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Last-Minute Cancellations in Pediatric Ambulatory and Day Surgeries in Italy: Prevalence and Risk Factors

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ABSTRACT

Background: Cancellation of pediatric day and ambulatory surgeries on the day of the procedure poses a significant challenge, impacting hospital resources and patient care. In Italy, ambulatory surgery is defined as a surgical/diagnostic procedure without hospitalization, and day surgery is defined as a surgical/diagnostic procedure with daytime hospitalization.

Aims: To measure the rate and causes of cancellations on the day of the procedure in a tertiary pediatric hospital in Italy.

Methods: We collected the data retrospectively from the electronic health record between January 2020 and March 2022 at Ospedale Pediatrico Bambino Gesù in Rome, Italy. The number of case cancellations were captured. The reasons for cancellation were categorized into three different buckets: anesthetic reasons, surgical reasons, and non-adherence to protocol. The reasons under each of these categories were further explored. We analyzed the difference in the rate of last-minute cancellations between ambulatory surgery and day surgeries to examine if different pathways produce different results.

Results: A total of 4,600 procedures were scheduled and 183 were canceled (3.9% of total procedures). Surgical reasons contributed to most cancellations (49%), followed by anesthesia reasons (42%) and non-adherence to protocols (9%). Surgical reasons, including the need for post-operative hospitalization, were the primary causes for cancellation, often due to mismatches between pre-operative evaluations and the final decision-making process. Younger patients, particularly those prone to respiratory tract infections, were more likely to experience cancellations. Anesthetic reasons were also a significant factor but less prevalent than surgical ones.

Conclusions: Using standardized treatment and diagnosis pathways can reduce the number of canceled procedures and optimize resources. A telephone re-assessment before the procedure and telemedicine can be useful strategies to further reduce the cancellation rate.

Giuliano Marchetti and Sergio G. Picardo contributed equally to this work as two formal last authors.

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Clinical Implications: The use of pediatric day surgery has significant advantages: minimizing last-minute canceled procedures means increasing patient comfort and reducing healthcare costs. Identifying the causes of cancellations on the day of the procedure allows one to improve the organizational system of the operating room.

1 | Introduction

Last-minute cancellation (procedures canceled on the day of the procedure) is an ongoing issue for patients prior to pediatric anesthesia [1]. This unfortunately happens many times after the patient has already been admitted to the hospital. There are multiple reasons identified in the literature for last-minute cancellations of elective procedures [2]. The leading causes reported are patients not at optimal health, inappropriate nil-per-os (NPO) times, patient no-shows, lack of theater time, and the intervention no longer being necessary [1, 3]. However, other causes like anticipated admission to the hospital for overnight observation or intensive care stay may also be reasons for cancellations on the day of the procedure [4]. Reducing the prevalence of last-minute cancellations can be a strategy to optimize operating room scheduling. Optimizing operating room scheduling is one of the foundations of optimizing resources to reduce costs and human hours [5]. There are factors that cannot be modified, like the increased duration of operating rooms beyond a certain time, physical space, and complexity of procedures that can be performed in day-surgery. On the contrary, reducing cancellations on the day of the procedure is a modifiable factor and can lead to resource optimization.

Although there are studies done on reducing cancellations on the day of the procedure, the strategy is different within each health care system. In general, according to the International Association for Ambulatory Surgery, there is no distinction between ambulatory surgery and day surgery, and the two terms are superimposable [6]. In the UK and the USA, there is typically one pre-operative evaluation of same-day procedure patients [7–9], while in Italy, there are two distinct pathways: ambulatory surgery and day surgery, albeit some overlap between them [10]. These pathways are dictated by the Italian Ministry of Health. The rationale for this distinction is based on the procedure type and the differential costs for public health. In a logic of containment of public spending, a differentiation of paths can be another way for resource optimization.

There are no data on case cancellation on the day of the procedure specific to Italian pediatric anesthesia. Moreover, the reasons for cancellations for outpatients can be different from those for inpatients. With this background, we examined the clinical factors that resulted in case cancellation on the day of the procedure. While many studies categorize cancellation reasons into predictable and unpredictable [2, 11–13], we categorized the reasons into three different buckets: anesthetic reasons, surgical reasons, and non-adherence to protocol. The rationale for this choice lies in the particular Italian paths, so as to highlight which points of the process are more critical.

The primary aim of the study was to measure the rate of last-minute cancellation retrospectively from a tertiary pediatric day surgery center. The secondary aim was to explore the reasons for the last-minute cancellations under three different categories: surgical, anesthetic, and non-adherence to protocol. We analyzed the difference in the rate of last-minute cancellations between ambulatory surgery and day surgeries to examine if different pathways produce different results.

2 | Materials and Methods

The study was approved by the Ethics Committee of the Ospedale Pediatrico Bambino Gesù IRCCS (Ethics Committee no. 888, Chairman Professor Alessandro Nanni Costa) on 04 October 2023. The Ethics Committee waived the requirement of informed consent. All methods were performed in accordance with the ethical standards as laid down in the Declaration of Helsinki and its later amendments or comparable ethical standards.

This manuscript adheres to the applicable Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (www.strobe-statement.org).

We examined the records of patients who had same-day cancellations retrospectively. The data were extrapolated from the electronic records provided by GSED and OBGClinico and by the data manager of Ospedale Pediatrico Bambino Gesù using automated procedures. The data was downloaded into Microsoft Excel (Redmond, Washington, USA). Our focus was on clinical reasons for the cancellations. All procedures scheduled between January 7, 2020, and March 31, 2022, at Ospedale Pediatrico Bambino Gesù San Paolo headquarters were included. The San Paolo venue is a venue entirely dedicated to outpatients, without wards, an intensive care unit, and a blood establishment [14].

The number of case cancellations was analyzed overall and with both the categories: ambulatory and day surgery procedures.

Outpatients had their preoperative evaluation a few days prior to surgery. Our policy involves obtaining a written informed anesthesia consent and instructions on fasting. Any preoperative testing was at the discretion of the anesthesiologist.

In our practice, ambulatory surgery is defined as a surgical/diagnostic procedure without hospitalization, and day surgery is defined as a surgical/diagnostic procedure with daytime hospitalization (Figure 1). The Italian Ministry of Health defines which procedures should follow the path of ambulatory surgery and which should follow that of day surgery [10].

Day surgery patients are evaluated by both the surgeon and the anesthesiologist the day before and the day of the procedure (e.g., patients who are candidates for orchidopexy). Instead, patients who are candidates for ambulatory surgery are evaluated directly on the day of surgery by the operating surgeon and the anesthesiologist (e.g., patients who are candidates for circumcision). In summary, patients who are candidates for ambulatory

surgery have one less surgical visit and one anesthetic visit than patients who are candidates for day surgery (Figure 1).

The reasons for cancellation were categorized into three different buckets: anesthetic reasons, surgical reasons, and non-adherence to protocol (Table 1). Anesthetic reasons were defined as anesthesia that was considered unsafe by the anesthesiologist or anesthetic that could not be performed in the outpatient center (e.g., requirement of prolonged postoperative monitoring) causing cancellation on the day of the procedure. Surgical reasons were defined as surgery that was considered unsafe by the surgeon or a surgery that could not be performed in the outpatient center (e.g., need for a bladder catheter). Non-adherence to protocols was considered when there was deviation from our hospital policy and those not attributable to anesthesia or surgery (e.g., lack of COVID-19 swab).

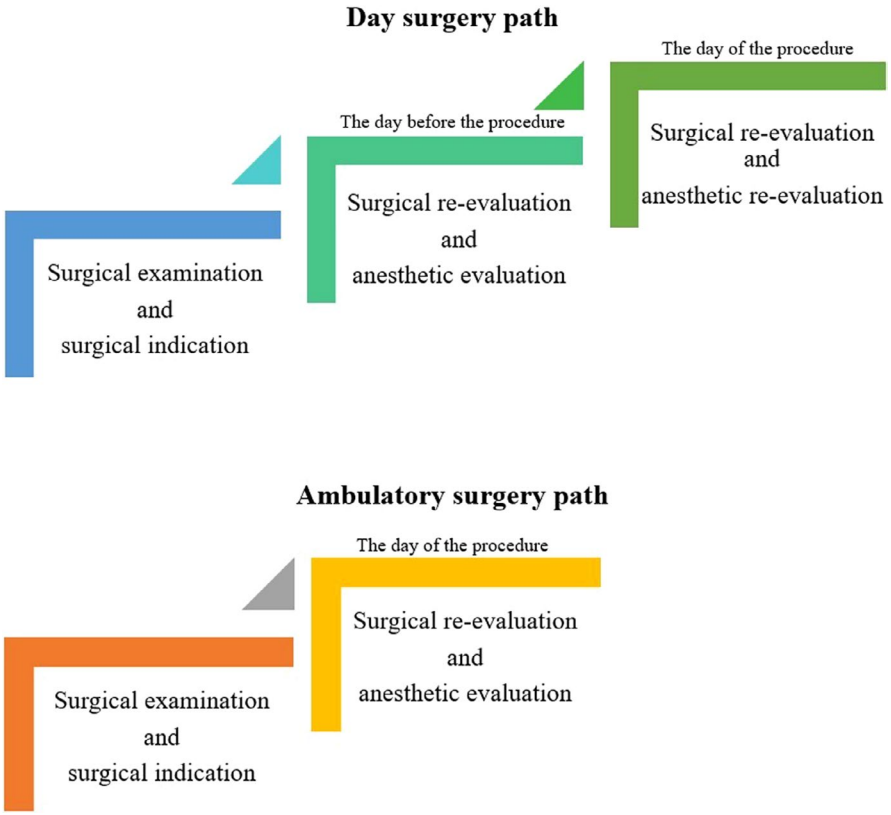

FIGURE 1 | Day surgery path and ambulatory surgery path.

TABLE 1 | Reasons for cancellation.

Surgical reasons	Anesthetic reasons	Non-adherence to the protocol
• Change of diagnosis • No surgical indication • Other recent surgical procedure • Parent withdrawal of consent • Skin inflammation • Technical problems with the instruments	• Gastrointestinal acute disease • Inadequate fasting • Parent withdrawal of consent • Cardiac arrhythmias • Family history of major anesthetic complications • Family history of neuromuscular diseases • Parent withdrawal of consent • Technical problems with the instruments • Lipotimia • Lips herpes simplex • Pharyngitis • Pre-operative tests needs • Recent head trauma • Recent pneumothorax • Suspected coagulation disorders • URI	• Covid-19 swab not valid • Cultural barriers • Language barriers • Disagreement between parents • Incomplete family history • Neonate • Procedure requiring hospitalization

Abbreviation: URI, upper respiratory infection.

The reasons under each of these categories were further explored. We analyzed the difference in the rate of cancellations on the day of the procedure between ambulatory surgery and day surgeries to examine if different pathways produce different results.

The data were extracted automatically by querying the software that manages the visit reports (OBGClinico) and the operating registers (GSED) downloaded on Microsoft Excel. With this, the transcription and selection errors were avoided. The final dataset was registered on Zenodo [15]. The confidentiality of the data was ensured.

We looked at both the total number of patients who underwent surgery and the number of patients whose appointments were canceled the day of the surgery. We used the patients' age, operation type, treatment type, and clinical justification for the referral as predictive variables for case cancellations.

2.1 | Statistical Analysis

Data from the electronic health records at Ospedale Pediatrico Bambino Gesù were transferred from GSED and OBGClinico software applications to IBM SPSS Statistics (Version 23) for analysis. Data integrity was verified, and any missing values were addressed through imputation methods suited to the nature of the missing data.

Descriptive statistics included frequencies and percentages for categorical variables, as well as mean, median, and standard deviation for continuous variables. The normality of the distribution was assessed using skewness indicators and the Shapiro–Wilk test [16].

For comparing cancellation rates between the pathways, we calculated the odds ratios with 95% confidence intervals. Age differences between canceled and completed procedures were analyzed using independent samples *t*-tests with effect sizes (Cohen's *d*) and 95% confidence intervals. Specialty-specific cancellation rates were calculated with Wilson score intervals. Chi-squared tests assessed associations between pathway type and cancellation reasons, with standardized residuals identifying significant contributors to associations. Statistical significance was set at $p < 0.05$.

3 | Results

Between January 7, 2020, and March 31, 2022, 4600 procedures for ambulatory surgery and day surgery were scheduled. This included 2023 ambulatory procedures and 2577 day surgery procedures. The age distribution was slightly skewed to the left (skewness = −0.24) but considered to be normally distributed for reporting, as it falls within the acceptable range of −2 to +2 [17]. Results are reported in Table 2.

With a total of 183 canceled procedures, our rate of cancellations was 3.9% (95% CI: 3.45%–4.58%) on the day of theprocedure.

The cancellation rate was 3.81% (77/2023, 95% CI: 3.05%–4.74%) for ambulatory procedures and 4.11% (106/2577, 95% CI:

TABLE 2 | Patients population.

Patients	Age in years (mean)	Gender: F (female); M (male)	Surgical specialties	Top 3 procedures
4417	7.75 (SD ± 4.79)	F = 1922 M = 2495		
1719	7.31 (SD ± 4.53)	F = 309 M = 1410	Urology	Circumcision (*n* = 675) Orchiopexy (*n* = 618) Hydrocelectomy (*n* = 101)
1027	7.07 (SD ± 5.10)	F = 751 M = 276	Plastic surgery	Skin lesion removal (*n* = 1270) Eyelid lesion removal (*n* = 127) Syndactyly correction (*n* = 27)
779	7.58 (SD ± 4.36)	F = 352 M = 427	General surgery	Unilateral herniotomy (*n* = 176) Bilateral herniotomy (*n* = 126) Onychectomy (*n* = 21)
690	10.83 (SD ± 4.49)	F = 434 M = 256	Endoscopy and digestive surgery	Esophagogastroduodenoscopy (*n* = 510) Drug infiltration (*n* = 37) Colonoscopy (*n* = 10)
155	5.42 (SD ± 3.38)	F = 52 M = 103	Dentistry	Tooth extraction (*n* = 80) Lingual frenulotomy (*n* = 49) Tooth repair (*n* = 5)
47	4.38 (SD ± 2.10)	F = 24 M = 23	Orthopedics	Trigger finger correction (*n* = 47)

3.40%–4.95%) for day surgeries, with no significant difference between pathways (OR: 0.92, 95% CI: 0.68%–1.24%).

Significant variation existed across specialties. General surgery showed the highest cancellation rate (11.39%, 95% CI: 8.62%–14.89%), followed by dentistry (7.74%, 95% CI: 4.57%–12.82%) and andrological surgery (5.51%, 95% CI: 4.41%–6.86%). Other specialties had lower rates: orthopedics (4.65%, 95% CI: 1.28%–15.47%), digestive endoscopy (3.54%, 95% CI: 1.38%–8.74%), urology (3.42%, 95% CI: 2.04%–5.67%), and plastic surgery (2.90%, 95% CI: 2.04%–4.12%) (Table 3).

The pattern of cancellation reasons differed significantly between pathways ($\chi^2 = 21.815$, $p < 0.001$). In ambulatory surgery, surgical reasons predominated (66.2%, 51/77), followed by anesthetic (22.1%, 17/77) and protocol-related reasons (11.7%, 9/77). Conversely, in day surgery, anesthetic reasons were most common (56.6%, 60/106), followed by surgical (36.8%, 39/106) and protocol-related reasons (6.6%, 7/106) (Table 4).

TABLE 3 | Scheduled and canceled procedures.

Type of procedure	Scheduled procedures *n* (%)	Canceled procedures *n* (%)
Urology	1807 (39)	88 (48)
Plastic surgery	1057 (23)	30 (16.4)
General surgery	825 (18)	46 (25.1)
Endoscopy and digestive surgery	694 (15)	4 (2.1)
Dentistry	168 (4)	13 (7.1)
Orthopedics	49 (1)	2 (1.1)

The age range of all patients was between 0.13 and 17.99 years, with a mean of 7.6 years and a standard deviation (SD) of 4.8. Patients with canceled procedures were significantly younger (mean age 6.95 ± 4.77 years) than those whose procedures were completed (mean age 7.76 ± 4.79 years), with a mean difference of −0.81 years (95% CI: −1.52 to −0.10, $p = 0.026$). There were no missing data: all enrolled patients were included in the analysis.

4 | Discussion

Approximately 18% in present-day practice are day surgeries at Ospedale Pediatrico Bambino Gesù IRCCS [4, 18]. Day surgery is increasingly being used in pediatrics to reduce healthcare costs, increase family comfort, and reduce perioperative infections [19]. However, it is difficult to combine the increase in the number of procedures performed in day surgery or ambulatory surgery with the maintenance of satisfactory quality and safety standards, avoiding unplanned admissions [14, 20]. In order to maintain safety standards, it is necessary to use well-defined hospital pathways, with protocols for patient selection based on guidelines and clinical re-evaluation [21, 22]. There is evidence in the literature of how adequate patient selection can minimize perioperative complications and unplanned admissions [14].

However, the risk is that of nullifying the beneficial effects of ambulatory surgery and day surgery on costs, thus reducing the number of procedures performed in one operating session [23]. If it is true that over 80%–85% of the time available in an operating room is impossible to fill, to optimize resources, it is possible to reduce the number of canceled procedures on the day of the procedure [24–26]. Even if the percentage of last-minute canceled procedures at our hospital is better than the literature data (3.9% vs. 6%), our study has revealed some interesting data to reflect on. In literature, the reasons for cancellation on the same day of the procedure are generally categorized as foreseeable and unforeseeable. Our choice to

TABLE 4 | Canceled procedures.

	Surgical reasons	Anesthetic reasons	Non-adherence to the protocol
Canceled procedures ($n = 183$)	• Change of diagnosis ($n = 17$) • No surgical indication ($n = 37$) • Other recent surgical procedure ($n = 1$) • Parent withdrawal of consent ($n = 15$) • Skin inflammation ($n = 15$)	• Gastrointestinal acute disease ($n = 9$) • Inadequate fasting ($n = 1$) • Lipotimia ($n = 1$) • Lips herpes simplex ($n = 4$) • Pharyngitis ($n = 11$) • Pre-operative tests needs ($n = 6$) • Recent head trauma ($n = 1$) • Recent pneumothorax ($n = 1$) • Suspected coagulation disorders ($n = 9$) • URI ($n = 34$)	• Covid-19 swab not valid ($n = 1$) • Disagreement between parents ($n = 2$) • Incomplete family history ($n = 4$) • Neonate ($n = 1$) • Procedure requiring hospitalization ($n = 8$)
Ambulatory surgery path ($n = 77$)	51 (66.23%)	17 (22.08%)	9 (11.69%)
Day surgery path ($n = 106$)	39 (36.79%)	60 (56.60%)	7 (6.60%)

Abbreviation: URI, upper respiratory infection.

categorize them into three different buckets (anesthetic reasons, surgical reasons, and non-adherence to protocol) is due to the need to investigate which are the actors in the process that can be intervened upon, based on the Italian practice of ambulatory surgery and day surgery. Further analysis of the cancellation patterns reveals important differences between the two surgical pathways. While surgical reasons predominated in ambulatory surgery cancellations (66.2%), anesthesia-related causes were more frequent in day surgery cases (56.6%). This difference could be explained by the different pathway, whereby in outpatient surgery there is no intermediate step between the visit in which the surgeon makes the surgical indication and the procedure. In fact, some pathologies can benefit from a medical therapy that makes the intervention no longer necessary. Therefore, the cancellation by the surgeon does not always presuppose an error in diagnosis/indication, but there is the concrete possibility (as for example in phimosis) that a medical therapy has resolved the patient's pathology.

Although there is no statistical significance, it is possible to state that the number of procedures canceled by surgeons is distributed in a nonrandom manner, thus highlighting a statistical value that indicates possible areas for improvement.

To understand why the main causes of cancellation in day surgery are anesthetics, it should also be remembered that some of the anesthetic reasons, such as acute respiratory tract infections, may present themselves 24–48 h after the last reassessment. It is no coincidence that the average age of patients who do not undergo procedures is significantly lower than those who undergo procedures: it is precisely the youngest patients who are most exposed to acute respiratory tract infections.

Indeed, from the analysis of the data, it is possible to suggest some strategies in reducing cancellations on the day of the procedure. It is necessary to standardize the surgical path of patients even more, providing for a surgical re-evaluation also of patients in outpatient surgery, perhaps even remotely, with the aid of telemedicine. This measure could be made even more effective by pre-assigning the same physician for that particular patient. The second possible intervention concerns the evaluation of any cultural barriers with families (e.g., fasting understanding the management of the perioperative period at home). In pediatric ambulatory surgery and day surgery, the contribution of families is fundamental, as is the role of the acute pain service in managing post-operative pain [27]. For this purpose, it is desirable to produce brochures and video tutorials capable of best explaining and remembering the hospital's safety protocols (such as instructions on fasting) [28]. Furthermore, it would be desirable to establish a telephone service managed by an anesthesiologist, which families can contact. The telephone service could provide further clarification regarding the protocols and could be combined with a real telemedicine service, as "third level" pre-evaluation before the appointment, as it happens in North America and Europe [29–31]. The use of telemedicine could drastically reduce the number of patients canceled due to acute pathologies (such as respiratory tract infections), allowing the patient to be replaced in the planning in a timely manner, and therefore optimizing the occupancy of the operating rooms [32–34].

4.1 | Limitations

Our study has several limitations. First, although the data were automatically extrapolated from the electronic health records by querying the GSED and OBGClinico programs, the data are limited by its retrospective nature. The second limitation is that ours is a single-center study, but it is conducted in the largest pediatric hospital in Europe.

5 | Conclusion

Our results suggest that surgical and anesthetic reasons were the predominant factors leading to procedure cancellations, while nonadherence to protocol accounted for a smaller proportion of cancellations.

Creating standardized patient pathways (i.e., the same surgeon who indicates the procedure must then perform it), educating to raise awareness among families and patients, and the use of telemedicine to re-evaluate patients in real time are strategies that could potentially reduce case cancellations on the day of the procedure.

Author Contributions

G.M. and S.G.P. contributed equally to this work as two formal last authors; conceptualization: A.V., R.S.I., and G.M.; data curation: A.V., R.T., and G.M.; formal analysis: A.V., R.S.I., R.P., and G.M.; funding acquisition: A.V. and S.G.P.; investigation: A.V., R.T., E.F., I.M., C.M.P., and G.M.; methodology: A.V., R.S.I., M.C., R.P., G.M., and S.G.P.; project administration: A.V., G.M., and S.G.P.; resources: A.V. and G.M.; Software: A.V., R.P., and G.M.; software A.V., R.P. and G.M.: A.V., G.M., and S.G.P.; validation: A.V., R.T., R.P., and G.M.; visualization: A.V. and R.S.I.; writing – original draft: A.V., R.S.I., M.C., R.P., G.M., and S.G.P.; writing – review and editing: A.V., R.S.I., M.C., R.T., E.F., I.M., C.M.P., F.M., R.P., G.M., and S.G.P. All authors have read and approved the final version of the manuscript.

Ethics Statement

Ethical approval for this study (Ethics Committee n° 888) was provided by the Ethics Committee of the Ospedale Pediatrico Bambino Gesù IRCCS (Chairperson Prof. Alessandro Nanni Costa) on 04 October 2023. The Ethics Committee of the Ospedale Pediatrico Bambino Gesù IRCCS waived the requirement for informed consent.

Conflicts of Interest

Rajeev S. Iyer wishes to disclose his professional engagement in providing career guidance and coaching to medical graduates and other healthcare professionals through his company IMG Secrets. He is an Associate Editor of Pediatric Anesthesia. The other authors declare that they have no competing interests.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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