

OPERATION THEATRE UTILIZATION AT A QUATERNARY CARE HOSPITAL IN KENYA: ASSESSMENT AND OPTIMIZATION STRATEGIES

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

by

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Under the Supervision and Guidance of

Dr. Ritu Vashistha

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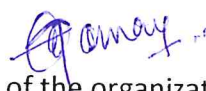
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This is to certify that dissertation titled '**Operation Theatre utilization at a Quaternary care hospital in Kenya: Assessment and Optimization strategies**' is a record of the research work undertaken by **Sana Shamoil** in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.



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Date **20-06-2025**



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DECLARATION BY STUDENT

I hereby declare that this dissertation titled '**Operation theatre utilization at a Quaternary care hospital in Kenya: Assessment and Optimization strategies**' is the Bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.


Name of the Student: Sana Shamoil

Date:

ACKNOWLEDGEMENT

This dissertation represents the conclusion of a significant academic chapter—one that has been both intellectually enriching and personally fulfilling. Its completion would not have been possible without the support, guidance, and encouragement I received from numerous individuals and institutions.

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Abstract:**Background:**

Efficient utilization of Operation Theatres (OTs) is a cornerstone of effective hospital management, especially in high-acuity settings like quaternary care hospitals. Optimal OT use not only ensures better allocation of hospital resources but also leads to reduced patient waiting times, minimized surgical backlogs, and improved clinical outcomes. However, many hospitals face challenges in achieving optimal OT efficiency due to factors such as unplanned delays, prolonged turnover times, last-minute cancellations, and poor coordination among surgical teams. These inefficiencies increase healthcare costs, reduce throughput, and negatively affect patient satisfaction and safety.

Objective:

The primary objective of this study was to assess the current status of OT utilization in a Quaternary Care Hospital in Kenya. It aimed to quantify the utilization rates, identify the primary causes of underutilization and inefficiencies, and propose practical, evidence-based strategies to optimize OT performance. The study was intended to provide a framework for better surgical service planning and resource management in similar healthcare settings.

Results:

A prospective observational study was conducted over 60 days to assess the utilization of five main operation theatres (OTs) in a quaternary care hospital, covering both scheduled and emergency surgeries. Data were collected from hospital records and direct OT observations, focusing on surgery timings, turnover durations, cancellations, and delays. Overall, OT utilization was notably low at 12.34%, with individual rates ranging from 3.25% to 6.77%. A total of 791 surgeries were performed—392 major and 399 minor—with the highest volumes in General Surgery (318 cases), Orthopedics (108), Gynecology (73), and ENT Surgery (55).

Key factors contributing to low utilization included prolonged turnover times, lack of standardized scheduling, overlapping bookings, and inadequate preparation. Resource allocation inefficiencies and poor communication among surgical, anesthesia, and nursing teams further affected performance. The study recommends implementing real-time scheduling systems, standardizing preoperative processes, improving interdepartmental coordination, and conducting regular audits and staff training to enhance OT efficiency and sustainability.

Conclusion:

The findings reveal significant underutilization of operation theatres in the hospital, driven by a combination of operational, procedural, and communication-related issues. To address these challenges, the study recommends a multipronged

approach involving the adoption of real-time scheduling tools, standardization of surgical and preoperative protocols, and better interdepartmental coordination. Implementing these strategies can significantly improve OT efficiency, reduce patient waiting times, enhance clinical outcomes, and optimize resource utilization. As healthcare systems strive for cost-effective and patient-centric care, focused efforts on OT optimization will be essential for long-term sustainability.

Keywords:

Operation Theatre Utilization, OT Efficiency, Healthcare Optimization, Quaternary Care Hospital, Surgical Workflow, Hospital Resource Management, Surgical Services, Turnaround Time, Scheduling Strategies.

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Chapter 1: Introduction

Purpose of the study:

The primary purpose of this study is to comprehensively evaluate the utilization of operation theatres (OTs) within a Quaternary Care Hospital in Kenya and to identify actionable strategies for their optimization. Operation theatres are among the most resource-intensive units in healthcare settings, requiring substantial investments in specialized staff, equipment, and infrastructure. Inefficient OT usage often leads to increased operational costs, extended patient waiting times, surgical backlogs, and diminished quality of healthcare delivery. This study seeks to systematically analyze the current OT utilization, identify key inefficiencies, and propose targeted interventions aimed at improving operational performance, patient outcomes, and resource management within the hospital.

Aim of the study

The overarching aim is to assess the efficiency and effectiveness of operation theatre utilization in the hospital and develop evidence-based strategies for optimization. By understanding existing practices and challenges, the study intends to contribute to improved surgical workflows, enhanced resource allocation, and better overall hospital service delivery.

Primary Objective

- To determine the current utilization rate of operation theatres at the Quaternary Care Hospital.

Secondary Objective

- To identify factors contributing to inefficiencies in OT scheduling, usage, and resource allocation.
- To assess the impact of surgical delays, cancellations, and prolonged turnover times on overall service delivery.
- To develop recommendations aimed at streamlining OT operations, improving scheduling efficiency, and enhancing interdepartmental communication.
- To support the hospital's goal of delivering timely, safe, and high-quality surgical care through improved OT management.

Clinical significance

Efficient operation theatre utilization is critically linked to patient care quality and

safety. Underutilization or mismanagement of OTs results in prolonged patient waiting times, delayed surgical interventions, and increased risk of clinical complications. In a quaternary care setting—where complex and time-sensitive surgeries are performed—the timely availability of OT time is essential for patient outcomes. Optimizing OT workflows enhances coordination among surgeons, anaesthetists, nursing staff, and other stakeholders, leading to improved patient safety, reduced perioperative risks, and higher patient satisfaction. Ultimately, efficient OT management supports the hospital’s mission to deliver effective, patient-centered care by minimizing unnecessary delays and ensuring surgical procedures are conducted within appropriate timeframes.

Financial Impact

Operation theatres represent one of the most expensive components of hospital infrastructure due to high costs associated with specialized personnel, equipment, consumables, and maintenance. Inefficiencies such as delays, cancellations, and extended turnover times increase the cost per surgical procedure by underutilizing available OT time and escalating staffing expenses. These inefficiencies not only waste valuable resources but also reduce hospital revenue by limiting the number of procedures that can be performed within a given period. By improving OT utilization, the hospital can reduce operational costs, optimize resource use, and increase throughput, thereby enhancing financial sustainability. Cost savings achieved through better OT management can be reinvested into improving other aspects of patient care and hospital infrastructure.

Operational Efficiency

Optimizing the operational efficiency of OTs involves minimizing idle theatre time, reducing turnaround durations between cases, and streamlining scheduling processes. Efficient OT management improves staff productivity, maximizes equipment use, and enhances the overall flow of surgical services. Standardized protocols and improved communication between surgical teams, anesthesia providers, and nursing staff help reduce cancellations and delays caused by poor coordination or resource shortages. Improved operational efficiency also decreases overtime work, limits staff burnout, and fosters a more organized and predictable work environment. Ultimately, enhanced OT efficiency supports higher surgical volumes, reduces patient backlogs, and ensures better alignment of hospital resources with patient care demands.

Chapter 2: Review of Literature

2.1 Introduction

Efficient utilization of operation theatres (OTs) is fundamental to delivering high-quality surgical care, optimizing resource use, and maintaining hospital financial health. This chapter presents a comprehensive review of relevant literature on OT utilization, common inefficiencies, and evidence-based optimization strategies. The review integrates global findings to highlight universal challenges and successful interventions, providing a solid framework to contextualize the current study conducted at a Quaternary Care Hospital in Kenya.

Table 2.1 Overview of Relevant Literature: Studies on OT Utilization and Optimization

Study Theme	Author & Year	Study Setting	Salient Features / Methodology	Key Findings / Implications
OT Utilization Assessment	Sheikh et al. (2021)	Tertiary Care Teaching Hospital	Observational study analyzing OT scheduling and utilization	Identified poor scheduling, inadequate staffing, and equipment shortages as key factors causing underutilization; recommended continuous monitoring and performance audits.
OT Utilization Assessment	Phadtare, Kodate, and Joshi (2022)	Teaching Hospital	Investigation into OT efficiency with a focus on surgical workflows	Highlighted late starts, early finishes, and inefficient patient flow as major contributors to reduced OT utilization and patient dissatisfaction.
Operation Room Time Utilization	Singh et al. (2019)	Various (General focus)	Time-motion study focusing on different phases of OT time use	Emphasized managing preparation, surgical, and cleaning times effectively to improve overall OT productivity and reduce idle time.

Operating Room Management	Al-Riyamiet al. (2019)	General healthcare settings	Systematic review advocating comprehensive operational reforms	Stressed the need for systemic interventions in OT management over isolated process fixes to address inefficiencies.
Impact of OT Inefficiencies	Macario (2010)	Global review	Literature synthesis on economic and operational consequences	Highlighted that inefficiencies lead to financial losses, increased operational costs, patient dissatisfaction, and staff burnout.
Optimization Strategies	Dexter et al. (2013)	Multiple US Hospitals	Implementation study of data-driven scheduling systems	Demonstrated that robust scheduling tools, standardization, and dedicated OT management teams improve utilization, reduce cancellations, and optimize staff coordination.
Optimization Strategies	Bortoluzzi et al. (2020)	University Hospital (Italy)	Mixed-methods study on OT workflow improvement	Showed that preoperative assessments, staff training, and enhanced interdepartmental communication significantly reduce turnover times and improve OT throughput.
OT Utilization & Efficiency	Van Veen-Berkx et al. (2018)	Teaching Hospital (Netherlands)	Retrospective analysis of OT scheduling and utilization data	Found that accurate case duration predictions and flexible scheduling reduce overtime and increase OT efficiency.

Factors Influencing OT Efficiency	Zafar et al. (2021)	Public Hospitals (Pakistan)	Cross-sectional study on OT delays and cancellations	Identified patient no-shows, equipment unavailability, and staff shortages as critical factors leading to OT inefficiencies in low-resource settings.
OT Utilization Benchmarking	Vinukondaiah et al. (2000)	General Hospital, India	Audit-based analysis of OT utilization and daily scheduling efficiency	Found overall OT utilization at just 46%, with most inefficiencies due to lack of standardization in scheduling and delays in patient readiness and transport.
Lean Healthcare Application	Guerriero & Guido (2011)	International (Systematic Review)	Survey of operational research methods applied to OT management, especially lean and queuing models	Highlighted how lean management, simulation, and queuing theory applications in OT scheduling can significantly enhance throughput and utilization efficiency.

2.1 Factors Contributing to OT Inefficiencies

Operation Theatre (OT) inefficiencies are a well-documented concern across various healthcare settings, from tertiary to quaternary care facilities. A comprehensive review of literature and empirical studies has identified several recurring factors that contribute to suboptimal OT performance. These are elaborated as follows:

1. Scheduling and Planning Deficiencies

Inaccurate estimations of surgical durations often lead to either overbooking or underutilization of OT slots. Overbooking results in rushed operations, increasing the risk of complications, while under booking leads to idle time and reduced throughput. Many hospitals lack adaptive scheduling systems capable of responding to changes in case complexity, emergency procedures, or unexpected delays. Additionally, rigid allocation of OT blocks to specific departments without room for dynamic adjustments leads to

inefficient use of available time.

2. Prolonged Turnaround Times

Turnaround time, or the interval between the end of one surgery and the start of the next, is a critical factor in determining OT efficiency. Delays in this period are commonly caused by prolonged cleaning processes, delayed patient transfer, slow setup of surgical instruments, and incomplete documentation. Studies suggest that even minor improvements in turnover protocols—such as concurrent task execution, well-trained housekeeping staff, and standardized cleaning checklists—can significantly increase the number of surgeries performed per day.

3. Delays and Cancellations

Surgical case cancellations are a major barrier to efficient OT utilization. Common causes include patient-related factors such as failure to arrive on time, lack of preoperative clearance, or last-minute medical issues. On the provider side, cancellations can occur due to surgeon or anaesthetist unavailability, malfunctioning equipment, unavailability of sterile supplies, or lack of postoperative beds. These cancellations not only waste valuable OT time but also contribute to increased waiting lists and patient dissatisfaction.

4. Resource Misallocation

Ineffective deployment of human and material resources often results in operational bottlenecks. Examples include inadequate staffing of anaesthetists or OT nurses, uneven distribution of surgical teams across theatres, and insufficient availability of critical instruments or consumables. Moreover, lack of standby staff for emergencies or technical support can paralyze operations in the event of unforeseen issues. A more flexible, real-time approach to resource allocation is necessary to ensure smooth functioning.

5. Communication Gaps

Breakdowns in communication among the surgical team, anaesthesia providers, nursing staff, and administrative personnel often lead to misunderstandings, missed updates, and redundant procedures. Such gaps can result in incomplete patient preparation, scheduling conflicts, or unavailability of critical support. Studies emphasize the need for structured communication tools—such as daily briefings, electronic status boards, and instant messaging platforms—to promote transparency and real-time coordination.

6. Patient Preparation and Preoperative Assessment Issues

Delays in patient preparation stem from incomplete investigations, missing consent forms, or delayed anaesthesia clearance. Inadequate preoperative assessments can lead to day-of-surgery cancellations or extended preparation times that disrupt the OT schedule. Implementing standardized preoperative assessment protocols, including timely pre-anaesthesia checkups and checklists, can help mitigate these disruptions.

7. Technological and Process Limitations

Many hospitals continue to rely on outdated manual booking systems, paper-based checklists, and disconnected data systems that limit the ability to respond to real-time changes. The absence of integrated OT management software prevents quick reallocation of slots, monitoring of real-time delays, and predictive planning. The adoption of modern technologies—such as AI-assisted scheduling tools, automated reminders, and digital dashboards—can greatly enhance the responsiveness and efficiency of OT operations.

In conclusion, OT inefficiencies are multifactorial and interlinked. Addressing these requires a combination of process optimization, workforce management, technology adoption, and cultural change toward continuous quality improvement. Hospitals that succeed in mitigating these inefficiencies are better positioned to deliver safe, timely, and patient-centered surgical care.

Chapter 3: Methodology

3.1 Study Approach

This study adopts a **prospective observational design** to evaluate Operation Theatre (OT) utilization at a quaternary care hospital in Kenya. A prospective approach enables the real-time collection of data as surgical activities unfold, providing a dynamic and accurate picture of current practices. The observational method ensures that no interventions are made, allowing natural workflows to be studied in their true operational context.

The primary aim is to measure how much of the available OT time is effectively used for patient- related surgical activities. Through detailed observation and analysis of OT schedules, occupancy durations, and workflow sequences, the study seeks to identify opportunities for optimization within existing resources and infrastructure.

3.2 Study Respondents

The study population includes **all patients undergoing surgical procedures (elective and emergency)** in the five main operation theatres of the hospital during the 60-day study period. The study will consider only those cases that require full use of OT infrastructure, including anesthesia, sterile conditions, and surgical teams.

Although no healthcare personnel are directly enrolled as research participants, the work of surgeons, anesthetists, OT nurses, and support staff (such as orderlies, biomedical technicians, and housekeeping) will be **indirectly observed** as part of the overall workflow assessment. Their roles are essential to understanding resource deployment and OT operational patterns.

3.3 Data Collection and Calculation

3.3.1 Data Collection Methodology – Prospective Data Extraction

Data for this study were collected on a real-time, prospective basis throughout the 60-day study period, ensuring that information was captured as surgical cases occurred, rather than relying on retrospective review. This approach allowed for the timely and accurate documentation of OT utilization patterns.

The data was extracted from multiple concurrent hospital information sources during the course of routine surgical operations, including:

- Electronic Health Records (EHR)

- Manual surgical logbooks maintained by OT staff

For every surgical case performed during the study period, the following data points were recorded contemporaneously:

- Date of surgery
- Name or ID of the operation theatre
- Type of surgery (categorized by department, e.g., General Surgery, Orthopaedics, Neurosurgery, ENT, Gynaecology)
- Classification of surgery (major or minor, as per hospital categorization)

This method of prospective data capture ensured minimal reliance on post-hoc record review and improved the precision of time-sensitive data, particularly where digital systems were incomplete or manually logged.

3.3.2 Calculation Methodology

The core metric of interest is **OT utilization**, which reflects the efficiency with which the hospital's operating theatres are being used.

Operation Theatre Utilization (%) =

(Total OT Occupied Time for All Cases / Total OT

Available Time) × 100 Where:

- **OT Occupied Time** = Total cumulative time during which the OT is physically occupied by surgical procedures (from patient entry to exit).
- **OT Available Time** = Total number of operational hours scheduled for each OT during the study period.

This metric allows the hospital to identify how much of the scheduled OT time is being used for its intended purpose (i.e., conducting surgeries) and how much remains unutilized or underutilized.

3.2 Inclusion & Exclusion criteria

Inclusion Criteria

- All elective and emergency surgical cases conducted in the five selected operation theatres during the 60-day study period.
- Surgical cases with complete documentation of:
 - Patient OT entry and exit times
 - Procedure type and specialty
 - Theatre ID

Exclusion Criteria

- Any procedures performed outside the selected five operation theatres (e.g., minor procedure rooms, endoscopy suites).
- Surgical cases with missing or incomplete records that prevent accurate calculation of OT occupancy time.
- Non-operative procedures that do not require full OT support (e.g., bedside procedures, catheterizations).

Table 3.1 Operational Definitions

To ensure consistency in measurement and analysis, the following definitions will be applied:

Term	Definition
Operation Theatre (OT)	A sterile, fully equipped facility where surgical operations are performed under anesthesia by qualified surgical teams.
OT Utilization	The percentage of available OT time that is used for active surgical procedures, measured from patient entry to patient exit.
Major Procedure	A complex surgery involving significant tissue manipulation, longer duration, and higher resource utilization, as defined by the hospital's internal classification.
Minor Procedure	A less complex surgery that is shorter in duration and generally involves fewer risks and resources.
Quaternary Care Hospital	A highly specialized medical institution providing advanced care, including complex surgeries and rare procedures, often functioning as a regional referral center.

3.6 Ethics and Implications of Research Ethical

Considerations

- **Institutional Approvals:** Prior to data collection, approval will be sought from both the **Institutional Ethics Committee (IEC)** of the hospital and the **University Ethics Committee**, ensuring alignment with national and international ethical guidelines for health research.
- **Non-Interventional Design:** As this is a non-interventional observational

study, patient care will not be altered in any way. Observations will be conducted passively, without influencing clinical decisions or workflows.

- **Confidentiality and Data Security:** All patient-related data will be de-identified before analysis. No names, medical record numbers, or personally identifiable information will be disclosed. Data will be stored securely in encrypted formats and will be accessible only to authorized personnel.
- **Consent and Staff Awareness:** Since direct patient interaction is not involved, individual patient consent is not required. However, staff involved in the OT processes will be informed about the study to promote transparency and ensure professional cooperation.

Implications of the Research

- The study will generate actionable insights into how OTs are currently being used and the extent to which existing resources are optimized.
- Findings may support hospital administrators in improving scheduling practices, capacity planning, and infrastructure utilization.
- The methodology may be replicated across similar facilities for benchmarking and quality improvement.
- The study contributes to the growing body of operational health research in the African context, particularly in high-acuity tertiary and quaternary care settings.

Chapter 4: Results

4.1 Overview of Surgical cases

Over the 60-day prospective study period, a total of **791 surgical cases** were conducted across five operation theatres (OTs) at the Quaternary Care Hospital. These surgical interventions were classified as either **major** or **minor** procedures based on the hospital's internal classification system.

- **Major Procedures:** 392 cases
- **Minor Procedures:** 399 cases

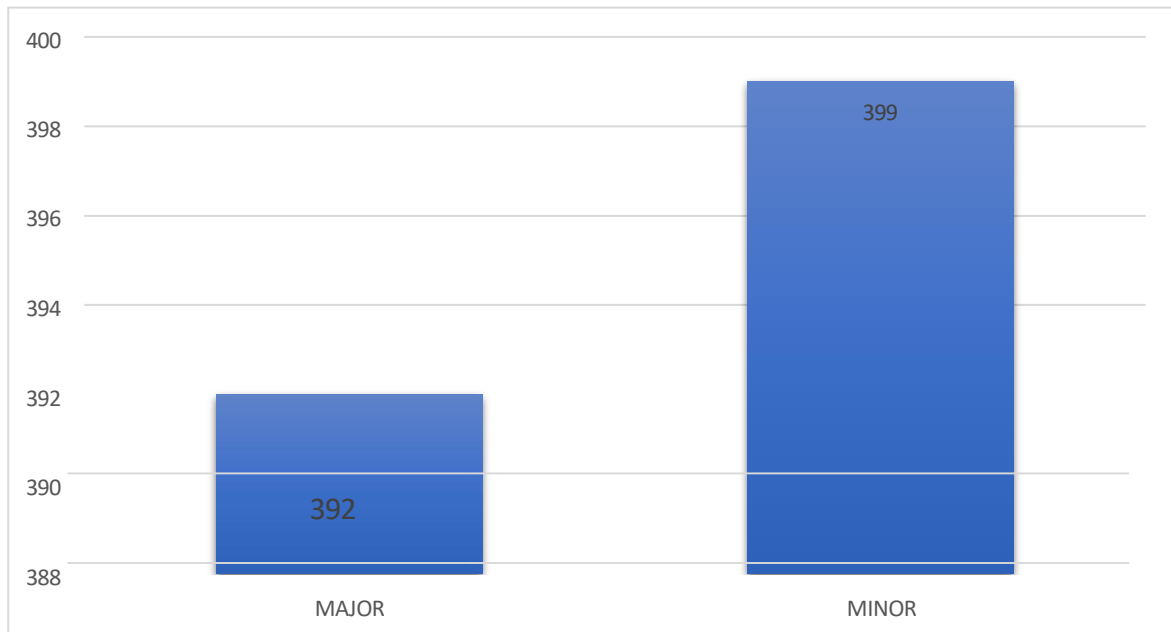


Figure 4.1: Comparison of OT Utilization for Minor vs. Major Surgical Cases

During the study period, a total of **791 surgical procedures** were performed in the Operation Theatres (OTs) of the hospital. These procedures were classified into **Major Procedures (392 cases)** and **Minor Procedures (399 cases)**. The distribution indicates a nearly equal caseload between high-complexity and low-complexity surgeries, with major procedures accounting for approximately 49.6% of the total workload, and minor procedures comprising around 50.4%.

This close parity between major and minor surgeries reflects the hospital's ability to manage a diverse and balanced surgical caseload on a routine basis. Major procedures typically involve greater surgical complexity, longer operating times,

and higher resource utilization, including skilled personnel, advanced equipment, and postoperative care. In contrast, minor procedures are generally less complex, involve shorter durations, and often require fewer resources.

The consistency in the distribution of these procedures suggests a well-established OT scheduling system that accommodates both types of cases efficiently. It also implies that the hospital's infrastructure, surgical teams, and operational protocols are equally well-prepared to handle both complex and routine surgeries. This balance is important in optimizing OT utilization, ensuring equitable access to surgical services, and maintaining the continuity of care.

Moreover, such a distribution can be interpreted as an indicator of effective case triaging and prioritization mechanisms within the surgical departments. It allows for better planning of surgical lists, optimal use of theatre time, and efficient manpower allocation.

In conclusion, the nearly equal number of major and minor procedures highlights the hospital's comprehensive surgical capabilities and suggests that it operates with a strategic balance between complexity and volume, which is crucial for the overall efficiency, cost-effectiveness, and quality of surgical care delivery.

4.2 Distribution of Cases by Department

During the study period, a total of 791 surgical procedures were performed across a wide spectrum of specialties, showcasing the multidisciplinary capabilities of the hospital. The data reveals a broad range of surgical interventions, spanning from high-volume general surgeries to more specialized, low-frequency procedures.

The highest number of surgeries was recorded in the General Surgery department, with 318 cases, representing approximately 40.2% of the total surgical workload. This is indicative of the department's central role in managing a wide array of abdominal, soft tissue, and emergency surgical cases.

Following General Surgery, Orthopaedics accounted for 108 procedures (13.6%), reflecting a significant demand for musculoskeletal interventions, including fracture management, joint surgeries, and trauma care. Gynaecological surgeries contributed to 73 cases (9.2%), highlighting the hospital's commitment to women's health services.

ENT (Ear, Nose, and Throat) Surgery registered 55 cases (7.0%), comprising procedures related to otolaryngology. Other specialties with notable surgical volumes included:

- Neurosurgery with 48 cases (6.1%)

- Urology with 46 cases (5.8%)
- Plastic Surgery with 21 cases (2.7%)
- Maxillofacial Surgery with 19 cases (2.4%)

Specialties such as Cardiothoracic Surgery (27 cases), Gastroenterology (24 cases), and Paediatric Surgery (11 cases) also contributed to the surgical caseload, indicating a comprehensive range of specialized services.

Smaller yet essential contributions were made by departments such as Haematology, Psychiatry, Oncology, Ophthalmology, Anesthesia, and Chest Physiotherapy, whose roles, though numerically limited in surgical volume, are critical to patient care and perioperative management.

Table 4.1 summarizes the full distribution of surgical cases by department:

Department	No. of Cases
Anesthetist	10
Breast	9
Cardio	27
Chest Physio	2
ENT Surgery	55
Gastro	24
General Surgery	318
Gynaecology	73
Haematologist	4
Maxillofacial	19
Neurosurgery	48
Oncologist	2
Ophthalmologist	10
Orthopaedics	108
Paediatric Surgery	11
Plastic Surgery	21

Psychiatrist	4
Urology	46
Total	791

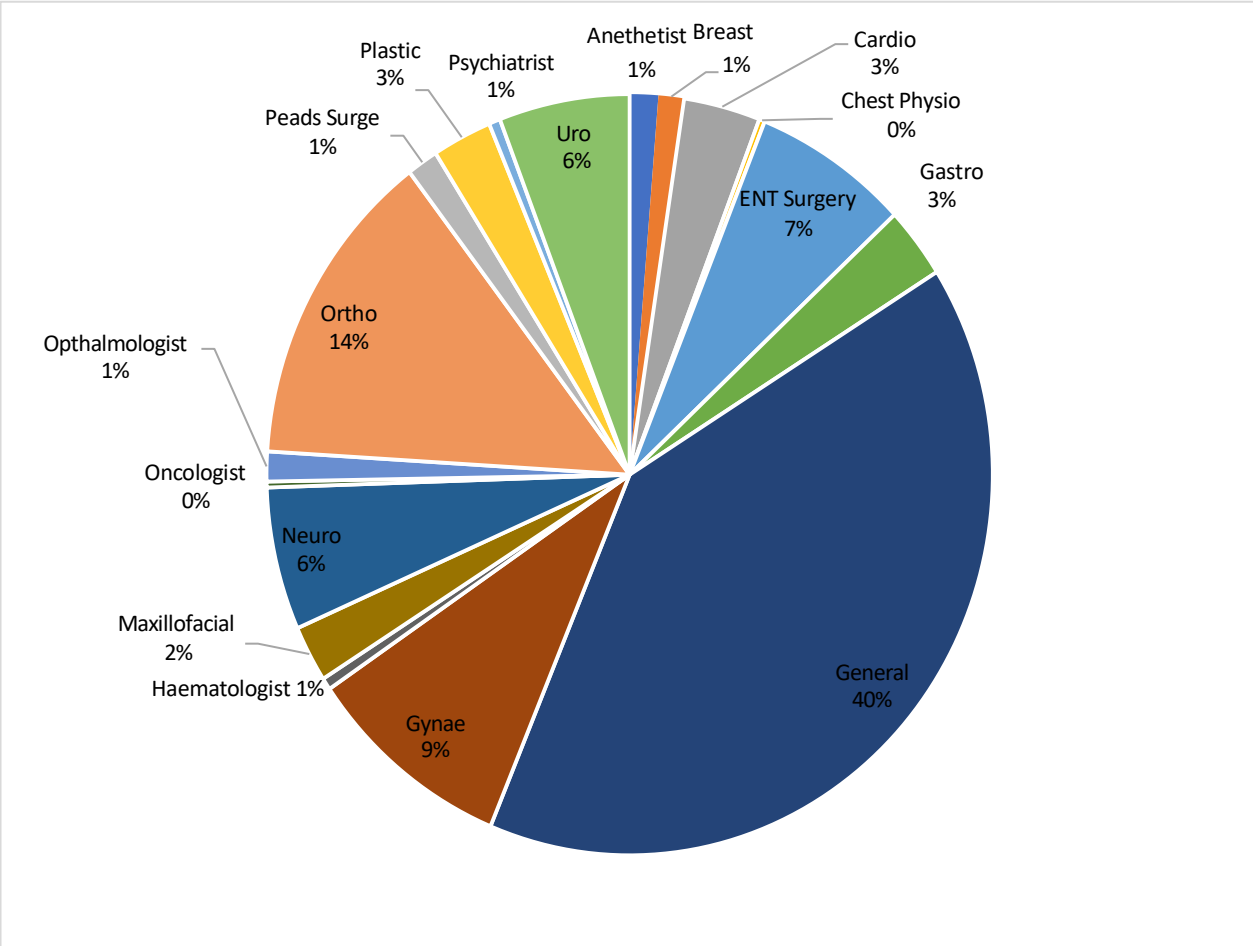


Figure 4.2: Percentage Distribution of OT Utilization Across Departments

4.3 Operation Theatre Utilization Rates

Operation Theatre (OT) utilization is a key performance indicator reflecting the efficiency and effectiveness of surgical service delivery within a hospital. It is defined as the proportion of the total available OT time that is actively used for surgical procedures. Optimizing OT utilization is critical for maximizing surgical throughput, resource allocation, and overall hospital productivity.

In this study, OT utilization was calculated by measuring the actual time each OT was occupied for surgical procedures relative to the total available OT time during the 60-day study period. Each OT was operationally available for 12 hours per day, resulting in 86,400 minutes (12 hours $\times$ 60 days) of potential resource time per OT. Considering the hospital's five OTs, the combined total available OT time amounted to 432,000 minutes (5 OTs $\times$ 86,400 minutes).

Overall Utilization

The combined utilization across all five OTs was found to be only **12.34%**, indicating that just over one-eighth of the total available OT time was actually used for surgical cases during the study period. This utilization percentage is **substantially lower** than optimal benchmarks, which typically range between 60-85% in efficiently managed tertiary and quaternary care hospitals.

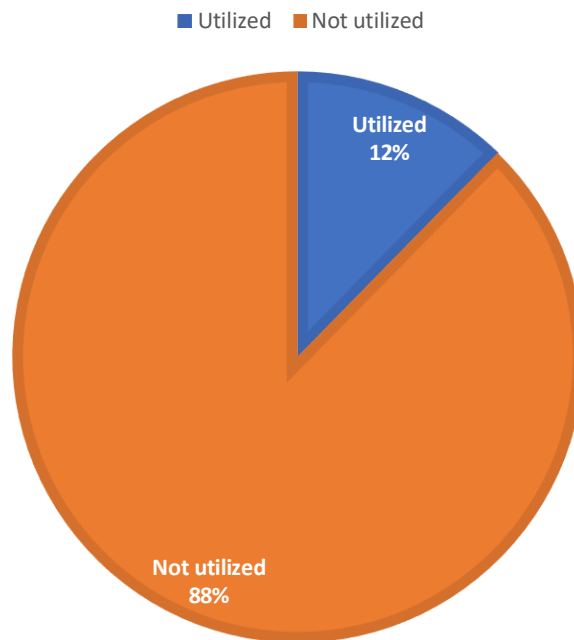


Figure 4.3: Utilization of Available OT Hours

Individual Operation Theatre Utilization

A closer analysis of the utilization rates of each individual Operation Theatre (OT) reveals the extent of underutilization at the hospital. Despite having five fully functional and resource- equipped OTs, none of them came close to the internationally accepted benchmarks for efficient OT use, which typically range between 70% and 85%.

The breakdown of individual OT Utilization over the 60-day study period is as follows:

- **OT1: 3.41% Utilization**

- This OT recorded the second-lowest utilization rate, indicating that it remained idle for more than 96% of its available time. Such a low usage rate suggests either a lack of surgical scheduling in this theatre or frequent cancellations and underbooking. This underutilization represents a missed opportunity to increase surgical throughput and revenue generation.

- **OT 2: 3.25% Utilization**

- OT 2 showed the lowest utilization of all five theatres. This might be attributed to dedicated allocation to a department with fewer scheduled surgeries or possible staffing or equipment limitations that restricted its effective use. This data point strongly emphasizes the need to revisit OT allocation strategies and scheduling logic.

- **OT 3: 5.99% Utilization**

- While marginally better, OT 3 still operated at less than 10% of its capacity. This low usage suggests similar issues as above, potentially including poor coordination, lack of prioritization for elective cases, or limited surgeon availability. Although the improvement compared to OT 1 and OT 2 is visible, the figure is still far below acceptable performance thresholds.

- **OT 4: 6.04% Utilization**

- OT 4 showed slight improvement over OT 3 and may have been used for a mix of minor and major procedures. Despite this, the OT remained underutilized for more than 93% of the total available

time. This raises questions about the efficiency of daily planning, the time taken between cases (turnover), and overall throughput.

- **OT 5: 6.77% Utilization**

- OT 5 had the highest utilization rate among the five, yet still fell drastically short of ideal usage. At only 6.77%, this theatre was also inactive for the majority of the time. The relatively better performance may indicate that this OT was assigned to a high-volume or high-complexity specialty (e.g., general surgery or orthopaedics), yet even that could not push its utilization into an efficient range.

Interpretation:

These low individual OT utilization figures collectively point to systemic inefficiencies in surgical scheduling, theatre allocation, and process management. The near-identical performance across all theatres suggests that the issue is not isolated to specific OTs or departments, but rather embedded in the operational model of the OT complex.

Key implications include:

- **Inefficient Block Allocation:** Fixed block allocation to departments that may not consistently fill their time slots contributes to idle theatre time.
- **Lack of Real-Time Scheduling Flexibility:** The inability to dynamically reassign unused OT time to other departments or emergency cases limits effective resource use.
- **Delays and Turnaround Time:** Extended intervals between cases due to inadequate cleaning protocols, slow patient preparation, or lack of surgical readiness can significantly reduce usable OT hours.
- **Poor Demand Forecasting:** Without accurate projections of daily surgical volume, theatres may be over-resourced on days of low demand or underutilized despite available cases.

Conclusion

1. The analysis reveals critically low utilization of individual OTs, with the best-performing OT operating at just 6.77%.
2. This falls far below global efficiency benchmarks of 70–85%, indicating severe underuse of high-cost infrastructure.

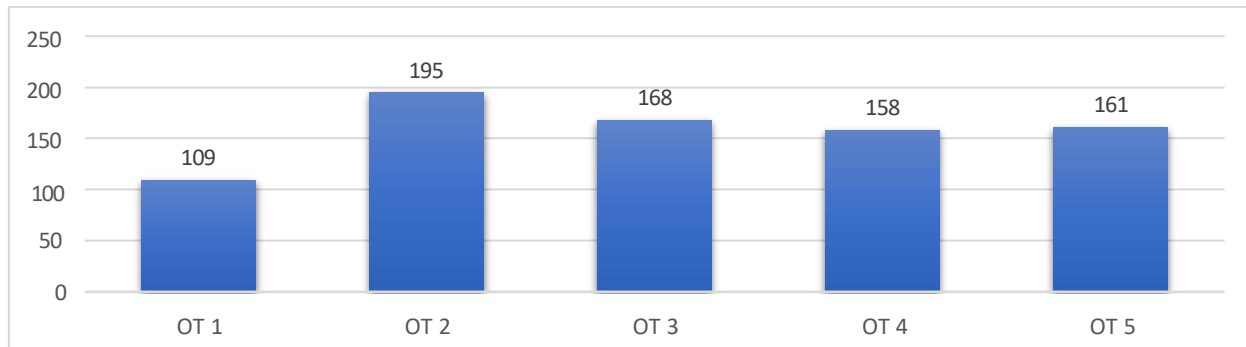
3. The uniformly low utilization across all OTs suggests systemic issues rather than isolated department-level problems.
4. Key contributing factors include rigid block scheduling, poor forecasting, and absence of real-time scheduling systems.
5. Low OT use limits surgical capacity, delays patient care, and reduces potential hospital revenue.
6. It also leads to inefficient use of skilled personnel and impacts staff morale due to unpredictable work routines.
7. Improving utilization requires digital scheduling tools, better resource allocation, and standardizing turnaround processes.
8. Interdepartmental coordination and daily planning meetings can enhance case readiness and theatre use.
9. Monitoring key performance indicators (KPIs) helps drive accountability and continuous improvement.
10. Overall, systemic operational redesign is essential to unlock the full potential of the hospital's OT services.

Table 4.2: Operation Theatre Utilization Summary – Monthly Overview:

OT	Total Procedures	Total Resource Hours (mins)	Hours Utilized (mins)	Hours Not Utilized (mins)	% Utilized	% Not Utilized
OT1	109	86400	7364	79036	3.41%	96.59%
OT2	195	86400	7022	79378	3.25%	96.75%
OT3	168	86400	12928	73472	5.99%	94.01%
OT4	158	86400	13038	73362	6.04%	93.96%
OT5	161	86400	14632	71768	6.77%	93.23%
Total	791	432000	53321	378679	12.34%	87.66%

These results clearly indicate significant underutilization of the hospital's surgical infrastructure. Despite having five fully equipped Operation Theatres, even the most efficiently used OT (OT5) operated at less than 7% of its available capacity during the study period. This level of performance is far below internationally

accepted efficiency benchmarks and highlights critical gaps in scheduling, planning, and resource management. Such underutilization not only leads to



financial inefficiencies but also limits the hospital's ability to meet surgical demand and serve more patients. The findings call for immediate operational reforms to enhance scheduling flexibility, improve interdepartmental coordination, and fully leverage existing OT resources.

Figure 4.4: Operation theatre – wise utilization (%) over the study period:

4.4 Departmental Contribution to Total Utilized Time

Beyond merely counting the number of surgical procedures performed, understanding the departmental contribution to Operation Theatre (OT) usage provides deeper insight into how surgical resources are consumed across specialties. This analysis involved calculating the total number of minutes each department utilized the theatres during the 60-day study period and expressing this as a percentage of the available OT time per theatre.

The data indicates that General Surgery accounted for the highest occupancy of OT time, reflecting its large surgical volume and often complex procedures that require longer operative durations. Specifically, General Surgery utilized 17,008 minutes, which corresponds to 19.69% of the available OT time for a single theatre (86,400 minutes over 60 days). This significant share underscores the pivotal role General Surgery plays in the hospital's surgical workload and resource consumption.

Following General Surgery, Orthopaedics utilized 8,243 minutes, representing 9.54% of the available OT time per theatre. Orthopaedic surgeries, often involving fractures, joint replacements, and trauma management, are typically resource-intensive and time-consuming, justifying their substantial OT utilization.

Neurosurgery and Gynaecology also made major contributions, with

neurosurgical cases occupying 6,044 minutes (7.00%) and gynaecological surgeries using 5,884 minutes (6.81%) of OT time respectively.

Other departments with notable OT utilization include:

- Urology: 3,387 minutes (3.92%)
- ENT Surgery: 3,173 minutes (3.67%)
- Cardiothoracic Surgery: 3,090 minutes (3.58%)
- Plastic Surgery: 1,617 minutes (1.87%)
- Maxillofacial Surgery: 1,530 minutes (1.77%)

Departments with lower volumes or shorter procedures, such as Anesthetist, Breast Surgery, Chest Physiotherapy, Haematology, Oncology, Ophthalmology, Paediatric Surgery, and Psychiatry, collectively contributed smaller proportions of OT time.

Table 4.3 below summarizes the departmental OT time utilization:

Department	No. of Cases	Time Utilized (mins)	% of OT Time Used (per OT)
Anesthetist	10	195	0.23%
Breast	9	525	0.61%
Cardio	27	3,090	3.58%
Chest Physio	2	65	0.08%
ENT Surgery	55	3,173	3.67%
Gastro	24	740	0.86%
General Surgery	318	17,008	19.69%
Gynaecology	73	5,884	6.81%
Haematologist	4	120	0.14%
Maxillofacial	19	1,530	1.77%
Neurosurgery	48	6,044	7.00%
Oncologist	2	310	0.36%
Ophthalmologist	10	550	0.64%

Orthopaedics	108	8,243	9.54%
Paediatric Surgery	11	785	0.91%
Plastic Surgery	21	1,617	1.87%
Psychiatrist	4	55	0.06%
Urology	46	3,387	3.92%
Total	791	53,321	61.71% of one OT's capacity

The total utilized time by all departments combined was 53,321 minutes, representing 61.71% of the total available capacity of one OT over the 60-day period. When this total is distributed across all five OTs, it corresponds to the overall utilization rate of 12.34%, as previously reported in Section 4.3.

Implications:

This departmental breakdown highlights not only the workload distribution but also the resource intensity across specialties. Departments like General Surgery, Orthopaedics, Neurosurgery, and Gynaecology dominate OT utilization, suggesting these units should be prioritized for process improvements, scheduling optimization, and capacity enhancement to improve overall OT efficiency.

Conversely, departments with smaller contributions may benefit from flexible scheduling or shared OT time to better match their case complexity and volume.

4.5 Utilization Rate of Operation Theatres:

Table 4.4 Overall Operation Theatre Utilization – Aggregate Summary:

TOTAL TIME UTILISED	TOTAL RESOURCE HOURS (IN MINS)
53321	86400*5 = 432000

TOTAL PERCENTAGE OF OT(s) UTILISED	12.34%
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Calculation:

- Total Time Utilized: 53,321 minutes This represents the cumulative duration during which surgeries were actively performed across all OTs during the observation period.
- Total Resource Hours Available:

$$= 86,400 \text{ minutes/day} \times 5 \text{ days} = 432,000 \text{ minutes}$$

This value is derived by multiplying the total number of OT minutes available per day (assumed as 86,400 minutes) by the number of days in the study period. This includes all OTs and assumes full-day availability for elective or emergency procedures.

- OT Utilization Rate:

$$= (53,321 / 432,000) \times 100 = 12.34\%$$

Interpretation

The OT utilization rate during the study period was found to be 12.34%. This means that only 12.34% of the total available OT time was actually used for performing surgical procedures.

This low utilization rate is indicative of significant underuse of OT capacity. Such underutilization could be attributed to multiple factors, including but not limited to:

- Delays in patient preparation or anesthesia induction
- Inefficiencies in theatre cleaning and turnover
- Cancellation or postponement of scheduled cases
- Lack of coordination in scheduling and resource allocation
- Underreporting of actual usage due to manual documentation errors

4.6. Analysis of Utilization Data

The findings from this study expose a critical inefficiency in the utilization of Operation Theatres (OTs) within the Quaternary Care Hospital. With OTs being one of the most resource-intensive areas in any hospital, their underutilization has significant implications not just for institutional efficiency but also for patient access, financial sustainability, and clinical outcomes.

4.6.1 Overall OT Utilization vs. Global Benchmarks

The overall OT utilization rate was recorded at only 12.34%, which is drastically below globally recognized benchmarks for efficient surgical facilities, typically ranging from 70% to 85% (Macario, 2010; Dexter et al., 2013). These benchmarks represent an optimal operating balance where:

- Theatres are sufficiently busy to justify the costs of personnel, utilities, and equipment,

- Yet not overbooked to the point of causing surgical delays, staff burnout, or compromised quality of care.

The 87.66% of unutilized OT time across the five theatres underscores a massive gap between capacity and actual usage. This shortfall suggests that valuable institutional resources, including infrastructure, surgical staff, equipment, and sterilization facilities, are not being effectively leveraged.

4.6.2 Individual Operation Theatre Performance

When broken down by individual theatres:

- OT1 and OT2 were the worst performers, with utilization rates of just 3.41% and 3.25% respectively. These figures indicate that on most days, the theatres remained either idle or significantly underused.
- OT5, which recorded the highest usage, still only reached a maximum utilization of 6.77%, far below even the minimum threshold of acceptable operational efficiency.

This uniformity in low usage across all five theatres suggests a systemic operational issue rather than localized inefficiencies. It indicates that challenges are embedded within scheduling systems, governance models, and broader hospital workflow structures rather than being restricted to specific personnel or departments.

4.6.3 Departmental Contribution to OT Utilization

Analyzing departmental contributions to the total utilized OT time provides important context:

- General Surgery was the most frequent user, contributing to 19.69% of total OT time, followed by Orthopaedics (9.54%), Neurosurgery (7.00%), and Gynaecology (6.81%).
- This is consistent with these specialties handling a higher surgical caseload, and/or more complex procedures requiring longer operative times.

However, despite these contributions, no department alone—or in combination—was able to significantly elevate total OT occupancy. This reveals that even high-volume departments are operating well below their potential capacity, likely due to inefficient scheduling, delays, and poor coordination.

Interestingly, departments such as Cardiothoracic Surgery and Neurosurgery, although handling fewer cases, recorded longer OT occupancy per procedure. This

suggests that case complexity and procedure duration are not being adequately accounted for in scheduling, resulting in underutilization and time wastage.

4.7 Systemic Operational Inefficiencies Identified

From the utilization data, several potential causes of underperformance can be inferred:

a) Inefficient Scheduling Protocols

- The current scheduling mechanism may not be optimized to accommodate variations in case duration, emergency add-ons, or surgeon availability.
- Fixed scheduling slots may not reflect real-time demand or dynamic prioritization of cases, leading to gaps in the OT calendar.

b) Delayed start times and early closures

- Daily operations may be hindered by late first-case starts, often caused by delayed patient shifting, unavailability of surgical staff, or incomplete pre-operative assessments.
- OTs may close early even when additional cases could have been accommodated, pointing to poor time management.

c) Prolonged Turnover Times

- Excessive time taken for post-operative cleaning, sterilization, and setting up equipment for the next case reduces OT productivity.
- Delays in the recovery room, transport logistics, or document finalization also contribute to extended non-operative hours.

d) Rigid Theatre Allocation and Resource Silos

- The practice of assigning specific OTs to specific departments on fixed days results in unused blocks when departments have fewer cases.
- There is little evidence of adaptive OT utilization, where unused time can be reallocated to other departments with higher caseloads.

e) Resource and staffing constraints

- Limited availability of trained staff (nurses, anaesthetists, and surgical assistants) may prevent optimal use of available OT infrastructure.
- Equipment shortages, delayed sterilization, or malfunctioning devices can further disrupt planned schedules.

4.8 Latent Capacity and Opportunity Cost

Despite the hospital having five well-equipped operation theatres and the capacity to support a much higher surgical throughput, only 61.71% of the OT capacity of one single OT (86400 minutes) was used across all departments in 60 days. When divided across five theatres, this yielded the dismal 12.34% utilization rate.

This suggests a huge latent capacity that, if unlocked, could dramatically improve:

- Surgical access for patients
- Institutional revenue from increased case volume
- Clinical team engagement and skill development
- Return on investment for expensive OT infrastructure

The opportunity cost here is significant. Every minute of unused OT time translates into:

- A patient not getting operated on
- A surgical team remaining idle
- Equipment and facilities being under-leveraged
- A financial loss in terms of unscheduled, reimbursable procedures

Implications:

The low OT utilization reflects both an operational and strategic challenge. From an operational standpoint, the hospital is not maximizing the value of existing assets, leading to wasted resources and lost revenue. From a patient care perspective, underutilization may contribute to longer waiting times for surgical procedures, affecting clinical outcomes and patient satisfaction.

Chapter 5: Discussion

This chapter interprets the key findings outlined in Chapter 4 by situating them within the broader context of hospital operations, surgical service delivery, and health system efficiency. The discussion not only analyzes the implications of low Operation Theatre (OT) utilization but also explores the systemic and operational factors contributing to this underperformance. Strategic insights are provided to pave the way for informed decision-making and process optimization in OT management.

5.1 Summary of Key Findings

The analysis of OT usage over a 60-day period revealed significantly low overall OT utilization, with the combined rate across five operation theatres standing at 12.34%. This is far below the globally accepted benchmarks of 70% to 85%, which are considered indicative of well-functioning surgical services in tertiary and quaternary care hospitals.

Each OT individually performed below par, with utilization ranging from 3.25% to 6.77%. This stark underutilization is alarming, especially in a high-capacity facility equipped for a broad spectrum of surgical interventions.

Despite performing 791 procedures during the study period—a substantial number—the resource utilization remained inefficient. This suggests that surgeries were spread thinly across time and space, with large proportions of daily theatre hours left unused.

The General Surgery department was the largest contributor, accounting for 19.69% of total OT time utilized, followed by Orthopaedics (9.54%), Neurosurgery (7.00%), and Gynaecology (6.81%). It was also noted that certain specialties, such as Cardio and Neuro, though contributing fewer cases, consumed disproportionately higher OT time per case—indicating a high level of procedural complexity.

5.2 Interpretation of Underutilization

The persistently low OT utilization observed in this study can be attributed to a complex interplay of systemic, procedural, and administrative inefficiencies, which are explored below.

5.2.1 Inefficient OT Scheduling

The absence of an optimized scheduling mechanism appears to be a primary contributor to OT underuse. In many instances, OT blocks may not have been filled to capacity, and surgeries were likely spread out with large gaps between cases. This results in underutilized time slots, particularly when departments have

no backup cases prepared or when surgical volumes are inconsistent.

5.2.2 Delays in Start and Turnover Times

One of the most commonly cited causes of low theatre productivity is delay in first-case start times and prolonged turnover times between cases. Factors such as:

- Late patient arrival
- Unavailable instruments or surgical kits
- Delays in anaesthesia preparation
- Slow post-operative cleaning and setup

all contribute to unproductive idle time within the OT environment. Even small delays can accumulate into significant time losses over the course of a day.

5.2.3 Inadequate Co-ordination Across Departments

Surgical operations require seamless collaboration between various departments—surgeons, anaesthetists, nurses, porters, and central sterile services. Breakdowns in communication or coordination—such as patients not being prepped on time, or anaesthesia teams not being informed of case urgency—lead to workflow bottlenecks. These delays compound into underutilization at the system level.

5.2.4 Inflexible Resource Allocation

The allocation of specific OTs to certain departments on designated days without consideration of real-time demand creates inefficiency. When a department has no scheduled cases or fewer surgeries than time allotted, the unused time remains locked unless policies allow dynamic reassignment. This rigid model limits the ability of the hospital to maximize OT utility based on actual case volumes.

5.2.5 Limited Surgical Case Load

Although 791 procedures were conducted, this number may still fall short of the potential capacity of the OTs. Barriers such as:

- Limited referrals from outpatient departments
- Financial constraints affecting patient decisions
- Equipment shortages
- Unavailability of operating staff or specialists

may be restricting the number of scheduled procedures, thereby suppressing theatre demand and utilization.

5.3 Comparison with Existing Literature

When compared with findings from other tertiary and quaternary hospitals in countries like India, South Africa, the UK, and the U.S., the utilization rates observed in this study are lower. Literature consistently reports OT utilization in the range of 70%–85% in efficient institutions, supported by robust scheduling systems, lean operations, and performance audits.

For example:

- A study from a tertiary hospital in India reported a 78% OT utilization after implementation of electronic scheduling.
- A UK-based hospital achieved 81% utilization through multidisciplinary pre-op huddles and daily performance feedback loops.

Challenges such as delayed first-case starts, long turnovers, and high cancellation rates are common globally, but the extent of underutilization in this hospital is comparatively severe, suggesting deeper structural or process-related issues that need targeted intervention.

5.4 Impact on Hospital Performance

Low utilization of Operation Theatres (OTs) has wide-reaching implications that affect nearly every aspect of hospital performance, both clinically and operationally.

1. Clinical Impact

Suboptimal OT usage can lead to delays or cancellations of surgeries, directly affecting patient care. For patients with time-sensitive conditions such as cancer, trauma, or cardiovascular issues, these delays may result in the worsening of their condition, increased anxiety, or even irreversible complications. Long wait times also erode patient trust and satisfaction, which are critical indicators of hospital quality.

1. Operational Inefficiency

OTs are among the most resource-intensive units in any hospital. They require continuous availability of skilled staff, high-cost equipment, strict sterilization protocols, and uninterrupted utility services. When surgeries are not scheduled or conducted efficiently, these fixed costs persist without yielding proportional clinical output. As a result, the cost per surgical case increases significantly, reducing overall operational efficiency.

2. Revenue Loss

Surgical services often account for a substantial portion of a hospital's total revenue. Underutilization of OTs results in fewer billable procedures, thereby affecting the hospital's revenue stream. In the context of quaternary care, where high-complexity surgeries could generate significant income, poor OT performance undermines return on investment (ROI) for capital expenditures such as advanced surgical equipment, infrastructure, and specialized staffing.

3. Staff Morale and Burnout

Theatre teams—including surgeons, anaesthetists, nurses, and technicians—may experience dissatisfaction when their work schedules are underutilized or frequently disrupted by delays and cancellations. This can lead to reduced engagement, lack of motivation, and underutilization of clinical skills. In contrast, erratic scheduling and pressure to compensate for earlier delays can cause fatigue and burnout. Over time, this affects staff retention and the overall quality of care delivered.

5.5 Positive Observations

Despite the overall low utilization figures, the study uncovered several promising trends and structural strengths that highlight the hospital's potential for growth and improvement. These positive indicators reinforce the institution's capacity as a quaternary care center and serve as building blocks for operational reform.

A. Balanced Mix of Major and Minor Procedures

The surgical case mix during the study period included 392 major and 399 minor procedures, demonstrating a near-equal distribution. This balance is noteworthy for several reasons:

- **Clinical Skill Retention:** Minor cases allow surgical teams, especially residents and trainees, to refine foundational skills, while major cases challenge experienced surgeons and promote advanced clinical proficiency.
- **Resource Optimization:** A diverse case load ensures better use of OT time and staffing. Minor procedures often require less time and can fill shorter time blocks efficiently, while major cases utilize blocks more comprehensively.
- **Financial Viability:** While major surgeries often bring in higher reimbursement, minor procedures contribute to steady revenue and

volume. A balanced mix supports both clinical training and sustainable income generation.

Implication: The balanced case distribution lays a solid foundation for future planning of OT schedules, training programs, and departmental growth.

B. Diverse Specialty Involvement

The participation of over 15 specialties in the surgical workload reflects the hospital's multidisciplinary capacity, a hallmark of high-tier, quaternary care institutions. These include General Surgery, Orthopaedics, Neurosurgery, Gynaecology, ENT, Urology, Cardiology, Cardiothoracic Surgery, and more.

- **Comprehensive Service Offering:** The presence of multiple specialties allows the hospital to manage a wide spectrum of clinical conditions, enhancing its reputation as a full-service facility.
- **Referral Attractiveness:** A multidisciplinary OT ecosystem makes the hospital an attractive referral center for complex or rare surgical conditions.
- **Collaborative Potential:** Cross-disciplinary procedures and shared OT use encourage interdepartmental collaboration, innovation, and knowledge sharing.

Implication: This diversity supports not only surgical throughput but also institutional branding as a center of excellence.

C. Capacity to handle High – Complexity Procedure

Though departments like Cardiology and Neurosurgery reported fewer total cases, they consumed a substantial amount of OT time. This reflects the high complexity and duration of the surgeries performed.

- **Examples include:** Coronary artery bypass grafting (CABG), valve replacements, craniotomies, spinal surgeries, and vascular interventions.
- **High Acuity Handling:** Performing such intricate procedures indicates the hospital's readiness in terms of skilled manpower, advanced technology, and infrastructure.
- **Clinical Reputation:** Successfully handling complex surgeries boosts the institution's standing among peers, referring physicians, and patients. It also positions the hospital for accreditations, grants, and strategic partnerships.

Implication: The ability to manage time-intensive, high-risk surgeries is a

valuable asset that, if paired with better utilization practices, can drive both clinical excellence and revenue growth.

Summary

These positive observations reveal that while OT utilization is low, the hospital has the necessary clinical diversity, infrastructure, and procedural capabilities to operate at a much higher level of efficiency and reputation. Leveraging these strengths through better planning, scheduling reforms, and stakeholder engagement can significantly enhance overall performance.

5.6 Opportunities for Improvement

The data indicates several actionable pathways to improve OT efficiency:

1. Implement OT Scheduling Software

To Deploy an advanced digital scheduling platform tailored to OT operations. The software should:

- Allow real-time scheduling of surgeries and procedures, minimizing communication gaps and manual errors.
- Prevent double-booking and scheduling conflicts by integrating surgeon availability, OT resources, and preoperative requirements.
- Optimize block scheduling by analyzing historical utilization trends, urgency levels (elective vs. emergency), and specialty-specific demands.
- Provide automated alerts for any scheduling deviations or clashes.
- Integrate with Hospital Information Systems (HIS) and Electronic Medical Records (EMRs) for seamless coordination across departments.

Benefits: Enhances scheduling efficiency, maximizes OT utilization, and reduces idle time.

2. Reduce Non-clinical Delays

To Develop and implement detailed Standard Operating Procedures (SOPs) for all non-clinical workflows surrounding surgical procedures. Key SOPs include:

- Patient Preparation: Standardize preoperative checklists, fasting guidelines, and consent verification to ensure patients are ready before OT time.

- Instrument Sterilization: Streamline the sterilization cycle and tray preparation with barcode tracking and real-time inventory status.
- Anaesthesia Workflow: Optimize pre-induction and induction processes with well-defined roles and preoperative assessments.
- Theatre Cleaning and Turnaround: Set strict protocols for quick yet thorough cleaning between cases, including clear roles for housekeeping staff and minimum turnaround times.

Benefits: Reduces preoperative delays, improves turnover time, and increases daily surgical throughput.

3. Monitor Key Performance Indicators (KPIs)

To Establish a real-time dashboard for continuous tracking of critical OT performance metrics, such as:

- First-case on-time start percentage: Indicates discipline in morning readiness and start-of- day processes.
- Turnover Time: Measures efficiency between two successive surgeries, highlighting scope for workflow improvements.
- Theatre Occupancy Per Hour: Reflects the productive use of OT hours and helps in demand forecasting.
- Cancellation Rates: Identifies avoidable cancellations due to administrative or clinical reasons, enabling root cause analysis and resolution.

Benefits: Fosters accountability, supports data-driven decisions, and enables continuous performance improvement.

4. Adopt Flexible Theatre Models

To Introduce dynamic OT allocation models that respond to daily case load fluctuations:

- Allow reassignment of underutilized OTs to high-demand specialties or urgent/emergency cases.
- Incorporate cross-departmental flexibility, enabling departments like general surgery, orthopedics, or gynecology to utilize open slots when required.
- Use real-time dashboards and predictive analytics to proactively reassign blocks, avoiding underutilization and improving access.

Benefits: Improves resource efficiency, reduces patient wait times, and accommodates more cases with existing infrastructure.

5. Increase Case Volume via Outreach

To Implement a robust outreach and engagement strategy to drive surgical case intake and expand community access:

- Strengthen partnerships with referring physicians, peripheral clinics, and diagnostic centers for streamlined patient referrals.
- Collaborate with insurance providers and government health schemes to remove financial barriers for patients.
- Organize outreach programs, health camps, and surgical screening drives in rural or underserved areas to identify and channel surgical cases.
- Conduct public education and awareness campaigns to build trust, educate communities, and highlight the hospital's surgical expertise.

Benefits: Expands patient base, enhances community trust, and boosts surgical volume and hospital revenue.

Chapter 6: Conclusion

6.1 Conclusion

The present study meticulously examined the utilization of Operation Theatres (OTs) in a quaternary care hospital over a 60-day observational period, aiming to uncover inefficiencies and recommend improvements for operational optimization. The primary focus was to evaluate how effectively the OT infrastructure is being leveraged and to identify areas of underperformance that hinder the delivery of timely surgical care.

Operation Theatres are critical resources within any hospital setting, and their optimal utilization is crucial for clinical efficacy, patient safety, operational efficiency, and financial sustainability. In this study, the utilization of OTs was quantitatively assessed by comparing the total time actively used for surgeries against the total available OT resource time. The results were revealing.

The overall OT utilization rate was determined to be only 12.34%, significantly below the internationally accepted benchmark of 70% to 85% observed in efficiently managed hospitals. This figure was calculated based on 53,321 minutes of total OT time utilized for surgeries, compared to a total of 432,000 minutes of resource time available across five OTs over five working days (assuming 86,400 minutes per day). Such low utilization is indicative of systemic inefficiencies and highlights a substantial gap between existing capacity and actual performance.

When the data was disaggregated to the level of individual theatres, utilization rates ranged between 3.25% to 6.77%, further emphasizing the suboptimal use of OT infrastructure. These figures reflect not only a lack of scheduling efficiency but also point towards broader challenges such as prolonged case preparation time, inadequate coordination, rigid OT allocation models, and a lack of dynamic reallocation strategies.

Despite the hospital conducting 791 surgeries during the 60-day period, this volume did not correspond proportionally with the available OT capacity. Major departments such as General Surgery, Orthopaedics, Neurosurgery, and Gynaecology accounted for a significant share of the utilized time. Interestingly, departments with lower case numbers such as Cardiology and Neurosurgery contributed disproportionately higher OT minutes due to the complex and time-intensive nature of their procedures. This reflects the advanced clinical capabilities inherent to a quaternary care institution.

Several key issues emerged from the analysis:

- Inefficient scheduling: Many time slots were either unutilized or poorly matched to case complexity and duration.

- Delays in first-case starts: Late initiation of the first surgery of the day created a cascading effect, reducing overall throughput.
- Long turnover times: The time taken between two successive surgeries was found to be higher than desirable, primarily due to delayed cleaning, equipment sterilization, and patient shifting.
- Poor interdepartmental coordination: Lack of real-time communication among surgical teams, anesthesiologists, and OT staff led to unnecessary delays.
- Rigid theatre allocation: Fixed OT assignments per department limited the hospital's flexibility to adjust for daily variability in surgical demand.
- Lack of data-driven monitoring: Absence of automated tools or dashboards to track performance indicators in real-time hampered the ability to identify and respond to inefficiencies promptly.

Despite these challenges, the study also identified several strengths:

- A diverse and complex case mix suitable for a quaternary setting
- Multidisciplinary involvement across various surgical specialties
- A balanced number of major and minor procedures, offering scope for efficient case bundling and time management

In summation, while the hospital possesses the physical infrastructure, clinical expertise, and procedural diversity characteristic of a high-capacity tertiary or quaternary care center, it has yet to fully capitalize on its potential. The findings underscore an urgent need for systemic redesign, better coordination, and strategic management to elevate OT performance to internationally acceptable levels.

6.2 Recommendations

In light of the findings, the following targeted and evidence-based recommendations are proposed to address identified inefficiencies and enhance overall OT performance:

1. Implement Advanced OT Scheduling Systems

- Digital Scheduling Tools: Deploy an integrated OT management system that allows real-time slot booking, visibility across departments, and prevents overlapping or idle slots.
- Dynamic Block Allocation: Enable reallocation of unused time slots to

other departments based on daily demand.

- Integration with HIS/EMR: Ensure the OT scheduler is linked with hospital-wide systems for seamless case tracking and coordination.

2. Standardize OT Processes and Turnover Protocols

- SOP Development: Create detailed SOPs for pre-operative protocols, anesthesia workflows, instrument sterilization, and post-operative cleaning.
- Use of Lean Tools: Apply Lean Six Sigma methodologies to reduce delays and standardize processes (e.g., checklists, 5S, kaizen).
- Benchmarking: Set internal benchmarks for turnover time and continuously audit for compliance.

3. Improve interdepartmental Coordination

- Daily OT Huddles: Institutionalize brief meetings each morning among surgeons, anesthesiologists, nurses, and OT support teams to review schedules and readiness.
- Centralized Command Role: Appoint a full-time OT coordinator to manage logistics, resolve on-the-spot issues, and ensure schedule adherence.

4. Monitor and Track Key Performance Indicators (KPIs)

- Real-Time Dashboard: Develop an OT performance dashboard with automated updates to track:
 - First-case on-time starts
 - Turnover times
 - Theatre occupancy rates
 - Cancellation rates and root causes
- Monthly Analytics Reports: Disseminate periodic performance summaries to department heads to drive accountability.

5. Introduce Flexible OT Allocation models

- Shared Theatre Pools: Transition from rigid department-specific OT allocations to pooled access based on dynamic requirements.
- Surge Planning: Utilize forecasting tools to anticipate high-volume days

and prepare OT schedules accordingly.

6. Expand Surgical Case Volume

- **Strengthen Referral Systems:** Engage primary health centers, smaller hospitals, and general practitioners through formal referral agreements.
- **Outreach Initiatives:** Organize screening camps and teleconsultation programs to identify surgical patients in advance.

7. Invest in Staff Training and Engagement

- **Regular Skill Development:** Provide in-service training on time management, coordination, and infection control.
- **Team Involvement:** Encourage staff participation in performance audits and QI projects.
- **Recognition Programs:** Establish a reward system for high-performing OT teams or individuals.

8. Explore Resource Optimization Through Shift Models

- **Extended Hours or Dual Shifts:** Pilot extended OT hours or staggered shifts for high-demand days.
- **Cost-Benefit Analysis:** Conduct a feasibility study to ensure additional shifts are financially and operationally sustainable.

6.3 Final Remarks

The study clearly demonstrates that even in hospitals with advanced infrastructure and capable clinical teams, operational inefficiencies can significantly undermine service delivery. With an OT utilization rate as low as 12.34%, the hospital is operating far below its optimal capacity, missing opportunities to improve patient care, reduce waiting times, and generate revenue.

Surgical services are a cornerstone of modern healthcare. Therefore, improving OT efficiency is not just a matter of better resource management—it is essential to achieving clinical excellence, financial health, and patient satisfaction. The recommendations presented in this study are designed to address both strategic and tactical aspects of OT management. When implemented effectively, they will enable the hospital to enhance its service delivery, make better use of its infrastructure, and improve patient outcomes.

In a broader context, these findings and recommendations have implications for healthcare systems facing similar challenges in resource-constrained or high-demand environments.

By applying principles of lean management, embracing digital innovation, and fostering a culture of continuous improvement, hospitals can ensure that their Operation Theatres truly function as the heart of surgical excellence.

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