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The Incidence of PAediatric unPlanned dAY case Admissions (PAPAYA) in the UK and Ireland: A prospective multicentre observational study.

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Short running title:

Unplanned admission post paediatric day case anaesthesia

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Abstract

Background: Failure to discharge home following day case procedures has a negative impact on patients, families and hospital finances. There are currently no national paediatric data on the incidence and causes of unplanned admission. We determined the incidence of unplanned admissions after paediatric day case anaesthesia and identified risk factors leading to unplanned admission.

Methods: During a 6-week period (October and November 2017), all children aged 16 years or under, receiving general anaesthesia, without an inpatient bed on arrival, were included. Hospital, surgical and procedural details, anonymised demographic data, plus anaesthetic and surgical experience were collected by local Paediatric Anaesthesia Trainee Research Network (PATRN) coordinators. A mixed effects binary logistic regression model with backward selection was used to determine variables associated with unplanned admission.

Results: 93 hospitals across the United Kingdom and Ireland participated. There were 25,986 cases, of which 640 were unplanned admissions. Independent risk factors for unplanned admission were ASA-PS (ASA-PS III/IV vs ASA-PS I OR (95% CI) 2.80 (2.07, 3.77)), duration of procedure (1.04 (1.03-1.05)) and surgical specialty (vs ENT (highest caseload specialty): Cardiology 1.89 (1.15, 3.06), Orthopaedics/Trauma 0.91 (0.69, 1.18), General Surgery 0.59 (0.46, 0.77)). The commonest reasons for admission were unexpected surgical complexity, pain, postoperative nausea and vomiting and late finish.

Conclusions: This is the first large paediatric multicentre observational study investigating unplanned admissions following day case procedures under general anaesthesia in the UK and Ireland. This study provides baseline figures for focused quality improvement projects to reduce unplanned day surgery admissions.

Keywords:

Ambulatory surgical procedures, Anaesthesia, Patient admission, Paediatrics, Quality improvement, Risk factors

Introduction

Surgical, interventional or diagnostic procedures in children are primarily performed as day case admissions and do not require an overnight stay in the UK and Ireland[1]. This is in line with the European Association for Children in Hospital (EACH) statement that 'children shall be admitted to hospital only if the care they require cannot be equally well provided at home or on a day basis'[2]. An initial target for over 75% of elective surgery to be performed on a day case basis was set in 2000[1], but advances in both surgical and anaesthetic techniques, as well as changes in patient and family attitudes and expectations lead to ever increasing demands for day case procedures[3].

The selection of children suitable for day case anaesthesia varies between hospitals. Whereas the majority of procedures in secondary hospitals will be suitable for day case anaesthesia, tertiary centres, receiving referrals for complex patients from a network of secondary hospitals and beyond, will have a different day case population. The correct patient selection for day case anaesthesia and identification of high risk procedures and associated factors is essential because failure to discharge home on the same day has a negative impact on patient and family experience, service provision and hospital finances. To date, there are no national data available to inform this selection process for day case anaesthesia in children.

The Paediatric Anaesthesia Trainee Research Network (PATRN) represents trainees and hospitals with an interest in paediatric anaesthesia across the United Kingdom and Ireland. A dedicated local coordinator is available in most if not all UK/Ireland hospitals to support national audit projects. The PATRN network was utilised to establish the PAediatric unPlanned dAY case Admission (PAPAYA) rate in participating secondary and tertiary centres in the UK and Ireland.

The primary aim of this study was to determine incidence of unplanned admissions after paediatric day case anaesthesia in the UK and Ireland. Secondary aims were identification of risk factors for admission and highlighting areas for future quality improvement work.

Methods

The PAPAYA study was a prospective service evaluation conducted by PATRN. This study did not require research ethical approval or patient consent. The nomination of service evaluation was confirmed by discussion with the Quality and Safety Team at Great Ormond Street Hospital and the Health Research Authority decision tool (http://www.hra-decisiontools.org.uk/research/). The study protocol was registered locally and audit approval obtained at each participating centre. NHS Scotland Public Benefit and Privacy Panel for Health and Social Care (PBAPP) approval was obtained for centres in Scotland.

Data collection

During a 6-week period between October and November 2017 hospitals in the public healthcare sector performing paediatric day case procedures under general anaesthesia were invited via the PATRN email database, Association of Paediatric Anaesthetists of Great Britain and Ireland (APAGBI) Linkman Scheme and Research and Audit Federation of Trainees (RAFT). Patients aged 16 years or less, receiving general anaesthesia for elective or urgent procedures, arriving to hospital without a pre-booked inpatient bed were included in this study. Successful day cases were defined as those discharged by midnight on the same calendar day that they arrived at hospital. An unplanned admission was defined as a patient that arrived without a booked inpatient bed, and was discharged the following calendar day or thereafter. Patients having procedures under oral

sedation, or privately funded were excluded. Patients being discharged in under 24 hours, but on the next calendar day were also excluded.

Each centre used a team of anaesthetic trainees to source the unplanned admissions on a daily basis over the data collection period. The following data were collected for each unplanned day case admission: age, sex, American Society of Anaesthesiologists Physical Status classification (ASA-PS), specialty, procedure, urgency, anaesthetic start time, time into recovery, grade of primary anaesthetist and surgeon, pre-assessment (by phone or in person, by nurse or anaesthetist), reason for admission (surgical, anaesthetic, medical or social) and destination (ward, high dependency or intensive care). In addition, the baseline data on all intended day case patients was also collected. Data collection methods were left at the discretion of the local co-ordinator and were dependent on number of patients and number of day case sites. If electronic data capture was not possible in some remote sites, for example, endoscopy, radiology or haematology, data were recorded manually. Any patient identifiable data that was collected locally was removed prior to data upload with ZendTo, a safe haven data portal. All data were uploaded as an excel spreadsheet and crosschecked to ensure that all unplanned admissions were captured. The data for each unplanned admission was separately entered via REDCap, a secure data portal. The data was stored in the Grampian Data Safe Haven, a joint NHS Grampian and University of Aberdeen facility.

Cases were excluded in line with the exclusion criteria: patients over 16 years of age, procedures under local anaesthesia and private cases. Additional exclusions were made for cases where both chief investigators agreed that there had been erroneous data entry: ASA-PS 5 patients, cases intended as inpatients (the centre informed the authors of submission error), and those who underwent major surgery. Major surgery constituted intracranial, thoracic, scoliosis correction,

bowel and urological surgery where disturbance to bowel or bladder function is routinely expected and orthopaedic surgery with expected major blood loss. Unplanned admissions that were classified as major surgery were retained so as to capture inappropriate bookings. Successful elective day cases outside of the following times were also excluded: anaesthetic start times before 07:00 or arriving into recovery after 21:00. Unplanned admissions outside of these times were retained to capture those inappropriately booked for day surgery.

Sample size calculation

A retrospective pilot survey of 48 centres was performed over a 12-month period (Jan 2016 – Dec 2016) and included 101381 day case anaesthetics with 4515 unplanned admissions (4.45%). The median unplanned admission rate was 3.9% (IQR 1.44%-7.48%). A data collection period of 6 weeks in a minimum of 60 centres was subsequently proposed, to generate at least 15300 day cases. This would enable us to estimate the prevalence of unplanned admission with a precision of +/-0.3% and permit multivariable logistic regression analysis to identify potential predictors of unplanned admissions. When the sample size is 15300, the logistic regression test of odds ratio (OR) = 1 (a = 0.050 two-sided) will have 80% power to detect an OR of 1.049; this assumes that one normally distributed covariate is being added to the model after adjustment for prior covariates, that its multiple correlation with covariates already in the model is 0.100 and, that the proportion of successes at the mean of the covariate is 0.50. nQuery Advisor 7.0 was used to calculate the effect size.

Statistical analysis

The authors approved the statistical analysis plan before analyses began. Descriptive statistics were calculated for patient and procedure variables. The frequency and percentage was presented for

each categorical variable; sex, ASA-PS, urgency (elective versus urgent), specialty and grades of primary surgeon and anaesthetist. Since age and duration of surgery were skewed continuous variables, the median and interquartile ranges were calculated along with the range. The overall proportion, with 95% confidence interval, of unplanned admissions following day case general anaesthesia in children was calculated for all hospitals combined and for each hospital separately.

The above variables, collected on all day case procedures, were compared between patients with and without an unplanned admission. The association between binary categorical variables (sex and urgency) and unplanned admission versus successful day case was tested using the continuity-corrected chi-squared test. For categorical variables with more than two categories the Pearson's chi-squared test was used. The distribution of age and duration of surgery were compared between patients with an unplanned admission and a successful day case using the Mann-Whitney test.

A mixed effects binary logistic regression model was fitted using backward selection to determine those variables showing a statistically significant association with unplanned admission. Variables considered for the model were sex, age, ASA-PS, urgency versus elective, specialty, surgeon grade, anaesthetist grade and duration of surgery. The mixed effects model accounted for the clustering effect of individual patients within hospitals. To do this, hospital ID was utilised as a random intercept. We used multiple imputation to impute missing data in the 2.5% patients with incomplete baseline characteristics. We assumed that the data were missing at random which is required for the multiple imputation process.[4] Five imputed datasets were generated using the Markov Chain Monte Carlo method and all available demographic and clinical variables were used to inform the imputation. Since duration of surgery was positively skewed, it was log-transformed to ensure normality which is a requirement for multiple imputation. The mixed model was fitted to

each imputed dataset and pooled odds ratios (95% CI) were obtained. Procedures within the three specialties with the most unplanned admissions were sub-categorised into groups of similar surgeries for further analysis. These were categorised independently by the two chief investigators to minimise error. Common reasons for unplanned admissions were reported as frequencies and percentages, across all specialties and separately for the three specialties with the highest proportion of unplanned admissions.

At hospital level, descriptive statistics were calculated; tertiary or district general hospital, paediatric only or mixed adult and paediatric centre, arrangement of pre assessment services, and availability of on-site high dependency and intensive care services. The relationship between the availability of pre-assessment services and the proportion of unplanned admissions was tested using a continuity-corrected chi-squared test. A two-tailed alpha level of 0.05 was used to determine statistical significance.

Statistical analysis was carried out using SAS (V.9.3) (SAS Institute, Cary, NC).

Results

A total of 93 hospitals participated and submitted data for this study. In total, there were 26212 cases submitted with 226 cases excluded, leaving a sample size of 25986. 640 patients required an unplanned admission (2.5%, 95% Confidence Interval (CI) 2.3% - 2.6%) (see flowchart appendix 1). The percentages of unplanned admissions varied from 0 to 16.3% between participating centres (appendix 2). The excluded cases were: 90 cases 17 years and older, 27 elective cases starting before 07:00, 39 cases arriving in recovery after 21:00, 2 cases with ASA-PS 5, 2 private cases, 41 cases that were intended inpatients or having major surgery and 9 cases performed under local

anaesthesia. There were 16 cases without an outcome. These were included in the description of demographics, but excluded from further analysis.

The baseline descriptive statistics for all day cases are given in appendix 3. The majority of hospitals were district general hospitals 60 (64.5%), and 63 (67.7%) had on-site high dependency care services. Of the 33 tertiary centres, 14 (42%) were paediatric only and 19 (58%) had a mixed adult and paediatric caseload. 69 (74.2%) centres did not have paediatric intensive care services on site. 50 (53.8%) centres had pre-operative assessment services, and 4.3% had specialty specific pre-assessment services only.

Of the admissions to hospitals with no pre-assessment services, there were 140 (1.9%) unplanned admissions compared to 387 (2.4%) in those with pre-assessment services and 113 (4.3%) in those with specialty specific pre-assessment services. The Pearson's chi-squared test was statistically significant ($p<0.001$) suggesting that there is a strong association between availability of pre-assessment services and the proportion of unplanned admissions. There was no significant difference when comparing the unplanned admission rates at district general hospitals, 190 (2.3%) and tertiary centres 450 (2.5%) ($p=0.25$).

Age, sex, urgency, and grade of anaesthetist were not significantly associated with the proportion of unplanned admissions (table 1). The median (IQR) age was 7 (3 to 12) years for children with unplanned admissions and 6 (4 to 11) years in children with successful day cases ($p=0.27$). There was no difference between males and females with unplanned admissions ($p=0.78$).

ASA-PS, specialty, duration of surgery and grade of surgeon were significant factors associated with unplanned admission in the unadjusted analysis. After backward selection, ASA-PS, specialty and duration of surgery were found to be associated with unplanned admission in the final adjusted model (all p<0.001) (table 2). The odds of an unplanned admission for ASA-PS 3/4 were almost three times higher than for ASA-PS 1 (OR (95% CI) = 2.80 (2.07 to 3.77)). With every 15-minute increase in duration of surgery the odds of an unplanned admission increased by 4% (OR (95% CI) = 1.04 (1.03 to 1.05)).

Reasons for unplanned admissions

The most frequent group of reasons for an unplanned admission was surgical (238, 38.4% as a percentage of total unplanned admissions with a recorded reason, n=619) (table 3). Of the surgical reasons the most frequent was 'unexpected surgical complexity/more extensive than expected' (69, 11.1%). Anaesthetic reasons accounted for 224 (36.2%) unplanned admissions, with the most frequent anaesthetic reason being pain (73, 11.8%) followed by postoperative nausea and vomiting (66, 10.7%). Social factors were responsible for unplanned admission in 125 patients (20.2%) and medical reasons in 116 (19%) cases. Some patients had multiple factors contributing to their admission.

Table 3 describes the reasons for admission in all specialties. The most frequent category that contributed to unplanned hospital admission following day case cardiology procedures was surgical (20 patients, 71%). The most frequent category within Ear, Nose and Throat surgery (ENT) unplanned hospital admissions after day case surgery was anaesthetic (83 patients, 39%), followed by surgical (74 patients, 34.7%). For those children being admitted under orthopaedics and trauma, the most frequent reason for unplanned hospital admission was surgical (45 patients, 50%)

followed by anaesthetic (34 patients, 37%). Figure 1 provides a breakdown of the reasons in these 3 specialties.

The procedures performed for cardiology, ENT and orthopaedics and trauma are presented in table 4. The most frequent procedure admitted within cardiology was 'cardiac catheterisation with intervention' (24/31, 77.4% of this speciality's unplanned admissions). Overall in cardiology, 62/177, 21.5% of the cases underwent cardiac catheterisation with an intervention, the remainder of cases were diagnostic cardiac catheterisations. For ENT the most frequently admitted procedure was tonsillectomy and/or adenoidectomy (131/213, 61.5%). Tonsil and/or adenoid surgery made up 1801/5028, 35.8% of the total ENT workload. For orthopaedics and trauma, the most frequent procedure within the unplanned admissions was soft tissue surgery (14/91, 15.4%), which made up 565/2251, 25.1% of the total orthopaedic and trauma procedures performed during the study period.

Discussion

This prospective, multi-centre evaluation of unplanned admissions from paediatric day case procedures across Great Britain and Ireland identifies an unplanned admission rate of 2.5% (CI 2.3-2.6), with risk factors of ASA-PS, specialty and duration of procedure.

The Royal College of Anaesthetists (RCoA) recommends that centres performing paediatric day case procedures target an unplanned admission rate under 2% and regularly audit this[5]. The most recent Guidelines for the Provision of Anaesthetic Services (GPAS), also drawn up by the RCoA, reinforce the appropriateness of day surgery for the paediatric population where possible, but they do not stipulate a target figure for paediatric unplanned admission rates[6].

There is no universally accepted definition of day case procedures, unplanned admissions and age ranges. A discharge of within 23 hours is commonly used but discards the potential need of an overnight stay. The largest study of such 2.3 million day-cases, extracted retrospectively from a national database, reported an unplanned admission rate of 0.6%[7]. Other reported unplanned admission rates range from 0.4% to 8%[8-16] without clearly reporting the definition of day case used.

This study identified cardiology, ENT and orthopaedics and trauma to be the three specialties with the highest risk of unplanned admission. Although the proportion of unplanned admissions for general surgery was less than 3%, it was the second largest contributor in absolute numbers after ENT (14% of overall workload). This is in contrast to a previous report from Scotland[15] that suggested a higher proportion of unplanned general surgery admissions (70% of total unplanned admissions), followed by dental (13%) and ENT (8%). The main reasons for unplanned admission in that study were postoperative nausea and vomiting (PONV) (23.5%), bleeding (13.9%) and

unexpected surgical difficulty (11.8%). The overall admission rate for general surgery, however, was very similar (2.8%) to that reported here.

Anaesthetic factors contributed to more than 1 in 3 unplanned admissions across all the specialties with the commonest anaesthetic reasons being inadequate pain control, PONV and airway and/or breathing problems. This is a much lower incidence than that observed by Whippey and colleagues in a retrospective case control study with almost 1 in 2 admissions due to anaesthetic events[16]. Age less than 2 years, ASA-PS 3, duration of surgery over 1 hour, completion of surgery after 3pm, orthopaedic, dental or ENT surgery, adverse intra-operative events and obstructive sleep apnoea were all found to be predictors of unanticipated admission. Notably, the authors excluded patients that were inappropriately booked as day case procedures, procedures performed outside of the operating theatres, and included patients admitted up to 24 hours from the time of surgery. Inappropriately booked day cases were seen across all the 4 categories in this study, accounting for over 10% of all the unplanned admissions.

Generic anti-emetic drugs as well as an increasing use of total intravenous anaesthesia in children in the UK and Ireland[17] may have contributed to the lower rate of PONV seen in this study, which remains a prominent cause of unexpected admission, in particular within ENT and orthopaedics and trauma patients. Inadequate pain control was a contributing factor in over 10% of admissions. Analgesic regimes are frequently multi-modal with an emphasis on opiate sparing recipes in order to prevent PONV or respiratory depression and to expedite discharge home. However, more than 1 in 4 admissions for orthopaedics and trauma were due to analgesic requirements, highlighting an area that needs improvement. Additionally, airway and/or breathing problems were the third highest contributor to anaesthetic admissions, in particular in children undergoing ENT procedures.

Adenotonsillectomy in patients with sleep disordered breathing and without other comorbidity is safe in children over the age of 4,[18-22] however, these children are experiencing unplanned admissions and new solutions are needed to predict likelihood of admission. Pre-operative questionnaires such as the Sleep-Related breathing Disorder Scale of the Pediatric Sleep Questionnaire (SRBD-PSQ) have been formulated and validated to predict polysomnographic results sufficient for research purposes, however this has not yet shown reliability on an individual patient basis[23, 24].

Unexpected surgical complexity was also a major contributing factor to unplanned admissions. An effective use of pre-operative assessment to address the contribution of pre-existing comorbidities may minimise admissions attributable to surgical complexity. Development of surgical care pathways that facilitate the pre-operative assessment process may result in an increased efficiency and care quality for paediatric surgical patients. Success has been identified in some centres creating specific surgical day case urgent pathways with the aim of reducing the length of stay of urgent cases and streamlining the service provided to these patients[25]. The scheduling of patients for day case procedures could additionally be assisted by a predictive multifactorial score utilising factors identified to increase the likelihood of unplanned admission.

Quality improvement (QI)

The retrospective pilot survey performed prior to this study revealed that 15 of 63 registered centres were unable to access the appropriate total annual figures, and only 21% of the participating centres were auditing their unplanned admission rates regularly. This study empowered and equipped all 93 centres to capture their day case and unplanned admission

numbers. The site-specific methodology has been established and can be used in the future for QI work within each centre.

Specific areas for QI should target the 'high risk' specialties as well as surgical and anaesthetic factors. Anaesthetic improvements for airway/breathing issues, PONV and pain are in urgent need of attention. Specific detailed anaesthetic techniques and drugs need to be included in these projects. Surgical factors, such as children requiring postoperative treatment or surgical review the following day, suggests inappropriate booking of patients for day case procedures. Pre-existing medical factors contributing to admission should also be considered alongside those labelled as inappropriate for day case procedures. Together they form a large group of patients for whom a thorough pre-operative assessment and booking process is imperative. With pre-assessment not currently undertaken routinely for children in the UK, this provides stimulus to investigate administrative processes such as the booking of both patients and procedures that are inappropriate for day case anaesthesia, and the planning of theatre lists with regular overruns.

When considering the unplanned admissions by procedure, a few procedure groups were noticeable. Although only 21.5% of the children admitted for cardiology procedure underwent cardiac catheterisation and intervention this small group accounted for more than 3 in 4 admissions in this specialty. Similarly, only approximately 35% of ENT procedures were for tonsillar and/or adenoid surgery, but accounted for more than 60% of the unplanned ENT admissions. Therefore, with ENT owning the largest day surgery workload (approximately 1 in 5 of almost 26000 cases), the tonsil and/or adenoid surgeries are a particular area of interest for QI.

Finally, the benefits of a collaborative approach for collecting large-scale data over a short time period are also apparent. Trainees are increasingly recognised as a useful resource for facilitating data collection[26, 27]. Trainee research networks have also proven a useful avenue to encourage and provide opportunities for trainee participation in such projects[28].

Limitations

The exclusion of cases arriving into recovery after 21:00 may have excluded a small sample of cases that were true scheduled day cases, and for any reason, ran late. However, if they were not submitted as an unplanned admission, it was considered unlikely to be accurate that a child arriving in recovery after 21:00 would be discharged that day. This study did not capture the day cases that were admitted from the emergency department on the evening before their procedure. By definition they became an inpatient, but perhaps for no other reason than it being impractical to go home late in the evening and return early the following morning.

This study may also have missed the urgent work that came to theatre straight from the emergency department without any formal decision or documentation about whether the child could be a day case. It is possible that there were a limited number of urgent day cases not captured within the dataset.

Some tertiary paediatric specialties use their day case ward as a receiving hub for peripheral referrals. On assessment of the child, it may have been obvious the case would not be day casework, but admission from a starting point on the day case ward triggered an unplanned admission. Participating centres worked around these set ups to produce accurate data.

It would be useful to know if 'on the day cancellations' result in reduced unplanned admissions. However, the relationship between cancellation rate and unplanned admission rate has not been investigated here. In addition, readmission rates were also not part of this study. Therefore, there was no record made of factors leading to readmissions at any stage after discharge.

Over the short period of data collection, it is unlikely that any patients had more than one general anaesthetic. However, the possibility of this cannot be entirely excluded. No patient identifiable data was submitted outside of the hospitals. Therefore, identification of repeat patients was not possible.

Conclusions

This study saw an unplanned admission rate from paediatric day case procedures of 2.5% (CI 2.3-2.6), with risk factors of ASA-PS, specialty and duration of procedure. Cardiology, ENT and orthopaedics and trauma were the three specialties with the highest unplanned admission rates. General surgery is also an important contributor to the number of unplanned admissions following day case surgery, with the second largest caseload across 93 hospitals, after ENT. Anaesthetic and surgical factors contributed to more than 1 in 3 of all unplanned admissions across all the specialties with inadequate pain control, PONV, airway/breathing problems and surgical complexity, respectively. Multiple areas are identified for future quality improvement work to improve both patient and parent experience as well as system efficiency. These findings are relevant to ambulatory practice across the UK and Ireland, and other health care systems may also take note of the lessons learned. The information gathered may also contribute to preoperative conversations with parents and carers. A speciality specific trainee network (PATRN) successfully

conducted a large-scale prospective study and is able to further quality improvement and research in this anaesthetic subspecialty.

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ZG and NW: study design, prepared, revised and edited the draft

DM: data analysis, revised and edited the final draft

PATRN: data collection

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Table and Figure legends:

Table 1: Descriptive statistics by successful day case versus unplanned admission.

Table 2: Adjusted final mixed effects logistic regression model showing the odds ratios (95% CI) for characteristics that are statistically significantly associated with unplanned admissions when compared with the most common day case specialty, ENT.

Table 3: Reasons for unplanned admissions for all specialties.

Table 4: Procedures for Cardiology, ENT and Orthopaedics and Trauma specialties by unplanned admissions versus successful day cases (In descending order of overall number of procedures. Percentages for successful/ unsuccessful day case are calculated per main procedure in each row.)

Figure 1: Reasons for unplanned admission within the specialties with the highest admission rates: ENT, orthopaedics and trauma (O&T) and cardiology.

Figure 2: Forrest plot of adjusted Odds Ratios (95% CI) for predictors of unplanned admission following day case surgery.

Table 1:

Outcome		**Successful day case** (n, %)	**Unplanned admission** (n, %)	**P-Value**
Sex	Female	10448 (97.5)	268 (2.5)	0.78 [a]
	Male	14886 (97.6)	372 (2.4)	
Age (years)	Median (IQR)	6.0 (4.0, 11.0)	7.0 (3.0, 12.0)	0.27 [b]
	Range	0.0 to 16.0	0.0 to 16.0	
	Missing	21 (0.1)	0 (0.0)	
ASA-PS	1	17156 (97.9)	367 (2.1)	<0.001[c]
	2	5610 (96.8)	185 (3.2)	
	3-4	2069 (96.2)	81 (3.8)	
Urgency	Elective	22730 (97.6)	566 (2.4)	0.33 [a]
	Urgent	2611 (97.2)	74 (2.8)	
Specialty	Cardiology	146 (82.5)	31 (17.5)	<0.001 [d]
	ENT	4815 (95.8)	213 (4.2)	
	Orthopaedics & Trauma	2160 (96.0)	91 (4.0)	
	Gastroenterology	938 (96.9)	30 (3.1)	
	General Surgery	3538 (97.1)	104 (2.9)	
	Urology	1104 (97.4)	30 (2.6)	
	Other	751 (97.7)	18 (2.3)	
	Plastics	2021 (97.9)	43 (2.1)	
	Ophthalmology	1442 (98.5)	22 (1.5)	
	Radiology	1853 (98.9)	20 (1.1)	
	Oral and Maxillofacial Surgery (OMFS)	1501 (99.0)	15 (1.0)	
	Oncology	860 (99.1)	8 (0.9)	
	Dental	3349 (99.6)	13 (0.4)	
	Oral Surgery	861 (99.8)	2 (0.2)	
Surgeon Grade	Consultant	19806 (97.3)	541 (2.7)	<0.001 [d]
	Specialty Trainee	2544 (97.9)	54 (2.1)	
	Others*	2911 (98.5)	45 (1.5)	
Anaesthetist Grade	Consultant	23053 (97.5)	583 (2.5)	0.39 [d]
	Speciality Trainee	1409 (97.8)	31 (2.2)	

	Others**	820 (96.9)	26 (3.1)	
Duration of surgery (minutes)	Median (IQR)	41 (25, 60)	72 (50, 107)	<0.001 [b]

[a]Continuity-corrected chi-squared test
[b] Mann-Whitney test
[c] Mantel-Haenszel chi-squared test
[d] Pearson's chi-squared test
*Nurse or Advanced nurse practitioner, Associate Specialist, Audiologist, Core Trainee, Dentist, Fellow, Foundation Doctor, Plaster Technician, Radiology, Senior Dental Officer, Staff Grade, Not Applicable
**Associate specialist, Core Trainee, Fellow, Staff Grade, Not Applicable
The grades within Surgical Others and Anaesthetic Others individually had insufficient numbers to meet the assumptions for the Pearson's chi-squared test, and were therefore grouped together.

Table 2:

Characteristic		**Odds Ratio (95% CI)**	**P-Value**
ASA-PS			<0.001*
	ASA-PS 2 vs. ASA-PS 1	1.59 (1.31, 1.94)	<0.001
	ASA-PS 3/4 vs. ASA-PS 1	2.80 (2.07, 3.77)	<0.001
Specialty	**Vs. ENT**		<0.001*
	Cardiology	1.89 (1.15, 3.06)	0.01
	Orthopaedics & Trauma	0.91 (0.69, 1.18)	0.46
	Urology	0.64 (0.43, 0.96)	0.03
	General Surgery	0.59 (0.46, 0.77)	<0.001
	Gastro	0.54 (0.36, 0.81)	0.003
	Plastics	0.49 (0.34, 0.69)	<0.001
	Ophthalmology	0.34 (0.22, 0.54)	<0.001
	OMFS	0.21 (0.12, 0.36)	<0.001
	Radiology	0.14 (0.09, 0.23)	<0.001
	Oncology	0.10 (0.05, 0.22)	<0.001
	Dental	0.08 (0.04, 0.14)	<0.001
	Oral Surgery	0.08 (0.02, 0.31)	<0.001
	Other	0.39 (0.23, 0.65)	<0.001
Duration of surgery (per 15 minutes)		1.04 (1.03, 1.05)	<0.001

* Overall effect of categorical variable on unplanned admissions

We used multiple imputation to impute missing baseline data from 675 (2.5%) patients. We excluded 16 (0.06%) patients with missing outcome.

Table 3:

Reason for unplanned admission	n	%*
SURGICAL	**238**	**38.4**
Unexpected surgical complexity/more extensive than expected	69	11.1
Post-operative treatment, further surgery or next day review required	55	8.8
Bleeding	42	6.8
Surgical complication	14	2.3
Not passed urine	12	1.9
Monitoring needed	10	1.6
Other, please specify:	50	8.1
Inappropriately booked	32	5.2
Airway / breathing problem	7	1.1
Where n<5, reasons grouped together	10	1.9
ANAESTHETIC	**224**	**36.2**
Pain	73	11.8
Post-operative nausea and vomiting	66	10.7
Airway/breathing problem, please specify:	38	6.1
Obstructive sleep apnoea	8	1.3
Laryngospasm	5	0.8
Where n<5, reasons grouped together	20	3.4
No explanation given	5	0.8
Postoperative hypoxia	31	5.0
Prolonged emergence/drowsiness	23	3.7
Apnoeas	9	1.5
Adverse drug reaction	7	1.1
Aspiration	5	0.8
Other, please specify	13	2.1
Inappropriate for day case (medical complexity=3; age/prematurity=1; no reason=1)	5	0.8
Where n<5, reasons grouped together	8	1.6
SOCIAL	**125**	**20.2**
Late out of theatre/over run	76	12.3
Parent or any member of team requests admission	29	4.7
Social unsuitability such as long distance to home or transport issue	28	4.5
Where n<5, reasons grouped together	2	0.4
MEDICAL	**116**	**19.0**
PRE-EXISTING MEDICAL CONDITION CAUSING COMPLICATION:	72	11.8
Obstructive sleep apnoea	34	5.5
Inappropriate for day case	5	0.8
Where n<5, reasons grouped together	33	6.4

NEW MEDICAL CONDITION CAUSING COMPLICATION	17	2.8
New condition diagnosed causing complication/requiring treatment	7	1.1
Where n<5, reasons grouped together	10	1.7
OTHER MEDICAL CONDITION	27	5.7
Inappropriately booked	10	1.6
Pyrexia	6	1.0
Where n<5, reasons grouped together	11	2
MISSING REASON	**30**	

* Percentage of unplanned day case admissions with the specified reason for the unplanned admission. Reasons are not mutually exclusive.

Table 4:

Specialty	Procedure	Successful day cases		Unplanned admissions	
		n	%	n	%
Cardiology 177 cases	*Total*	*146*	*82.5*	*31*	*17.5*
	Cardiac catheterisation with intervention	38	61.3	24	38.7
	Diagnostic cardiac catheterisation	55	93.2	4	6.8
	Cardiac CT/MRI	31	96.9	1	3.1
	Trans oesophageal echo	12	100	0	0.0
	Insertion of line	3	100	0	0.0
	Combination procedure	7	77.8	2	22.2
ENT 5028 cases	*Total*	*4815*	*95.8*	*213*	*4.2*
	Tonsillectomy and/or adenoidectomy (TA)	1670	92.7	131	7.3
	External ear	1392	99.4	8	0.6
	Nasal	447	99.8	1	0.2
	TA and External Ear	294	93.9	19	6.1
	Middle Ear	265	91.1	26	8.9
	Airway	232	95.1	12	4.9
	Examination under anaesthesia/Audiometry	179	100	0	0.0
	Other	119	100	0	0.0
	Neck	55	91.7	5	8.3
	Tongue Tie	60	100	0	0.0
	TA and Nasal	27	87.1	4	12.9
	Pinnaplasty	17	89.5	2	10.5
	Salivary Gland	18	94.7	1	5.3
	Nasal and External ear	15	100	0	0.0
	TA and Airway	5	71.4	2	28.6
	No data	6	100	0	0.0
	Combination procedure	14	87.5	2	12.5
Orthopaedics/ Trauma 2251 cases	*Total*	*2160*	*96.0*	*91*	*4.0*
	Soft tissue	551	97.5	14	2.5
	Removal of metalwork	456	97.6	11	2.4
	Upper limb fracture	280	95.2	14	4.8
	Fracture – site unspecified	223	97.4	6	2.6
	Joint Injection/Arthrogram	118	98.3	2	1.7
	Minor bony procedure	100	90.9	10	9.1
	Arthroscopy	91	95.8	4	4.2
	Application of cast	88	98.9	1	1.1
	Hand	50	98.0	1	2.0
	Foot	41	93.2	3	6.8

	Knee	31	81.6	7	18.4
	Lower limb fracture	27	75.0	9	25.0
	Major bony procedure	18	78.3	5	21.7
	Examination under anaesthesia	21	100	0	0.0
	No data	21	100	0	0.0
	Other	18	90.0	2	10.0
	Shoulder/clavicle	15	93.7	1	6.3
	Combination procedure	11	91.7	1	8.3

Figure 1:

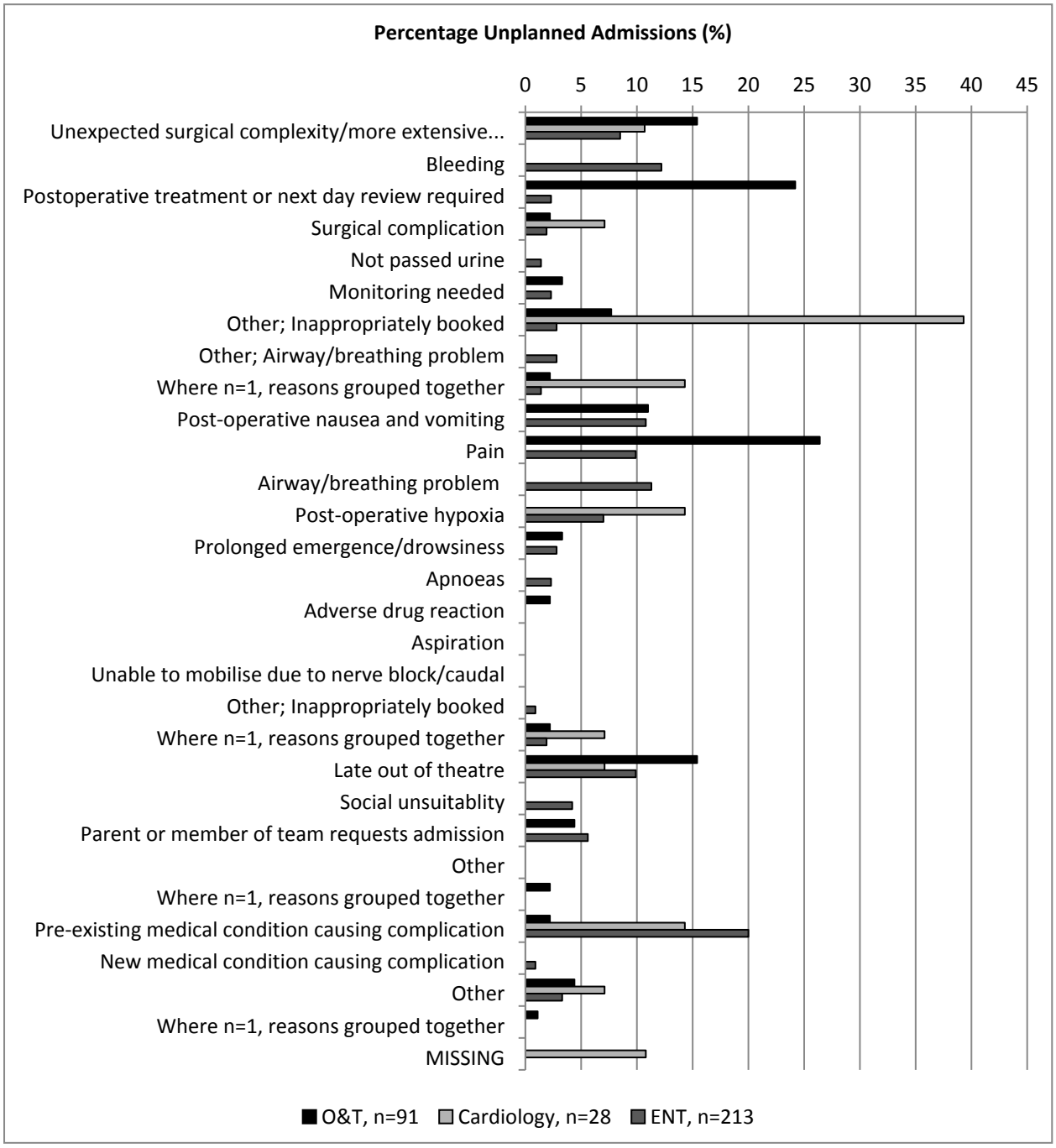
Percentage Unplanned Admissions (%)
0
5
10
15
20
25
30
35
40
45
Unexpected surgical complexity/more extensive...
Bleeding
Postoperative treatment or next day review required
Surgical complication
Not passed urine
Monitoring needed
Other; Inappropriately booked
Other; Airway/breathing problem
Where n=1, reasons grouped together
Post-operative nausea and vomiting
Pain
Airway/breathing problem
Post-operative hypoxia
Prolonged emergence/drowsiness
Apnoeas
Adverse drug reaction
Aspiration
Unable to mobilise due to nerve block/caudal
Other; Inappropriately booked
Where n=1, reasons grouped together
Late out of theatre
Social unsuitablity
Parent or member of team requests admission
Other
Where n=1, reasons grouped together
Pre-existing medical condition causing complication
New medical condition causing complication
Other
Where n=1, reasons grouped together
MISSING
O&T, n=91
Cardiology, n=28
ENT, n=213

Figure 2: