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# Incidence and root causes of surgery cancellations at an academic medical center in Iran: a retrospective cohort study on 29,978 elective surgical cases

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## Abstract

**Introduction** Canceling scheduled surgeries on the day of surgery places a heavy burden on healthcare providers and has psychological, social, and financial consequences on patients and their families. This study aimed to investigate the main reasons for cancellations of elective procedures and provide appropriate recommendations to reduce the rate of such avoidable cancellations.

**Methods** Data were collected retrospectively from all consecutive elective cases scheduled for various elective surgeries from January 1, 2020 to March 31, 2022 at Namazi Teaching Hospital, a major referral center in southern Iran with a capacity of 938 beds. Daily data were collected on the number of planned electives, cancellations, and reasons for cancellations. Surgical cancellation reasons were categorized as patient-related, surgeon-related, hospital/system-related, and anesthesia-related. Data were expressed as frequency (percentage) and analyzed with SPSS version 19 software.

**Results** The cancellation rate on surgery day for elective procedures in all fields was 6.3%. The highest cancellation rate was related to minor surgeries (19%), followed by urology (8%), pediatrics (7%), and plastic surgery (7%). The most common reasons for cancellation were patients not suitable for the procedure (37%), followed by patients who did not follow instructions (10%), lack of time (10.5%), and equipment/supplies problems (10%), and refusal to consent (6%).

**Conclusions** According to this study, patients' unsuitability for surgery, non-compliance with instructions, lack of time, and problems with equipment/supplies are the main reasons for canceling surgery. Proper preoperative assessment and preparation of patients and improved communication between medical teams and patients reduce the cancellation of booked surgeries.

**Keywords** Cancellation, Cases, Elective surgery, Prevalence, Iran

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## Introduction

Canceling scheduled surgeries on the intended day of surgery is not an uncommon occurrence worldwide. Canceling and delaying surgeries put a huge burden on healthcare providers, including hospitals, physicians, medical assistants, and nursing staff [1], and it has financial, psychological, and social consequences for patients and their families [2–4]. In the United States (US), the value of each wasted minute of operating room time was estimated to be between \$10 – \$20, and the average canceled operation costs \$ 5,000–8,000 [5]. Only one single-center study in Iran has reported the average cost of surgery cancellations to be around US\$ 92,049.0 [3].

Long waiting lists cause the migration of pre-scheduled cases to the upper stage, leading to poor patient turnover and lost teaching opportunities in teaching hospitals [6]. Cancellation of elective operations is a parameter to evaluate the quality of patient care and the quality of the management system [7]. The overall elective surgery cancellation rate varies significantly by country and type of setting, ranging from 1 to 30% of booked elective surgeries [8, 9].

The most common reasons for cancellation of elective surgery cases included a wide range of hospital, anesthesiologist, surgeon, and patient-related factors such as bed unavailability due to an increased number of emergency admissions, equipment shortages, ICU bed shortage, inadequate preoperative assessment, not following instructions, etc. [10, 11].

Despite the regional recognition of high-quality healthcare, there has been only one study reviewing the causes of cancellation before and after the implementation of a health sector transformation plan in Iran at Namazi Hospital [3]. This research aimed to investigate the main reasons for elective procedure cancellation and to make appropriate recommendations for reducing the rate of such avoidable cancellations and optimizing the utilization of the workforce and resources.

## Methods

In this retrospective study, all consecutive elective cases scheduled for various elective surgeries from January 1, 2020, to March 31, 2022, were included in Namazi Teaching Hospital. Individuals listed for elective surgery but performed as an emergency before the day of the schedule were excluded from the study. Namazi is the main referral center in southern Iran affiliated with Shiraz University of Medical Sciences, Shiraz, Iran. Also, it serves a large population of neighboring Arab countries of the Persian Gulf. This institution has a total capacity of 938 beds and has maintained an average occupancy rate of 79% during 2021–2022. Patients were clinically evaluated 1–7 days before the surgery in the hospital or outpatient department. Day cases were admitted on the morning of

surgery. The list of operations for elective procedures is prepared and sent to the operating rooms by the preceding afternoon. The listed cases are assessed in the ward the evening before surgery, and complicated cases are reported to the consultant anesthetist. Operations data, including the number of electives scheduled, the number of cancellations, and specialty-related reasons for cancellations were collected manually by an operating room nurse. Reasons for surgical cancellations in this study were classified as patient-related, including non-adherence to instructions, refusal to consent, not attending, high blood pressure / uncontrolled blood sugar, upper respiratory tract infections, and impaired cardiac/ pulmonary function; surgeon-related factor that includes patient unsuitable for surgery, change in plan, absence of surgeon, lack of operating theater time; hospital/system-related factors include unavailability of drugs, equipment, and supplies, ICU bed shortage, last-minute emergencies, and anesthesia-related factors that include patient unpreparedness for surgery due to incomplete preoperative assessment. The data were entered into SPSS software version 19 (IBM Co., Armonk, NY, USA), analyzed descriptively, and presented in the tables and text.

## Results

We analyzed 29,978 elective surgical cases scheduled retrospectively; Pediatric and urology surgeries were performed for 7,509 (25.04%) and 6,827 (22.8%) cases in the study period, respectively, the cancellation rate on surgery day for elective procedures in all fields was 6.3% and highest cancellation rate among different surgical subspecialties was related to minor surgeries, for example, intravascular catheter placement, endoscopy, taking a biopsy, etc. (19%), followed by urology (8%), pediatric (7%), and plastic surgeries (7%) (Table 1).

The highest reasons for cancellation were patient unfit for operation (37%), then failure to follow instructions by the patient (10%), lack of time (10.5%), and equipment/supplies issues (10%). Other documented reasons (20%) include the patient did not attend, no procedure required, surgeon unavailability, ICU bed shortage, emergency priority, and overscheduled elective surgery (Table 2).

We reported the details of the cancellation along with the underlying reasons in Table 3.

## Discussion

There is considerable variation in the rate of and reasons for cancellations on the day of surgery, depending on the national healthcare service structure and individual hospital policies and management practices. This study aimed to investigate the main reasons for the cancellation of elective procedures and provide appropriate recommendations to reduce the rate of such avoidable cancellations and optimize the use of manpower and resources.

**Table 1** Total day of surgery cancellation per speciality distribution of booked cases

Specialty	Number of scheduled cases(n)	percentage of scheduled cases	Number of cancelled cases (n)	Ratio of cancelled/scheduled In each field (%)
Urology	6827	22.8	558	8.17
Pediatric surgery	7509	25.04	525	6.99
General surgery	3506	11.7	203	5.79
Vascular surgery	3349	11.17	182	5.43
Neurosurgery	2864	9.5	138	4.81
Thoracic surgery	1640	5.4	112	6.82
Plastic surgery	1165	3.9	80	6.86
Orthopedics	1734	5.8	66	3.80
Gynecological surgery	1275	4.2	10	0.78
Minor surgery	109	0.36	21	19.26
<b>Total</b>	<b>29,978</b>	<b>100%</b>	<b>1895</b>	<b>6.32</b>

**Table 2** Reasons for cancellation on day of surgery

reasons	type	frequency	percentage
Patient unfit for surgery	PR/AR/SR	701	37
Patient didn't follow instruction	PR	190	10
Refusal of consent	PR	114	6
Patient did not attend	PR	95	5
Procedure not required	PR	95	5
Lack of time	SR	198	10.5
Change in plan	SR	122	6.5
Surgeon unavailability	SR	76	4
Equipment/ supplies issues	HR	190	10
ICU bed shortage	HR	57	3
Emergency case priority	HR	57	3

**Table 3** Reasons for cancellation on day of surgery-further analysis

Cancellation type	Underlying reason
Patient unfit for surgery	Missed clinical work up
	Patient on medication
	Abnormal laboratory result
	High blood pressure / Uncontrolled blood sugar
	Acute medical illness
Equipment/ supplies issues	Equipment not available (i.e. intravascular catheter)
	Problems with necessary equipment (i.e. XRAY, echo)

The cancellation rate on surgery day for elective procedures in all fields was 6.3%. The highest cancellation rate was related to minor surgeries (19%), followed by urology (8%), pediatrics (7%), and plastic surgery (7%). The most common reasons for cancellation were patients not suitable for the procedure (37%), followed by patients who did not follow instructions (10%), lack of time (10.5%), and equipment/supplies problems (10%), and refusal to consent (6%). Our findings are inconsistent with studies conducted in St. Paul's Hospital, Addis Ababa (8.9%) [12], Saudi Arabia (7.6%) [13], Brazil (6.8%) [14], and Wales

(7.6%) [15], also lower than studies conducted in Sudan (20.2%) [16], Nigeria (20.2%) [17], Germany (12.7%) [18], New Delhi (17.6%) [19], and India (16.49%) [20]. In our research, the rate of cancellation was high in internal surgeries (minor surgery, e.g., intravascular catheter insertion, endoscopy, taking a biopsy, etc. (19%), followed by urology (8%), pediatric (7%), and plastic surgeries (7%). These variations may be explained by the national healthcare service's structure, individual hospital policies, and management practices. Although there is a well-established pre-assessment service in the study hospital and pre-anesthetic clinic, the most common reason for cancellation on the surgery day was that the patient was medically unfit for the operation. Some of the reasons identified were disagreement between the outcome at pre-assessment and the opinion of the anesthesiologist in charge on the day of the operation, the deterioration of the patient's condition between pre-assessment and the operation day, and abnormal laboratory results detected after admission.

Previously, it has been reported that pre-assessment of the patient 30 days before surgery is not associated with a reduction in the volume of cancellations compared to pre-assessment 24 h before surgery [21]. If the health status of patients is assessed too early before surgery, it may change in the period leading up to surgery. In addition, if the patient is diagnosed late for proper surgery, the time available for any intervention will be limited, and there will not be enough time to make appropriate changes in the surgery list. Thus, the effectiveness of providing surgical services will be compromised [22].

The second most common reason for cancellation on surgery day was lack of time at the study hospital. Published studies from public hospitals have reported similar rates of cancellations on surgery days due to lack of time [23, 24]. Major surgeries in all specialties are performed in the study center, which sometimes requires the simultaneous attendance of several surgical specialists. These

long-term surgeries disrupt the process of performing other surgeries as well.

Another common reason for cancellation on surgery's day in this hospital was that patients did not follow guidelines, consistent with studies conducted worldwide [25, 26].

Patients turn up for their operations without following the fasting instructions or eliminating their anticoagulation medications, leading to delays, rescheduling, or cancellations. The root cause of patient noncompliance with preoperative instructions is a multifactorial and arduous problem to manage. It is possible that the surgeon did not express the specific fasting instructions and instructions for taking or removing their current medications understandably, or the patients did not remember the instructions well because of impaired memory [26]. Instructions should be given verbally, information sheets should be provided, instructions should be repeated in pre-assessment clinics, and information should be shared with all those involved in the patient's care, such as ward staff in inpatient cases or patients relevant in day cases. Also, sending automated reminders can prepare patients for surgery and prevent cancellations. The last common reason for cancellation at the study hospital was Equipment/supplies issues.

The limited capacity to provide basic medical equipment to diagnose and treat all referring patients can be partly attributed to the indirect effects of the Health Sector Transformation Plan (HSEP), which was carried out in hospitals affiliated with the Ministry of Health and Medical Education (MOHME), including this hospital, to reduce catastrophic health expenses (CHE) to 1% as announced in the fifth plan of economic, social and cultural development. As a result, the amount paid by patients eligible for basic health insurance will be reduced by 6% and 3% of the total hospitalization costs, and all people without basic health insurance will be covered for free [27]. In this situation, the high load of patients referring to public hospitals to use these services, the limited financial resources of the hospital, and the failure to return the hospital expenses on time by the insurance organizations reduce the ability of the hospital to provide the necessary equipment.

### Limitations

This study was a retrospective chart review of the main reasons for canceling elective procedures in the largest referral center in southern Iran. It was so hard to separate reasons for cancellations into distinct categories; some cancellation reasons may fall into more than one category. We are interested in preparing a special questionnaire for canceled surgeries in which the reason for the cancellation is clearly specified.

### Conclusion

This study highlights some extent the causes of cancellation of operations are avoidable. Patients not being suitable for the procedure, not following instructions, lack of time, and equipment/supplies issues are the main reasons for cancellation.

Although automatic reminders are helpful for patients who do not adhere to the preoperative instructions, how well patients understand preoperative instructions and the cooperation of all involved in patient care are unavoidable factors.

Determining the exact duration of each surgery is difficult, but setting a controlled schedule with the cooperation and advice of the surgical and anesthesia teams based on their experience seems to prevent overbooking of the operating room list and reduce the cancellation rate in university hospital settings.

To reduce the hospital's limitations in providing medical equipment, it seems that our policy in the Health Sector Transformation Plan (HSEP) and obligations of insurance organizations to return hospital expenses on time need revision.

### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s13037-023-00377-6>.

Supplementary Material 1

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### Authors' contributions

All authors contributed to the study design. R.Z. and M.N. were responsible for proposal writing and collecting data. V.N., M.S., and M.E. were responsible for study conception, data interpreting, manuscript drafting, and final manuscript revision. M.B. contributed to data analysis, editing, and revising manuscript and manuscript preparation. All authors read the final version of the manuscript and accept accountability for all aspects of this work.

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### Data availability

Data related to the study are available upon reasonable request to the corresponding author.

### Declarations

#### Ethical approval

It was not necessary for this study because operating room cancellation statistics were used.

#### Competing interests

The authors declare no competing interests.

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## References

1. Nigatu YA, Aytolign HA. Cause and incidence of Cancellation of elective surgeries at Gondar University hospital, Ethiopia. 2020.
2. Nanjappa B, Kabeer KK, Smile SRJJoCR. Rev Elect Surg case cancellation-an Audit. 2014;6:19.
3. Maimaiti N, Rahimi A, Aghaie LAJEJoHD. Economic impact of surgery cancellation in a general hospital. Iran. 2016;30:94–8.
4. Robb WB, O'Sullivan MJ, Brannigan AE, Bouchier-Hayes DJ. Are elective surgical operations cancelled due to increasing medical admissions? Ir J Med Sci. 2004;173:129–32. <https://doi.org/10.1007/bf03167925>. PubMed PMID: 15693380.
5. Turunen E, Miettinen M, Setälä L, Vehviläinen-Julkunen K. Financial cost of elective day of surgery cancellations. 2018.
6. Ojo E, Ihezue CJE, Surgery, CAJo. An audit of day case cancellations in a nigerian tertiary hospital based day case unit. 2008;13:150–3.
7. Lankoande M, Bonkougou P, Traore S, Kabore R, Ouangre E, Pendeville PJSaJoA et al. Cancellation of elective surgical procedures in the university teaching hospital center Yalgado Ouedraogo in Burkina Faso: incidence, reasons and proposals for improvement. 2016;22:140–4.
8. Trentman TL, Mueller JT, Fasset SL, Dormer CL, Weinmeister KPJJoA, Research C. Day of surgery cancellations in a tertiary care hospital: a one year review. 2010;1.
9. Garg R, Bhalotra AR, Bhadoria P, Gupta N, Anand R. Reasons for cancellation of cases on the day of surgery-a prospective study. Indian J Anaesth. 2009;53:35–9. PubMed PMID: 20640075; PubMed Central PMCID: PMC2900031.
10. Zafar A, Mufti TS, Griffin S, Ahmed S, Ansari JA. Cancelled elective general surgical operations in Ayub Teaching Hospital. J Ayub Med Coll Abbottabad. 2007;19:64–6. PubMed PMID: 18444594.
11. Haana V, Sethuraman K, Stephens L, Rosen H, Meara JG. Case cancellations on the day of surgery: an investigation in an Australian paediatric hospital. ANZ J Surg. 2009;79:636–40. <https://doi.org/10.1111/j.1445-2197.2009.05019.x>. PubMed PMID: 19895520.
12. Bekele M, Gebre S, Mesai DJE, Surgery, CAJo. A cross-sectional study investigating the rate and determinants of elective case cancellations at St. Ethiopia: Paul's Hospital Millennium Medical College, Addis Ababa; 2020. p. 25.
13. Dhafar KO, Ulmalki MA, Felemban MA, Mahfouz ME, Baljoon MJ, Gazzaz ZJ, et al. Cancellation of operations in saudi arabian hospitals: frequency, reasons and suggestions for improvements. Pak J Med Sci. 2015;31:1027–32. <https://doi.org/10.12669/pjms.315.7932>. PubMed PMID: 26648980; PubMed Central PMCID: PMC4641249.
14. Santos G, Bocchi SCM. Cancellation of elective surgeries in a brazilian public hospital: reasons and estimated reduction. Rev Bras Enferm. 2017;70:535–42. <https://doi.org/10.1590/0034-7167-2016-0084>. PubMed PMID: 28562801.
15. Chiu CH, Lee A, Chui PT. Cancellation of elective operations on the day of intended surgery in a Hong Kong hospital: point prevalence and reasons. Hong Kong Med J. 2012;18:5–10. PubMed PMID: 22302904.
16. Mutwali IM, Abbass AM, Elkheir IS, Arbab SS, Bur A, Geregandi TJSMM. Cancellation of elective surgical operations in a teaching hospital at Khartoum Bahri. Sudan. 2016;11:45.
17. Okeke CJ, Obi AO, Tijani KH, Eni UE, Okorie CO. Cancellation of elective surgical cases in a nigerian teaching hospital: frequency and reasons. Niger J Clin Pract. 2020;23:965–9. [https://doi.org/10.4103/njcp.njcp\\_650\\_19](https://doi.org/10.4103/njcp.njcp_650_19). PubMed PMID: 32620726.
18. Schuster M, Neumann C, Neumann K, Braun J, Geldner G, Martin J et al. The effect of hospital size and surgical service on case cancellation in elective surgery: results from a prospective multicenter study. Anesth Analg. 2011;113:578–85. <https://doi.org/10.1213/ANE.0b013e318222be4d>. PubMed PMID: 21680860.
19. Kumar R, Gandhi R. Reasons for cancellation of operation on the day of intended surgery in a multidisciplinary 500 bedded hospital. J Anaesthesiol Clin Pharmacol. 2012;28:66–9. <https://doi.org/10.4103/0970-9185.92442>. PubMed PMID: 22345949; PubMed Central PMCID: PMC3275976.
20. Shivakumar G, Lokesh VJI. Reasons and appropriate measures to circumvent cancellation of elective surgical cases: a clinical audit of a government teaching hospital. 2021;4:06–10.
21. Pollard JB, Olson L. Early outpatient preoperative anesthesia assessment: does it help to reduce operating room cancellations? Anesth Analg. 1999;89:502–5. <https://doi.org/10.1097/0000539-199908000-00048>. PubMed PMID: 10439775.
22. Singh GC, Agha R, Roberts DRJAS. Cancellations in day-case ENT surgery. 2005;12:57–60.
23. González-Arévalo A, Gómez-Arnu JI, delaCruz FJ, Marzal JM, Ramírez S, Corral EM, et al. Causes for cancellation of elective surgical procedures in a spanish general hospital. Anaesthesia. 2009;64:487–93. x. PubMed PMID: 19413817.
24. Demilew BC, Yisak H, Terefe AA. Magnitude and causes of cancellation for elective surgical procedures in Debre Tabor General hospital: a cross-sectional study. SAGE Open Med. 2021;9:20503121211003357. : 10.1177/20503121211003357. PubMed PMID: 33796304; PubMed Central PMCID: PMC7975488.
25. Dimitriadis PA, Iyer S, Evgeniou E. The challenge of cancellations on the day of surgery. Int J Surg. 2013;11:1126–30. <https://doi.org/10.1016/j.ijso.2013.09.002>. PubMed PMID: 24035905.
26. Feleke MG, Chichiabellu TY, Ayalew TL. Magnitude and reasons of surgery cancellation among elective surgical cases in Wolaita Sodo University Comprehensive Specialized Hospital, Southern Ethiopia, 2021. BMC Surg. 2022;22:300. <https://doi.org/10.1186/s12893-022-01749-y>. PubMed PMID: 35927654; PubMed Central PMCID: PMC9354349.
27. Pirooz B, Moradi G, Nouri B, Mohamadi Bolbanabad A, Safari H. Catastrophic Health Expenditure after the implementation of Health Sector Evolution Plan: a Case Study in the West of Iran. Int J Health Policy Manag. 2016;5:417–23. <https://doi.org/10.15171/ijhpm.2016.31>. PubMed PMID: 27694669; PubMed Central PMCID: PMC4930347.

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