

FACTORS RESPONSIBLE FOR POSTPONEMENT OF ELECTIVE GENERAL SURGICAL PROCEDURES IN A TERTIARY CARE TEACHING HOSPITAL: A CROSS-SECTIONAL OBSERVATIONAL STUDY

Akshi Jain¹, N.K. Singh², M.K. Prasad³, Richa Tandon⁴

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Corresponding Author:

Dr. Richa Tandon,

Email: akshi1599@gmail.com

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¹Junior Resident, Department of General Surgery, Teerthankar Mahaveer Medical College & Research Centre, India.

²Professor & Principal, Department of General Surgery, Teerthankar Mahaveer Medical College & Research Centre, India.

³HOD & Professor, Department of Anesthesiology, Teerthankar Mahaveer Medical College & Research Centre, India.

⁴Junior Resident, Department of General Surgery, Teerthankar Mahaveer Medical College & Research Centre, India.

ABSTRACT

Background: Delayed elective surgeries are a recurring problem in health care systems that negatively impact operating theatre utilization, patient outcomes, hospital efficiency and healthcare costs. The understanding of factors leading to surgery postponement is critical to better perioperative management and the allocation of resources. This study was done to assess the health profession-related, patient-related and institution related factors responsible for delay of elective general surgical procedures in a tertiary care teaching hospital. **Materials and Methods:** An observational, cross-sectional study was conducted in the department of General Surgery of Teerthankar Mahaveer Medical College and Research Centre (TMMC & RC), Moradabad, Uttar Pradesh, India, which is set in a hospital setting. Patients with elective general surgery procedures whose clearance was postponed were consecutively sampled to obtain a total of 163 patients. A structured proforma was used to collect data on demographic, diagnosis, planned surgical procedure and causes for postponement. The factors that cause postponement were divided into three groups: health professional related, patient related, and facility related. The obtained data were analyzed statistically using SPSS version 21.0. **Results:** The mean age of patients was 43.2 ± 12.1 years, and 58.9% were males. The most frequent diagnosis was cholelithiasis (62.0%) and the most commonly postponed procedure was laparoscopic cholecystectomy (62.0%). Patient-related factors (50.9%) were the most common cause of postponement, followed by health professional-related factors (24.5%) and facility-related factors (23.3%). Factors related to the availability of resources were shown to be significantly associated with postponement including unavailability of surgical instruments ($\chi^2 = 12.84$, $p = 0.01$) and blood shortage ($\chi^2 = 12.84$, $p = 0.01$). Other administrative and scheduling issues such as insufficient operating theatre time (10.4%) and emergency case prioritisation (15.3%) were also significantly associated with postponement ($\chi^2 = 15.27$, $p = 0.004$). Patient-related factors that showed significant association with postponement ($p < 0.05$) were medical causes. **Conclusion:** Elective general surgical procedures are mostly delayed because of facility related factors such as resource constraints and scheduling inefficiencies. Improvements in operating theatre management, better availability of resources and better optimization of patients preoperatively can significantly reduce avoidable postponements and improve the delivery of surgical services in tertiary hospitals.

INTRODUCTION

One of the most resource-intensive and expensive parts of today's health care systems, operating

theatres (OTs) make up a significant portion of hospital spending, staffing, and building investment. In order therefore to maintain the quality of operating theatre services, institutional productivity and the

outcome of patients, it is important to use the operating theatre resources efficiently. Every inefficiency in the theatre schedule and workflow can contribute to substantial losses in time, resources and revenue, and negatively impact patient satisfaction and healthcare delivery.^[1] Elective surgery is a significant part of the surgical burden in most health care facilities and is performed in an organized and orderly fashion to allow the patient to be optimally prepared, resources to be coordinated and perioperative care to be managed appropriately. Surgery for elective conditions is still very vulnerable to delays, even in its scheduled format, due to various factors including scheduling inefficiencies, limited resources, patient related factors and emergency clinical demands. The delays in elective surgery have significant clinical, psychological and economic implications and remain a major problem for health systems globally.^[2]

The effect of postponing elective surgery is not only the delay of a planned surgery. Patients may experience disease progression, worsening symptoms, morbidity, suffering, and a diminished quality of life due to postponements. There is also an increased level of anxiety, frustration and trust in healthcare services related to repeated delays.^[3,4] In a healthcare system context, postponed surgeries lead to the underutilization of operating theatre resources, inefficient staffing patterns, growing waiting lists and increasing healthcare system costs.^[5,6] Operating theatre time is among the most expensive and resource-intensive components of hospital services, and unused theatre slots represent lost opportunities to provide timely surgical care to other patients. Furthermore, repeated postponements can negatively affect staff morale, disrupt surgical training schedules, and increase the administrative burden associated with rescheduling procedures and communicating with patients.^[7] Therefore, reducing unnecessary delays has become a key metric for the efficiency of operating theatres and quality of healthcare.

There are a number of international and national research projects which have investigated the reasons why elective surgery is delayed or cancelled. The patient, surgeon and system related factors have been identified as the major factors that contribute to elective surgery delays in healthcare settings by Koushan et al. (2021), through a systematic review.^[8] The effect of operating room management, staffing restrictions, emergency case scheduling, patient medical fitness, infrastructure, and other factors have been reported in different countries on the surgical scheduling outcomes.^[9-11] Bharti et al. (2023) reported the same day cancellation was commonly seen in uncontrolled comorbidities, poor optimization prior to surgery and hospital factors in India.^[12] Likewise, in a tertiary care centre patient's medical unfitness and failure to follow preoperative directives were found to be the top two causes for delayed surgery by Sailo et al., (2021). Another study in India has highlighted the impact of the operating

theatre utilization, workflow inefficiencies, scheduling issues and multidisciplinary coordination on surgical productivity and case completion.^[1,5] Taken together, they show that elective surgery is a complex issue that is related to interactions between patients, healthcare professionals and institutional resources and that these factors can contribute to postponement.

Despite all the evidence, there is still much that we don't know. Most of the published study has dealt with individual factors associated with postponement, either patient-related, anesthesia-related, or administrative-related; and none of the published studies has comprehensively assessed factors for postponement at the same time. In addition, the majority of published research studies are retrospective studies, which are unable to capture real-time operational challenges on the day of surgery. The evidence from developing countries is very limited and the results from high-resource health care systems may not be truly representative of the situation in tertiary care hospitals in India where high patient loads, limited resources, emergency surgical workloads, and infrastructural challenges often affect elective surgical services. Furthermore, facility-specific information about the relative contribution of each of the three factors (patient-related, health professional-related, facility-related) is very limited. Hence, the present study was undertaken to find out the factors responsible for postponement of elective general surgical procedures in a tertiary care teaching hospital namely health professional related, patient related and facility related factors.

MATERIALS AND METHODS

Study Design and Setting

A cross-sectional observational study was done in the department of general surgery at Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India in a hospital setting. The study was conducted for 18 months after getting approval from the Institutional Ethics Committee.

Study Objective

The objective of the study was to find health professional related, patient related and facility related factors responsible for delayed elective general surgical procedures in OT. The purpose of the study was to identify the factors responsible for delay in elective general surgical procedures in the OT of a tertiary care teaching hospital from the various health professional related, patient related and facility related factors.

Study Population

Adult inpatients aged ≥ 18 years admitted to the Department of General Surgery who were scheduled for elective general surgical procedures during the study period were included in the study. Those whose surgeries were delayed after pre-anesthetic clearance (PAC) were the only ones eligible for inclusion.

Sample Size and Sampling Technique

The sample size was calculated using the formula:

$$n = Z^2 \times P \times (100 - P) / E^2$$

where $Z = 1.96$ at a 95% confidence level, $P = 29.5\%$, and $E = 7\%$. The minimum required sample size was calculated to be 163 patients. Consecutive sampling was employed, and all eligible patients meeting the inclusion criteria during the study period were enrolled until the required sample size was achieved.

Inclusion and Exclusion Criteria

Patients aged 18 years and above who were admitted to the general surgery ward, scheduled for elective general surgical procedures, and whose surgeries were postponed after pre-anesthetic clearance were included in the study. Patients who underwent emergency surgical procedures, conservatively managed patients, patients who left against medical advice (LAMA) and patients who refused surgery were excluded.

Data Collection

A pre-designed and structured data collection proforma was used to collect data. The data documented comprised of demographic data, clinical diagnosis, planned surgical procedure, planned surgery date, date of surgery postponement and documented reason for postponement. The causes identified were divided into three major categories: health professionals factors, patient factors and facility factors. Surgeon-related and anesthesia-related causes were classified as health professional related factors. Surgery related and anesthesia related factors were categorized as health professional related factors. Medical comorbidities, abnormal preoperative investigations and non-compliance with preoperative instructions were included among patient-related factors. The facility related factors were operation theatre infrastructure problems, shortage of resources, emergency cases as a priority and administrative or scheduling related problems.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences

(SPSS) version 21.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean $\pm$ standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages. Descriptive statistics were used to determine the distribution of postponement factors. Associations between categorical variables were evaluated using the Chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant. The findings were presented using tables, bar charts, and pie charts wherever appropriate.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Patient confidentiality and anonymity were maintained throughout the study, and all collected information was used solely for research purposes.

RESULTS

Patient Characteristics

A total of 163 patients whose elective general surgical procedures were postponed were included in the study. The mean age of the study population was 43.2 ± 12.1 years (range: 18–74 years). Most of the patients were in the age group of 41–60 years (45.4%) and the second largest age group was 21–40 years (34.4%). Males made up 58.9% of the study population and females comprised 41.1%.

Most patients were Hindu (49.7%), followed by Muslim (22.1%), Sikh (18.4%), and Christian (9.8%). In the study population, 57.7% lived in urban areas while 42.3% lived in rural areas. The top three occupations of the population were labourers (28.2%), farmers (17.8%) and service workers (16.6%). There was no statistically significant relationship between the postponement factors category and demographic characteristics ($p > 0.05$). [Table 1]

Table 1: Demographic Characteristics of Patients with Postponed Elective General Surgical Procedures (n = 163)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–20	13	8
	21–40	56	34.4
	41–60	74	45.4
	>60	20	12.3
	Mean $\pm$ SD	43.2 ± 12.1	—
Gender	Male	96	58.9
	Female	67	41.1
Religion	Hindu	81	49.7
	Muslim	36	22.1
	Sikh	30	18.4
	Christian	16	9.8
Residence	Urban	94	57.7
	Rural	69	42.3
Occupation	Labourer	46	28.2
	Farmer	29	17.8
	Service	27	16.6
	Business	21	12.9

	Homemaker	24	14.7
	Student	9	5.5
	Unemployed/Retired	7	4.3

Clinical Profile and Planned Surgical Procedures

Out of the postponed cases, 101 (62.0%) were diagnosed with cholelithiasis and 17.8% with a breast lump, while 12.3% were diagnosed with inguinal hernia. Less than 8% of cases occurred with appendicitis, epigastric hernia and umbilical hernia (Table 2). Surgical procedures were indicated according to the diagnostic profile, as supported by

the distribution of postponed surgical procedures. The most commonly delayed surgeries were laparoscopic cholecystectomy (62.0%), breast lump excision (17.8%), and inguinal hernia repair (open) (12.3%). There was no statistically significant difference between the kind of surgical procedure and the postponement factors group ($p > 0.05$). [Table 3]

Table 2: Distribution According to Diagnosis and Annual Surgical Workload (n = 163)

Diagnosis	Frequency (n)	Percentage (%)
Cholelithiasis	101	62.0
Breast lump	29	17.8
Inguinal hernia	20	12.3
Appendicitis	7	4.3
Epigastric hernia	3	1.8
Umbilical hernia	3	1.8
Total	163	100.0

Inference: Not statistically significant

Table 3: Planned Surgical Procedures Postponed (n = 163)

Planned Surgical Procedure	Frequency (n)	Percentage (%)
Laparoscopic cholecystectomy	101	62.0
Breast lump excision	29	17.8
Open inguinal hernia repair	20	12.3
Appendectomy	7	4.3
Epigastric hernia repair	3	1.8
Umbilical hernia repair	3	1.8
Total	163	100.0

Inference: Not statistically significant

Health Professional-Related Factors

In 38 cases (23.3%), postponement was related to health professionals. Surgeon-related causes included unavailability of the surgeon (4, 2.5%), and change of diagnosis after a thorough reassessment of the patient preoperatively (3, 1.8%). None of these

factors proved to be statistically significant ($\chi^2 = 0.14$, $p = 0.71$).

Due to anaesthetist availability, six patients (3.7%) were delayed as a result of anaesthesia. This association was also not statistically significant ($\chi^2 = 0.89$, $p = 0.35$). [Table 4]

Table 4.4: Surgeon-Related Factors Responsible for Postponement of Elective General Surgical Procedures (n = 163)

Surgeon-related factor	Frequency (n)	Percentage (%)
Surgeon unavailable	4	2.5
Change in diagnosis	3	1.8
Chi-square value (χ^2)	0.14	
p-value	0.71	

Inference: Not statistically significant

Patient-Related Factors

In 40 patients (24.5%), the postponement was patient related. The largest subcategory in this was medical related types. In 15 patients (9.2 %), abnormal pre-operative investigations were noted, while 13 patients (8.0 %) had acute medical conditions (i.e. uncontrolled blood pressure, fever or blood glucose), and 4 patients (2.5 %) had medical conditions which had not been diagnosed previously but needed optimization.

Table 5 shows that medical related factors showed a statistically significant association with postponement ($p < 0.05$). Five patients (3.1%) were identified with compliance related factors, all of which were unable to follow the pre-operative instructions. There was no statistically significant association between this and the other variables ($\chi^2 = 1.84$, $p = 0.17$). Three patients (1.8%) were unable to afford HIV/HCV testing kits, which was not statistically significant ($\chi^2 = 0.92$, $p = 0.34$).

Table 5: Patient-Related Factors Responsible for Postponement of Elective General Surgical Procedures (n = 163)

Patient-related factor	Frequency (n)	Percentage (%)
Abnormal pre-operative investigations	15	9.2
Acute medical issue (BP/Fever/RBS)	13	8.0
Undiagnosed medical condition	4	2.5
Did not follow pre-operative instructions	5	3.1

HIV/HCV kit unaffordable	3	1.8
Total	40	24.5

Abbreviations: BP, blood pressure; RBS, random blood sugar.

Facility-Related Factors

The most common factor associated with postponement was facility related (83 patients or 50.9%). The factors related to operation theatre infrastructure were relatively infrequent such as unavailability of oxygen (2.5%), unavailability of power (1.8%) and unavailability of central suction (0.6%). None of these factors were statistically significant ($\chi^2 = 1.36$, $p = 0.72$). Factors related to resource availability were a significant reason for postponing. The problem of unavailability of surgical instruments was seen in 37 patients (22.7%), blood

shortage in 23 patients (14.1%) and equipment failure in four patients (2.5%). These factors had a statistically significant association with postponement ($\chi^2 = 12.84$, $p = 0.01$) (Table 6). Postponement was also significantly caused by administration and scheduling issues. 25 patients (15.3%) had the procedure postponed due to emergency case prioritisation, 17 patients (10.4%) had inadequate operating theatre time and five patients (3.1%) were fumigated in theatre. These factors were statistically significantly related to postponement ($\chi^2 = 15.27$, $p = 0.004$). [Table 7]

Table 6: Facility Resource and Infrastructure Factors Responsible for Postponement of Elective General Surgical Procedures (n = 163)

Facility-related factor	Frequency (n)	Percentage (%)
Instruments faulty/unavailable	37	22.7
Blood shortage	23	14.1
Oxygen unavailable	4	2.5
Equipment failure	4	2.5
Power outage	3	1.8
Central suction unavailable	1	0.6
Total	72	44.2

$\chi^2 = 12.84$, $p = 0.01$

Inference: Statistically significant

Table 7: Administrative and Scheduling-Related Factors Responsible for Postponement (n= 163)

Administrative factor	Frequency (n)	Percentage (%)
Emergency case prioritized	25	15.3
Insufficient OT time	17	10.4
Theatre fumigation	5	3.1
Chi-square value (χ^2)	15.27	
p-value	0.004	
Inference	Statistically significant	

Comparative Distribution of Postponement Factors

The three major categories of postponement factors were compared and it was found that the greatest number of postponements (50.9%, 83) were due to facility-related factors. Forty cases (24.5%) were due to patient-related factors and 38 cases (23.3%) to health professional-related factors. For two cases (1.2%) no specific cause was found. Facility-related factors was the most common reason for postponement of elective general surgical procedures overall, followed by patient-related and health professional-related factors. [Figure 1]

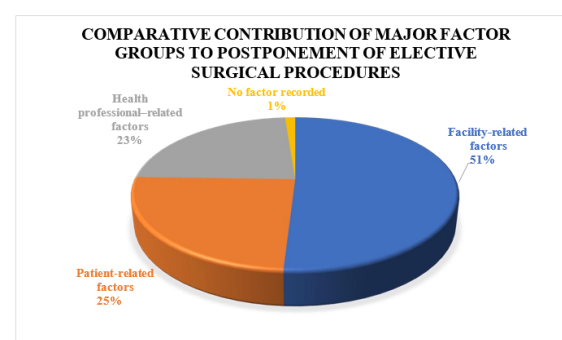


Figure 1: Comparative contribution of major factor groups responsible for postponement of elective general surgical procedures (n = 163). The pie chart demonstrates that facility-related factors constituted the largest proportion of postponements (50.9%), followed by patient-related factors (24.5%) and health professional-related factors (23.3%). Only a small proportion of cases (1.2%) had no identifiable factor recorded

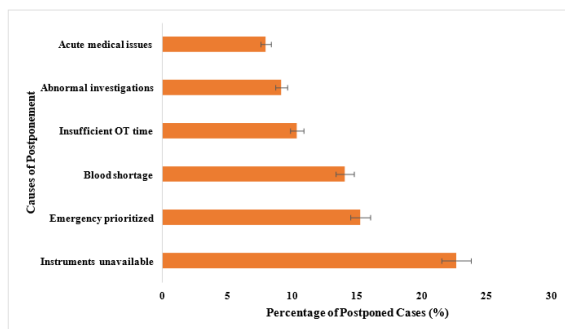


Figure 2: Major causes of postponement of elective general surgical procedures (n = 163). The bar chart illustrates the most frequently reported causes of postponement of elective general surgical procedures. Unavailability of surgical instruments was the leading cause, followed by emergency case prioritization, blood shortage, insufficient operating theatre time, abnormal pre-operative investigations, and acute medical conditions.

DISCUSSION

In the present study, the factors responsible for postponement of elective general surgical procedures were evaluated in a tertiary care teaching hospital wherein facility-related factors were shown to be the most significant, followed by patient-related and health professional-related factors. Resource availability and administrative/scheduling concerns were the top administrative patient-related factors for postponement, respectively, while medical optimization was the primary medical patient-related concern. These results indicate that although there are a number of patient and provider factors, the postpone elective surgery decision is more likely to be influenced by system-level constraints. Facility related factors had the highest percentage of postponed procedures, underscoring the importance of hospital infrastructure, management of resources and efficiency on surgical service delivery. Raghavan et al. (2024), Rudresh et al., (2023) and Sukwana et al. (2023) found that infrastructure constraints, equipment shortages and inefficiencies in operating theatres were significant factors behind elective surgery delays in both resource-rich and resource-poor healthcare environments.^[5,14,15]

The majority of facility related causes in the present study, mainly due to the problems of the tertiary level hospitals as a result of high patient volume, emergency service competition and scarcity of resources which often interfere with the planned surgical schedule. Resource availability was the only factor among the facility-related factors that statistically significantly associated with postponement. The most common cause related to resources was unavailability and/or malfunction of surgical instruments. The discovery underscores the need for proper inventory management, equipment maintenance, and sterilization processes to ensure a seamless surgical experience. The same was found by Rudresh et al. who showed that lack of equipment

management is one of the significant reasons for operating theatre inefficiency and underutilisation of surgical capacity.^[5] There was also a significant number of blood shortages, which indicated the reliance of elective surgical services on adequate blood transfusion provision. Other studies have also found limitations in the blood banks to be significant delays in surgical care in high volume tertiary care settings.^[10]

There was also a strong association between administrative/scheduling factors and postponement. One of the biggest contributors was emergency case prioritization, highlighting the constant issue of emergency versus elective surgical needs in a constrained operating theatre. Similar observations have been made by Raghavan et al. (2024) and Karki et al. (2020) who reported that elective procedures were frequently preempted by emergency procedures, causing significant disruption to planned operating lists and impacting theatre efficiency.^[4,14] Inadequate operating theatre time was also important, indicating that the estimation of case-duration, list planning and turnover management were inadequate. Other studies have also found the scheduling error and the time it takes for the surgeries to be performed as significant factors leading to elective surgery delays.^[11,16] Together, these results suggest that better operating theatre design and optimization, ongoing theatre schedule tracking and specific theatre resources for emergencies could contribute to fewer unnecessary theatre delays.

Patient-related factors accounted for the second largest group of postponements, and were mainly medical. Patient-related factors included abnormal pre-operative investigations, uncontrolled medical conditions and newly identified comorbidities to be optimized (most common). The strong correlation reported between medical factors and postponement highlights the need for thorough evaluation and optimization of medical comorbidities prior to surgery. The findings are consistent with those of Karki et al. (2020) and Sailo et al. (2021) who found that uncontrolled hypertension, diabetes mellitus, acute infections and abnormal laboratory investigations are the common reasons for postponing elective surgery.^[4,13] These observations highlight the importance of having a pre-anesthetic assessment clinic and identifying high-risk patients early to reduce cancellations and delays at the time of surgery.

The others, such as compliance related and socioeconomic factors, had lesser contributions to postponement and were not statistically significant. Delayed cases were few due to failure to follow up the pre-operative instructions and lack of pre-operative investigations. These findings contradict those of Becker et al., (2021) and other investigators, who have reported that socioeconomic factors and patient preparation for surgery are important factors leading to surgical postponement.^[17] This lower contribution of these factors in the present study could be due to the availability of the institutional

support systems, inpatient optimization protocol, and preoperative counseling services that help alleviate patient-related barriers to surgery.

Postponements were less likely due to health professional-related factors than to facility-related and patient-related factors. Surgeon unavailability, reassessment of diagnosis and anaesthetist unavailability were identified but none proved to be statistically significant with postponement. Other studies from high-volume hospitals reporting workforce related delays have reported similar findings, although in these hospitals delays are encountered intermittently and often due to case allocation in emergency situations, rather than due to ongoing staffing shortages.^[3,15] While these factors occur less often, they are important as single incidents of a surgical team not being available can have an impact on the efficiency of operating theatres and patient scheduling.

The general trend of postponement factors seen in the current study corroborates the current evidence that the majority of elective surgery postponements are system driven. This is in line with the results of international systematic reviews and institutional studies which have highlighted the importance of organizational and operational difficulties in the field of surgical efficiency.^[8,14,15] The results indicate interventions that increase the availability of resources, optimize operating theatre scheduling, improve the management of theatre equipment, and increase perioperative planning will be more effective at reducing the postponements rates than interventions focusing solely on patient-level variables.

This study's results have implications for health care administrators and surgical teams. Many avoidable postponements could be significantly cut if the services of preoperative assessment were enhanced, instruments and blood products were available in a timely fashion, data-driven scheduling was used and there were dedicated pathways for emergency surgical cases. The implementation of such measures could optimise the operating theatre utilisation, lower health care cost, increase patient satisfaction, and ultimately better the quality of delivering health care in tertiary care institutions.

CONCLUSION

The present study shows that it is a multifactorial problem and facility-related factors are the most important factors. Institutional and system-level issues accounted for over half of all postponements, highlighting the need to ensure that resources are available, theatre set-up is efficient, and administrative processes run smoothly for the successful delivery of elective surgical services. Resource-related or unavailability issues, especially surgical instruments and blood products, and scheduling issues like emergency case prioritization,

lack of operating theatre time, were recognized as the top factors contributing to postponement.

The second most frequently cited group of postponements were patient-related factors, where the major contributors were abnormal preoperative investigations, unmanageable acute medical conditions and newly diagnosed comorbidities. The results of this study underscore the need for thorough preoperative evaluation and prompt medical optimization to minimize unnecessary delays. By contrast, factors associated with compliance and socioeconomic factors had a relatively small effect on postponement within the study population. A smaller proportion of delays was related to health professional-related factors, and there was no statistically significant association with postponement, implying that health workforce factors were less important than other institutional factors.

The results of the study suggest that the system-based approach with the emphasis on increasing the rates of returning the postponed cases, increasing the availability of equipment and its maintenance, increasing the support of the blood bank, optimizing the scheduling of operating theatres, and optimizing the planning processes of the operating theatre is necessary. The development of strong pre-anesthetic pathways and ongoing performance monitoring in operating theatre may still further enhance efficiency. Improving the utilization of operating theatres, lowering the cost of healthcare, improving patient satisfaction, and improving the overall quality of care delivered in these operating theatres in tertiary care teaching hospitals could be achieved by addressing these modifiable factors.

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