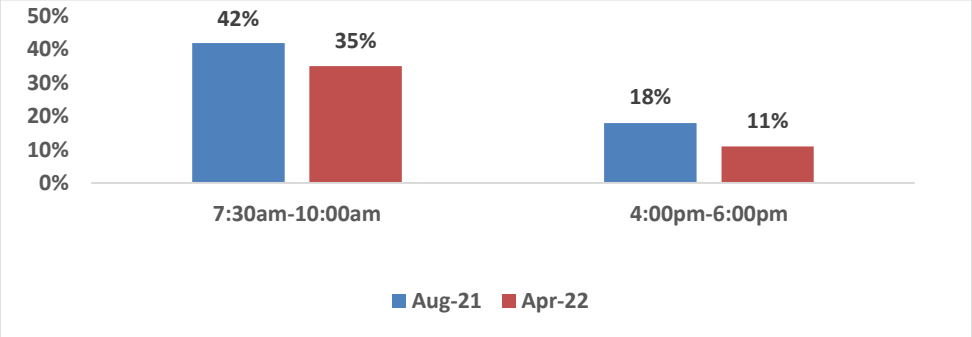

Figure5: Comparison of Percentage of cases in peak hours in Aug-2021 & April-22

Table3 explains the details of the peak hour statistics of Aug-21 and April-22 and in figure 5, the peak hour case distribution comparison between Aug-21 and April-22 data showed that there was an improvement in the case scheduling plan in phase 2 wherein although percentage of cases in shift 1 was almost same as phase 1 yet the peak hour case statistics showed that only 35% of cases were posted in phase 2 in comparison to 42% in phase 1during 7:30am-10:00am and only 11% of case were posted in phase 2 in comparison to 18% in phase 1 during 4:00pm to 6:00pm.

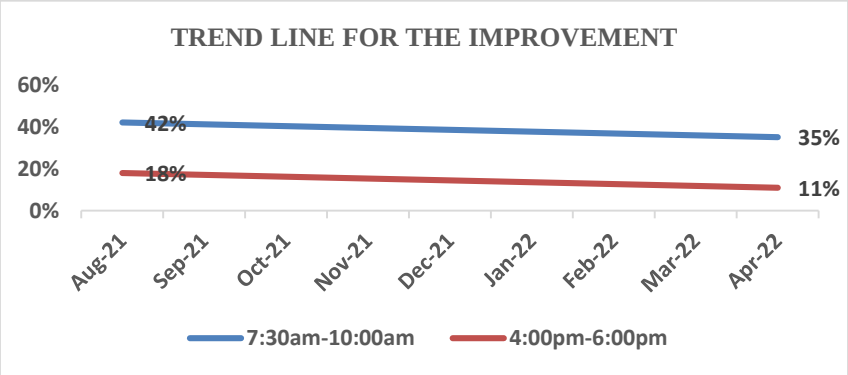

Figure6: Trend line depiction of the improvement in peak hour case scheduling

Figure 6 shows that the trend line depicted an improvement in the process flow of case scheduling in OT Unit from Phase 1 of the study to phase 2 study during the peak hour period.

Table4: Comparison of OT wise Statistics details Aug-21 & April-22		
OT No.	**Total case-Aug-21 (430)**	**Total Case-Apr-22 (622)**
OT-1	**74**	**82**
OT-2	**67**	**128**
OT-3	**48**	**75**
OT-4	**62**	**98**
OT-5	**67**	**98**
OT-6	**76**	**87**
OT-7	**36**	**54**

Table4, explains the OT wise statistics of Aug-21 and April-22 and same is compared in the study for assessing the manpower distribution after implementation of the improvement points from Phase-1 study.

Table5: OT wise shift wise statistics of case distribution details-April-22			
	Shift-1 (n=197)	Shift-2 (n=358)	Shift-3 (n=67)
OT-1(n=82)	28	50	8
OT-2(n=128)	44	76	9
OT-3(n=75)	22	45	10
OT-4(n=98)	34	56	7
OT-5(n=98)	22	57	17
OT-6(n=87)	26	44	13
OT-7(n=54)	21	30	3

Table5, shows the OT wise statistics in each shift in April-22. depicting the increase in the number of cases conducted in each OT. Also, on comparing the OT wise statistics of Phase 1 and Phase 2, there was major increase in workload during the phase 2 study period. It was observed that in April-22, maximum cases were conducted in OT-1, OT-3, and OT-2. Among these cases most of the cases were performed considering the available manpower and minimal during the peak hours. The suggestions provided to surgeons from phase 1 study was considered and manpower issues during phase 2 study were drastically negligible.

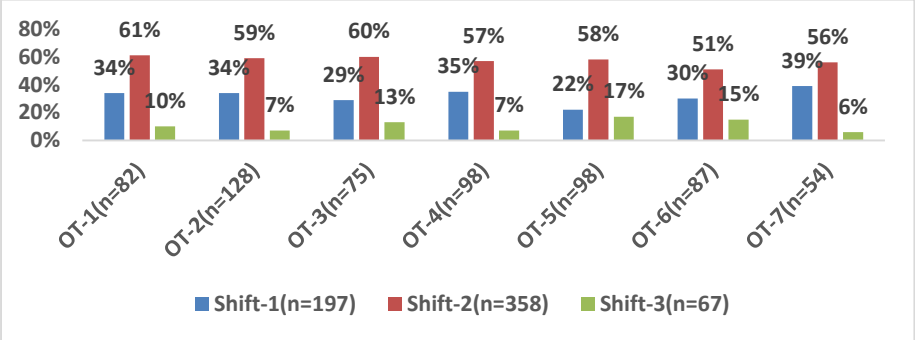

Figure7: OT wise shift wise Percentage of cases April-2022

Figure 7 shows the details of cases posted in each OT shift wise for April-22 in percentage. In April-22, it was observed that maximum number of cases (61%) was posted in OT-1 during shift-2.

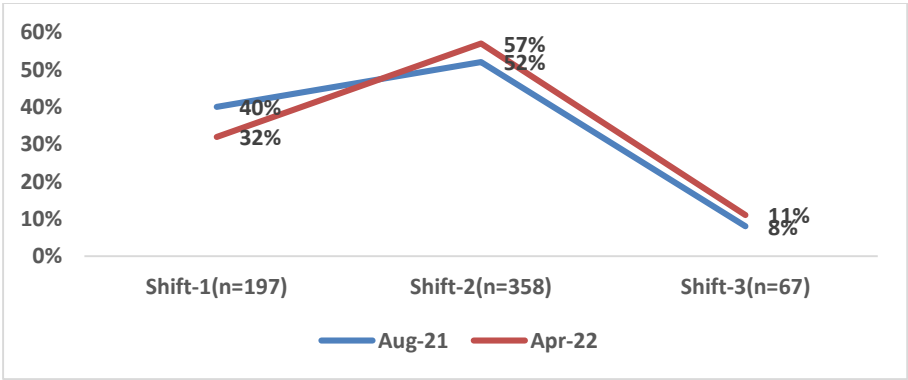

Figure8: Comparison of the average percentage of the cases -OT wise shift wise

Figure8 shows that there was an improvement in the trend line of the OT wise shift wise average cases performed during shift 1 which was the gap identified for the peak hour statistics. Only 32% of cases on an average got posted during the shift-1 in phase -2 study period where less manpower was identified in comparison to 40% on an average case during phase -1 study period. This improvement had addressed the manpower crisis faced by OT unit with the suggestions from the phase -1 of the study.

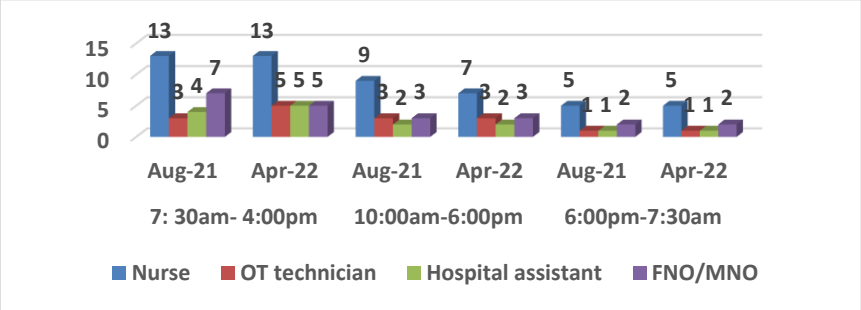

Figure9: Comparison of the Shift wise average manpower details in OT

Figure9 explains that the manpower allocation in the phase 1& Phase 2 of the study. It is observed that, in Phase 2 despite having an increase in number of cases, almost the same number of staff could manage the workload in OT unit with no manpower crisis being reported. This was an improvement noticed because of the changes made in the OT administration with the suggestions derived from the Phase 1 of the study.

Section 2 of the study:

Gap analysis report of the Job descriptions of OT Manpower:The operation theatre unit of a multispecialty tertiary care hospital comprises of various categories of staffingother than the surgeons & Anaesthetists. The various categories of staffing excluding the surgeons and anaesthetists were included in the audit and they were the OT technicians, OT nursing staff, OT nursing aides and OT female and Male nursing orderlies. The Job Descriptions of each category of staff are defined in the departmental manual by the Human resource department and the same is shared with every category of staff soon after their appointment to the job. The same Job description are trained timely to all category of staff. This Job description was taken up for gap analysis to find out the compliances, Partial compliances, and the non-compliances. Certain parameters in job description were not applicable as operation theatre unit is functionally different from other clinical departments.The gap analysis performed showed that among all the parameters mentioned in the job description, there were nil non compliances among the technicians, nursing aides and scrub nurse. Partial compliances were observed among technicians, nursing aides and the FNO/MNO categories. Few parameters described for nursing aides and FNO/MNO were not applicable. In the Gap analysis of the JDs of various category of staff the following important points are noted in general: Every category of person in OT is performing all few works irrelevant to the assigned and hence it is taken for granted that anyone among the group will be performing that job (generalized not specified).Assigned works are performed by different category of staff as dedicated staff is performing some other special jobs assigned from years without appropriate JD described on the same. Miscellaneous jobs in all categories can be viewed as common jobs performed by OT staff to help each other but are forced to perform them currently. Co-operation between all category of staff needs to be built up to encourage specific jobs to be performed by specified people for perfect maintenance of the machines and manpower utilization hours. Suggestions to all the observation points from the gap analysis were given to the management and accordingly implemented through appropriate corrective action.

Phase 2: After implementation of corrective actions- April 2022

The data were compiled for Aug-21 & April-22 to derive the outcomes of the implementation of the corrective actions from the phase 1 to phase 2 of the study.

Quality improvement Tools applied:

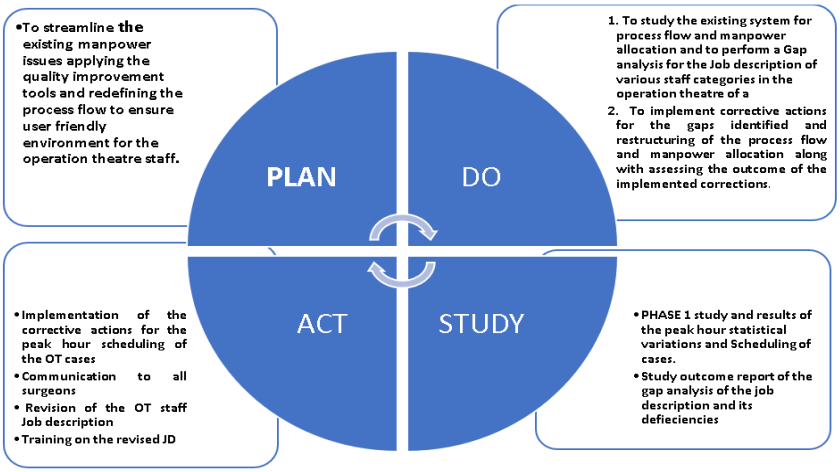

Image1: PDSA cycle

The Image1 explains the PDSA cycle[11] applied to the study. It explains the Plan, Do, Study and actions undertaken in the study and thus the outcome of the study is observed.

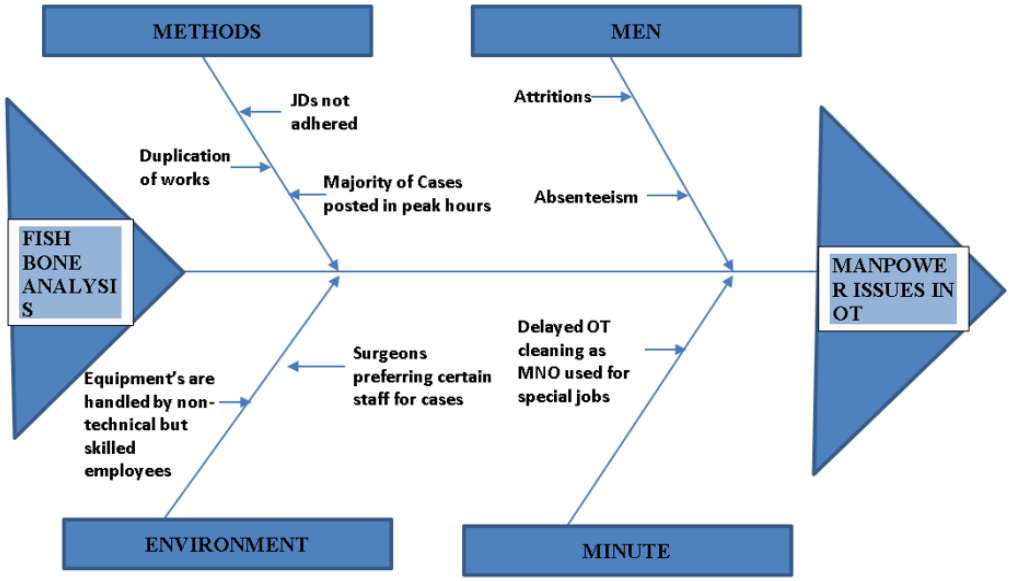

Image2: Fishbone Analysis

Image2 shows the fish bone analysis [12] [14] [15] performed for the identified manpower issues in the OT unit pertaining to the methods, men, environment, and minutes. Thus the causative factors being the duplication of works, Job description not being adhered and majority of cases being posted in peak hours under the methods followed, among the men, attrition and absenteeism are the factors, in minutes being the delay in OT cleaning as the MNO are involved in special job other than their jobs described and environmental factors such as equipment's being handled by non-technical but skilled staff and surgeons preferring to certain chosen staff for case in particular.

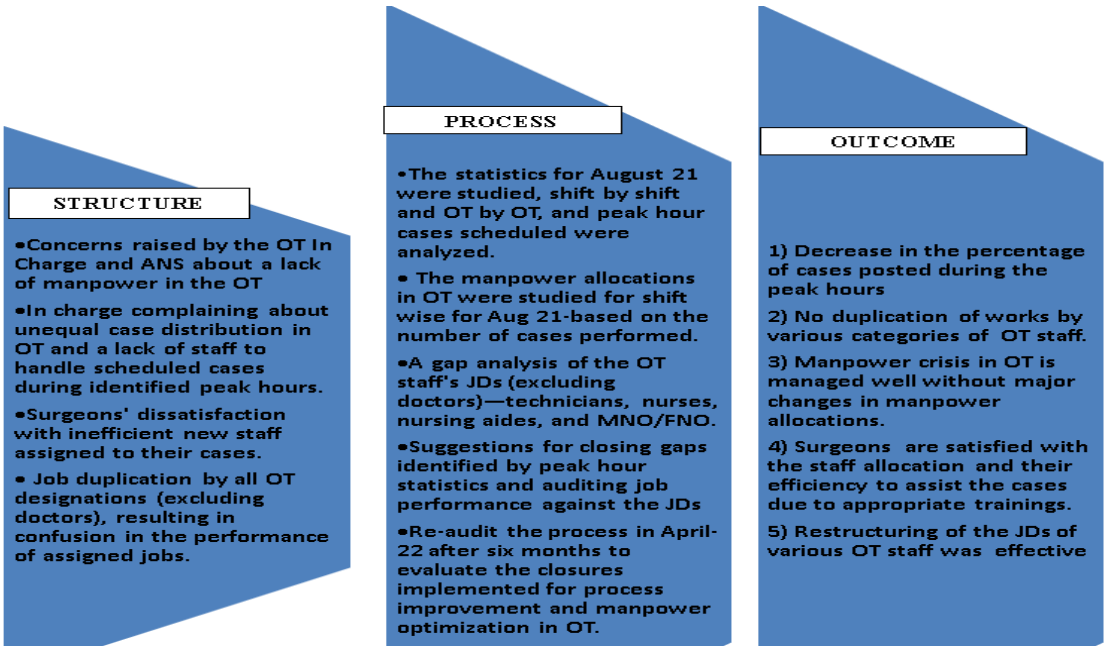

Image3: DONABEDIAN MODEL

Image3 represents the Structure, process and outcome model also called as Donabedian model [13] for the study. The structure includes the concerns related to the manpower issues in OT unit, Process explains the methodology applied in the study to analyse the issues and the measures taken to improvise the process flow and in outcome the details of improvement noted due the study suggestions of phase 1 are explained in detail.
The PDSA methodology is applied step by step using a hypothetical example from a real Quality Improvement Initiative supported by the American Academy of Pediatrics Chapter Quality Networks. The outcomes of healthcare were significantly improved because of the changes that were observed after numerous iterative PDSA cycles. [11] The usage of "fishbone diagrams" by S&T (Science & Technology) programme managers to enhance the calibre of programme proposals is covered in the article. They can effectively connect issues, aims, goals, and quantifiable indicators by utilising this technology. This study suggests combining fishbone diagrams with the "mutually exclusive; collectively exhaustive principle" and the ideas of problem tree and objective tree from the logical framework approach to effectively employ fishbone diagrams in S&T program proposals[12] The DONABEDIAN model can be applied to describe and assess individual quality systems as well as to compare several quality systems. A methodical, evidence-based approach to working with quality improvements in hospital departments could also be helpful[16]. Utilizing Donabedian's technique, patients' experiences with nursing care were confirmed, and practitioners, managers, and policy makers can use this information to enhance the quality of nursing practice [17].

Findings from the Gap Analysis:

Job description explained about responsibilities to technicians pertaining to overall operation room, but gap observed that they were confined only to perform anaesthesia pertaining duties and hence the manpower was underutilised comparatively.The job description of nursing aides included jobs performed by FNO/MNO, and there were jobs which could be performed by technicians themselves, and these categories of nursing aides could be utilised for nursing assistant jobs in actual. Few OT's equipment's to be handled by technicians are operated by non-technical but skilled employees.A Dedicated job of nursing was performed by senior MNO which is not acceptable and to be performed by Nursing fraternity only.Surgeons opt for certain specific staff teams for a few of the specific cases for better work performance.FNO/MNO are observed to be used for other special jobs other than the Job description wherein gaps were observed due to exchange of job description between the technicians, nursing aides and FNO/MNO failing to adhere to the hospital policy.The involvement of MNOs in technical jobs due to their hands-on skills experience has caused a delay in the OT cleaning process.Duplication of jobs from all categories of staff in operation room was observed wherein leading to confusion in work performance, waste of time and deficiency in manpower management reported.Monitoring of the jobs performed by the concerned reporting in charges for various category of staff and its cross audits were missing in action and hence the gaps noted.Lastly increase in staff attrition and absent rate due to the prevailing pandemic period.

Corrective actions suggested in Phase 1:

The surgeons need to be addressed about the distribution of elective cases throughout the whole day to reduce the burden on the OT during the peak period to manage the OT with existing manpower for the elective cases.Anaesthesia HOD to allocate the OT considering the Peak hour for manpower and same to be strictly adhered by all surgeons for all planned elective cases. Case specific operating doctor details from among the team to be specified to allocate case specific, efficient staff for the case.Training to all the OT staff for efficient and effective exhibition of their skills for case specific.The job descriptions of all categories of staff in OT are to be redefined and the same to be trained for easy privileging and credentialing processes and to manage perfect manpower planning in OT. All the suggestions were implemented by the management and the outcome of the implementation to be studied in phase 2.

Outcome of the Implemented suggestions in Phase 2:

Decrease in the percentage of cases posted during the peak hours.No duplication of work by various categories of OT staff due to restructuring of the JDs of various OT staff and conducting effective training for all categories of staff.The OT In-charge and Supervisor are empowered with leadership skills to monitor and manage the work performed by every category of staff in OT.Surgeons are satisfied with the staff allocation and their efficiency in assisting the cases due to appropriate training.The manpower crisis in OT was managed well without major changes in manpower allocations or burden on management.

VII. DISCUSSION

In a Level I trauma hospital, observations on the management of information flow within a group of six operating rooms were performed. The approaches used in this study helped to identify the methods of information sharing that the process's main players used. By evaluating the information, the charge nurse could access through various channels, examples of information needs, and information exchange interruptions were produced. The findings show how essential distributed team planning is to the system's effectiveness and highlight how information technologies might support coordination in a complicated environment [18] The management of the operating room necessitates the coordination of human and material resources so that surgery can be performed in a way that is safe, effective, and economical. A study was carried out to determine the problems with operating room management coordination and their solutions for better patient outcomes. Doctors (surgeons and anesthetists), nurses, operating room technicians, and anesthesia technicians made up the four strata that made up the study population. The result demonstrated that there were some issues, such as inadequate and outdated equipment, a lack of proper sterilization, poor leadership, work overload, a lack of equipment quality checks, a lack of teaching programs, and staff members who aren't always on time or poorly organized in the operating room. It was determined that with the right leadership and organization, these issues could be resolved. [19] The recent Covid-19 pandemic had put a strain on healthcare services, especially given the infrastructure's limitations. To improve screening services and make sure no patient was turned away, they sought to implement a queuing model at the Covid-19 screening area. However, the system was saturated too soon because of the rise in arrival rate from 10 to 20. Queuing models provided a chance for healthcare professionals and hospital administrators to optimize patient care services, particularly in urgent situations with a constantly shifting environment like the prevailing pandemic [20].

VIII. CONCLUSION

The manpower optimization process in the operation theatre unit of a multispecialty tertiary care hospital was performed successfully using the quality improvement tools.The desired outcomes from the suggested improvement points were observed in the phase 2 study, thus achieving the implications of the study.The surge in the number of OT cases in the post pandemic period during the phase 2 study period had no influence on the manpower allocations in the Operation Theatre unit due to the appropriate corrective actions undertaken from the phase 1 study suggestions.

IX. SCOPE FOR FUTURE RESEARCH

This study method and tools should be similarly considered for application in various clinical departments to achieve manpower optimization without compromising on quality of care delivered. The same could also be applied to support service departments such as diet, laundry, maintenance, biomedical, housekeeping, shifting personnel, patient care assistants, etc. to achieve better manpower management in those departments with quality improvement procedures in place.

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REFERENCES

[1]. Rohini R, Mallikarjun J. Six Sigma: improving the quality of operation theatre. Procedia-Social and Behavioral Sciences. 2011 Jan 1; 25:273-80.
[2]. Sonu M. LEAN thinking of an initiative towards process improvement in the operation theatre department. The Journal of Japanese Operations Management and Strategy. 2016;6(1):1-6.
[3]. Zheng Q, Shen J, Liu ZQ, Fang K, Xiang W. Resource allocation simulation on operating rooms of hospital. In2011 IEEE 18th International Conference on Industrial Engineering and Engineering Management 2011 Sep 3 (pp. 1744-1748).
[4]. Ozcan S, Hornby P. Determining hospital workforce requirements: a case study. Hum Resour Dev J. 1999 Sep;3(3):210-0.
[5]. Wong J, Khu KJ, Kaderali Z, Bernstein M. Delays in the operating room: signs of an imperfect system. Canadian Journal of surgery. 2010 Jun;53(3):189.
[6]. Apornak A, Raissi S, Keramati A, Khalili-Damghani K. Optimizing human resource cost of an emergency hospital using multi-objective Bat algorithm. International Journal of Healthcare Management. 2021 Jul 3;14(3):873-9.
[7]. Bahranifard A, Rahzani K, Rad AA, Malekpour M. Proposing an optimization procedure and applying management performance in health and medical emergency on preparedness of emergency department in suburb city hospitals.
[8]. Roland B, Di Martinelly C, Riane F, Pochet Y. Scheduling an operating theatre under human resource constraints. Computers & Industrial Engineering. 2010 Mar 1;58(2):212-20.
[9]. Reddy LK, Reddy B. Gap Analysis Study for Enhancing Operating Theatre Efficiency. Healthcare and Hospital Management Contemporary Issues and Strategies.:27.
[10]. Overdyk FJ, Harvey SC, Fishman RL, Shippey F. Successful strategies for improving operating room efficiency at academic institutions. Anesthesia & Analgesia. 1998 Apr 1;86(4):896-906.
[11]. Christoff P. Running PDSA cycles. Current problems in pediatric and adolescent health care. 2018 Aug 1;48(8):198-201.
[12]. Li SS, Lee LC. Using fishbone analysis to improve the quality of proposals for science and technology programs. Research Evaluation. 2011 Oct 1;20(4):275-82.
[13]. Moore L, Lavoie A, Bourgeois G, Lapointe J. Donabedian's structure-process-outcome quality of care model: validation in an integrated trauma system. Journal of Trauma and Acute Care Surgery. 2015 Jun 1;78(6):1168-75.
[14]. Slameto S. The Application of Fishbone Diagram Analisis to Improve School Quality. Dinamika Ilmu. 2016 Jun 1;16(1):59-74.
[15]. Gold J, Reyes-Gastelum D, Turner J, Pediatric Asthma Quality Team, Davies HD. A quality improvement study using fishbone analysis and an electronic medical records intervention to improve care for children with asthma. American Journal of Medical Quality. 2014 Jan;29(1):70-7.
[16]. Kunkel S, Rosenqvist U, Westerling R. The structure of quality systems is important to the process and outcome, an empirical study of 386 hospital departments in Sweden. BMC health services research. 2007 Dec;7(1):1-8.
[17]. Kobayashi H, Takemura Y, Kanda K. Patient perception of nursing service quality; an applied model of Donabedian's structure-process-outcome approach theory. Scandinavian journal of caring sciences. 2011 Sep;25(3):419-25.
[18]. Plasters CL, Seagull FJ, Xiao Y. Coordination challenges in operating-room management: an in-depth field study. In AMIA Annual Symposium Proceedings 2003 (Vol. 2003, p. 524). American Medical Informatics Association.
[19]. Hassan T, Saeed S, Moazzam M, Sadiq M, Siddique S, Ayub F. Coordination Difficulties in the Management of Operation Theatre in Children Hospital Lahore. Asian Journal of Allied Health Sciences (AJAHS). 2020.
[20]. Yadav SK, Singh G, Sarin N, Singh S, Gupta R. Optimization of man power deployment for Covid-19 screening in a tertiary care hospital: A study of utility of queuing analysis. Disaster Medicine and Public Health Preparedness. 2022 Dec;16(6):2388-92.