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ASSESSMENT OF SURGICAL CASE TURNOVER TIME AND FACTORS AFFECTING OPERATION THEATRE EFFICIENCY

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ABSTRACT

Background: *The operating room (OR) is one of the most resource-consuming and revenue units in any hospital, which makes up about 70% of all hospital revenues. Turnover time (TOT) - the time interval between the completion of one case and the onset of another one- turnover time is a critical non-operative period, the optimization of which is the key to maximizing OR throughput, cost reduction, and preservation of surgical schedules. Regardless of its importance, TOT has a multifaceted interaction of staffing, organizational, patient-related, and time-specific factors which are not fully described in various surgical environments.*

Objective: *To both assess the scale of the TOT delays objectively and examine the most common factors that contribute to these delays, as well as to review how OR team composition, time of the day, and institutional factors affect OR efficiency.*

Methodology: *Evidence synthesis involved a series of observational and retrospective studies that were carried out in academic and teaching hospital environments. There were studies based on prospective observational data observation of TOT in general surgery and orthopaedic theatres, multi-specialty studies of elective cases, and specialty-based studies in hand surgery. Some of the variables that were tested were the identity of the surgeon and continuity, anesthesiologist, nursing team, time of the day, patient ASA status, complexity of the case and institutional/hospital factor.*

Results: *In all studies, most of the turnovers (77-79) included were performed within benchmark ranges and the average ranges of TOT were 15.5 to 96 minutes provided the setting and time of the day. Four major categories of causes that led to delays were surgeon related (22.5%), anesthesia related (9%), patient related (18%), and hospital/institutional related (50.5%), and the latter was the most prevailing. There were also specific identifiable contributors, such as the unavailability of staff, delays in the transportation of patients, the introduction of the emergency cases in the elective lists, equipment problems, and the breakdown of communication. Multivariate analyses continuously showed consecutive surgeon, consecutive anesthesiologist, and same surgical specialty to be independent predictors of lower TOT. Most importantly, time of day proved to be a powerful independent variable-*

cases that had previously undergone a previous procedure and were terminated after 14:00 had much longer TOT (mean 95.5 vs. 78 min, p<0.001), which coincided with the change of nursing and support staff shifts at 15:00. A dedicated OR staff model was related to a meaningfully lower TOT in hand surgery than a non-dedicated model.

Conclusions: *Multifactorial determinants that influence the efficiency of TOT and OR include continuity of staffing, institutional infrastructure, time of the day factors, and scheduling of cases. The most influential and adjustable ones are the use of stable surgical, anesthesia teams in the successive cases, the scheduling of staff shift changes in sequence in order to have a time overlap, specialty-specific OR teams, and parallel processing of patient preparation. The most critical interventions to the delay in hospitals are at the hospital level such as the better communication system, standardized turnover practices, and sufficient staffing of support. To maximize the efficiency of the OR, minimize its costs and enhance the overall quality and safety of the delivery of surgical care, it is needed to have a multidisciplinary systems-based approach to its optimization.*

Keywords: *OR efficiency; turnover; OR staffing; surgical scheduling; perioperative management; case*

INTRODUCTION

The operating room is the part of the hospital that uses the resources and it makes about 60 to 70 percent of the hospital's money. Even though it is so important a lot of time in the operating room is spent on things that do not help patients or the hospital. One of the problems is the time it takes to get ready for the next patient after one patient leaves the operating room. This is called Surgical Case Turnover Time. It is the time from when one patient leaves the operating room to when the next patient comes.

If this time is too long it means the operating room is not being used much as it could be. This can cause problems like patients having their surgeries cancelled staff having to work overtime and patients having to wait for surgery. In hospitals where a lot of people are waiting for surgery even small reductions in turnover time can make a difference. It can mean more patients can have surgery and the hospital can make money. Every minute that the operating room is not being used costs the hospital around 15 to 30 US dollars. So the time it takes to get ready for the patient is very important to the people who run the hospital and make decisions, about healthcare.

The time it takes to get a patient from the operating room to the recovery room, which is called TOT is affected by things. These things include the surgeon, the anesthesia team, the patient and the hospital. When we look at the facts we see that more than half of the delays in getting patients from the operating room to the recovery room are caused by things that have to do with the hospital. This can be because there are not staff or the equipment is not working or the tools are not clean and ready to use or there is an emergency that interrupts the schedule of planned surgeries. The time of day also makes a difference. If a surgery starts after 2:00 in the afternoon it usually takes a lot longer to get the patient, from the operating room to the recovery room, which is called TOT.

The thing that happens when nursing and support staff change shifts at 15:00 is a problem.

Most of the information we have about this issue comes from countries like those in North America, Europe and Australasia.

We do not have information about what happens in countries like Pakistan that are not as rich.In Pakistan the operating rooms have some problems. They do not have enough people to clean emergency cases often stop scheduled surgeries they do not get the things they need on time and they do not always get the work done before surgery that they need to.

These problems are likely to make the issue with nursing and support staff changing shifts worse than it is in Western countries.

So it is really important to do a study that asks the staff in Pakistan what they think and what they see happening because this will give us information that's specific to Pakistan and will help us come up with solutions that will actually work in Pakistani hospitals.

This kind of study is not a good idea it is necessary if we want to make things better in Pakistani hospitals.

- **Rationale of the Study**

The thing is, we know that TOT has an effect on how well the operating room runs and the quality of care that patients get. The problem is, we do not have any information about this from hospitals in Pakistan. Most of the information we have comes from countries with good healthcare systems, which are very different from what we have in Pakistan. This means that the information we have does not really apply to our operating rooms. The people who work in the operating room like surgeons, anesthesiologists, nurses and technicians are the ones who can tell us what really causes delays. They are the ones who see what is going on every day. So we should ask them what they think. We can do this by giving them a survey to fill out. This is a way to get the information we need. This study is trying to figure out what causes delays in the operating room at a hospital, in Sialkot, Pakistan. We want to know what the staff thinks about this. When we have this information we can use it to make a plan to improve how the operating room runs. This will help patients get the care they need. It will also help the hospital and the staff.

1.2 Objectives of the Study

The study was designed to achieve the following objectives:

- To ascertain the perceived frequency and extent of surgical case turnover time delays in the operating rooms of a tertiary care hospital, as determined by staff-reported occurrence ratings on a 5-point Likert scale.
- To identify the most common surgeon-related, anesthesia-related, patient-related, and hospital/institutional factors that OR staff perceive as contributing to TOT delays.
- To generate institution-specific recommendations for a multidisciplinary, systems-based approach to improving OR efficiency in the study setting.

2: REVIEW OF LITERATURE

The operating room is the part of the hospital that makes the money but it can still be very inefficient. The time it takes to get the operating room ready for the surgery, which is called surgical case turnover time is a big factor in how well the operating room runs and how much it costs. The time, between surgeries is what we mean by surgical case turnover time. This is something that the hospital can change to make the operating room work better and get patients through. We looked at all the information that has been published about this between 2020 and 2026 to see what we can learn about surgical case turnover time and the operating room.

2.1 Systematic Evidence on Turnover Time Determinants

The best and most complete look at the evidence for Turnover Time was done by MacMillan and other people in the year 2025. They looked at 181 studies from countries and healthcare systems. They found that the main things that affect Turnover Time are staffing continuity, team composition, time of day case scheduling and the hospitals infrastructure. They said that to really improve Turnover Time we need to make changes in all of these areas at the time.

Pasquer and other people did a study in the year 2024. They looked at how the operating room's organised and how it affects surgical performance. They found that the way the team works together the schedule for shifts and getting everything ready before surgery are more important for Turnover Time than how complicated the case's how sick the patient is. Both of these studies say that we cannot just focus on one thing to improve Turnover Time. We need to look at the system and make changes in many areas. Turnover Time is affected by things so we need to use a multidisciplinary approach to really make a difference, in Turnover Time.

2.2 Time-of-Day Effects and Staffing Transitions

Kamande and his team (2022) looked back at 2,174 surgery cases across 13 different surgical areas. They used statistical methods and a tool called Receiver Operating Characteristic (ROC) analysis to study the data. They found that cases

where the previous surgery ended after 2:00 pm had a turnover time (TOT) of 95.5 minutes. In comparison cases that started earlier had a TOT of 78 minutes. This difference was significant ($p<0.001$). The ROC analysis showed a high accuracy of 0.848.

The researchers thought that the reason for this pattern was that nursing and support staff changed shifts at 3:00 pm.

Lovasik and his team (2026) built on these findings. They created a checklist for turnover and a dedicated coordinator at a big medical centre. They achieved a 20% reduction, in TOT. The biggest improvements happened during afternoon sessions. This confirmed that staffing strategies that consider the time of day are important.

2.3 OR Team Composition and Consecutive Staffing

Sarpong and his team did a study in 2022. They looked at what happens when the same surgeon and the same team that gives anesthesia work on operations one after the other. They found out that this actually helps to reduce the time it takes to get everything for the next operation.

If the same surgeon did the operation it took a lot less time to get ready. It took sixty six minutes if the surgeon was the same. One hundred and ten minutes if the surgeon was different. This is a big difference. The team also found out that having the same person give anesthesia made a difference.

Another team, MacMillan and his team did a review of lots of studies in 2025. They found out the thing. When hospitals use teams that always work together they do a job than teams that are always changing. Some hospitals decided to use these fixed teams. They were able to reduce the time it takes to get ready, for the next operation by fifteen to twenty five percent.

2.4 Parallel Processing as an Efficiency Strategy

Others published a report in 2026 that showed how some changes can make things better. They found out that if the operating room team gets ready for the surgery while they are finishing up the current one they can save about 18 minutes, per surgery. They did not have to hire people to do this.

Riveros Perez and others talked about a way of doing things in the operating room in 2022. They had a plan where the team would work together and take over for each other in a way. This made the time it took to do surgeries shorter. It used to take 42 minutes. It was reduced to 27 minutes. That is a reduction of 36 percent. They were able to keep this going after six months and they did it without needing a lot of extra resources.

2.5 Specialty-Specific and Anesthesia-Related Considerations

Researchers like He and his team found that using care plans in orthopaedic operating rooms can really make a difference. They saw a 22 percent reduction in the time it takes to get everything for the next patient, which is called turnover time. They also saw a 31 percent decrease in the number of cancelled surgeries. This is important because orthopaedic surgeries often involve equipment and expensive implants so any delay can cause big problems.

Another team of researchers led by Huang looked at ways to improve the process of getting ready for surgeries in the urology department. They found that handling equipment setting up the operating room and getting the patient in the position were the things that took the most time. By making a changes they were able to cut the turnover time from 34 minutes to 21 minutes for 200 surgeries in a row.

Some other researchers, like Le Guen did a study, on how to help patients recover from anaesthesia quickly. They found that using a medicine called sugammadex can really help. When patients take a time to recover from anaesthesia it can delay the next surgery, which is called prolonged extubation. Using medicines that help patients recover quickly can be a big part of making operating rooms run more smoothly.

2.6 Research Gap

Collectively studies show that five main areas affect how long surgery takes:

The team working together and staying the same the time of day. Changing shifts, doing multiple tasks at once, getting ready for specific surgeries, managing anesthesia.

Many studies agree that we need to look at the system and work together not just try one thing. Most research is from rich countries in North America, Europe and Australia. Operating rooms in Pakistan have problems. Like delays with cleaning and sterilizing equipment,
emergency surgeries interrupting planned ones not enough cleaning staff and different ways of preparing patients.
This study looks at these problems, in operating rooms for the first time.

3: MATERIALS AND METHODS

3.1 Research Design

This study employed a descriptive, cross-sectional survey design. This approach allowed for the systematic capture of OR staff perceptions of TOT delay factors at a defined point in time, without experimental intervention. Cross-sectional survey methodology is well-established and widely validated in perioperative efficiency research, enabling broad sampling across all professional cadres of the OR team (Pasquer et al., 2024; MacMillan et al., 2025).

3.2 Clinical Setting

The study was conducted at Imran Idrees Teaching Hospital, Sialkot, Punjab, Pakistan — a functioning tertiary care teaching institution operating under the authority of the Imran Idrees Institute of Rehabilitation Sciences (IIIRS). The hospital operates a multi-room operating theatre complex handling both elective and emergency surgical cases across general surgery, orthopaedics, gynaecology, urology, and neurosurgery. The theatre complex comprises four to six operating rooms and runs morning and evening surgical lists on weekdays.

3.3 Sample Size

The estimated OR workforce at the study institution across all professional cadres was 80–120 staff members. Sample size was calculated using the standard prevalence-based formula for cross-sectional studies:

$$n = Z^2 \times p(1-p) / d^2$$

Where Z = 1.96 (95% confidence interval), p = 0.50 (maximum variance assumption), and d = 0.10 (margin of error at 10%). Calculation yielded $n = (1.96)^2 \times 0.5 \times 0.5 / (0.10)^2 \approx 96$. To account for incomplete responses and non-participation, a minimum of 100 participants was targeted. All 100 questionnaires distributed were returned completed and eligible for analysis, yielding a response rate of 100%.

3.4 Sampling Technique

Non-probability purposive sampling was employed. This method was appropriate given the small and clearly defined OR workforce at a single institution and the requirement to include all relevant professional cadres — surgeons, anesthesiologists, scrub nurses, circulating nurses, OR technicians, and housekeeping staff. All eligible staff members who met the inclusion criteria were invited to participate.

3.5 Inclusion and Exclusion Criteria

3.5.1 Inclusion Criteria

All OR staff actively employed at the study institution for a minimum of three months prior to data collection, including surgeons, anesthesiologists, scrub nurses, circulating nurses, OR technicians, and housekeeping/sanitation personnel; staff directly involved in intraoperative care or the OR turnover process; and staff willing to provide written informed consent prior to participation.

3.5.2 Exclusion Criteria

Administrative or managerial personnel not directly involved in intraoperative care or OR turnover activities; rotating, locum, or visiting staff with less than one month of experience at the study institution; and staff who were on extended leave, unable to participate, or who declined to provide informed consent during the data collection period.

3.6 Data Collection Instrument

A self-administered structured questionnaire was developed in accordance with validated instruments from the perioperative efficiency literature and adapted to the local institutional context. Prior to full distribution, a pilot test was conducted with ten OR staff members to assess face validity and item clarity; minor revisions were incorporated based on pilot feedback.

The questionnaire comprised five sections: (1) demographic information — designation, years of experience in the OR, primary surgical specialty, usual shift, and highest qualification; (2) Section B — perceived causes of TOT delay, comprising 8 items on a 5-point frequency Likert scale (1=Never to 5=Always), covering surgeon-related, anesthesia-related, and patient-related factors; (3) Section C — institutional factors, comprising 6 items on the same 5-point Likert scale; (4) Section D — improvement strategies, comprising 5 items on a 5-point agreement Likert scale (1=Strongly Disagree to 5=Strongly Agree); and (5) two open-ended qualitative questions.

3.7 Data Collection Procedure

Completed questionnaires were distributed to all eligible OR staff during their working shifts over a three-week data collection period in April–May 2026. Participants completed questionnaires independently and returned them in sealed envelopes to ensure confidentiality. The principal investigators were available to clarify any questions regarding questionnaire items. All completed questionnaires were reviewed for completeness prior to data entry.

3.8 Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Review Committee (IERC) of IIIRS prior to commencement of data collection (Ref No: IIIRS/A/26/31, dated 07-May-2026). All participation was entirely voluntary. Each participant provided written informed consent using the standardised consent form. Anonymity and confidentiality were strictly maintained throughout; no personally identifiable information was recorded on questionnaires. Data were stored in a password-protected digital database accessible only to the principal investigators.

3.9 Data Analysis

Data were entered and analyzed using IBM SPSS Statistics Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were reported as frequencies and percentages for categorical variables, and as mean ± standard deviation (mean ± SD) for Likert-scale items. Cross-tabulation and chi-square tests were used to explore associations between staff designation or experience and perceived TOT delay factors. A p-value of less than 0.05 was considered statistically significant.

4: RESULTS AND DISCUSSION

4.1 Demographic Profile of Respondents

A total of 100 OR staff members participated in this study, yielding a 100% response rate. The demographic characteristics are presented in Table 4.1.

Table 4.1: Demographic Characteristics of Respondents (n=100)

Characteristic	n	%
Designation		
OR Technician	33	33.0
Scrub Nurse	22	22.0
Circulating Nurse	18	18.0
Surgeon	12	12.0
Anesthesiologist	8	8.0
Housekeeping Staff	7	7.0
Years of Experience in OR		
3–5 years	31	31.0
1–2 years	27	27.0

6–10 years	20	20.0
11–15 years	13	13.0
<1 year	9	9.0
Primary Surgical Specialty		
General Surgery	31	31.0
Gynaecology	25	25.0
Orthopaedics	21	21.0
Urology	10	10.0
Other	9	9.0
Neurosurgery	4	4.0
Usual Shift Worked		
Morning	34	34.0
Rotating Shifts	25	25.0
Evening	25	25.0
Night	16	16.0
Highest Qualification		
Bachelor's Degree	40	40.0
Master's Degree	21	21.0
PhD/Postgraduate	17	17.0
Intermediate	8	8.0
Matriculation	5	5.0

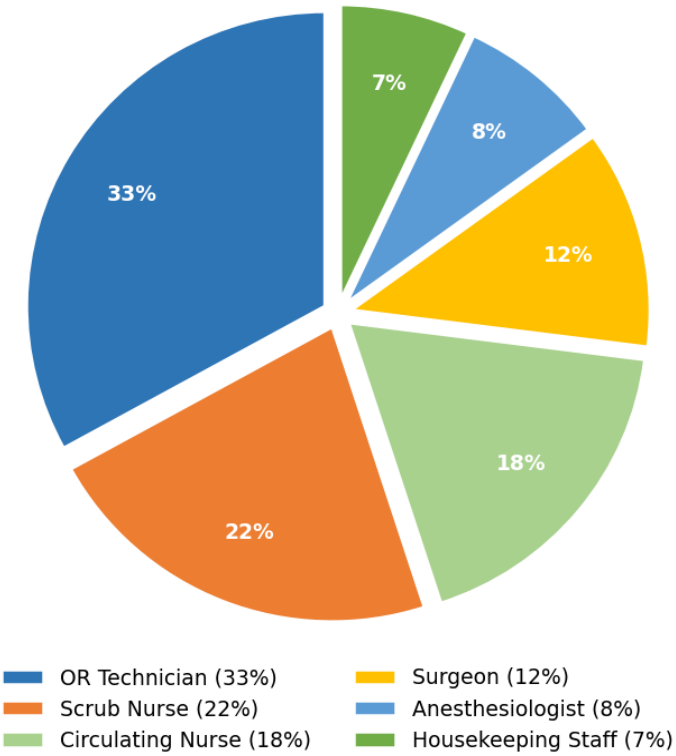
OR Technicians constituted the largest professional group (n=33, 33.0%), followed by Scrub Nurses (n=22, 22.0%), Circulating Nurses (n=18, 18.0%), Surgeons (n=12, 12.0%), Anesthesiologists (n=8, 8.0%), and Housekeeping Staff (n=7, 7.0%). This distribution reflects the staffing composition of a functioning multi-speciality operating theatre complex in a Pakistani tertiary care setting. The predominance of nursing and technical staff in the sample is consistent with the larger absolute numbers of these cadres in any OR workforce, and it is significant that their perceptions are well-represented, as these staff members are directly responsible for the physical execution of OR turnover processes.

In terms of clinical experience, the majority of respondents had between one and ten years of OR practice (58%, n=58), with 31% having three to five years of experience. A meaningful minority (13%) reported 11–15 years of experience, reflecting an experienced core within the workforce. The predominance of relatively junior staff may partly reflect the demographic characteristics of an allied health institution training institution, and it has implications for TOT, as more experienced teams have been shown to execute turnovers more efficiently (Sarpong et al., 2022).

General Surgery accounted for the largest specialty group (31%), followed by Gynaecology (25%) and Orthopaedics (21%). This specialty distribution is

broadly representative of the elective and emergency surgical workload of a Pakistani teaching hospital, where general surgery and obstetric/gynaecological cases predominate. The morning shift was the most commonly reported (34%), with rotating and evening shifts each accounting for 25%.

Figure 4.1: Distribution of Respondents by Designation (n=100)



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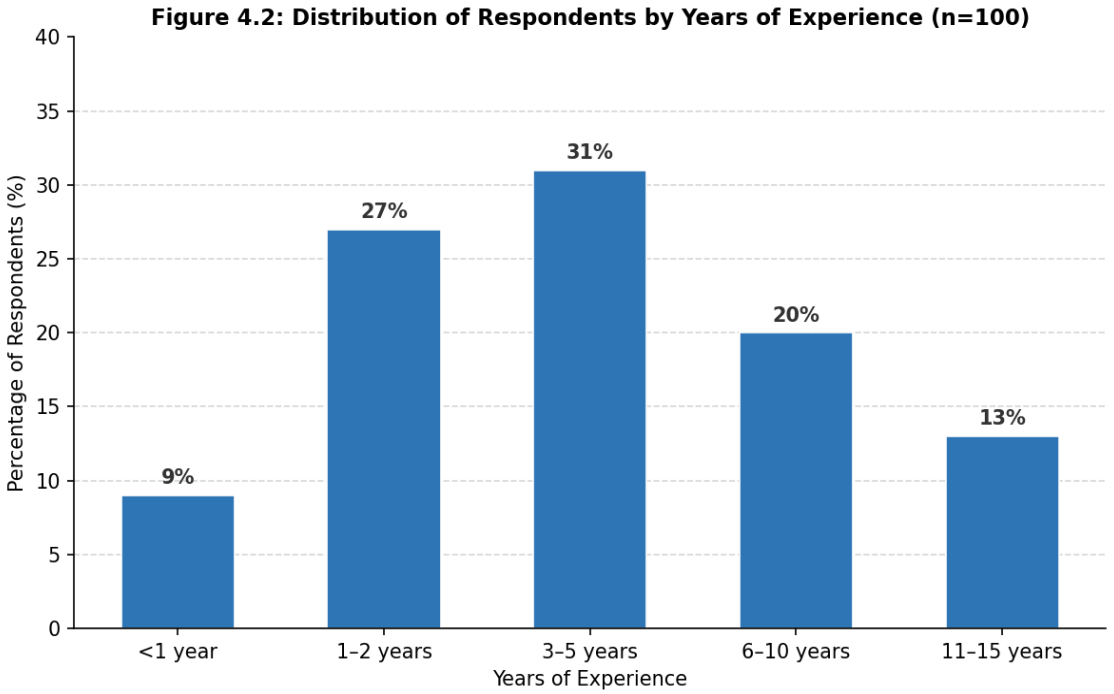

Figure 4.2: Distribution of Respondents by Years of Experience (n=100)

Figure 4.3: Distribution of Respondents by Primary Surgical Specialty (n=100)

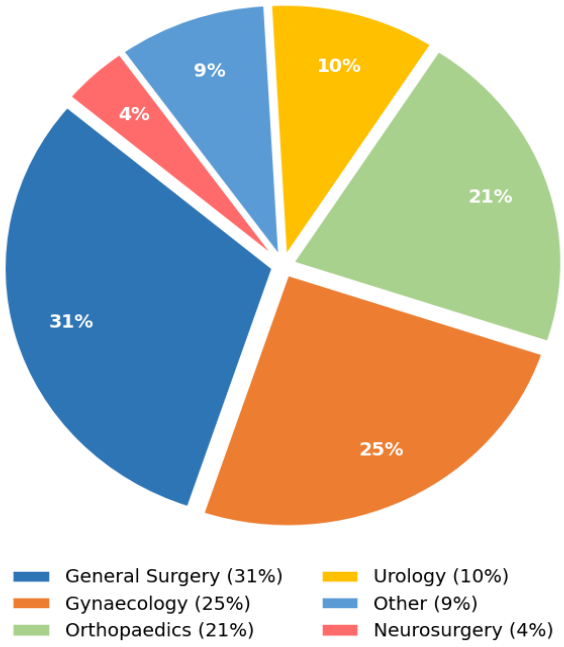

Figure 4.3: Distribution of Respondents by Primary Surgical Specialty (n=100)

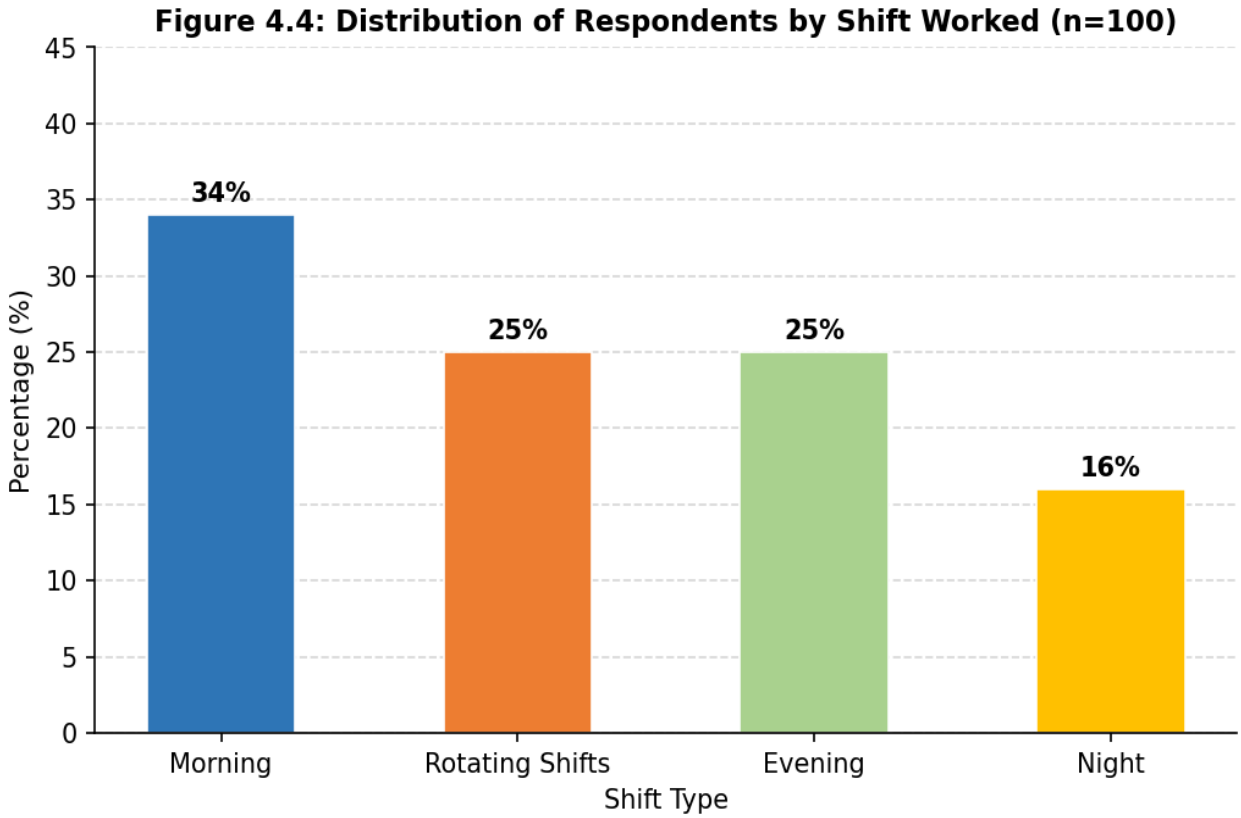

Figure 4.4: Distribution of Respondents by Shift Worked (n=100)

4.2 Perceived Frequency of TOT Delay Factors — Section B (Surgeon, Anesthesia, Patient Factors)

Respondents rated the perceived frequency of eight individual TOT delay causes using a 5-point Likert scale (1=Never to 5=Always). Results are presented in Table 4.2.

Table 4.2: Perceived Frequency of TOT Delay Factors — Surgeon, Anesthesia, and Patient Domains (n=100)

Factor	Mean	SD	Often/Always n (%)
Surgeon unavailability or late arrival	2.86	0.91	27 (27.0%)
Surgeon/specialty change between cases	2.98	0.95	35 (35.0%)
Difficult airway/prolonged extubation	2.76	0.95	23 (23.0%)
Patient transport delay from ward	2.71	0.95	21 (21.0%)
Incomplete preoperative workup	2.90	0.94	31 (31.0%)
CSSD instrument/tray delivery delay	2.84	0.94	25 (25.0%)
Equipment malfunction/unavailability	2.80	0.95	28 (28.0%)
Inadequate housekeeping staff	2.76	0.95	24 (24.0%)

Likert scale: 1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Always. SD = Standard Deviation.

The highest mean rating in this section was obtained for surgeon or specialty change between consecutive cases (M=2.98, SD=0.95), which 35% of staff rated as occurring "Often" or "Always." This is consistent with findings from Sarpong et al. (2022), who demonstrated that maintaining a consecutive surgeon across cases was among the strongest independent predictors of reduced TOT. Surgeon unavailability or late arrival received the second highest frequency rating (M=2.86, SD=0.91), with 27% endorsement at the "Often/Always" level, a finding that aligns with the institutional and contextual realities of surgical scheduling in Pakistani tertiary care environments. Incomplete preoperative workup was endorsed by 31% of respondents, making it the third most frequently cited delay factor in this section (M=2.90, SD=0.94). In LMICs, preoperative preparation is frequently compromised by limited diagnostic infrastructure, poor coordination between wards and OR, and inadequate pre-admission protocols. Equipment malfunction was endorsed by 28% (M=2.80), and CSSD delays by 25% (M=2.84), both representing important infrastructure-related modifiable targets. Difficult airway or prolonged extubation was endorsed by 23% (M=2.76, SD=0.95), reflecting the anesthesia-controlled component of TOT that can be addressed through pharmacological strategies such as sugammadex reversal as documented by Le Guen et al. (2020).

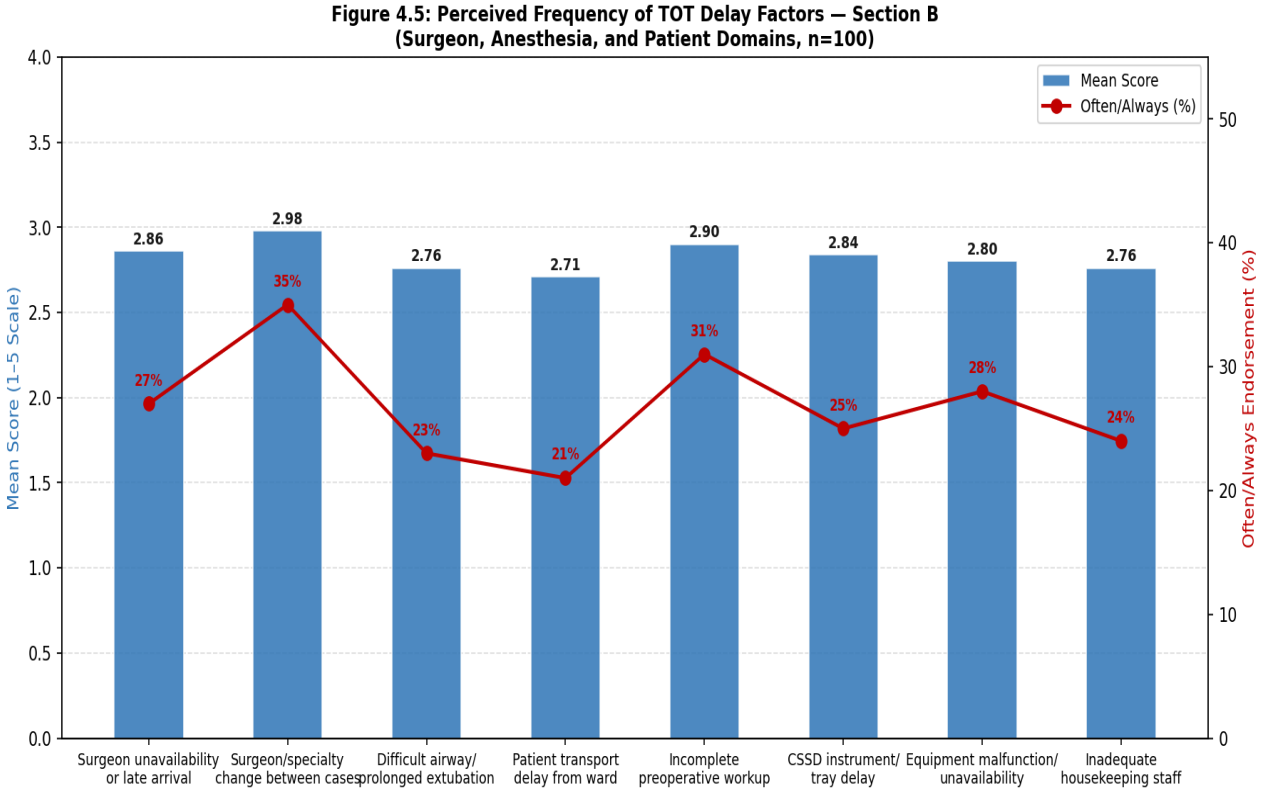

Figure 4.5: Perceived Frequency of TOT Delay Factors — Section B (n=100)

4.3 Perceived Frequency of TOT Delay Factors — Section C (Institutional Factors)

Table 4.3 presents staff perceptions of institutional TOT delay factors, covering shift change effects, time-of-day effects, coordination, and patient acuity.

Table 4.3: Perceived Frequency of TOT Delay Factors — Institutional Domain (n=100)

Factor	Mean	SD	Often/Always n (%)
Emergency case insertions disrupting elective list	2.80	0.89	21 (21.0%)
Poor interdepartmental communication	2.90	0.85	26 (26.0%)
Staff shift changeovers increase TOT	3.02	0.84	31 (31.0%)
Cases after 14:00 h have longer TOT	2.83	0.95	28 (28.0%)
Inadequate preoperative coordination	2.81	0.95	26 (26.0%)
High ASA status patients delay turnovers	2.91	0.83	26 (26.0%)

Likert scale: 1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Always. ASA = American Society of Anesthesiologists. SD = Standard Deviation.

Staff shift changeovers received the highest mean rating among all delay factors across both sections (M=3.02, SD=0.84), with 31% of staff endorsing this at the "Often" or "Always" level. This finding is in strong concordance with the body of literature documenting that shift transitions — particularly those occurring around 15:00 hours — represent a period of heightened TOT delay risk. Kamande et al. (2022) identified this phenomenon as the most time-sensitive predictor of prolonged TOT in their retrospective analysis, and Lovasik et al. (2026) demonstrated that targeted interventions during afternoon sessions yielded the greatest efficiency gains.

Cases commencing after 14:00 hours were perceived to experience longer TOT by 28% of respondents (M=2.83, SD=0.95), corroborating the well-documented time-of-day effect observed in international literature. High ASA physical status patients were cited by 26% of respondents as contributing to delayed turnovers (M=2.91), reflecting the extended anaesthetic preparation and recovery durations associated with medically complex patients. Poor interdepartmental communication (26% endorsement, M=2.90) and inadequate preoperative coordination (26%, M=2.81) highlight systemic organisational weaknesses that are particularly amenable to non-capital improvement interventions such as structured communication protocols and pre-list briefings.

The mean scale total for institutional factors (Section C Scale: M=17.27, SD=2.32, range 12–23) indicates a moderate-to-high perceived burden of institutional delay sources, and suggests that staff collectively view the institutional domain as a meaningful contributor to OR inefficiency in this setting.

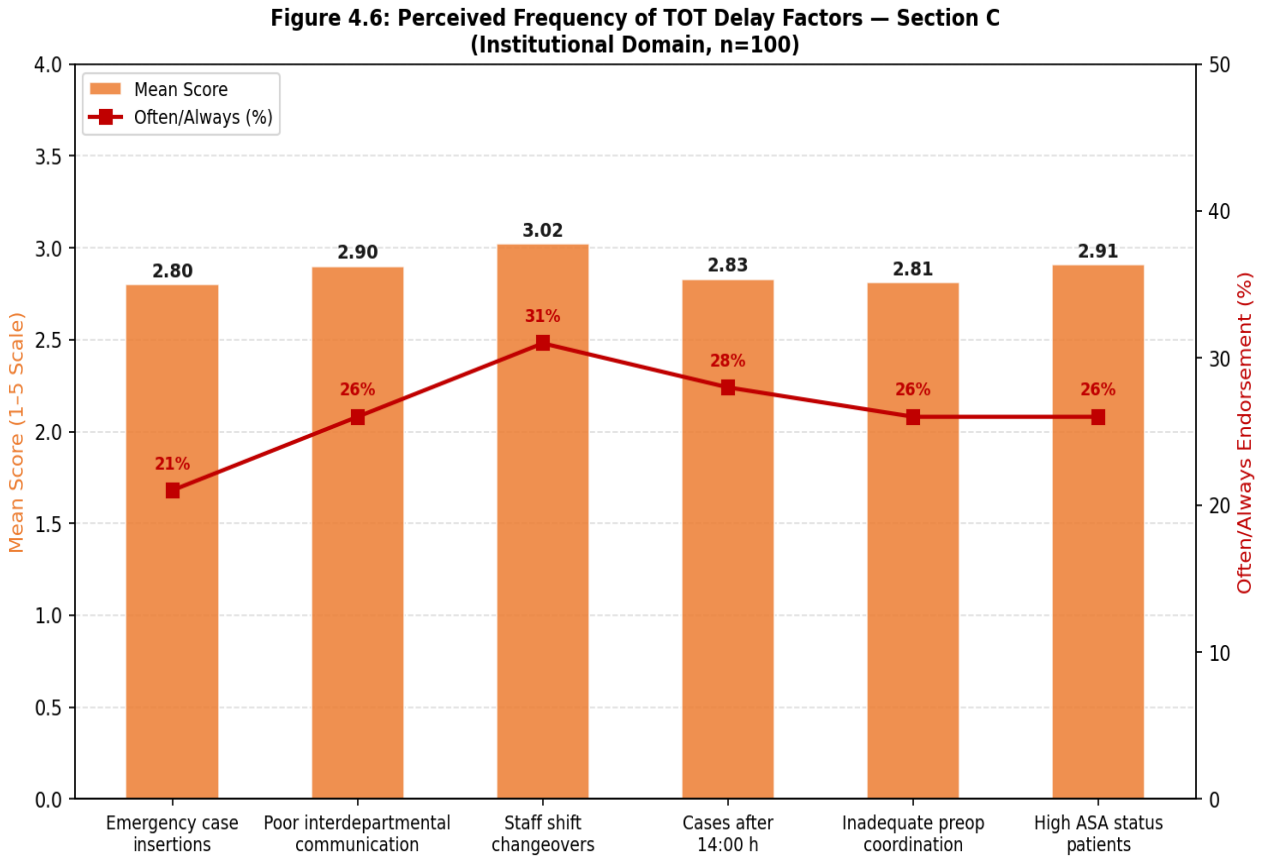

Figure 4.6: Perceived Frequency of TOT Delay Factors — Section C (n=100)

4.4 Perceptions of Improvement Strategies — Section D

Table 4.4 presents staff ratings of five evidence-based OR efficiency improvement strategies on a 5-point agreement Likert scale (1=Strongly Disagree to 5=Strongly Agree).

Table 4.4: Staff Perceptions of OR Efficiency Improvement Strategies (n=100)

Strategy	Mean	SD	Agree/Strongly Agree n (%)
Dedicated OR team reduces TOT	3.74	1.21	64 (64.0%)
Parallel processing reduces TOT	3.77	1.09	71 (71.0%)
Standardized turnover checklist would help	3.82	1.04	71 (71.0%)
Regular auditing & feedback motivates improvement	3.76	1.04	69 (69.0%)
Dedicated housekeeping team reduces delays	3.95	0.98	76 (76.0%)

Likert scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. SD = Standard Deviation.

Dedicated housekeeping staff assigned exclusively to the operating theatre received the strongest endorsement of all improvement strategies, with 76% of respondents indicating agreement or strong agreement (M=3.95, SD=0.98). This finding is particularly noteworthy in the Pakistani tertiary care context, where housekeeping and sanitation personnel are frequently shared across

multiple wards and departments rather than being assigned permanently to the OR. Given that OR cleaning and room turnover are critically time-sensitive, the lack of dedicated housekeeping represents a high-yield, low-cost intervention target.

Standardized OR turnover checklists and regular auditing of TOT data both received 71% endorsement (M=3.82 and M=3.76, respectively). Checklists have been shown to systematically reduce cognitive errors during turnovers by ensuring that all preparatory steps — including equipment checks, instrument counts, and patient documentation — are completed in the correct sequence (Lovasik et al., 2026). Regular TOT auditing and feedback have been demonstrated to create institutional accountability and motivate sustained improvement by making delays visible and attributable.

Parallel processing — initiating preparation for the next case during closure of the preceding one — was endorsed by 71% (M=3.77), and a dedicated OR team approach by 64% (M=3.74). Riveros Perez et al. (2022) and Chase et al. (2026) both provide evidence that parallel processing protocols are feasible even in resource-limited environments and can yield 15–36% reductions in mean TOT without additional staffing costs. The scale total for improvement strategies (Scale D: M=19.04, SD=2.49, range 13–24) reflects a consistently positive endorsement of all five strategies, indicating broad staff receptivity to evidence-based improvement initiatives.

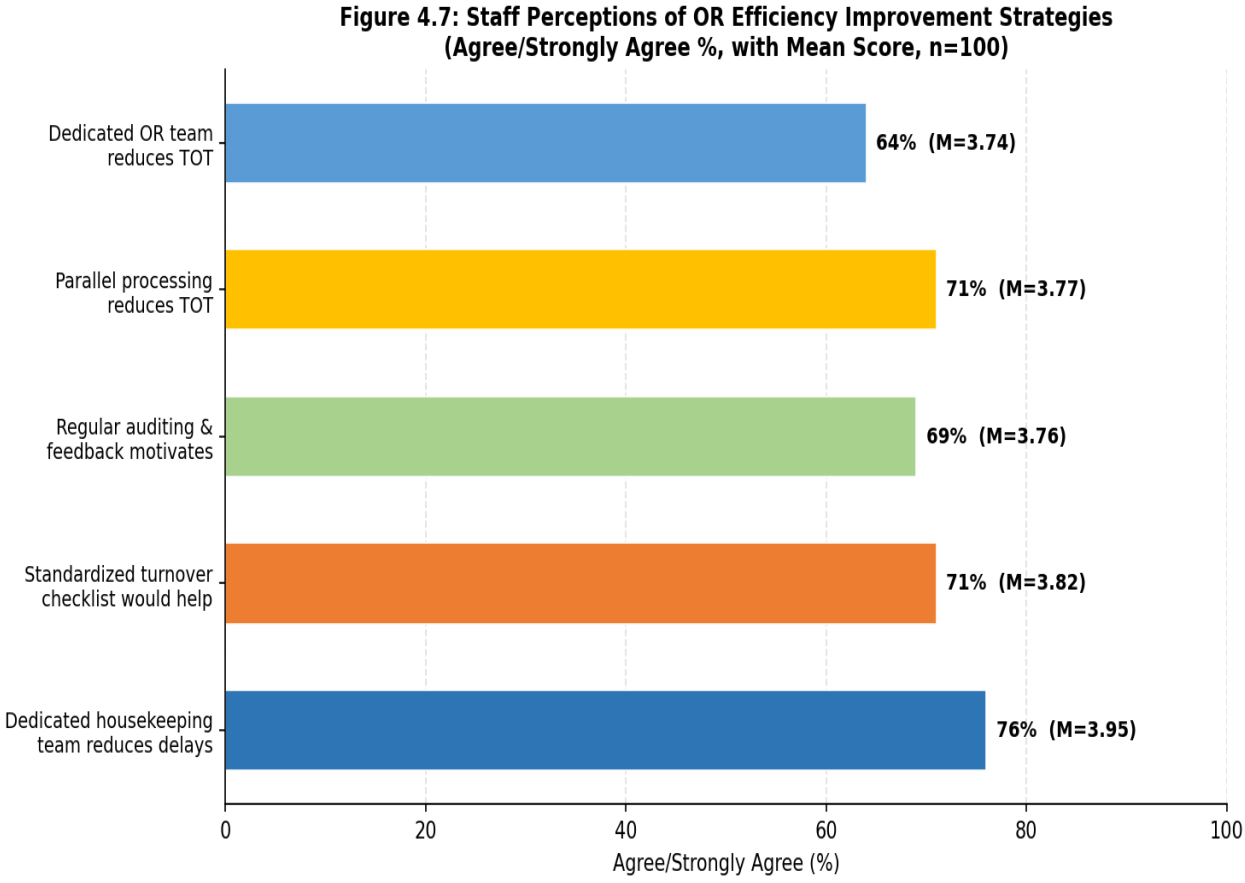

Figure 4.7: Staff Perceptions of OR Efficiency Improvement Strategies (n=100)

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This descriptive cross-sectional survey study was conducted to systematically assess the perceptions of operating room staff regarding the frequency and determinants of surgical case Turnover Time (TOT) delays at Imran Idrees Teaching Hospital, Sialkot, Pakistan. A total of 100 OR staff members across six professional cadres — OR Technicians (33%), Scrub Nurses (22%), Circulating Nurses (18%), Surgeons (12%), Anesthesiologists (8%), and Housekeeping Staff (7%) — participated, yielding a 100% response rate.

Key findings demonstrate that staff shift changeovers (M=3.02, SD=0.84; 31% Often/Always), surgeon or specialty change between consecutive cases (M=2.98, SD=0.95; 35%), and incomplete preoperative workup (M=2.90, SD=0.94; 31%) were the most frequently perceived contributors to TOT delay. Cases after 14:00 hours (28%), high ASA status patients (26%), poor interdepartmental communication (26%), and CSSD delivery delays (25%) were also substantially endorsed. Among improvement strategies, dedicated housekeeping staff assignment to the OR received the strongest support (76% agreement, M=3.95), followed by standardized turnover checklists (71%), regular TOT auditing (69%), parallel processing (71%), and dedicated OR teams (64%). These findings are broadly concordant with published international evidence while providing the first institution-specific perioperative efficiency data from this regional setting in Pakistan.

5.2 Conclusions

The following conclusions are drawn from the findings of this study:

- Staff shift changeovers represent the single most frequently perceived institutional driver of TOT prolongation at this institution, confirming the critical importance of shift transition management as a primary improvement target.
- Surgeon scheduling practices — including late arrival and inter-specialty case sequencing — are significant modifiable delay factors requiring targeted scheduling intervention.
- Preoperative workup completeness and CSSD instrument delivery represent high-priority systemic gaps that require interdepartmental coordination protocols.
- OR staff demonstrate broad and strong receptivity to evidence-based improvement strategies, indicating a favourable organisational climate for implementing structured TOT reduction programmes.
- This study provides the first staff-perception-based perioperative efficiency evidence from a tertiary care institution in Sialkot, Punjab, contributing to the sparse LMIC literature on OR management.

5.3 Recommendations

Based on the findings and conclusions of this study, the following recommendations are proposed for institutional leadership, OR management, and future researchers:

For Institutional Leadership and OR Management:

- Assign dedicated housekeeping and sanitation personnel exclusively to the operating theatre complex to eliminate delays attributable to shared or unavailable cleaning staff.
- Implement a standardised, checklist-driven OR turnover protocol to systematically guide all staff through the preparatory steps between cases, reducing cognitive errors and variance.
- Introduce an overlap or staggered shift transition protocol to ensure continuity of OR coverage during the high-risk 14:00–15:00 shift change period, with explicit handover documentation.
- Establish a parallel processing protocol whereby induction of the next patient and OR setup for the subsequent case begins during the closing stages of the preceding procedure.
- Introduce a structured preoperative checklist that confirms complete workup (laboratory results, ECG, informed consent, and nil-by-mouth status) before the patient enters the OR holding area.

- Establish a regular TOT audit cycle with monthly feedback reports shared with all OR team members, to create institutional accountability and motivate sustained improvement.

For Future Research:

- Future studies should employ objective TOT measurement using electronic anaesthetic information management systems to supplement staff perceptions with quantitative data.
- Multi-centre studies across multiple tertiary care institutions in Pakistan are needed to generate generalisable national estimates of TOT and its determinants.
- Interventional studies evaluating the effectiveness of the recommended improvement strategies in this institutional context are required to translate perceptual findings into measurable efficiency gains.

LIST OF ABBREVIATIONS

ABBREVIATION	FULL FORM
AHS	Allied Health Sciences
ASA	American Society of Anesthesiologists
BS	Bachelor of Science
CSSD	Central Sterile Supply Department
ECG	Electrocardiogram
IERC	Institutional Ethics Review Committee
IIIRS	Imran Idrees Institute of Rehabilitation Sciences
LMIC	Lower-Middle-Income Country
OR	Operating Room
OTT	Operation Theatre Technology
ROC	Receiver Operating Characteristic
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
TOT	Turnover Time

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