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A STUDY ON OPERATION THEATRE UTILIZATION AT A MULTISPECIALITY HOSPITAL IN HYDERABAD

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Abstract

Efficient utilization of operation theatres (OTs) is crucial in healthcare settings as it directly influences patient access to surgical care, optimal use of resources, and overall cost-effectiveness. The operation theatre utilization rate is defined as the percentage of time an operating room is actively used for performing surgical procedures. This study focuses on understanding and evaluating the utilization rate of operation theatres and the various factors that affect it, including surgical scheduling, staff availability, equipment readiness, and patient flow management. Data for the study were collected from hospital records over a four-month period to assess OT performance and identify areas for improvement.

The findings of the four-month study indicate that the operation theatre utilization rate varied across the months, with **March recording the highest utilization at 80%**, while the remaining three months showed utilization rates below this level. Several factors contributed to delays, postponements, and cancellations of surgeries. The major reasons identified were **doctor unavailability (18%), robot or equipment unavailability (14%), patient-related issues (18%), insurance-related delays (12%), planning for higher procedures (9%), implant unavailability (1%), wrong booking (3%), and reasons not mentioned (25%)**. These factors significantly influenced the efficiency and scheduling of surgical procedures.

The study also analyzed **block time utilization for the two most frequently performed surgeries: knee replacement surgery and lower segment caesarean section (LSCS)**. The results showed that knee replacement surgeries often exceeded the allotted block time. Hypothesis testing using the **Z-test** confirmed that there was a significant difference between the standard block time and the actual time taken for these surgeries. In contrast, all LSCS procedures were completed within the allotted block time, indicating efficient time management for these surgeries.

Based on these findings, the study recommends several strategies to improve OT utilization rates. These include implementing advanced surgical scheduling systems, improving staff training and coordination, ensuring proper equipment and implant availability, and enhancing communication among surgical teams and support staff. Additional measures such as introducing new surgical specialties, adopting advanced surgical procedures, following up with patients who require surgery and providing proper patient education are also suggested. Overall, optimizing operation theatre utilization is essential for improving healthcare efficiency, ensuring timely surgical care, and maintaining high-quality patient outcomes while supporting the financial sustainability of healthcare institutions.

Key Words: Operation Theater, OT Utilization, Utilization Rate, Block time utilization.

1. INTRODUCTION

There is an increasing need for the efficient utilization of limited hospital resources while maintaining high standards of patient care and safety. Operation theatres (OTs) are among the most critical and cost-intensive units in a healthcare facility and their improper utilization can lead to longer patient waiting times, increased operational costs, staff inefficiencies, and reduced patient satisfaction. Evaluating OT utilization rates helps in identifying issues such as surgical delays, cancellations, underutilization, or overcrowding of operation theatres. Understanding these factors enables hospital administrators to improve surgical scheduling, optimize staff allocation, and plan infrastructure more effectively. In the context of increasing surgical demand, financial limitations, and the continuous need for quality improvement in healthcare services, such studies



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play an important role in supporting evidence-based decision-making, improving operational efficiency, and enhancing overall hospital performance.

2. REVIEW OF LITERATURE

Naik, S. V et.al., (2018) conducted a study over **96 working days** across **eight operation theatre tables of different specialties**, excluding Sundays and holidays. The study concluded that **most surgical delays and cancellations are avoidable through better preoperative planning, patient optimization, efficient resource management, and effective communication among surgeons, anesthesiologists, and nursing staff.**

Talati, S et.al.,(2015) studied the parameters like time spent on supportive services, time spent on actual surgery, room turn over time, time spent for total procedure and time between entry and exit of patient. They found that 78.1% of the time cancellations were due to operating time.

Vinukondaiah, K et.al., (2000) in their study found that **43.6% of surgical lists started late and 63.6% finished earlier than scheduled**, indicating inefficiencies in scheduling and resource use. They concluded that factors such as **delayed start times, under-scheduling, emergency interruptions, administrative issues, and anaesthesia induction practices** contribute to inefficient OT utilization, and correcting these issues could **increase available operating time by nearly 20%.**

Kamat, A. S., & Parker, A. (2015) have shown that efficient utilization of operating theatre (OT) time is essential for improving surgical throughput, reducing delays, and minimizing cancellation rates in hospitals.

Testi, A et. al., (2017) has proposed a hierarchical three-phase scheduling approach to improve operating room planning by integrating session allocation, Master Surgical Schedule (MSS) development, and simulation-based sequencing of surgical cases.

Saha, P et.al., (2019) conducted a prospective observational study in a teaching hospital and identified significant delays in elective operating lists, mainly due to prolonged patient transfer from the ward to the anaesthetic room and waiting time between consecutive surgeries. The study suggests that improving patient transport systems, ensuring timely patient arrival, and optimizing anaesthesia staffing can enhance operating theatre efficiency and reduce idle time for surgeons and anaesthetists.

A retrospective observational study evaluating robotic-arm assisted total hip arthroplasty (THA) highlighted the presence of a learning curve that initially influences operating theatre utilization and procedure duration. The findings suggest that with increased surgical experience, robotic-assisted procedures can achieve improved efficiency and comparable or reduced operative times compared with conventional techniques.(Pagkalos, J et.al., 2021)

Talati, S et.al., (2015) conducted a prospective study in a tertiary care teaching hospital, evaluated operating theatre time utilization and identified reasons for cancellation of scheduled surgeries. The findings revealed that although OT utilization was relatively high, lack of operating time was the most common cause of case cancellations, highlighting the need for better scheduling and resource management to improve OT efficiency.

A prospective study analyzing elective and emergency surgeries found that a high proportion of cancellations occurred in elective cases due to factors such as non-availability of recovery room beds, improper pre-operative preparation, and staff shortages. The study highlights that delays in patient transport and inadequate resource management significantly affect operating theatre efficiency and timely surgical scheduling.(Jonnalagadda, R, 2015)

Asmal, I. I et.al., 2019 performed a prospective audit in a South African state hospital reported that operating theatre utilization which was below international benchmarks, with a large proportion of time lost due to late starts, prolonged



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changeover times, and early completion of surgical lists. The study also found a high day-of-surgery cancellation rate, mainly due to lack of operative time, emphasizing the need to optimize existing theatre resources and improve operational efficiency.

3. NEED FOR THE STUDY

The **operation theatre utilization rate** is an important indicator in healthcare management that measures how efficiently operating rooms are used in hospitals or healthcare facilities. Monitoring this rate is essential because a high utilization rate reflects efficient use of hospital resources, which can help reduce surgical waiting times and improve patient satisfaction. It can also lead to cost savings by minimizing the need for additional operating rooms or staff. Furthermore, tracking the utilization rate enables hospital administrators to allocate resources more effectively by identifying underutilized operating rooms and redistributing resources where needed. It also supports better planning for future expansion or renovation if demand for surgical services increases. Ultimately, maintaining an appropriate operation theatre utilization rate ensures timely surgical care, improves operational efficiency, and enhances the overall quality of patient care.

4. OBJECTIVES OF THE STUDY

1. To study the process flow of OT at study hospital.
2. To study the utilization rate of OT month wise, department wise & shift wise.
3. To identify the reasons for rescheduling, postponements and cancellations of the surgeries in the study period.
4. To study the block times for Knee Replacement & Lower Section Caesarian Section.

5. MATERIALS & METHODS

The study is observational & **quantitative research** and was conducted in a **multispeciality hospital in Hyderabad over a period of four months**. **Convenience sampling** was used for data collection. The **primary data** were collected through the **observation method**, while **secondary data** were obtained from hospital records and documents. The **operation theatre utilization rate** was calculated by dividing the total time that the operating rooms were used for surgeries by the total time they were available for use. Formulae is represented below:

$$\text{OT Utilization Rate} = (\text{Total Time Used for Surgeries} / \text{Total Available Time}) \times 100$$

The result was expressed as a **percentage**, where a higher percentage indicates more efficient utilization of operating theatre resources. For the analysis of the collected data mean and **percentages** were used. Z test is done to know the significance difference in block time and standard time for **knee replacement surgery and lower segment caesarian section (LSCS)**.

LIMITATIONS

The study is limited for a period of 4 months. The findings cannot be generalized to all the multispeciality hospitals in Hyderabad.

5. RESULTS:

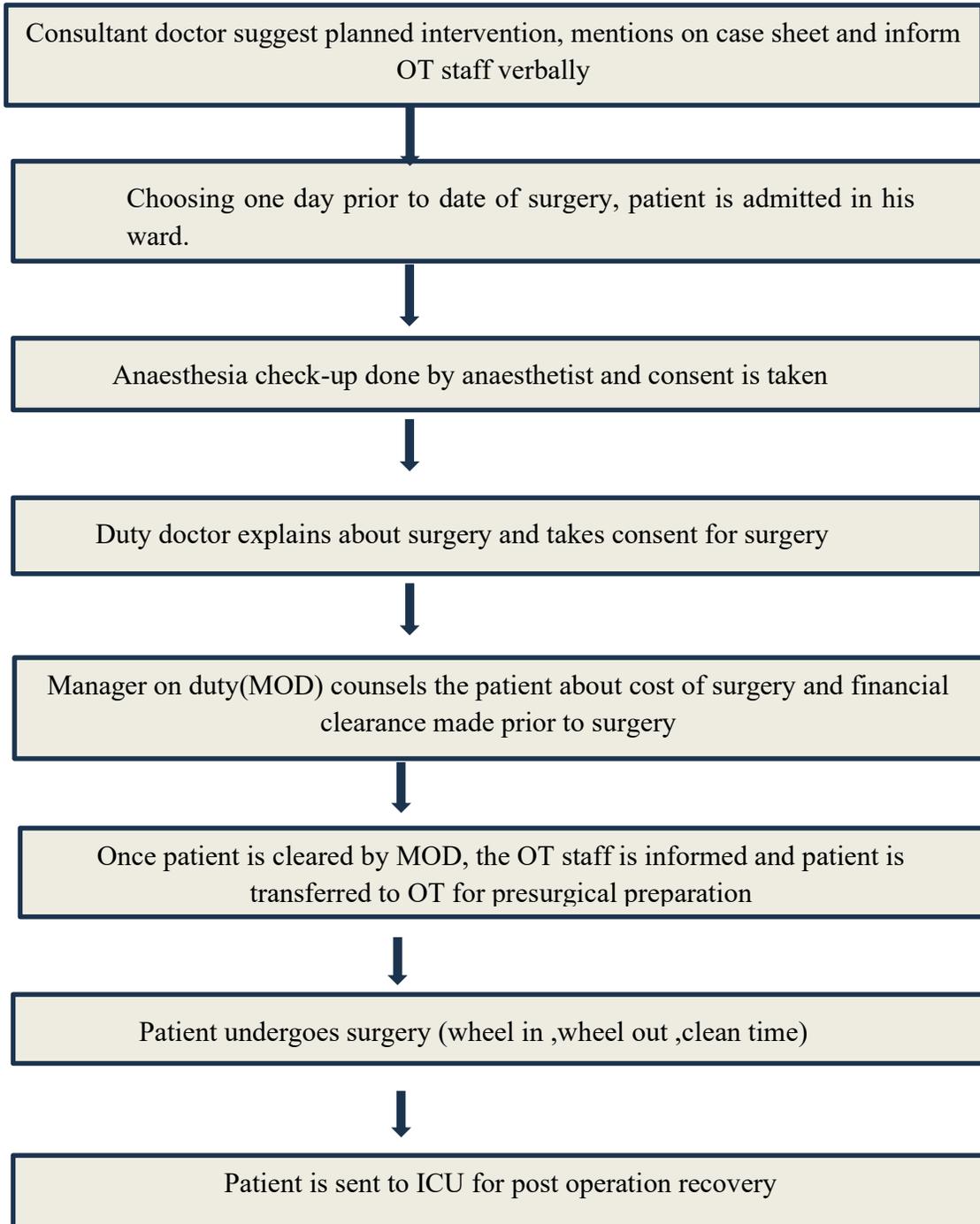


Fig 1 - Operation Theatre Process Flow



Figure 1 shows the process flow in Operation Theatre.

Allocation of departments to different OT

DEPARTMENTS	OPERATION THEATRE
General Surgery	O.T 2 AND O.T 3
Orthopaedics, Plastic Surgery & Neurosurgery	O.T 1
Gynaecology	O.T 2
Ent & urology	O.T 3

Table 1 – Departmental allocation of OT

Table 1 shows the departmental allocation of OT. OT 1 has the maximum number of departments.

UTILIZATION RATE

MONTH WISE UTILIZATION

Table 2 - Month Wise Utilization Rate

Months	Available time	Utilized time	Percentage utilized
March	22320	13689	61%
April	22320	14533	65%
May	22320	18265	81%
June	22320	15605	69%

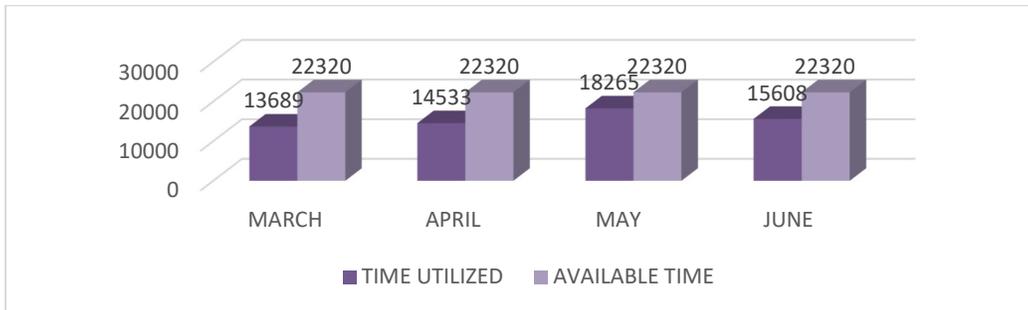


Fig 2 - Month Wise Utilization Rate



SHIFT WISE UTILIZATION

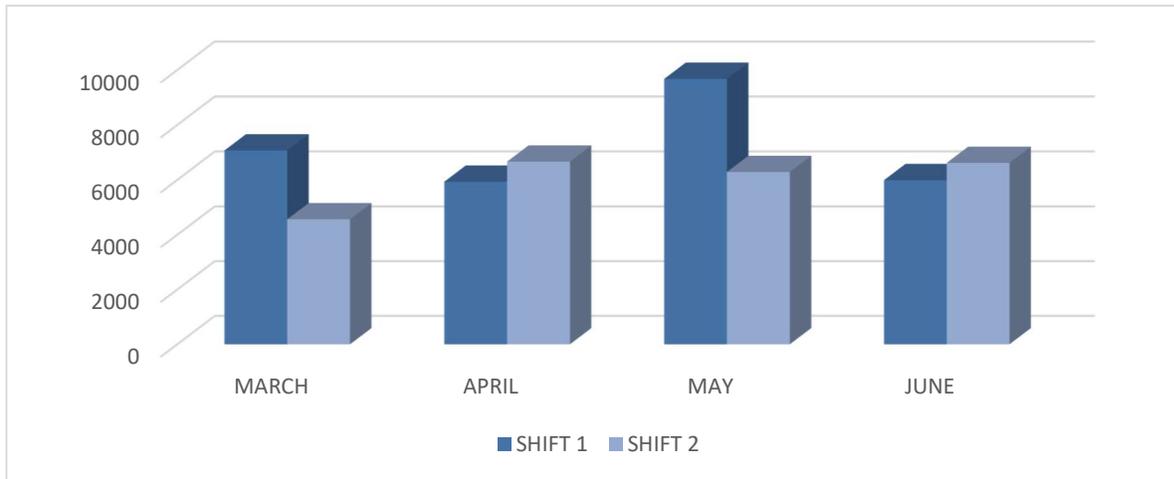


Fig 3 – Shift Wise Utilization

OT WISE UTILIZATION

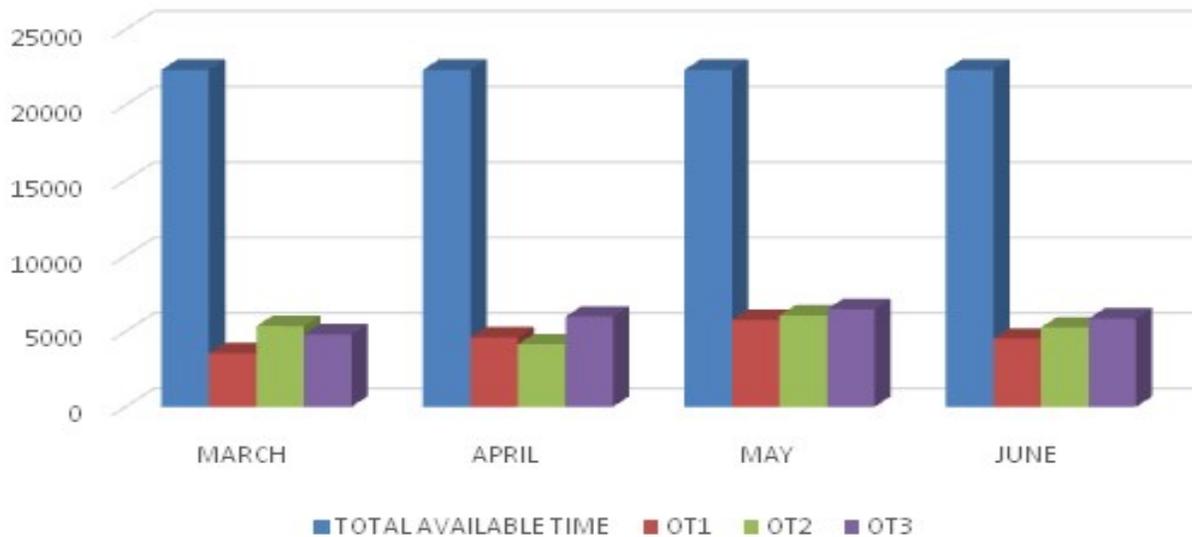


Fig 4 – OT Wise Utilization



DEPARTMENT WISE OT UTILIZATION

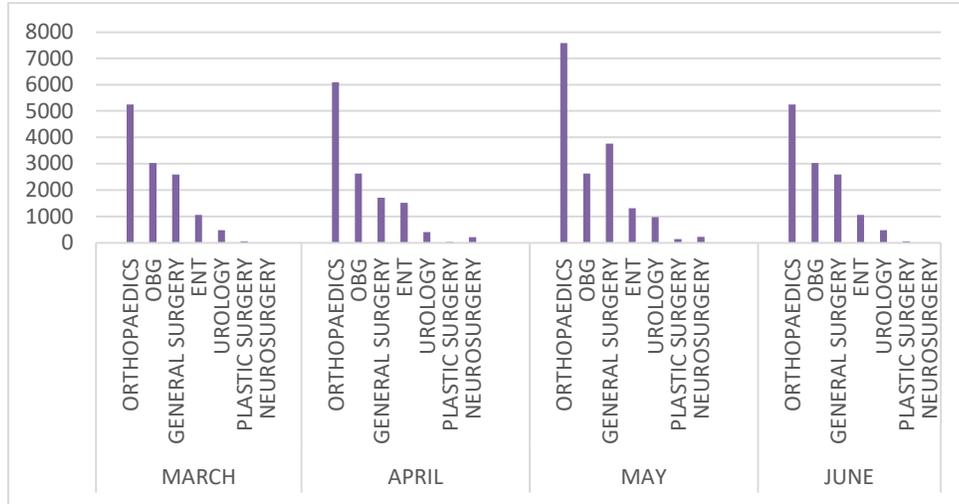


Fig 5 – Department wise utilization

MONTHLY DELAYS, POSTPONEMENTS AND CANCELLATIONS IN SURGERIES

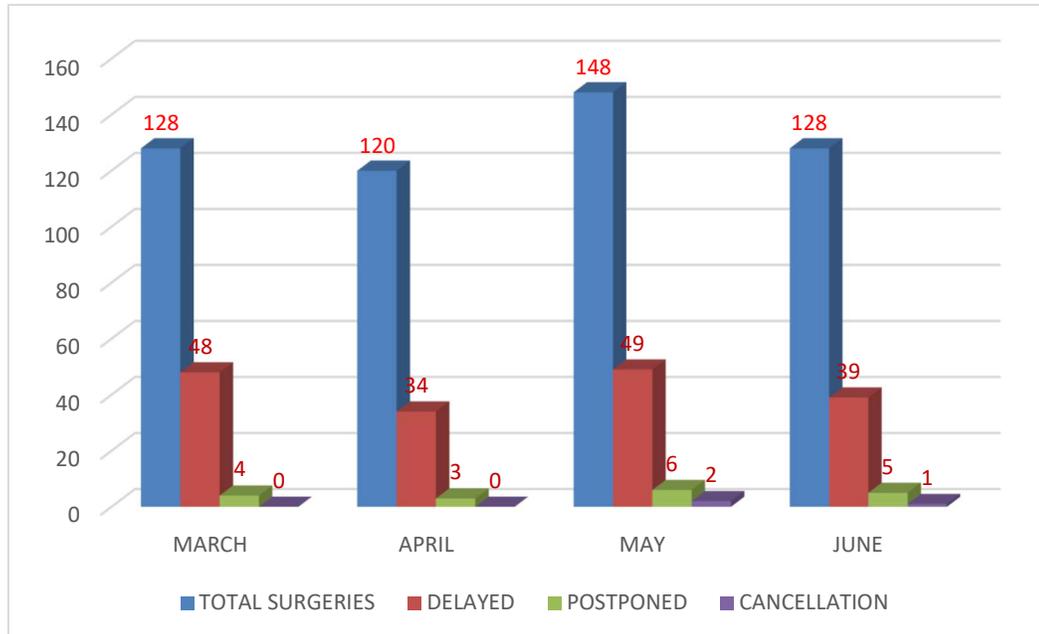


Fig 6 - Monthly Delays, Postponements and Cancellations in Surgeries



REASONS CAUSING RESCHEDULING, POSTPONE AND CANCELLATION

Table 3 - Reasons causing Rescheduling, Postpone and Cancellation

DOCTOR BUSY	18%
ROBO BUSY	14%
PATIENT RELATED	18%
INSURANCE TIE UP RELATED	12%
PLANNING HIGHER PROCEDURE	9%
IMPLANT NOT AVAILABLE	1%
WRONG BOOKING	3%
REASON NOT MENTIONED	25%

BLOCK TIME FOR TOTAL KNEE REPLACEMENT

Table 4 – Block time for total knee replacement

BLOCK TIME 180 MIN	NO OF SURGERY	< THEN 180	PERCENTAGE
MARCH	4	3	75%
APRIL	8	3	38%
MAY	13	5	39%
JUNE	6	3	50%

BLOCK TIME FOR LOWER SECTION CAESARIAN SECTION

Table 5– Block time for lower section caesarian section

BLOCK TIME 120 MIN	NO OF SURGERY	< THEN 120
MARCH	19	0
APRIL	11	0
MAY	21	0
JUNE	11	0

HYPOTHESIS TESTING

HO: There is no significant difference in the block time from that of standard time in knee replacement surgery.

H1: There is a significance difference in block time from that of standard time in knee replacement surgery.

Calculation of the Test Statistic (Z):

The following vaues show population mean, sample mean and standard deviation based on which Z statistic is calculated.



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$\mu=180$ min (Population mean)

$\tilde{x}=180.3$ min (sample mean)

$\sigma=36.18$ min

$n=30$

Following formula applied to calculate Z statistic:

$$Z = \frac{\tilde{x} - \mu}{(\sigma/\sqrt{n})}$$

$$= \frac{180.3 - 180}{(36.18/5.47)}$$

$$= 0.04$$

As 0.04 is less than level of significance 0.05, null hypothesis rejected & alternate hypothesis accepted. Therefore it is concluded that there is significance difference in block time from that of standard time in knee replacement surgery

6. DISCUSSION

- The **Operation Theatre (OT) utilization** was highest in **May (81%)**, followed by **June (69%)**, **April (65%)**, and **March (61%)**.
- Among the departments, **Orthopedics** had the highest OT utilization, followed by **Obstetrics and Gynecology**, **General Surgery**, **ENT**, **Urology**, **Plastic Surgery**, and **Neurosurgery**.
- In terms of theatre usage, **OT-3 was utilized the most**, followed by **OT-2** and **OT-1**.
- Overall, **both shifts showed almost equal utilization**, although variations were observed monthly. **Shift 1** had higher utilization in **March and May**, whereas **Shift 2** was more utilized in **April and June**.
- The **average number of surgeries performed per day was four**.
- Most **surgical delays occurred during the first shift**.
- The most common reasons for **delays and postponements** were **doctor unavailability or being busy**, followed by **robot (equipment) unavailability**, **patient-related issues**, **insurance-related delays**, **planning for higher procedures**, **implant unavailability**, and **unknown reasons**.
- The **highest number of delays and postponements occurred in May**, which also recorded the highest number of surgeries, followed by **March, June, and April**.
- With regard to **block time utilization**, out of **30 knee replacement surgeries**, **13 surgeries exceeded the allotted block time**, most frequently in **March**, followed by **June**.
- For **Lower Segment Caesarean Section (LSCS)**, all **62 surgeries were completed within the allocated block time**, indicating efficient time utilization.
- The **hypothesis testing using the Z-test** showed that there was a **significant difference between the actual surgery duration and the standard block time for knee replacement surgeries**, indicating that these procedures often take longer than the allotted time.

7. FINDINGS:

- **Operation Theatre Working Hours** - The operation theatre (OT) operates for 12 hours daily from 8:00 AM to 8:00 PM, divided into two shifts of 6 hours each. The remaining 12 hours (8:00 PM to 8:00 AM) and weekends are reserved for emergency surgeries only.



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- **Actual Surgical Start and End Time** - Although the OT is scheduled to start at 8:00 AM, surgeries usually begin at around 8:30 AM and are generally completed by 7:00 PM, resulting in a gap between the scheduled and actual utilization time.
- **Operation Theatre Staffing Pattern**
For each surgical procedure, the following staff members are typically required:
 - 1 Surgeon
 - 1 Assistant Surgeon
 - 1 Anaesthesiologist
 - 1 Scrub Nurse
 - 1 Circulating Nurse
 - 1 Staff Nurse
 - 1 OT Technician
 In addition to the above, the OT department has:
 - 8 nurses, with 4 nurses assigned per shift
 - 2 ayas (support staff)
 - 2 anaesthesiologists, who work on alternate days
- **Documentation and Record Maintenance** - The operation theatre utilization register is maintained but is generally updated only at the end of the month instead of on a daily basis. In addition, some entries in the OT register and related records are incomplete or improperly documented, indicating a need for improved documentation practices.
- **Capacity to Manage Emergency Surgeries** - With the availability of three operation theatres for 12 hours, the hospital performs an average of at least four surgeries per day. This capacity allows the OT to accommodate emergency cases when necessary, although staff availability may occasionally create constraints.
- **Cleaning and Infection Control Practices**
 - Surface cleaning is performed after every surgery.
 - Fumigation is conducted after handling infectious cases, including patients with HIV or other infections.
 - Used instruments and surgical materials are packed and sent to the Central Sterile Supply Department (CSSD) for sterilization.
 - Biomedical waste is segregated and disposed of in designated bins according to infection control guidelines.
 - The cleaning time between surgeries ranges from a minimum of 15 minutes to a maximum of 30 minutes.
- **Equipment and Safety Preparedness** - All equipment, implants, and crash carts are stored according to regulatory standards. These items are regularly checked, maintained, and updated to ensure patient safety and operational readiness.
- **Block Time Issues in Knee Replacement Surgeries** - In the case of knee replacement surgeries, approximately 50% of procedures exceed the allocated block time, which may lead to delays or rescheduling of subsequent surgeries. This may also reflect variations in surgical complexity or the learning curve of the surgeon.
- **Block Time Utilization in LSCS Procedures** - For Lower Segment Caesarean Section (LSCS) procedures, the allocated block time is 120 minutes, while most surgeries are completed within 90 minutes. This suggests that the block time could be reduced to improve scheduling efficiency and accommodate additional procedures.
- **Low Utilization of OT-I in the First Shift** - The first shift of OT-I often begins later than scheduled, resulting in lower utilization during the initial hours. This delay is mainly due to the assigned department surgeon attending outpatient consultations and completing inpatient rounds before starting surgeries.

8. SUGGESTIONS:

- **Expansion of Surgical Specialties** - Introduce additional surgical departments such as cardiology, ophthalmology, and oncology to broaden the hospital's service offerings and attract a larger patient base.
- **Adoption of Advanced Surgical Technologies** - Implement advanced surgical techniques including painless procedures, minimally invasive surgeries, fast-recovery methods, and robotic-assisted surgeries to enhance treatment quality and improve patient satisfaction.



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➤ **Providing OT Facilities to External Surgeons**

Encourage and facilitate the use of operation theatre facilities by external or visiting doctors who require surgical infrastructure, thereby increasing operation theatre utilization.

➤ **Follow-up with Patients Advised for Surgery** - Establish a system to contact and follow up with patients who were advised surgery but have not responded, to understand their concerns, provide clarification, and encourage them to proceed with the recommended treatment if appropriate.

➤ **Scheduled Time Slots for Surgeries** - Allocate specific time slots for particular types of surgeries or surgeons to prevent overbooking or underutilization of operation theatres and ensure efficient scheduling and optimal resource utilization.

➤ **Patient Education and Pre-Surgical Counseling** - Educate patients about the necessity of the surgery, estimated costs, pre-operative requirements, and post-operative care. Proper counseling can reduce last-minute cancellations and delays caused by patient-related issues.

➤ **Marketing and Community Outreach** - Promote the hospital and its surgical services through various media platforms and community outreach programs to increase awareness among the public about the availability of healthcare services.

➤ **Optimizing Surgical Start Times and Physician Scheduling** - Schedule the first surgery of the day at 8:00 AM and encourage surgeons to complete inpatient rounds before the scheduled surgical time, while conducting outpatient consultations after surgeries to ensure timely commencement of procedures.

9. CONCLUSION:

The **Operating Theatre (OT) Utilization Rate**, also known as the **Operating Room Utilization Rate**, is an important indicator in healthcare management that measures how effectively a hospital uses its operating theatres for performing surgical procedures. A higher utilization rate reflects efficient use of resources, while a lower rate indicates underutilization and inefficiencies. Factors such as surgical delays, postponements, cancellations, and procedures exceeding the allotted block time can contribute to reduced OT efficiency. The present study analyzed OT utilization on a **monthly basis, department-wise, and shift-wise** to understand the pattern of resource usage. The study also examined the **reasons for surgical delays, postponements, and cancellations** and evaluated the **block time utilization of common surgeries such as knee replacement surgery and lower segment caesarean section (LSCS)**. Furthermore, **hypothesis testing using the Z-test** was performed to determine whether the actual surgery duration exceeded the allocated block time, providing insights into operational efficiency and areas for improvement in OT management.

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