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Original Article

The incidence and impact of cancellations of elective paediatric surgery at a quaternary hospital in South Africa: A retrospective cohort design.

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Abstract

Background

Cancellation of elective paediatric surgery remains a significant challenge in resource-constrained healthcare systems. These impose emotional, financial, and logistical burdens on patients, families, and healthcare institutions, while potentially compromising patient outcomes.

Objectives

To determine the incidence and causes of cancellations of elective paediatric surgical procedures at a South African quaternary academic hospital.

Methods

A retrospective cohort review was conducted of paediatric patients scheduled for elective surgery at Charlotte Maxeke Johannesburg Academic Hospital between 1 January 2018 and 31 December 2019.

Results

During the study period, 2,098 elective paediatric surgical procedures were scheduled. Of these, 778 procedures were cancelled (37.1%). The median age of patients was 3 years (IQR 0–7), and 65% were male. Institutional factors accounted for most cancellations at first booking (59.7%). The leading institutional causes were time constraints (57.5%) and unavailability of intensive care or high-care beds (21.5%). Parent-related factors contributed 22.3% of first cancellations, patient-related factors accounted for 15.5% of cancellations, with medical unfitness and respiratory tract infections being the most common reasons. Repeated cancellations were common, and 182 patients (8.7%) were ultimately lost to follow-up. Following cancellation, a notable proportion of patients later required emergency surgery, while three patients died before undergoing their planned procedures.

Conclusion

Elective paediatric surgery cancellations occurred at a high rate, largely driven by institutional resource limitations. Repeated cancellations, loss to follow-up, emergency surgical conversion, and mortality highlight the potential consequences of delayed surgical care.

Recommendations

Targeted interventions should focus on improving operating theatre efficiency, reducing time-related cancellations, and expanding access to intensive care and high-care beds. Establishment of a dedicated preoperative assessment clinic and enhanced communication with caregivers may decrease cancellations. Future prospective studies should evaluate the long-term clinical, psychosocial, and economic consequences of surgical cancellations and assess the effectiveness of quality-improvement interventions.

Keywords: paediatric, surgery, cancellation, elective, emergency.
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Introduction

Elective paediatric surgical procedures are planned weeks in advance. (1, 2). The preparation is extensive and involves the whole family. (1, 2). A multidisciplinary team ensures that the patient and family are ready for surgery by providing information about the procedure. (3). Cancellation of elective surgery has multiple adverse effects, such as administrative, operational, social, financial, and emotional burden, which have an impact on the quality of patient care. (1-3).

The rates of cancellation of surgery are different in developed countries as opposed to developing countries. (3). The different rates and causes of cancellation of surgery may depend on the size of the hospital, the location, and various socio-economic factors (8). Paediatric patients are more likely to have elective surgery cancelled on the day of surgery because they are more susceptible to acute illnesses than adults (4). The reasons for the cancellation of surgery can be classified as either avoidable or unavoidable. (5). They may also be categorised as being hospital-related, patient-related, surgery-related, and anaesthesia-related (6). In a resource-constrained setting, such as the public sector hospital in South Africa, there may be a single operating theatre and one anaesthesiologist. (3, 5). The implication of this is that elective and emergency surgeries are performed in the same theatre. (3, 5). Often, the emergency surgeries will take precedence over elective surgeries. (3, 5). Cancellation rates of elective surgeries as a result of emergency surgery prioritization were reported as 64% in a South African audit of theatre records. (7).

Studies have found that most cancellations of elective surgery are avoidable. (2, 3, 5). In South Africa, the public health sector provides health care to 84% of the population. (8). This causes a disproportionate allocation of resources and highlights the importance of utilising the resources that are currently available. (8). An example is that of Pietersburg hospital in Limpopo province, South Africa, which has 500 beds and serves a population of approximately 5.5 million. (3). This bed-to-population ratio translates to the unavailability of post-operative beds, and this perpetuates the problem of cancellations of elective surgery. (9, 10). One of the most common unavoidable causes of cancellation of surgery in paediatric surgery is respiratory tract infection. (11).

The late cancellation of surgery affects families in multiple ways. (12). Families prepare for elective surgery emotionally, and arrangements to ensure attendance on the day of surgery are put in place. (2, 11, 13). Paediatric surgery involves the whole family. (2, 14). The family's reaction to news of the cancellation of the surgery may range from relief to anger or frustration. (15). Cancellations may delay the ability of patients and their families to return to the routines of their lives. (15). The long-term consequence of frequent cancellation of surgery is that patients and their families develop a distrust of the health system. (12). Parents of patients requiring surgery may come across as being resistant in future interactions with hospital personnel. (12).

In a developing country such as South Africa, many of the parents are employed in the informal sector, and some are self-employed, which means that the population most affected by cancellations of surgery is the low socio-economic groups (2, 3, 16). A study showed that as a result of elective surgical cancellation in paediatrics, parents lost income by paying for transportation, and they missed a day or more of work, and most were not paid for the days missed (17).

The influence of a low socio-economic background in all these is underestimated but is important. (3, 18). The socio-economic status of the family affects how the surgical procedure of the child is interpreted by the family. (16, 19). Socioeconomic status also affects the level of education acquired and may indirectly affect the ability of the parent to follow the pre-operative orders accurately, and therefore affect the overall healing process of the child after the surgery. (8, 16, 18, 19).

Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) is a quaternary hospital located in Johannesburg, South Africa; this is the setting of this research. The paediatric surgical department (PSD) cancellation rate has not been audited, despite an organised database being kept by the department. According to anecdotal evidence, the PSD performs 80 to 100 surgical procedures in a month. Both elective and emergency surgical procedures are conducted in one theatre during the day. At night, the PSD has access to an emergency theatre in the main theatre complex; this theatre is shared with all other surgical disciplines. The patients are aged 0 to 16 years old, and the surgical procedures are classified as general paediatric surgery. The department has 32 beds with access to a neonatal and paediatric Intensive Care Unit (ICU). The ICU is shared with the paediatric medical department. There is a paucity of data specific to paediatric surgery cancellations in South Africa. The objective of this study was to determine the incidence and causes of cancellations of elective paediatric surgical procedures at a South African quaternary academic hospital.

Methodology

Study design

This study was a retrospective observational cohort study conducted to determine the incidence and causes of cancellations of elective paediatric surgical procedures. The study reviewed routinely collected clinical and administrative data for paediatric patients scheduled for elective surgery over two years from 1 January 2018 to 31 December 2019.

Study setting

The study was conducted at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), a public-sector quaternary academic referral hospital situated in Johannesburg, Gauteng Province, South Africa. CMJAH is affiliated with the University of the Witwatersrand and serves as a tertiary

and quaternary referral centre for Gauteng and neighbouring provinces. The hospital provides a comprehensive range of specialist and subspecialist services, including paediatric surgery, paediatric anaesthesia, neonatal intensive care, paediatric intensive care, oncology, trauma, transplant, and various surgical disciplines. During the study period, elective and emergency paediatric surgical procedures were conducted within a shared theatre environment, with access to neonatal and paediatric intensive care facilities.

Participants

The study population consisted of all paediatric patients scheduled for elective surgical procedures within the Paediatric Surgery Department between 1 January 2018 and 31 December 2019. Eligible participants were patients aged 0–16 years who were booked for elective surgery during the study period. Exclusion criteria included patients older than 16 years, emergency surgical cases, and records with incomplete or missing data that precluded analysis.

Participants were identified from the departmental paediatric surgery database and theatre booking records. All eligible patients meeting the inclusion criteria during the study period were included, thereby constituting a consecutive sample of elective paediatric surgical bookings.

Bias

Several measures were implemented to minimise potential sources of bias. Selection bias was reduced by including all eligible elective paediatric surgical bookings recorded during the study period. Information bias was mitigated by multiple data sources, including theatre records, departmental databases, and patient files, to verify surgical bookings and reasons for cancellation. Standardised data collection procedures were used to ensure consistency in data extraction. As a retrospective study, the potential for missing or incomplete records remained a limitation and was addressed by excluding records with insufficient information for analysis.

Data Collection

Data were collected retrospectively from the paediatric surgery database, theatre records, and patient medical files. Information extracted included patient demographics (age and sex), indication for surgery, date of scheduled surgery, cancellation status, reason for cancellation, subsequent rebooking dates, waiting times until surgery, additional cancellations, and patient outcomes following cancellation.

Reasons for cancellation were categorised into institutional factors, parent-related factors, patient-related factors, and cases where surgery was no longer indicated. Institutional factors included time constraints, unavailable intensive care or high-care beds, emergency case prioritisation, and equipment-related issues. Parent-related factors included failure to attend, consent issues, documentation problems, and financial constraints. Patient-related factors included medical unfitness for surgery, respiratory tract infections, anaemia, failure to comply with fasting instructions, and the need for further medical workup. Data were recorded using a structured data collection form to ensure consistency of measurement across all records.

Ethical Considerations

Ethical approval for the study was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg, South Africa.

Ethics approval number

Wits HREC M210407, which was approved on 30 April 2021.

Permission to access patient records and departmental databases was obtained from relevant departmental and hospital authorities at Charlotte Maxeke Johannesburg Academic Hospital. As the study involved a retrospective review of existing records, informed consent from individual patients was waived by the ethics committee. Patient confidentiality was maintained throughout the study by anonymising all data before analysis and reporting.

Statistical Analysis

Data were analysed using Stata version 15 (StataCorp, College Station, TX, USA). Continuous variables were assessed for normality and summarised using means and standard deviations for normally distributed data, or medians and interquartile ranges (IQRs) for non-normally distributed data. Categorical variables were summarised using frequencies and percentages. Cancellation rates were calculated as proportions of scheduled elective surgical procedures. Reasons for cancellation, subsequent rebookings, loss to follow-up, waiting times, and patient outcomes were analysed descriptively. Results were presented using tables, figures, and summary statistics.

Results

A total of 2098 paediatric patients were booked for paediatric surgery between 1 January 2018 and 31 December 2019 (figure 1). A total of 1303/2098 (62%) surgeries were done at first booking, with the majority being abdominal surgery (54%), urogenital (22.6%), and others (23.4%). Abdominal surgery accounted for the majority of cancelled surgeries (33%) and included hernia repairs, colostomy reversal, and exploratory laparotomies.

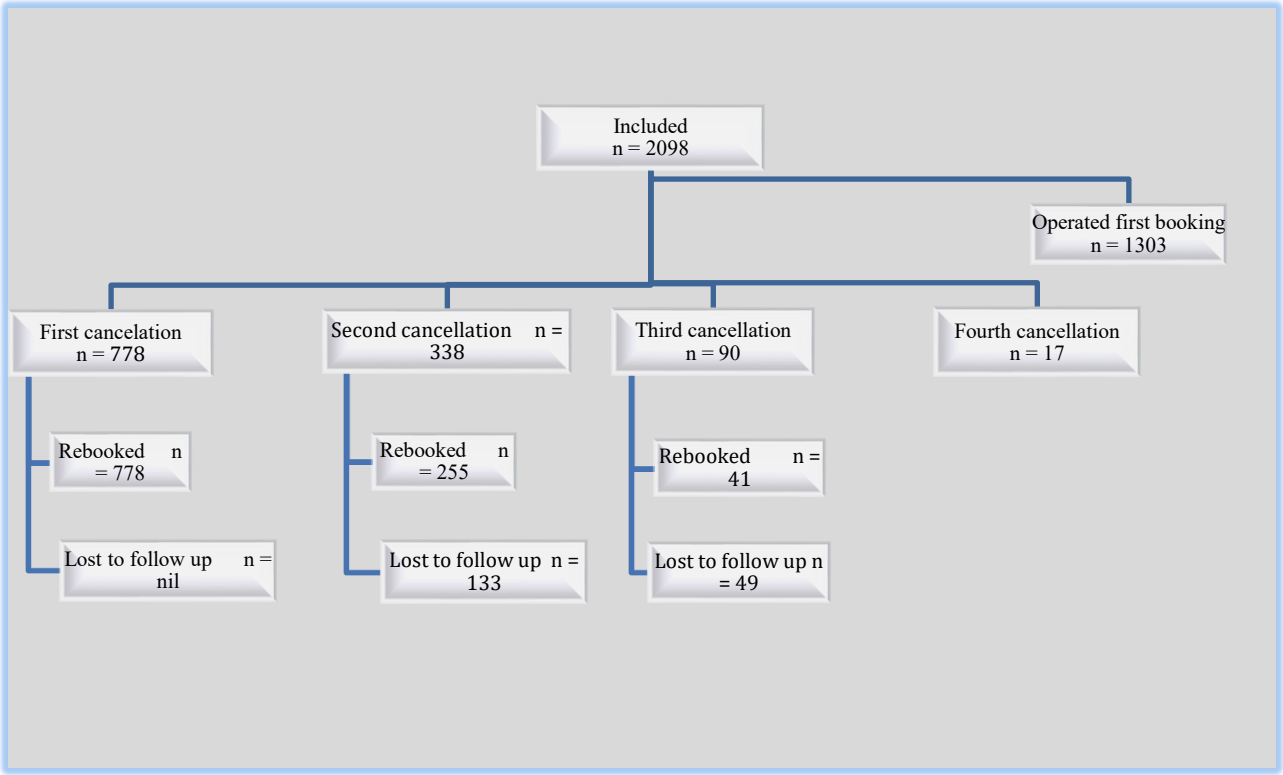

FIGURE 1. STUDY FLOW DIAGRAM

Out of the 2098 surgeries that were scheduled during the study period, 778 (37.1%) were cancelled (Figure 2). Of the 788 cancelled and rebooked, 388 (49.9%) were cancelled at first re-booking for surgery. A total of 255 (66%) were rebooked, and 133 (34%) were lost to follow-up. Ninety (41.9%) patients were cancelled at this second re-booking. Subsequent to being cancelled the third time, 41 (45.6%) patients were re-booked. At this stage, 17 (41.5%) patients were cancelled.

The median (IQR) age of the patients was 3 (0-7) years (Table 1). A majority of the bookings (34%) were for patients in the age range 1-4 years, followed by patients who were less than one year old (27%) and those who were in the age range 5-9 years (26%). The 10-16-year age group accounted for the least proportion of the surgeries booked. A majority (65%) of patients who were booked for surgery were male.

TABLE 1. STUDY CHARACTERISTICS

Parameter		N=2098 n (%)/median (IQR)
Sex - male		1361 (65%)
Age (years) median (IQR)		3 (0-7)
	<1	463 (27.1%)
	1-4	582 (34.0%)
	5-9	386 (22.6%)
	10-16	259 (15.1%)
	Unspecified	20 (1.2%)
Patients operated on		1320 (63.7%)
Cancellation rate at index booking (days)		778 (36.3%)
Time to surgery after index cancellation (days)		4 (1-12)
Patients who were rebooked after the first cancellation		778
Patients who were lost to follow-up after the first cancellation		0 (0%)
Patients operated on		390/778 (51.1%)
Cancellation rate at second rebooking		388/778 (49.9%)
Time to surgery after second cancellation (days)		4 (2-10)
Patients who were rebooked after the second cancellation		255/388 (66%)
Patients who were lost to follow-up after the second cancellation		133/388 (34%)
Patients operated on		165/255 (65%)
Cancellation rate at the third booking		90/255 (35%)
Time to surgery after third cancellation (days)		2 (1-3)
Patients who were rebooked after the third cancellation		41/90 (46%)
Patients who were lost to follow-up after the third cancellation		49/90 (54%)
Patients operated on		22/41 (54%)
Cancellation rate at the fourth booking		17/41 (46%)

The number lost to follow-up in total was 182 (8.7%). The median (IQR) waiting time until surgery after the first cancellations was 4 (1-12) days, 4 (2-10) days after the second cancellation, and 2 (1-3) days after the third cancellation.

Of the 133 surgeries that were rebooked after the second cancellation, 99 (80%) patients were operated on as elective surgeries, 25 (19%) as emergencies, and 1 (1%) patient demised before surgery (figure 2). After the 3rd cancellation, 22 patients were operated on, and 16 (67%) patients were as electives, 6 (25%) were as emergencies, and 2 (8%) patients demised before surgery.

Cancellations were classified into institutional reasons, parental-related, patient-related, and surgery-not-indicated reasons (Table 2). Institutional reasons accounted for a majority of the cancellations for first (59.7%), second (67.8%), and third (64.7%) booking cancellations. Parent-related reasons were the second leading contributor to the first booking cancellations, whilst patient-related reasons were second during the second booking.

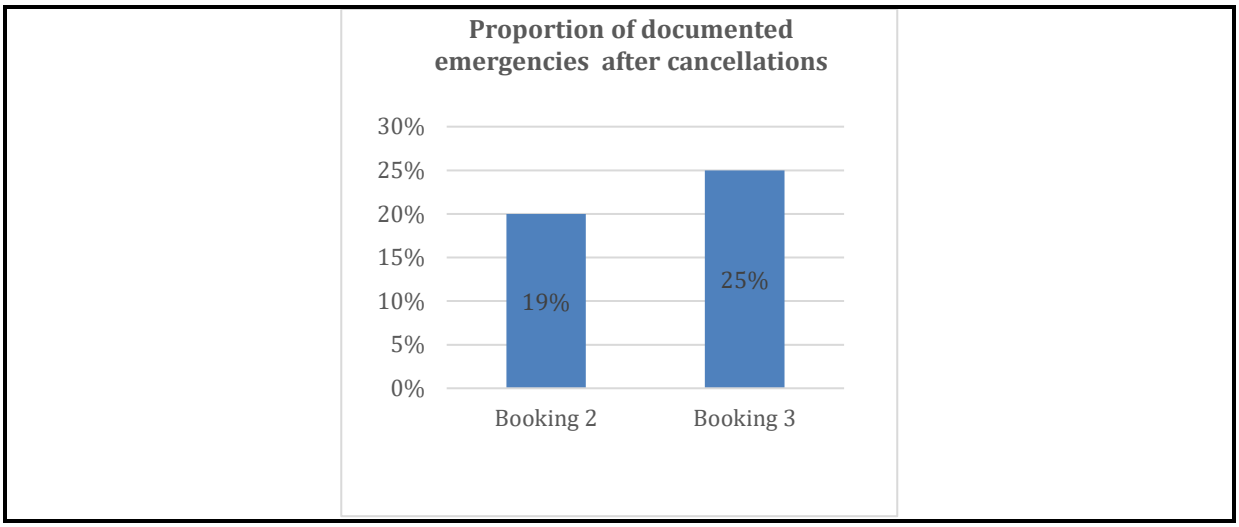

FIGURE 2. PROPORTIONS OF EMERGENCIES AS A RESULT OF PRIOR CANCELLATION

Factors that contributed to institutional, parent, and patient-related reasons for cancellation are tabulated (Table 3). Institution-related factors included: time constraints; unavailable intensive care unit (ICU) or high care beds; emergency priority cases; and equipment issues. In the first booking cancellation, a majority of the cancellations were attributed to time constraints (57.5%), followed by lack of ICU or high care beds (21.5%).

TABLE 2. REASONS FOR CANCELLATION OF SURGERY

Reasons for cancellation	First booking	Second booking	Third booking
Institution	428 (59.7%)	61 (67.8%)	11 (64.7%)
Parent	160 (22.3%)	11 (12.2%)	1 (5.9%)
Patient	111 (15.5%)	17 (18.9%)	2 (11.8)
Surgery not indicated	14 (2.0%)	1 (1.1%)	1 (5.9%)
Others	4 (0.5%)	-	2 (11.8%)

Emergency priority cases accounted for 14.2% of the cancellations, while equipment issues accounted for 4.7%. Similar patterns were observed in the second and third booking cancellations.

TABLE 3. FACTORS CONTRIBUTING TO CANCELLATIONS

Reasons		First booking	Second booking	Third booking
Institutional factors	Time constraints	246 (57.5%)	34 (55.7%)	5 (45.5%)
	No ICU/high care bed available	92 (21.5%)	23 (37.7%)	6 (54.5%)
	Emergency priority case	61 (14.2%)	2 (3.3%)	-
	Equipment issues	20 (4.7%)	2 (3.3%)	-
	Others	9 (2.1%)	-	-
Parental factors	No show	113 (70.6%)	9 (81.8%)	1 (100%)
	Consent issues	29 (18.2%)	1 (9.1%)	-
	Document issues	9 (5.6%)	1 (9.1%)	-
	Financial issues	9 (5.6%)	-	-
Patient factors	Unfit for surgery	32 (29.0%)	4 (23.5%)	2 (100%)
	URTI	20 (18.2%)	3 (17.7%)	-
	LRTI	19 (17.3%)	4 (23.5%)	-
	Ate food	15 (13.6%)	2 (11.7%)	-
	Further workup needed	13 (11.8%)	3 (17.7%)	-
	Anaemia	10 (9.1%)	1 (5.9%)	-
Others	Surgery not indicated	14 (77.7%)	1 (100%)	1 (33.3%)
	Referral	1 (5.5%)	-	-
	Report not available	1 (5.5%)	-	-
	Further workup needed	2 (11.1%)	-	2 (66.7%)

**URTI – upper respiratory tract infection, LRTI – lower respiratory tract infection, ICU – intensive care unit*

Parent-related factors were identified as: no shows, consent, official documents, and financial issues. Parents not showing up with the child for the booked theatre date was the biggest contributor across all the booking cancellations. Cancellations due to consent and document issues were only observed in the first and second cancellations.

Five predominant patient-related factors were identified: unfit for surgery; upper respiratory tract infection (URTI); lower respiratory tract infection (LRTI); patient eating food before surgery; further workup needed; and anaemia. The most common patient-related factors in the first booking cancellation were unfit for surgery (29.0%), URTI (18.2%), and LRTI (17.3%). Similar observations were made with the second booking cancellations, while most (64.7%) of the cancellations in the third booking were attributed to institutional factors. Other factors that contributed to cancellations include: surgery not indicated; referral and report not available. Eighteen patients were cancelled because surgery was not indicated.

Discussion

The cancellation rate in this study was 37% of elective paediatric surgeries. The majority of cancellations were for abdominal surgery, followed by urogenital surgery. Half of these cancelled operations could not be accounted for, and thus were assumed not to have ever been performed. These may have sought intervention at other institutions. A large proportion of patients were cancelled because of time constraints and lack of ICU or high care beds. The issue of unavailable ICU beds, particularly in a sick neonate, may have resulted in the demise of the neonate while awaiting surgery. This has been shown in other studies that cancellation of patients due to unavailability of a resource, such as an ICU, is correlated with death or complications of symptoms (3, 12, 20).

This study was not designed to follow the course of disease for all those who were cancelled; a significant number of those we lost to follow-up in subsequent bookings were operated on as emergencies. These included surgeries such as permanent catheter insertion for dialysis, exploratory laparotomies, Broviac line insertion, and surgeries that would later become emergencies due to the nature of disease progression. Three patients in total demised between bookings.

In addition, another large proportion of surgeries were cancelled due to parents not showing up on the day of surgery. Several reasons may contribute to parents not showing up on the day of surgery, including not being able to get time off work, inability to arrange for care of the other children remaining at home, financial constraints, and experiences before surgery. (1, 12). Studies have shown that cancellation of surgery caused by 'no show' is an avoidable cause, which may have psychological and physical aspects at play. (5, 12, 14). The parents may have had previous negative experiences from past interactions with the health system, which can influence their likelihood of not showing up for surgery. (12). Parental anxiety is associated with non-compliance to the instructions given at the hospital and may result in parents not showing up on the day of surgery. (9, 14).

The patient-related factors leading to cancellation in our study were those that necessitated optimisation before surgery, including fitness for surgery and low haemoglobin. These factors could be managed in a preoperative clinic. This would thus avoid cancellation on the day of surgery.

Respiratory tract infection is often acute and cannot be avoided (11), and affects medical fitness for surgery and anaesthesia negatively (1, 11, 21). Children may suffer up to eight respiratory infections a year, which often presents a challenge to the medical personnel involved (22, 23). In South Africa, Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) further complicate the presentation of respiratory infections in children (23), as HIV positive children tend to have an increased number of severe respiratory infections (7, 24). Cancellation of surgery for patients with respiratory infections should be individualized and must depend on the severity of the disease (1).

Time constraint is an avoidable reason for cancellation, which accounted for the majority of the institutional factors. One of the challenges with time constraints is a lack of efficiency with delayed changeover between patients. The nature of the institution, being a quaternary/teaching hospital, may compound time challenges, as juniors need to be trained, leading to longer operation times. Overbooking lists may also occur and are often used to circumvent no-shows on the day of surgery admissions. Data presented in this study show that 14.2 % and 3.3% of cancellations were due to an emergency case taking priority over an elective case in the first and second bookings, respectively.

Theatre is noted to be functioning optimally when cancellation rates are less than 5% (2). A Study by Dimitriadis et al (5) found a cancellation of 5.19%, while Kaddoum et al (5) found 4.4% cancellation rates. In our resource-constrained environment, this high cancellation rate has monetary cost implications. A study in a South African tertiary hospital estimated that in 2014, approximately R 25 860 was lost each time a patient was cancelled; this amount included a 4-day stay in hospital as well as transport and food costs. (3). Furthermore, a study in Brazil (21) showed a loss of $3 446 dollars. Consequences of cancellation are not only monetary but also impact training opportunities in an academic institution, as reported in Dimitriadis et al. (9). In this study, the cost implications were not measured.

Among other factors, the reputation of the hospital is dependent on the efficiency of the theatre complex. (7, 25, 26). Efficiency is assessed by evaluating how the allocated theatre time is being used, and cancellation of surgery rates are used as one of the factors to determine efficiency. (7). The benchmark figure for theatre efficiency quoted in international studies is 70% to 80% (25). In South Africa, a theatre efficiency figure of 55% was demonstrated in a single-centre study done in a public health facility. (25). This figure is low and causes a poor reputation for the hospital. (23, 26). Litigation from dissatisfied patients may ensue, and this may affect the accreditation of the hospital. (27).

Generalizability

The findings of this study are likely to be generalisable to other public-sector tertiary and quaternary hospitals in South Africa and similar low- and middle-income countries where resource constraints, limited intensive care unit capacity, high emergency surgical workloads, and shared operating theatre facilities are common. The high proportion of cancellations attributable to institutional factors reflects challenges encountered across many public healthcare settings. However, caution should be exercised when extrapolating these findings to private healthcare facilities or healthcare systems with greater resource availability, dedicated paediatric surgical theatres, and more extensive perioperative support services. The single-centre design may limit external validity, and multicentre studies are needed to further evaluate the burden and causes of paediatric surgical cancellations across diverse healthcare settings.

Conclusion

The study reported high rates of cancellation. The high cancellation rates are a testament to the ongoing struggle to utilise the currently available resources. Importantly, depending on the nature of the surgical procedure, postponement could be detrimental to all parties involved. An in-depth study aimed at outcomes of those that were cancelled, and their morbidity and mortality, would give a clear picture of the gravity of the situation. This further study would also give an opportunity for a change in policy relative to theatre utilisation and efficiency.

Limitations

The retrospective nature of this study was a significant limitation. The study was not designed to include the paediatric patients on the emergency list, which is separate from the theatre data and database in use in the elective theatre.

Recommendations

Beyond the scope of this study, it would be informative to expand on the issue of cost analysis. The costs incurred by the hospital as a result of on-the-day cancellation were alluded to from a study that was conducted in a hospital that may not be comparable to the Charlotte Maxeke Academic Hospital setting. It is recommended that the financial needs of the families that have been impacted by the cancellation of surgery be further investigated. The findings of this study have the potential to form the basis of a quality improvement project.

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List of Abbreviations

CMJAH – Charlotte Maxeke Johannesburg Academic Hospital
ICU – Intensive Care Unit

IQR – Interquartile Range
LRTI – Lower Respiratory Tract Infection
PSD – Paediatric Surgery Department
URTI – Upper Respiratory Tract Infection
HIV – Human Immunodeficiency Virus
AIDS – Acquired Immune Deficiency Syndrome

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No external funding was received for this research.

Conflict of Interest
The authors declare no conflicts of interest.

Author Contributions
Sinenkosi Dladla: Conceptualisation, data collection, data analysis, interpretation of results, manuscript drafting, and revision.
Nana Yaa Fening: Study supervision, methodological guidance, interpretation of results, critical review, and revision of the manuscript.
Ellen Mapunda: Data acquisition, interpretation of findings, and critical review of the manuscript.
Palesa Motshabi Chakane: Methodological oversight, interpretation of findings and results, critical review, and revision of the manuscript.
Palesa Mogane: Manuscript drafting, critical revision, and approval of the final manuscript.
All authors reviewed and approved the final manuscript.

Data Availability
The data supporting the findings of this study are available from the corresponding author upon reasonable request. Access to the data is subject to approval by the relevant institutional authorities and compliance with ethical and confidentiality requirements.

Author Biography
Sinenkosi Dladla is a medical practitioner and anaesthesia specialist trainee affiliated with the Department of Anaesthesiology, University of the Witwatersrand, Johannesburg, South Africa. Her research interests include paediatric perioperative care and healthcare quality improvement.

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