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All submitting authors have declared that appropriate ethical approval has been obtained and that written informed consent has been obtained from research subjects, and written consent for publication from patients for case reports.

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Diagnostic performance of indices of adiposity to identify children with perioperative respiratory complications
Olubukola Nafiu, Hannah Tuckwell
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Introduction
Childhood obesity prevalence has reached epidemic proportions worldwide. This secular trend has produced an increase in the number of overweight/obese children undergoing surgery and anesthesia. Several reports indicates that high body mass index (BMI) in children is a risk factor for perioperative respiratory adverse events (PRAE) (1, 2). Despite the popularity of BMI for profiling obesity-related acute and chronic complications, it is not a good indicator of total body adiposity and hence does not accurately predict the risks associated with excess body fat (3). Consequently, other indices of adiposity, particularly measures of central obesity have been shown to better predict obesity-associated complications. Indeed measures such as waist circumference (WC), neck circumference (NC) and waist-to-height ratio produce more precise estimates of obesity-related cardiovascular and metabolic risks (4). Given the recent upsurge of interest in other measures of adiposity as predictors of obesity-related risks, the purpose of this study was to determine which index of adiposity in children is most closely associated with PRAE.

Methods
This was a cross-sectional, observational study of 756 children aged 6-18yr who underwent elective, non-cardiac operations. Clinical and anthropometric variables were prospectively collected by trained research assistants in all patients. BMI was calculated as weight in kilograms divided by the square of the height in meters (BMI = kg/m²). PRAE was defined as the occurrence of one or more of the following: laryngospasm, bronchospasm and post-induction desaturation. The diagnostic accuracy of BMI, NC, WC and body weight to correctly identify children who developed PRAE was assessed with receiver operating characteristic (ROC) curves. Corresponding area under the curve (AUC) were calculated for each measure of adiposity. Furthermore, logistic regression analysis using PRAE as outcome and above indices of adiposity as predictors was used to calculate adjusted odds ratios for the occurrence of PRAE.

Results
The incidence of PRAE was 10.9%. All the indices of adiposity were significantly positively correlated (Pearson’s r = 0.39-0.87; p<0.001). ROC curve analysis (Fig 1) indicated that all the measures of adiposity performed well on average in identifying children with PRAE (AUC > 0.6). The ROC performance of BMI showed the highest discriminant accuracy in predicting PRAE. Logistic regression analyses showed that BMI and WC were positively and significantly associated with PRAE while weight and NC showed significant, negative coefficients.

Conclusion
BMI showed better accuracy at identifying children with PRAE than other indices of adiposity. Body weight had the lowest accuracy for PRAE in children. Given the established familiarity with BMI as well as the additional training needed and difficult logistics of measuring the other indices of adiposity in the preoperative setting, we encourage anesthesia providers to focus solely on BMI measurement for paediatric perioperative risk stratification. Weight measurement alone is insufficient.
Association of high body mass index (BMI) and incident bronchial asthma (BA) with paediatric perioperative laryngospasm

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Introduction

Childhood overweight or obesity and incident bronchial asthma (BA) are quintessential public health problems in contemporary United States (US). The increase in prevalence of these two disorders makes them important public health problems and increases the likelihood that they may occur concurrently. This may also increase the likelihood that children undergoing anaesthesia will have one or both disorders increasing their risk of perioperative airway complications. Laryngospasm is a serious perioperative complication frequently associated with rapid escalation of care in the perioperative period. It is unknown whether overweight or obese children with BA increase the rate of perioperative laryngospasm.

Hypothesis

Children who are overweight or obese and have incident BA at the time of surgery would have higher rates of perioperative laryngospasm compared to their healthy peers.

Methods

- Data for this report derived from earlier prospective observational study (IRB approved) in 1058 children aged 6-18yr, undergoing elective, non-cardiac operations.
- Clinical (age, ASA status, history of physician-diagnosed asthma) and detailed anthropometric data (height, weight, neck circumference, waist circumference) collected in all patients.
- Patients classified into two groups (normal and high BMI) based on sex-specific BMI ≥ 85th percentile for age. Further stratification based on history of asthma to yield two groups: high BMI asthmatic (HBA) and normal BMI/non-asthmatic (NBNA).
- Rates of perioperative laryngospasm compared between two groups.
- Univariate comparison of perioperative variables made across study groups
- Clinically relevant risk factors entered into a backward logistic regression model to calculate adjusted odds ratio for laryngospasm. Present report excluded non-obese asthmatic and obese, non-asthmatic children.

Results

- Overall prevalence of high BMI was 32.7% while 20.4% of children had BA BMI displayed a mesokurtic right skew in both sexes.
- 9.7% children with high BMI and BA. Perioperative laryngospasm occurred in 4.1% subjects.
- Subsequent comparative analyses made between high BMI asthmatic and normal BMI, non-asthmatic groups. Groups comparable in terms of age, anaesthesia induction and airway maintenance. All indices of adiposity were higher in the HBA group.
- Children in high BMI/asthma group had 2.8 times higher unadjusted odds of developing laryngospasm (OR = 3.7; 95% CI = 1.59-9.00, p =0.001).
- After adjusting for several relevant covariates (age, gender, intubation yes/no, OSA history, induction method) in a logistic regression model, high BMI/asthma remained the most consistent risk factor for intraoperative laryngospasm (OR = 6.3; 95%CI = 1.88-16.5, p = 0.003).

Conclusion

Results indicate that children with high BMI and incident BA at time of surgery have higher rates of perioperative laryngospasm compared to their lean, non-asthmatic peers. Mechanisms underlying these increased risks deserve further elucidation but may be related to systemic and airway inflammation. Recognising obese-asthmatic children as an at-risk group could prove helpful for perioperative risk stratification of patients and appropriate allocation of resources.
Impact of Oramorph TTO protocol used for day case tonsillectomy
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Introduction
Since the MHRA contraindicated the use of codeine following tonsillectomy in all children under 18 years of age, alternative strategies for breakthrough pain have been sought. Blackpool Victoria Hospital (BVH) audited the sufficiency of take-home analgesia without codeine, following which implementing a protocol for safely discharging day-case paediatric tonsillectomy patients with Oramorph. The protocol’s impact was re-audited thus completing the audit cycle.

Method
From February to May 2014 all paediatric (< 18 years) day-case tonsillectomies performed at BVH were followed up over 7 days. The standard TTO consisted of paracetamol and ibuprofen. Follow up was performed on postoperative day (POD) 7 via telephone with the parents, asking for the patient’s worst pain score (linear scale 0 to 10) on POD’s 4 & 7. The requirement to contact the GP or attend A&E for rescue analgesia was also assessed. Subsequently an ‘Oramorph TTO’ protocol was implemented. Children were discharged with; a weight based dose of Oramorph to be used to a maximum of 4 dosages daily for 4 days, an information leaflet and a dose appropriate syringe for administration. Utilising the same methodology a re-audit was conducted between November and December 2014 to assess the impact of increased take-home analgesia and identify safety issues regarding the home use of a strong opioid.

Results
The pre-intervention audit followed 25 cases, 60% had a worst pain score >5 at POD 4 and 8% at POD 7. Stronger analgesia was needed in 56% (14) and 40% (10) had to contact the GP/A&E. The post-intervention audit followed 19 cases, 84% reported using Oramorph, 58% had a worst pain score > 5 at POD 4 and 21% at POD 7. The number contacting their GP or A&E reduced to 11% (2) with no parents reporting adverse events following the administration of Oramorph.

Discussion
The results of the pre-intervention audit demonstrated a clear need for improvements in take-home medications to reduce the requirement for rescue analgesia prescriptions in the community for nearly half of our day-case tonsillectomies. Introduction of the Oramorph protocol significantly reduced community service use, whilst maintaining patient safety. A potential explanation for this is empowering parents with tools to deal with their child’s pain at home. Furthermore, due to the strict safety surrounding the protocol, the additional information parents receive is a beneficial intervention alone. The similar ‘worst pain scores’ seen between the two groups shows homogeneity within the degrees of pain experienced, which allows for accurate comparisons to be made. In view of similar numbers reporting high pain scores at POD’s 4 & 7, the reduction in community service use from 40% to 11% implies successful analgesia with Oramorph.
Pharmacokinetics of parecoxib and its metabolite in children
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Background
Limited data are available for study of COX-2 selective inhibitors in children. We wished to characterise the pharmacokinetics of parecoxib and its active metabolite, valdecoxib, in this population. The total (bound and unbound) IC₅₀ of Valdecoxib in blood is approximately 75.3 mcg/L¹ ² There is little parecoxib PK information for children or adults available in the literature.

Methods
Ethics and local research committee approval was obtained. Consent was granted by parents or guardian. There were 75 children given 0.25mg/kg, 1mg/kg and 2mg/kg of parecoxib during adenotonsillectomy. Samples (4-6 per child) for assay were obtained from indwelling cannulae over 24 hours.

Data were pooled with those (10 samples/24 h) from a further 38 children who underwent surgery at another hospital³. A 3-compartment parent and 1-compartment metabolite model with first order elimination was used to describe data using nonlinear mixed effects models. Assay data below the lower limit of quantification were handled using M3 method described by Beal⁴. Parameter estimates were standardised to a 70-kg person using allometry⁵. Simulation using derived parameter estimates and their variability were used to predict dose in children at different ages.

Results
Parameter estimates are shown below. There was no maturation of clearance over the age span studied. Parecoxib doses of 0.9 mg/kg in a 2 year old, 0.75 mg/kg in a 7 year old and 0.65 mg/kg in a 12 year old child achieve dose equivalence of 40 mg in a standard 70kg person. Parecoxib PK parameter estimates were, CL_PARECOXIB 10.5L/h/70kg, V₁_PARECOXIB 2.91L/70kg, Q₂_PARECOXIB 10.9 L/h/70kg, V₂_PARECOXIB 120 L/70kg, Q₃_PARECOXIB 3.82 L/h/70kg and V₃_PARECOXIB 1.52 L/70kg. We assumed all parecoxib was metabolised to valdecoxib with CL_VALDECOXIB 6.26 L/h/70kg and V_VALDECOXIB 30.6 L/70kg.

Conclusions
Higher doses in children than adults are required to achieve the same target concentration of valdecoxib. Clearance maturation may occur in infants younger than the current cohort.

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Specialist paediatric anaesthetists: an unnecessary luxury? A service evaluation assessing the need for paediatric anaesthetists in a regional paediatric centre

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Introduction and aims
The ability to provide safe anaesthesia for children age 3 and over is a core-learning outcome in the Royal College of Anaesthetists training curriculum. However, with the Shape of Training review suggesting a need to increase the number of generalist rather than specialist doctors, the number of specialist paediatric anaesthetists may decrease in the future.

Our hospital is a regional paediatric centre offering a full range of paediatric surgical services, excluding cardiac surgery. Within this environment, what proportion of our current case-load requires an anaesthetist with specialist training in paediatric anaesthesia?

Methods
We reviewed the anaesthetic charts of all children booked for elective procedures for 2 weeks in March 2014. We recorded age, ASA grade, and procedure. A specialist paediatric anaesthetist was deemed necessary if any one of the following conditions were met: age under 3 years, ASA 3 or more, or "high risk procedure (e.g. major abdominal, neurosurgical, or shared-airway procedures excluding dental, adenoidectomy and tonsillectomy). Emergencies, and intrathecal chemotherapy procedures were excluded.

Results
200 children were booked for elective procedures during the 2-week study period. 56 children (28.0%) were aged under 3 years, 29 (14.5%) were ASA 3 or more, and 30 (15.0%) were booked for "high-risk" surgery. Overall 88 children (44.0%) required a specialist paediatric anaesthetist. These children were spread across a range of elective lists. Maxillofacial, Respiratory medicine, and General Surgery had the highest proportion of children requiring a specialist anaesthetist (100%, 100%, 75.0% respectively), dental, ophthalmology and urology the lowest (10.0%, 14.3%, 32.1%).

Discussion and conclusion
Our data shows that almost half of children (44.0%) undergoing elective surgery in our hospital would benefit from the skills of a specialist paediatric anaesthetist. However workforce planning is more complex than this, since even day-case lists contained complex patients: for example 10% of children booked for day-case dental procedures were ASA 3 or greater. An ideal solution would be for every child to be cared for by a specialist paediatric anaesthetist. However this is unrealistic in the current workplace, and likely to become more so if the Shape of Training reforms are implemented.

Alternative solutions need to be explored to match complex children with appropriately experienced anaesthetists. We are currently piloting pre-assessment systems for all our children to improve this matching.

This small study has a number of limitations, in particular the exclusion of emergency cases, and the short study window. Nonetheless it provides evidence that paediatric anaesthetists will remain essential in our hospital if current levels of service are to be maintained.

References
**Pharmacokinetics of single dose oral morphine in healthy children following surgery**

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**Introduction**

Oral Morphine has been proposed as an effective and safer alternative to codeine for after-discharge pain in children following surgery. Current dose recommendations are extrapolated from a limited number of small paediatric studies using intravenous/intramuscular morphine administration data, or from slow-release morphine formulations in oncology patients. There is little evidence of the optimal oral dose. The aim of this study was to investigate the pharmacokinetic properties of oral morphine in healthy perioperative children.

**Methods**

After Research Ethics Board approval and written informed parental consent, 34 healthy children, aged ≥ 2 to < 6 yr, undergoing elective surgery and requiring opioid analgesia were block randomised to receive oral morphine preoperatively; Group 1 = 0.1 mg/kg, Group 2 = 0.2 mg/kg or Group 3 = 0.3 mg/kg. Blood sampling was performed at 30, 60, 90, 120, 180 and 240 minutes. Adverse drug effects were evaluated at 4 hr and 24 hr. Serum concentrations of morphine, morphine-3-glucuronide and morphine-6-glucuronide were measured using high-performance liquid chromatography with mass spectrometry (LC-MS/MS). C\(_{\text{max}}\), T\(_{\text{max}}\) and AUC were calculated.

**Results**

Data from 14 male and 20 female subjects were analysed. Age, weight, height and body mass index [mean (SD)] were 4.1 (1.2) yr, 17.0 (3.1) kg, 102.6 (9.8) cm and 16.1 (1.0) kg/m\(^2\), respectively. C\(_{\text{max}}\) (ng/ml) [mean (SD)] values for serum morphine were; Group 1: 6.8 (5.6) [n=4], Group 2: 16.4 (23.7) [n=15], and Group 3: 24.1 (14.3) [n=15]. T\(_{\text{max}}\) (min) [mean (SD)] values for serum morphine were Group 1: 69.3 (27.4) [n=4], Group 2: 64.5 (61.7) [n=15], and Group 3: 47.1 (27.0) [n=15]. There was a dose-dependent increase in AUC.

**Discussion**

Serum concentrations after 0.1 mg/kg oral morphine were below accepted therapeutic levels. C\(_{\text{max}}\) and T\(_{\text{max}}\) showed a dose-dependent relationship but with considerable variability. Oral morphine requires further investigation to evaluate efficacy and safety for paediatric postsurgical outpatient analgesia.

**Acknowledgements**

This study was funded in part by grants from the Canadian Anesthesiologist's Society Canadian Research Award in Pain Research and/or Regional Anesthesia and Innovations in Acute Care and Technology (iACT) and internal funding from the BCCH Department of Pediatric Anesthesiology and the Pediatric Anesthesia Research Team (PART).

LC-MS/MS analysis of serum samples was performed by Michael Leadley at the Analytical Facility for Bioactive Molecules (AFBM) of the Centre for the Study of Complex Childhood Diseases (CSCCD) at the Hospital for Sick Children, Toronto, Ontario. CSCCD was supported by the Canadian Foundation for Innovation (CFI). Sample preparation was performed by Katarina Aleska and Ariane Mandel at the Motherisk laboratory at the Hospital for Sick Children, Toronto, Ontario.

**Conflicts of Interest**

None declared.

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Safer Anaesthesia from Education (SAFE) paediatric anaesthesia in Uganda
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Background
Uganda is a low-income country (LIC) in East Africa, population 37.6M, 48% under 14 years (1). There are approximately 50 physician anaesthetists and 400 anaesthetic officers (AO). AOs are trained for 18 months and work in district hospitals and rural health centres without supervision (1). 85% of children in LICs are likely to require treatment for a surgical condition before their 15th birthday. Access is limited by lack of facilities and few trained providers; patients commonly present late, with high acuity of illness (1). Paediatric anaesthesia is of necessity the responsibility of the non-specialist non-physician anaesthetist.

The Association of Anaesthetists of Great Britain and Ireland (AAGBI) developed the three-day ‘SAFE’ paediatric anaesthesia course with the Uganda Society of Anaesthesia to provide refresher training to AOs in LICs such as Uganda, and we report the outcomes of the first pilot courses.

Course development
Anaesthetists with experience of working in LIC wrote the course after reviewing Ugandan theatre logbook data (1). There were two lectures per day, and 10 breakout sessions covering the principles of paediatric anaesthesia, pain, trauma, burns, management of the sick laparotomy, newborn and paediatric life support. Breakout sessions consisted of case scenarios, discussions and skill stations. Daily faculty meetings were held to check progress. The courses were held in Masaka Uganda in July 2014 and January 2015, funded by the AAGBI and the World Federation of Societies of Anaesthesiologists (WFSA).

The impact of the first 4 pilot courses was evaluated using the Kirkpatrick model (enjoyment, change in knowledge, change in skill). Each participant completed a feedback form by rating statements on a 10-point likert scale, and before and after MCQ test and skills assessment (newborn or paediatric life support, intubation or trauma assessment). Results were compared using a paired T-test.

Results
The facilitators were from Uganda and UK/USA, with 1:4 facilitator:participant ratio.

175 AOs attended 4 training courses. Median overall satisfaction for the course was 10 (range 7-10, n=123). The course was deemed relevant to local practice (median score 10, range 7-20, n=123), and feedback comments were very positive.

The mean MCQ scores increased from 35/50 to 44/50 (p<0.0001), and skills scores from 5.2/10 to 7.99/10 (p<0.0001)

Conclusion
The SAFE paediatric anaesthesia course provides training relevant to anaesthesia providers in Uganda. Participants demonstrated improvements in knowledge and skills, and high level of enjoyment. The course provided a vehicle for anaesthetists from high-income settings to work with their colleagues in a LIC, and to gain an insight into the working conditions of the AOs in rural areas.

References
Neonatal vital sign deviations during general anaesthesia for pyloromyotomy
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Introduction and aims
Rodent studies have demonstrated neurotoxic effects of commonly-used general anaesthetics on the developing rat brain. While these animal models of neurodegeneration cannot be extrapolated to the human model, retrospective clinical epidemiological data do suggest an association between anaesthesia/surgery exposure in human neonates and altered neurocognitive outcomes. General anaesthesia is now recognised as a potential risk to cognitive function at the extremes of age. Given that general anaesthesia in neonates cannot be avoided, it is important to explore potential factors that may influence anaesthesia-induced neurotoxicity. We previously reported on vital sign changes from continuously recorded data collected in 431 neonatal cases undergoing general anaesthesia between 2010 and 2013. We calculated the percentage of each case spent: hypothermic (temperature <36°C); hypoxic (SpO₂ <90%); with high FiO₂ (>95%); hypotensive or hypertensive (30% change in MAP, or MAP <35 mmHg); mildly, moderately or severely hypocarbic (etCO₂ <30, 25 or 20 mmHg). The present study reviews vital sign changes in 28 neonates undergoing general anaesthesia for pyloromyotomy. These are patients who should be optimally resuscitated prior to surgery, thus removing confounding factors that may affect their perioperative vital signs.

Methods
With local Research Ethics Board approval, we reviewed the anaesthetic records for the 28 pyloromyotomy cases. These records were summarised for demographics, comorbidities, surgical procedure and anaesthesia information. The electronic case plots, including automatically marked vital sign deviations, were reviewed and compared to the anaesthetic record.

Results
Median corrected postmenstrual age, of the 28 neonates, was 42.5 (IQR 41.3-43.4) weeks; median weight at time of procedure was 3.6 (IQR 3.2-4.0) kg; and median ASA status was 1.5 (IQR 1-2). Vital sign data deviations from the electronic record were triggered for hypotension (MAP <35 mmHg) in 12 (43%) neonates, hypothermia (temperature <36°C) in 12 (43%) neonates, hypocarbia (etCO₂ <30 mmHg) in 4 (14%) neonates, and hypoxemia (SpO₂ <90%) in 6 (21%) neonates. A full review of the electronic data changes correlated with the anaesthetic details will be presented.

Discussion
As pyloromyotomy is performed in well-resuscitated neonates we did not expect to observe hypotension and hypothermia in so many of these cases during general anaesthesia. Tight control of vital signs has been shown to improve perioperative outcome in adults, which should also be the case for neonates. We envisage that this correlated information provides extremely useful information to direct subsequent prospective audit, and drive improvements in quality of care aimed at targeting preventative strategies to minimise vital sign changes in neonates undergoing general anaesthesia.

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Hyponatraemia in paediatric surgical patients receiving intravenous fluids: A comparison of two departments
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Introduction
Perioperative hypotonic intravenous fluids can been associated with dilutional hyponatraemia in children, leading to cerebral oedema and death; four cases of which have been documented in the UK since 2000¹. Current NPSA and APA guidance recommend using isotonic fluids during the perioperative period, to minimise hyponatraemia due to increased ADH release following surgery¹,²,³. Despite this, it remains practice in many paediatric surgical departments to prescribe either hypotonic fluids or a combination of hypotonic and isotonic solutions. This may have an adverse outcome for children.

Aim
To determine if children developed hyponatraemia as a consequence of intravenous fluid prescriptions during the perioperative period, by comparing the fluid prescription practise in the surgical departments of the Royal Aberdeen Children’s Hospital and Starship Children’s Hospital Auckland, New Zealand.

Methods
After gaining ethical approval, retrospective review of serum sodium levels of 100 children undergoing surgery requiring more than 48hr of postoperative fluids was performed. Patients were grouped according to the types of fluids received, namely purely hypotonic, combination and purely isotonic. The duration of fluid administration, and all serum biochemistry results were recorded and analysed to determine if an increased incidence of hyponatraemia was associated with hypotonic fluid administration.

Results
Combined statistical analysis showed an increased probability of an association between hypotonic fluids and hyponatraemia (OR 1.2, 95% CI= 0.3352- 4.2965, p=0.7793). Patients receiving a combination of fluids in both departments had lower mean serum sodium (Aberdeen 135.73, 95%CI= 134.9-136.56, Auckland 134.7, 95%CI=133.7-135.7, p= 0.119) than both the population mean of the study (Aberdeen 136.04, 95%CI=135.2-136.88, Auckland 135.17, 95%CI=134.3-136.04, p=0.1616) and of patients receiving purely isotonic fluids (Aberdeen 143, Auckland 135.82, 95%CI=133.68-137.96). In addition, there were greater instances of hyponatraemia observed in patients receiving some form of hypotonic fluid (Aberdeen= 31.3%, Auckland= 52.9%) compared to purely isotonic solutions (Aberdeen=0%, Auckland 36.4%).

Conclusion
Children continue to receive hypotonic fluids in the postoperative period, and therefore are more likely to develop hyponatraemia. Although no child developed clinically harmful hyponatraemia, the results merit adoption of a postoperative/sick child fluid regime similar to that developed in Belfast (Dr P Crean, personal communication). Few children have regular post-operative biochemical testing for various reasons. This study reveals that close monitoring should be maintained for the duration of intravenous fluid administration.
Efficacy of post-operative analgesia for repair of Hirschsprung’s Disease and imperforate anus – An audit

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Introduction
Surgical repair of Hirschsprung’s disease is an infrequent procedure. The success of our current analgesic techniques was unclear, with concern over an epidural’s ability to adequately cover the rectal area. Using standards set by the RCOA¹ and APA², cases were audited on being pain free at rest, pain episodes being managed within two hours and the use of multimodal analgesia.

Method
37 cases of surgical repair were identified for the previous 5 years at the University Hospital of Wales, Cardiff. Notes were reviewed, producing 30 cases for analysis. For this audit, pain episodes were defined as a FLACC scale score of 2 or above.

Results
The patient ages ranged from 1 week to 3 years. 100% received Paracetamol and 30% of patients with no clear contraindication received Ibuprofen. 44% had epidurals, 23% had epidurals with a caudal, 27% had Morphine NCAs with a caudal and 6% had both NCAs and epidurals.

In the first 24 hours, 57% recorded pain episodes at rest. Epidural cases had a higher incidence of pain episodes (62%, 86% with a caudal) and higher pain scores (5.7, 3.8 with a caudal) compared to NCAs (36% and 2.7 respectively). For PSARP and anorectoplasty procedures, pain episodes occurred in 75% of epidural cases versus 20% of NCA cases.

64% of pain episodes were managed successfully within 2 hours (100% NCA and 58% epidural compliance), with a maximum duration of 7 hours.

Pain after 24 hours was less of an issue, with 13% of cases recording pain episodes and evenly spread amongst the analgesic techniques. 86% of pain episodes were managed successfully within 2 hours, with the non-compliance from epidural cases. 20% of epidurals were converted to NCAs.

Discussion
There was widespread use of multimodal analgesia and potentially ibuprofen could be increasingly used. Epidural cases had more pain episodes, particularly with PSARP, anorectoplasty and when performed with caudal anaesthesia, reinforcing concerns over inadequate spread and ‘bridging the gap’ issues.

Management of pain using NCAs was excellent but less successful with epidurals. Delays waiting for medical reviews, less familiarity, hesitation to act or use epidural top-ups and inadequate reassessment all appear to have contributed.

Following this audit, the department is developing a more uniform approach to analgesia for these cases including increasing the use of NCAs. Education will be provided at induction to the trainees covering out-of-hours paediatric pain calls, including a reassessment target time of 2 hours.

References
Endotracheal tube size estimation in children undergoing anaesthesia: effect of high body mass index
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Introduction
Endotracheal intubation is commonly used in children undergoing general anaesthesia. It is very important to select the appropriate-size endotracheal tube (ETT) for a child's age and body size. Over-sized ETT may lead to failure of intubation, multiple laryngoscopies, airway trauma, sore throat, croup and subglottic stenosis. Conversely, under-sized ETT may be associated with excessive leakage leading to hypoventilation, imprecise spirometry, and increases operating room pollution with anaesthetic gases.

Several methods are used to estimate the ETT size in children. Commonly the Cole formula (ETT size = Age in years/4 +4) is used to estimate uncuffed ETT sizes. The Motoyama formula (Age in years/4+3.5) is used for cuffed ETT. The current childhood obesity epidemic in the USA means that larger numbers are presenting for anaesthesia; therefore, one can speculate a comparative increase in their airway size. Consequently using ETT formulae developed 50 years ago is likely to underestimate ETT size. Therefore, this study assessed performance of commonly used age-based ETT estimation formulae at predicting ETT size selected by pediatric anaesthesia caregivers during elective non-cardiac operations.

Methods
We used preoperative anthropometric and clinical data on 13,933 children aged 1 to 12 years who underwent elective, non-cardiac operations from 2005 to 2013 to evaluate the performance of 2 ETT size estimation formulae. We computed the ETT sizes for each patient based on the Cole and Motoyama formulae and then compared formula-derived ETT sizes to the ETT that was actually used for the patient. Basic descriptive statistics for the study subjects were calculated. Pearson correlation coefficient (r) was used to explore the strength of relation between calculated ETT size and ETT size that was actually used for each child. Effect of BMI category on the accuracy of these formulae was also assessed.

Results
We analysed data on 21881 children who underwent general anaesthesia with oral ETT. Cuffed ETT was used in 77.1% of patients. All the anthropometric indices were significantly positively correlated with age and ETT sizes. Patient's height demonstrated the strongest positive correlation with actual ETT used. On average, ETT size by formula was significantly smaller than ETT size actually used for the patient across all ages. Furthermore, mean cuffed ETT size used was significantly larger when children with high BMI were compared with their peers of normal BMI (5.66±0.76 vs. 5.07±0.75; p<0.001). A similar less strong association was observed for uncuffed ETT and BMI category (p=0.02).

Conclusion
Two commonly used age-based ETT size estimation formulae significantly underestimated the ETT size used for children undergoing elective non-cardiac operations. High BMI was also a significant factor contributing to ETT size underestimation. Given the increasing size of contemporary American children and the known complications associated with inappropriate ETT size use, there is a need to develop more accurate methods for ETT size estimation in children.
Emergence delirium after paediatric dental extractions
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Introduction and aims
Propofol administered at the end of general anaesthesia has been shown to reduce emergence delirium during the recovery period\(^1\). Two differing consultant practices co-exist within this hospital, either employing propofol at the end of a surgical procedure or not. This prospective audit assessed the effect of propofol administration on the severity of emergence delirium in children attending our institution for dental extractions under sevoflurane anaesthesia.

Method
Intra-operative and post-operative data was prospectively collected, over a 4 month period, for children attending our Paediatric Dental Anaesthesia Clinic. Paediatric Anaesthesia Emergence Delirium (PAED) scores\(^2\) and pain scores were recorded at 5 minutes and on discharge from recovery. Administration of propofol 1mg/kg at the end of the procedure was routinely given by one consultant anaesthetist.

Results
239 children attended for dental extractions under general anaesthesia. Patients with incomplete data or those who had received sedative premedication, propofol induction or intra-operative opiates were excluded from analysis. 165 patients of mean(±SD) age 6.4(±2.4) years and mean(±SD) weight 25.5(±11.0) kg were analysed in two groups: Children who received 1mg/kg propofol at the end of their procedure (group P) (n=52) and those who received none (group N) (n=113). Groups were comparable for age, gender, weight, ASA, duration of procedure, median number of extractions and pain scores. Anaesthesia and dental practices were identical in all patients. Local anaesthetic infiltration was routinely used by the dentist. Patients who received 1mg/kg propofol at the end of their procedure did have lower median (range) PAED scores, both at 5 minutes: 3.5(0-15) and 6(0-20) in groups P and N respectively (p=0.18) and on discharge from recovery: 2.5(0-13) and 3(0-20) in groups P and N respectively (p=0.32). Results do suggest a reduction in emergence delirium severity, although non-significant. Nausea and vomiting occurred in 7 patients in group N but was absent in group P (p=0.16). Administration of propofol prolonged recovery stay by a median of 3 minutes (p=<0.01). More patients in group N received rescue analgesia in recovery: 6.6% and 13.3% in groups P and N respectively (p=0.16).

Discussion and conclusion
Propofol 1mg/kg, when administered at the end of the procedure, provides some benefit in reducing the severity of emergence delirium in children undergoing dental extractions under sevoflurane anaesthesia and may also provide additional antiemetic benefit. Reduction in emergence delirium may prevent administration of unnecessary analgesia in recovery.

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Pain @ home in ambulatory children after dental surgery - A re-audit following protocol changes
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Introduction and aims
In 2013 this centre investigated the incidence of early postoperative pain in children undergoing dental extractions. (1) Previously, 53% of children complained of pain at home but despite this only 13% of children received regular analgesia (≥ 3 doses of paracetamol and/or ≥ 3 doses ibuprofen). This prompted a service analysis and revision of local postoperative analgesic recommendations. This re-audit investigated if these changes had lead to a reduction in the number of children complaining of pain at home and resulted in an improvement in the analgesia provision at home.

Method
Prior to discharge all parents/guardians received a copy of the revised postoperative analgesic recommendations. Data was collected prospectively over a 4 months period (1/2/14-29/5/14). A structured telephone interview was conducted 24 hours post discharge to document pain scores as well as analgesic consumption post dental extractions. Pain scores were measured using the numeric pain rating scale (0-10) with 0 representing no pain and 10 representing the worst possible pain. Data collection was identical to the previously reported audit. (1)

Results
128 children were included in 2014 and 156 in 2013. Groups were comparable for demographic data and intra-operative management was standardised. (2) Median (range) number of teeth removed was 5 (0-16) in the 2014 and 6 in the 2013 (1-20). Fewer children complained of pain in 2014 than in 2013 (36% versus 53%, respectively). Worst median (range) pain scores were 1(0-8) in 2014 and 2(0-8) 2013 (p=0.002). The number of children receiving regular analgesia increased between 2013 and 2014 (26.1% versus 39.1%, P=0.03). The re-audit in 2014 also showed that fewer children attended school the next day (16% versus 26% P=0.045). There was no significant difference in the number of children having a full post discharge night’s sleep (80.1% 2013 versus 82.8% 2014 P=0.563).

Discussion and conclusion
The introduction of the revised post operative analgesic recommendations resulted in a reduction in the number of children complaining of pain at home and an increase in analgesic administration. Greater awareness of the child’s need for good analgesia may have resulted in a reduction in the number of children attending school the next day. This, however, requires further clarification.
Laryngeal mask airways in children: cuff pressure and sore throat

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Introduction
Monitoring the cuff pressure of laryngeal mask airways (LMAs) is currently not routine practice. Manufacturing companies recommend a maximum pressure of 60cmH2O and evidence suggests high pressures are associated with higher morbidity. This audit's aims were to monitor intraoperative LMA cuff pressure in children and measure the incidence of sore throat and dysphagia postoperatively.

Methods
The Trust Clinical Effectiveness Unit approved the audit. Data was collected on 50 children aged 2-16 attending for day surgery over a one-week period in January 2015. The LMA cuff was inflated to a volume considered appropriate by the attending anaesthetist. This volume was recorded and the cuff pressure was measured at the start and end of anaesthesia. A telephone interview was conducted postoperatively to ask if the child had experienced a sore throat or dysphagia.

Results
The volume of air in the cuff varied (0-9mls size 2 LMA, 3-9mls size 2.5, 10-15mls size 3, 18-30mls size 4). The average cuff pressure across all patients increased from 38cmH2O at the start to 42cmH2O at the end of anaesthesia. The average pressure increase was greater when nitrous oxide was used intraoperatively compared to air (4.5cmH2O vs. 2.2cmH2O). The average pressure in standard Ambu LMAs increased by 15cmH2O whereas that of flexible LMAs decreased by 7cmH2O. The average pressure increased by 21cmH2O in procedures lasting 30-60 minutes, and 50cmH2O in procedures lasting more than one hour. In procedures lasting less than 30 minutes the average pressure decreased by 5.5cmH2O. The cuff pressure was above 60cmH2O in 12 patients at either the start of anaesthesia, end of anaesthesia or both, with a maximum recorded pressure of 120cmH2O in two patients. A postoperative telephone interview was conducted with 36 parents. Of those one parent said their child had a sore throat on the first postoperative day and none complained of dysphagia.

Conclusion
Overall there was an increase in average cuff pressure from the start to the end of anaesthesia; this was greater when nitrous oxide was used and in longer procedures. The decrease in pressure in short procedures and when a flexible LMA was used is likely to be because most of these were dental extractions. The LMA position is frequently moved in these procedures to aid surgical access. Overall 24% of patients were subjected to cuff pressures higher than 60cmH2O. Only 3% of children that were followed-up experienced a sore throat postoperatively. We suggest cuff pressure should be monitored in our institution in procedures lasting more than 30 minutes.

References
The incidence and factors affecting paediatric distress in the anaesthetic room
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Introduction and aims
Anxiety during the anaesthetic process can have significant negative post-operative outcomes and can lead to a stressful experience that limits the quality of the anaesthetic. The reported incidence of anxiety varies widely based on older studies. Recently there has been increasing interest into ways of mitigating this distress.

We audited the incidence of distress during induction using a recently validated scoring tool(1). We compared this score to methods of distraction, persons providing distraction, cannulation attempts, method of induction and parental presence. We also compared those scores to a version completed by the parents.

Method
Prospective study completing a questionnaire for all paediatric cases over a three month period. The scoring tool marks behaviour on a three point scale ranging from happy, sad or mad (distraught). Distraction methods, personnel present and type of anaesthetic were all captured on the questionnaire.

Results
A total of 143 cases with an age range of 1-16 years (average 7.5 years) were recorded. During induction 72% of all children were happy, 22% sad and 6% distraught. Using an electronic device gave the highest percentage of happy children (78%) followed by books (67%), conversation (65%), bubbles (43%) and toy (0%). Play specialist were the best distractors with 85% of children happy, parents next at 72%, followed by ODPs 67%, paediatric nurses 65% and lastly Anaesthetists at 60%. IV induction resulted in 82% of children happy compared to inhalational at 38%. A single cannulation attempt resulted in 78% happy, while 67% were happy for two attempts. Parental presence made 75% of children happy compared to 68% if not present. There was good correlation between parental scores and those completed by staff.

Discussion and conclusion
Regarding our departmental target of 0% severely distressed children, the incidence of this distress was higher than hoped for. It fell just short of other standards, such as in the RCOA audit recipe stating 75% not crying (comparable with happy children). In keeping with other literature, electronic devices appeared to be the most successful distraction technique, interesting as the age range included those as young as one. Appropriately, play specialists gained the most favorable scores. Unsurprisingly, multiple cannulations increased unhappiness but, interestingly, IV inductions had almost double the percentage of happy children. Despite common practice parental presence had only a slightly favourable outcome, perhaps lending weight to the theory of an anxious parent results in an anxious child. Reassuringly, as parental scores where similar to those of the medical staff, this helps reduce concern of bias on the part of the medical teams.

References
Paediatric status epilepticus and barriers towards local extubation
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Introduction and aims
Status epilepticus is the most common neurological emergency in children and intubation is often necessary after thiopentone administration for refractory seizures or in cases of airway compromise. Not all cases require paediatric intensive care and in the absence of atypical features, extubation may be considered a safe option.

The aim of this study was to determine the proportion of patients referred to our paediatric retrieval service with status epilepticus in whom local extubation was advised, the characteristics of these patients, the proportion of successful extubations, the time taken to extubate and the barriers towards extubation.

Methods
Children referred to the Children’s Acute Transport Service (CATS) with status epilepticus between 31st October 2013 and 31st October 2014 were identified through a local database. Patient records were reviewed for data including co-morbidities, drug history, seizure details, benzodiazepine use, CT imaging and advice regarding local extubation.

Results
A total of 189 patients were referred with status epilepticus of which 131 (69%) were intubated. Extubation was advised in 47 cases (47/128; 37%). Mean age was four years (20 months to 16 years). In those children where extubation was advised, twenty one (45%) had neurological co-morbidities, 22 (47%) had fever, 21 (45%) were first fits, 16 (34%) had regular anti-epileptic medication and four (9%) had previous PICU admissions. Six (13%) received more than two benzodiazepine doses. Twenty three (49%) were intubated for respiratory depression and 18 (38%) for intractable seizures. CT was performed in 29 (62%) and all reported normal. Extubation was attempted in 32 (68%) and was successful in 30 (94%). Mean time to extubation was 133 min (30-610 min). Extubation was not attempted in 14 (30%) with consultant refusal being the cause in 12 (86%). The reason for consultant refusal was staffing issues in two cases, difficult parents in one and the reason was not specified in nine.

Discussion and conclusion
In our study, local extubation was advised by a CATS consultant in 37% of all intubated patients with status epilepticus referred for paediatric retrieval, and in those cases where extubation was attempted, 94% were successful. There were no predominating features of this group. The mean time to extubation was 133 min and may act as guide to local teams. Extubation was not attempted in 30% of patients because of local team reasons. Our study shows local extubation to be safe when advised by our paediatric intensive care consultants and with such a high rate of success, implies we are catching only the tip of this iceberg.

References
Understanding and reducing peri-operative errors in acetaminophen (paracetamol) administration: An improvement collaborative between Royal Belfast Hospital for Sick Children (RBHSC), N. Ireland and Cincinnati Children's Hospital Medical Center (CCHMC), USA

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Introduction
Acetaminophen errors are an acknowledged problem in paediatric anaesthesia, in both Europe and the United States. While the majority do not result in patient harm, acetaminophen overdose can cause serious morbidity and mortality. In October 2014 the Pediatric Anesthesia Safety Organisation, “Wake Up Safe”1 issued an alert after a large number of reported errors, as had the Royal College of Anaesthetists2 in May 2013. We present a collaborative project between our transatlantic hospitals, to better understand peri-operative acetaminophen errors, and to develop targeted interventions that will work towards their reduction.

Methods
Each hospital queried their adverse event database for acetaminophen errors for a five-year period between July 2009 and June 2014. The query included all acetaminophen events in the preoperative holding area, operating room, post anaesthesia care unit, and discharge instructions. Each event was reviewed and classified.

Results
There were 61 reported peri-operative medication errors involving acetaminophen in Cincinnati (in a caseload of ~ 185,000), and 9 in RBHSC (out of a caseload of ~24,000), both in this 5 year time period. Administration in close proximity to a previous dose accounted for the majority of errors in both hospitals (39 (63.9%) in CCHMC, 6 (66.6%) in RBHSC). The next largest category in both hospitals was wrong dose (11 (18%) in CCHMC and 3 (33.3% in RBHSC), then doses administered to the wrong patient (5 (8.2%) CCHMC) missed doses (3 (4.9% CCHMC), administration despite documented allergy (2 (3.3% CCHMC)), and incompatibility with other medications (1(1.6% CCHMC)).

Discussion
Despite being different hospitals of different sizes, world locations and healthcare systems, the paracetamol errors occurring to anaesthetic patients in both are due to the same mistakes, with similar incidences (0.0003% in both hospitals). Inappropriate administration time and wrong dose accounted for the 1st and 2nd most common problems respectively. In both hospitals, understanding these errors is helping us to develop key drivers and targeted interventions.

Drivers include increased use of technology, increased pharmacy collaboration with anaesthetists, improved culture and awareness. Early interventions include a double check by pharmacy on the timing of previously administered doses, and education for providers. Interventions currently being tested include a standardised double check by providers, and barcoding. While data is preliminary, we believe these interventions will reduce the incidence of peri-operative acetaminophen errors at our hospitals.

References
Capnography and rebreathing in the Paediatric Post Anaesthetic Care Unit (PACU) at Royal Manchester Children's Hospital (RMCH)

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Introduction
Emergence from anaesthesia and removal of artificial airways can be hazardous. This task is frequently delegated to appropriately trained staff and takes place in a PACU. Acceptable standards of monitoring should be available in these circumstances. National guidelines recommend that continuous capnography is used in all anaesthetised patients, regardless of the artificial airway device being used and the location of the patient. An audit at RMCH showed that capnography was used in 1 out of 100 PACU patients in February 2014. Although monitoring equipment was readily available further training of PACU staff was needed.

Aims
Improve compliance with national recommendations and train PACU staff in capnography use. Time duration supraglottic airway devices (SADs) remain in situ during recovery from anaesthesia. Record major (desaturation to <95% needing intervention, laryngospasm and re-intubation) and minor (coughing on/biting SAD) adverse airway incidents. Record T-piece flows, expired and inspired CO2 levels. Increase flows in patients found to be rebreathing.

Methods
A training package was provided for all PACU staff. This included a tutorial about capnography and anaesthetic breathing circuits, the Association of North West Intensive Care Units (ANWICU) e-learning module, further reading and resources via www.capnography.com.

Clear instructions regarding equipment set up were provided. 102 patients (99 Laryngeal Mask Airways) were audited over 12 days.

Results
Median age 5 years (range 0-16), weight 22kg (9-85), duration LMAs remained in situ in PACU 13mins (0-36), overall PACU stay 39mins (11-65). 65 patients' T-piece flows were adequate or excessive. 35 patients were rebreathing and needed oxygen flows increasing. Their average PACU stay was 5 minutes longer. Without capnography PACU adverse airway incidents were major-8% and minor-6% (overall-14%). Using capnography showed reduced major-2% and minor-1% (overall-3%) rates.

Discussion
This audit demonstrated that SADs often remained in situ for over 10 mins in PACU patients. Rebreathing might contribute to prolonged PACU stay and increased adverse airway incidents. Capnography allows early detection of airway obstruction, airway device displacement and hypoventilation. It can safeguard patients recovering from anaesthesia from adverse airway incidents.

Conclusion
We recommend routine capnography monitoring for paediatric PACU patients supported by appropriate local guidelines and training.

Acknowledgements
We thank Dr Papari Deka for performing the February 2014 baseline audit and all RMCH PACU staff for their hard work collecting audit data and implementing changes to their practice.

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**Comparison of the performance of a mobile phone respiratory rate counter with the WHO ARI Timer**

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**Objective**

Respiratory rate (RR) plays a fundamental role in clinical assessments for disease diagnosis, prognosis, triage and treatment. The Acute Respiratory Infection (ARI) Timer, introduced by the WHO to improve the measure of RR in low resource settings, has limitations. The RRate mobile application utilises the mobile phone as a timer and a counter, and measures RR from the median time interval between breaths. This study compared the performance of the RRate app and the ARI Timer.

**Methods**

With ethics approval and informed consent, twenty adult volunteers (nurses at a children's hospital) used both devices to measure the RR from 10 prerecorded videos of infants and children breathing at rates of 17-59 breaths per min (reference RR, br/min). The RR measurements from the two devices were compared to the reference RR and to each other, using correlation (Pearson's product-moment correlation, \( r \)), Bland-Altman analysis (bias and limits of agreement) and error metrics (percentage error, PE; root mean square error, RMSE; and normalized RMSE, NRMSE). The median time taken for measurement using both devices were compared using the paired Wilcoxon signed rank test.

**Results**

The RR measurements using the RRate app and the ARI Timer were highly correlated to the reference RR (\( r=0.991, p<10^{-15} \) and \( r=0.982, p<10^{-15} \) respectively), as well as to each other (\( r=0.973, p<10^{-15} \)). When compared to the reference RR, the RRate app had a larger bias than the ARI Timer (0.6 vs 0.04 br/min), but with tighter limits of agreement (-4.5 to 3.3 br/min vs -5.5 to 5.5 br/min). Compared to each other, the bias was 0.7 br/min, with limits of agreement -7.4 to 6.1 br/min. The RRate app was marginally more accurate than the ARI Timer (PE 10.6% vs 14.8%, RMSE 2.1 vs 2.8 br/min and NRMSE 5.6% vs 7.5%) when compared against the reference RR, but this difference is unlikely to be clinically significant. When compared to each other, the error metrics were higher (PE 18.2%, RMSE 3.5 br/min and NRMSE 9.4%). RR measurements were more than 10 times faster using the RRate app compared to using the ARI Timer (median times taken (interquartile range) 5.9 sec (3.8 - 10.9 sec) vs 60 sec (60 - 60 sec), \( p<10^{-15} \)).

**Discussion and conclusion**

During simulated RR measurements using prerecorded videos of infants and children, the RRate mobile app measured RR significantly quicker with similar accuracy compared to the ARI Timer. The RRate mobile app is freely available for Android and iOS devices, and may be a viable alternative to the ARI Timer. However, as with any novel technology, usability, reliability and further development, would be determined by user feedback from the field.
Elevated preoperative blood pressure is a risk factor for pre-incision hypotension in paediatric surgical patients
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Introduction
High blood pressure (HBP) in childhood is a strong predictor of future cardiovascular disease and is associated with left ventricular hypertrophy and abnormal vascular reactivity even in apparently healthy children. Although perioperative complications of chronic hypertension, such as labile BP trends, myocardial ischemia and stroke are vanishingly rare in children, the prevalence and consequences of preoperative HBP in children have not yet been studied. This study examined the prevalence of HBP in apparently healthy children undergoing elective non-cardiac operations. We also determined whether children with preoperative HBP were at increased risk for pre-incision hypotension (PIH), hypothesizing that preoperative HBP was associated with increased frequency of PIH.

Methods
This was a retrospective cohort study that used clinical and anthropometric data on children aged 3-17yr who underwent elective, non-cardiac operations from January 2006 to January 2014. Height-, age- and sex-specific systolic (SBP) and diastolic (DBP) blood pressure measurements were recorded on all patients during the pre-anesthesia evaluation and were used to stratify children into three categories: normal BP (SBP and DBP below the 90th percentile), prehypertension (PHT, SBP and/or DBP ≥90th percentile but <95th percentile or if the BP exceeds 120/80mmHg even if it is below the 90th percentile), and hypertension (HT, SBP and/or DBP ≥95th percentile). We also categorized each child’s SBP and DBP as being above or below 140mmHg and 90mmHg respectively (the threshold for adult hypertension). We explored the association of HBP with BMI categories. We calculated the overall incidence of PIH among the study cohort. Occurrence of single and multiple episodes of PIH was compared across BP categories. Multivariate logistic regression analysis was used to calculate adjusted odds ratios for PIH using age, gender, BMI and BP categories as covariates.

Results
Of 39654 children, 14.3% were overweight and 15.7% were obese. The overall prevalence of PHT, hypertension, and hypertension by adult standards were 16.4%, 6.8% and 3.3% respectively. Overweight and obese children had higher rates of elevated BP. Children with elevated baseline BP had significantly higher odds of multiple PIH compared with normotensive children (26.1% vs. 5.8%; OR = 5.7, 95%CI = 5.3-6.1; p<0.001). Increasing baseline SBP decile was significantly associated with increasing frequency of multiple PIH (Fig.1). Children with HBP were more likely to develop PIH that was treated with ephedrine (0.5% vs. 0.3%; p =0.016) or phenylephrine (1.1% vs 0.5%; p<0.001).

Conclusion
In children, elevated preoperative SBP is an independent predictor of PIH. Episodes of PIH were more frequent with increasing deciles of preoperative SBP. Although the longtime consequences of HBP are well known, this report provides the first intraoperative evidence of adverse event associated with preoperative HBP in children. Mechanisms underlying this hypotensive response are unclear.
Experience of using a new Aircraft Medical McGrath® MAC 1 videolaryngoscope blade to facilitate intubation in neonates and infants
Mark Ross, Alistair Baxter
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Introduction
The merits of videolaryngoscopy over conventional direct laryngoscopy in children were recently discussed by Sin et al\(^1\). Two recent studies also highlighted the challenges of direct laryngoscopy in neonates with the size 1 Miller and Macintosh blades\(^2,3\) with much comment thereafter\(^4\). The disposable Aircraft Medical McGrath® MAC 1 blade has only recently been developed and we have been trialling these in our unit. As such this is the first reported use of the new size 1 blade for the McGrath® MAC videolaryngoscope to facilitate intubation in neonates in clinical practice.

Case Series
We first used this new blade to intubate a 36-week-old neonate weighing 2.4 kg with gastroschisis. We passed the McGrath® MAC 1 videolaryngoscope blade to the right of the tongue and inserted the tip into the vallecula to lift the epiglottis. We compared direct laryngoscopy views before scoring the indirect video image. In our experience, the Cormack and Lehane view improved from 2b to 2a.

We have subsequently used the McGrath® MAC 1 videolaryngoscope to intubate 10 neonates; the youngest aged 25 weeks weighing 800 grams up to a 6 week old 5.4 kg infant with positive results. Intubation was achieved with the McGrath® MAC 1 videolaryngoscope on the first or second attempt in all infants without complication.

Conclusions
We felt the greatest advantage of this new small videolaryngoscope blade was in the magnification of the view of the laryngeal inlet. There is a further advantage in the demonstration and training of neonatal intubation. The McGrath® MAC videolaryngoscope emulates the traditional Macintosh laryngoscope in both design and in the application of an appropriately sized blade to a standard handle. With the introduction of this new size 1 blade, the McGrath® MAC videolaryngoscope can now truly facilitate intubation from cradle to grave.

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Acute tongue entrapment and injury by a sports bottle lid
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Introduction
An estimated 2270 children are treated each year for oral injuries related to bottles, pacifiers, and sippy cups in the United States 1. We report and illustrate with photographs the first, to our knowledge, case of acute threatened airway obstruction caused by the entrapment of a child’s tongue in the lid of a plastic sports bottle.

Case Report
The injury resulted in extensive tongue swelling and obstruction of the oral cavity necessitating fibreoptic nasal intubation. We describe the mixing of propofol and remifentanil in a total intravenous anaesthesia technique to facilitate intubation. Needle aspiration of the tongue failed to evacuate any hematoma or oedema and removal of the bottle lid was achieved using a dental drill in the operating theatre.

Redistribution of tongue oedema and further swelling during the post-operative period resulted in upward migration of the endotracheal tube on chest x-ray. The endotracheal tube was appropriately advanced with vigilant assessment of the airway using further chest radiographs and direct and indirect laryngoscopy. During her admission to the paediatric intensive care unit parenteral steroids were used to reduce tongue swelling and muscle relaxants were administered to minimise the risk of accidental extubation of her precarious airway. By day 7 tongue swelling had reduced and her ventilator requirements were such that we could safely extubate.

We discuss the dangers of tongue entrapment and the importance of immediate multidisciplinary management and human factors that can impede the successful management of emergency situations. We review the current literature and novel approaches to management of other cases of tongue entrapment in children. A safety alert regarding the use of this particular design of bottle has been raised with the European Child Safety Alliance for further investigation.

Conclusions
Tongue entrapment requires immediate intervention to prevent severe ecchymosis, oedema, airway obstruction and ischemia. This case illustrates the difficulties faced by paediatric anaesthetists, surgeons and intensivists both in the innovative approach to airway management, removal of the constricting bottle lid and the airway challenges faced in the post-operative period.

Ethics
Parents gave written consent for publication and presentation.

References
Audit of epidural, patient-controlled (PCA) and nurse-controlled analgesia (NCA) prescriptions in the regional children's hospital in Northern Ireland
Poppy Stewart, Aideen Keaney
Queen's University Belfast, Northern Ireland, UK

Introduction and aims
The Association of Paediatric Anaesthetists of Great Britain and Ireland's (APAGBI) updated document "Good Practice in Postoperative and Procedural Pain Management" in 2012 has provided anaesthetists an evidence-based medicine approach for managing pain in children. This document highlighted the importance of not only a multimodal analgesic strategy, but the need to prescribe medication to manage the adverse effects of opioids. Out of hours it is the trainee anaesthetist's responsibility to prescribe, prepare and programme PCA, NCA and epidural analgesia in our hospital. With over 700 cases per annum using these analgesic modalities we wanted to ensure a standardised approach to prescribing. We developed six criteria, based on this APAGBI document that should be met.

Methods
Retrospective audit of twenty randomly selected charts from the pain database: May - July 2014. Each chart was assessed to determine whether they met the following criteria:

- 1) Correct and legible prescription on the kardex.
- 2) Correct and legible prescription on the observation chart.
- 3) Multimodal analgesia prescribed.
- 4) Antimetic prescribed.
- 5) Naloxone prescribed.
- 6) Documentation of daily pain-team review.

Our standard was 100% of patient charts should meet each of these six criteria.

Results
The drug was prescribed correctly and legibly on the kardex in 90% of cases and on the observation chart in 100% of cases. 30% of patients were prescribed regular paracetamol and regular ibuprofen, 50% were prescribed regular paracetamol only, 15% were prescribed regular paracetamol and ibuprofen when required and in 5% of cases paracetamol and ibuprofen were prescribed when required only. An antiemetic was prescribed in 60% of cases and naloxone was prescribed in 5% of patients. 80% of patient charts indicated a daily pain-team review.

Discussion
Our set standard that 100% of patients would meet all six criteria was not met; in fact no patient met all six criteria. After presentation at departmental audit all anaesthetists were emailed these findings and a checklist was developed and displayed in each theatre. Re-audit showed considerable improvement with correct and legible prescription in 100% of charts, regular analgesia with paracetamol and ibuprofen in 80% of charts, anti-emetic and naloxone prescribed in 80% of charts and 100% of charts indicating a daily pain-team review.

Conclusion
Being the only children's hospital in Northern Ireland, anaesthetic trainees rotate through this department every three months. We feel that implementation of our checklist has shown an improvement in prescribing practice and is a beneficial aide for all anaesthetists. Further re-audit is required to monitor compliance and to sustain improvement.

References
“What matters to me today? “ In the regional paediatric intensive care unit (PICU)
Poppy Stewart, Aideen Keaney
Queen’s University Belfast, Northern Ireland, UK

Introduction and aims
The Institute of Medicine report “Crossing the Quality Chasm: “A new health system for the 21st century” (2001) identified the need for patient centered care1. Additionally the Institute of Healthcare Improvement advocate “flipping healthcare”- the shift of focus from asking patients “What’s the matter?” to “What matters most to you?”. In our 12-bedded PICU, there was no formal process to ask the child and family what mattered the most to them. Reflecting on this, and inspired by work in Glasgow Children’s hospital, we piloted the “What matters to me?” concept. Each child has a unique card displayed at their bedside, on which they (or their family) can write what matters most to them.

Method
Our aim was by the 1st February 2015 95% of children/week in PICU would have a "What matters to me?" card displayed. An email detailing the project was circulated to PICU staff. Ranges of cards were designed with a questionnaire included, which has to be completed on patient discharge.

Results
During the first month 24 cards were completed. Nursing staff rated the tool as “very good” (36%) and "good” (64%). Parents rated the tool as “very good” (45%) and “good”(55%). Only two children were capable of self-reporting and both reported it as "good”. During the second month, 9 cards were completed, reflecting an increase in long-term patients and decreased data collection due to increased PICU workload. Nursing staff rated the tool as "very good” (17%) and “good” (83%). Parents rated the tool as “very good” (50%) and "good” (50%). Again only two children could self-report, both reporting it as "very good". 70% of medical staff reported that the card was beneficial to patient-centered care. A run chart displayed weekly data.

Discussion
While we did not achieve our initial aim, given that 84% of patients/week displayed a card, the positive feedback we received from stakeholders’ has been encouraging and further interventions to achieve our aim will follow. During our pilot phase, there was interest from other clinical areas and consequently the project has been rolled out, with positive feedback to date. Monthly data collection continues. Through the Northern Ireland Paediatric Quality Improvement Collaborative, Children’s wards in district general hospitals are keen to adopt this tool.

Conclusion
“When matters to me?” immediately personalises patient care, giving autonomy to the child and family. Details captured on the cards make it possible for the child to be more involved in their care. It helps staff to focus on comfort in addition to clinical care. This concept has been a huge success in our hospital, quickly embedding into hospital culture.

References
Exposure to etomidate in neonatal mice: effects on adult spontaneous behaviour and apoptosis assessed by activated caspase-3

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Background
Numerous animal studies have shown that all commonly used intravenous induction agents are capable to cause cerebral apoptosis, sometimes combined with later cognitive and/or behavioural dysfunctions, problems also shared by volatile anaesthetics. Etomidate, as a lipid formulation, is an alternative to the currently established intravenous induction agents. Since etomidate binds to a different region of the chloride channel compared to other GABA-agonists¹,² it can be hypothesized that the potential for apoptosis is either enhanced or reduced. The main aim of our study was to investigate the effects of etomidate on cerebral apoptosis, levels of six different neuroproteins and adult behavioural effects in an established mouse model³,⁴. Since repeated or prolonged exposure to etomidate may cause adrenal insufficiency, a secondary goal was to assess the survival rate of the etomidate exposed mice pups.

Methods
Six groups of 10 day old mice were injected with either etomidate 0.3, 3, 10 mg kg⁻¹, propofol 60 mg kg⁻¹, ketamine 50 mg kg⁻¹ or vehicle only. Apoptosis and levels of neuroproteins were measured 24 h after treatment (activated caspase-3 and slot-blot analysis). Late behavioural effects were tested at 2 months of age using an established model (spontaneous activity in a new environment).

Results
No differences of activated caspase 3-concentration was found between the study groups. The protein analyses showed no significant alterations compared to the controls. When spontaneous activity was tested the etomidate groups and the propofol group did not differ from the controls in contrast to the ketamine-group where behavioural changes were observed. All mouse pups survived until behavioural testing.

Conclusion
A high single neonatal dose of etomidate did not induce any differences in cerebral apoptosis, levels of six different neuroproteins or adult motor behaviour.

Conflict of interest
None

Acknowledgement
This work was supported by departmental (Karolinska University Hospital) and local governmental health care (ALF/Stockholms Läns Landsting) funds.
An evaluation of the pain management of patients undergoing repair of pectus excavatum

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Repair of pectus excavatum using the Nuss procedure is associated with significant postoperative pain despite the procedure being minimally invasive. Thoracic epidurals (TE), and Patient Controlled Analgesia (PCA) are the most commonly used methods of post-operative analgesia.

Aim
To evaluate the effectiveness of current analgesia provision, identify issues and improve the quality of the pain management we provide.

Method
A retrospective review of the case records of patients who had undergone the Nuss procedure over the past 10 years (December 2003 -November 2013) was carried out. The following data was collected and reviewed:

- Demographics
- Daily pain scores (numerical scale of 0 to 10) at rest and on movement until the patient was discharged from the pain service.
- Pain modality
- Rescue analgesia
- Side effects & complications
- Average days required to transition to oral analgesia

Results
- 22 patients were identified (94.5% male, 4.5% female).
- Pain modality
  82% TE only (18 patients), 9% TE & PCA (2 patients), 4.5% PCA only (1 patient) and 4.5% PCA, ketamine infusion & intercostal blocks (1 patient)
- Average Pain scores
  Ranged from 2 - 2.8 at rest and 3.3 – 6 on movement
- Rescue analgesia
  56% of TE required addition of PCA morphine, 50% TE required top ups
- Side effects and complications
  Hallucinations (13%), unilateral block (13%), patchy block (13%), high block (13%), Horner’s Syndrome(4%), leaking epidural (4%), epidural kinked (4%), drowsiness (4%), nausea and vomiting (27%), dizziness (18%), itch(18%)
- Transitioning to oral analgesia
  TE group 3.5 days & PCA group 4 days.

Conclusion
Pain scores were low however, 50% of TE group required additional intravenous analgesia support and epidural top ups. PONV rates were high (27%). A guideline utilizing multimodal analgesia approach is being developed standardize the postoperative pain management and this will be presented at the conference.
Improving fasting times for urgent and emergency surgery at Sheffield Children's Hospital
Liz Shepherd, Joanna Gordon
Sheffield Children's Hospital, Sheffield, UK

Introduction
The Association of Paediatric Anaesthetists of Great Britain and Ireland (APAGBI), the Royal College of Nursing and the European Society of Anaesthesia recommend preoperative fasting as follows: clear fluids 2hours, breast milk 4hours, solids and formula milk 6hours. Prolonged fasting for children causes thirst, hunger, distress, anxiety and drowsiness and is unkind and unnecessary. Minimising excessive starvation for emergency theatre is particularly challenging due to repeated list changes and the uncertainty of case timings.

Methods
Anaesthetists completed questionnaires over three consecutive weeks in 2013 on starvation times of urgent or emergency surgical patients at Sheffield Children's Hospital (SCH). This was repeated in 2014 following the introduction of new starvation guidelines, outlining these team responsibilities:

Anaesthetists should:
- review starvation times at each team brief of every child listed and prompt clear fluids accordingly.
- prioritise handover of starvation times.
- hold a 17:30 team brief, prompting dinner for those delayed until the next day.

Surgeons should:
- inform parents of starvation recommendations including those referred from other hospitals.

The theatre coordinator should:
- liaise with anaesthetist regularly, prompting drinks throughout the day.
- remain the key contact for changes in list order and starvation.

Ward staff should:
- offer clear fluids to each child before 06:30am with the drug round.
- include starvation times in handovers.
- contact the theatre coordinator if a child has had no fluid for >6hours.
- contact anaesthetist at 19:00 if the surgery time is unclear and facilitate dinner if appropriate.

Results
Our sample included 45 questionnaires in 2013 and 49 in 2014. Starvation times following introduction of new guidelines were markedly reduced (see below).

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014 (following new guidelines)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear fluid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-6hrs, no IVI</td>
<td>51%</td>
<td>79%</td>
</tr>
<tr>
<td>6-10hrs, no IVI</td>
<td>22%</td>
<td>9%</td>
</tr>
<tr>
<td>10-14hrs, no IVI</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td>&gt;14hrs, no IVI</td>
<td>13%</td>
<td>0%</td>
</tr>
<tr>
<td>Solids/formula milk</td>
<td>2013</td>
<td>2014</td>
</tr>
<tr>
<td>&lt;10hrs</td>
<td>22%</td>
<td>47%</td>
</tr>
<tr>
<td>10-14hrs</td>
<td>24%</td>
<td>42%</td>
</tr>
<tr>
<td>14-18hrs</td>
<td>27%</td>
<td>10%</td>
</tr>
<tr>
<td>&gt;18hrs</td>
<td>27%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Following the new starvation guidelines, the mean starvation time for clear fluids with no intravenous fluids running decreased from 7.6hours to 4.2hours and for solids from 14.5hours to 10.3hours.

Discussion and conclusion
In 2013, starvation times were unacceptably long at SCH. Our new guidelines clearly outlined team responsibilities, introducing system changes to move staff culture towards intolerance of excessive starvation. By working together we have decreased the number of children who fast for long periods at Sheffield Children's Hospital.

Reference
Paediatric uvular necrosis following general anaesthesia in the prone position
Zoe A Smith, Shirley Lobo
Queen Alexandra Hospital, Portsmouth, UK

Introduction
Throat discomfort following tracheal intubation is relatively common, occurring in up to 50% of cases [1]. However, it usually runs a self-limiting course and in cases in which sore throat is severe or persistent, suspicions of a more serious complication may be raised. Whilst rare, localised pathological changes to the uvula may complicate general anaesthesia and result in potentially life-threatening consequences [2]. Uvular trauma and oedema may result in postoperative airway compromise or complete uvular necrosis. This occurs as a result of direct mechanical trauma or secondary to vascular compromise. Vigorous suctioning, multiple pharyngeal tubes and poor patient positioning have all been implicated.

Case report
We present the case of a 13-year-old girl who suffered uvular necrosis following a percutaneous nephrolithotomy performed in the prone position. She was fit and well and there was no self-reported throat infection. Her trachea was intubated using a 7.0mm internal diameter reinforced tracheal tube and she was a Cormack and Lehane grade I laryngoscopy. There was no difficulty inserting the tracheal tube which was then taped in the midline. A nasopharyngeal temperature probe was inserted and she was ventilated for the duration of her uneventful 70-minute anaesthetic. In the recovery room she complained of a sore throat which persisted overnight despite regular analgesia. There were no airway or breathing problems. On examination of her oropharynx, her uvula was slightly swollen and quite bruised. Since there was no threat to her airway and she was reassured and discharged home. Three days postoperatively, she attended the emergency department complaining of odynophagia and persistent sore throat. Oropharyngeal examination revealed an unusually elongated erythematous uvula with sloughing and white coating beyond a well demarcated line at the inferior third. The patient was managed conservatively with simple analgesia and antibiotics. After two weeks she had made a full recovery following auto-amputation of the necrosed portion of her uvula.

Discussion and conclusion
Anaesthetists should be aware of this unusual cause of postoperative sore throat. Severe or persistent sore throat should prompt further assessment and consideration of uvular necrosis. This should prompt appropriate monitoring for airway compromise. The paediatric population is particularly high risk due to the relatively smaller oropharyngeal space. However, this risk can be minimised by employing simple precautions including maintaining vigilance during airway manipulation, airway device insertion, patient positioning and oropharyngeal suctioning. Tracheal tubes, temperature probes and nasogastric tubes should be placed to one side of the midline to avoid uvular compression between the endotracheal tube and the hard palate.

References
A review of chronic pain services at the Royal Hospital for Sick Children, Glasgow, 2013
Laura Jack1, Ewan Wallace2
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Introduction and aims
Paediatric chronic pain has a prevalence of up to 8%. [1] Some of these children experience poor attendance at school, reduced participation in sport and higher levels sleep disturbance, as well as lower quality of life and higher levels of depression and anxiety. [2]

A review of patient data for 2013 was undertaken to determine:

- Number and type of referrals
- Source of referrals
- Time from referral to clinic appointment
- Evidence of psychology or physiotherapy prior to referral
- Evidence of a multidisciplinary approach to management

Methods
A proforma was created and applied to current paediatric pain service paper patient records, to gather the relevant information.

Results
Sixty patients were referred to the chronic pain service in 2013 and were included in the review. The mean time from patient presentation, with pain related symptoms, to referral was 20.7 months. The majority (78%) were consultant referrals from other disciplines within paediatrics and around 90% of these consultants worked at the Royal Hospital for Sick Children (RHSC).

Mean time from initial pain service referral to appointment was 7.3 weeks.

Almost 73% were given specific chronic pain medication. Overall 41.6% engaged with physiotherapy and 42.9% received psychology input either prior to referral or as a direct result of being seen by the Chronic Pain Services.

Discussion and conclusion
The roles of the paediatric chronic pain service should be to offer the most up to date management, improve level of function and consequently aspects like school attendance and minimize the risk of pain continuing to adulthood. Current evidence on management of paediatric chronic pain suggests the gold standard is a multi-disciplinary approach, with physiotherapy and psychology playing pivotal parts. [3]

From this data collection we can show that the chronic pain service at RHSC has a multi-disciplinary approach with access to physiotherapy and psychology from the outset. There is a long, mean time between symptoms presenting and pain referrals. This can be postulated to be due to the specific nature of the paediatric chronic pain cohort, as well as the need for investigation by other specialties prior to pain referral. Discussion on how early a referral to chronic pain services should be considered.

A similar audit of 2014 is planned. This may potentially show a growing number of referrals, which would reflect the feeling that waiting times for new patients are increasing.

References
Making paediatric intensive care safer: Implementation of a PICU safety brief
Anne Marie McClean, Aideen Keaney
Royal Belfast Hospital for Sick Children, Belfast, Northern Ireland, UK

Background and aims
The Paediatric Intensive Care Unit (PICU) at the Royal Belfast Hospital for Sick Children (RBHSC) is a regional 12 bedded unit staffed by a multidisciplinary team (MDT) of doctors, nurses, pharmacists, physiotherapists, medical technicians and allied professionals. PICU patients have complex medical and anaesthetic needs meaning good communication between MDT members is essential. Prior to our intervention medical and nursing handovers happened separately in different locations at different times without a formal safety briefing. An analysis of adverse events in PICU highlighted poor communication between different disciplines and lack of awareness of safety issues were contributory factors. Inspired by the Institute of Healthcare Improvement (2001) a daily morning safety brief was adopted to promote high quality MDT communication.

Methods
The safety brief is attended by all MDT members, lasts under five minutes and is structured by a checklist including previous incident reports (IR1s), medications measured outside therapeutic range, unplanned extubations, equipment issues, unplanned line removals and readmissions to PICU. A fun mascot "Daisy the Cow" is used. There is a cow stopwatch for timing, safety crosses for daily occurrence and colourful staff attendance graphs. A ten month retrospective review of safety briefs dating March- December 2014 was performed. A safety climate survey was distributed to staff before and after safety brief implementation.

Results
PICU had on average 9 patients March-December 2014. There was an increased number of IR1s reported. The reporting of medications outside therapeutic range increased as did the number of unplanned extubations, unplanned line removals and the identification of other incidents and potential safety issues. Feedback from the repeat safety climate questionnaire was positive. Staff felt the safety brief improved MDT communication, promoted team working and increased awareness of previous incidents and potential safety issues.

Conclusion
The safety brief has been embraced by the PICU team and has improved MDT communication as reflected in the safety climate survey feedback. Increased reporting of previous incidents and potential safety issues means preventable factors can be identified and strategies introduced to reduce future errors. There has been teaching on endotracheal tube taping and adequate precautions to prevent unplanned extubation. There has been MDT discussion of learning points from previous IR1s (displayed on a whiteboard) and junior medical staffing levels have been increased since December 2014 to improve the junior doctor to patient ratio. The pharmacist and medical technicians now attend safety brief and morning handover to explain new medications and equipment to the MDT. High risk patients (neonates and those over 50kg) are highlighted. There will be further review to assess the impact of these changes.
A survey of anaesthetic management for congenital tracheo-oesophageal fistula repair in a UK Tertiary paediatric centre
Helen Lewis, David Barman, Jan Owen
Royal Manchester Children’s Hospital, Manchester, UK

Introduction
The neonate with a tracheo-oesophageal fistula (TOF) presents an anaesthetic challenge, this includes the co-existence of other congenital abnormalities and the presence of a tracheal fistula whose position and size is generally unknown prior to induction. There is no clear superiority of one anaesthetic technique over another. An American study from 1998 advised paralysis at induction and, following bronchoscopy, tube placement below the fistula when possible. A more recent Australian study showed this method was still in use but a range of other techniques were also practiced. There is limited published research of current anaesthetic practice within the UK.

Aim
To determine current practice amongst paediatric consultant anaesthetists within our tertiary centre in the anaesthetic management of a neonate for congenital TOF repair using an open thoracotomy approach.

Method
An electronic survey was sent to all consultants at our institution. Results were anonymised and collated.

Results
26 out of 31 consultants responded. Preoperatively 96% of respondents would require blood test results with blood products were available for theatre; 81% would require an echocardiogram. For intra operative monitoring 58% would not routinely insert an arterial line; the remaining 42% would continue with the procedure if they were unable to insert one post induction. All respondents would choose to use a gas induction and would use muscle relaxant during the procedure. The timing of when relaxant was given varied; 27% would use it at induction, 50% once endotracheal placement confirmed and 12% after ligation of fistula. 54% would have had direct visualisation of the fistula prior to intubation. Where the fistula was close to the carina 39% would allow spontaneous ventilation until the fistula was ligated, 26% would intubate as normal and minimise inflation pressures, 22% would occlude the fistula with the endotracheal tube (ETT) and 13% would intubate the left main bronchus. Only 23% of respondents would confirm correct position of the ETT by bronchoscopy. 42% of respondents started positive pressure ventilation after placement of ETT and this was most frequently by manual ventilation (63%). 88% of respondents would not routinely aim to extubate the patient at the end of the procedure.

Conclusion
A variety of different anaesthetic techniques is used at our institution for managing a patient with congenital TOF. There is little recent UK data on this topic, and we aim to repeat this survey at a national level to determine current UK practice.

References
Persistent excessive preoperative fasting – Time to address the problem
Claire Wallace, Kay Davies, Zuzana Kusnírková
Royal Aberdeen Children's Hospital, Aberdeen, UK

Introduction
Following 2 separate incidents of preoperative hypoglycaemia, we conducted an audit of preoperative fasting times to quantify current practice and to identify areas for improvement. The “2-4-6 rule” for perioperative fasting, recommended by the Royal College of Nursing (RCN), is the fasting standard used at this hospital.

Methods
Data was collected prospectively over a one week period in June 2014, for all children attending our hospital for procedures under general anaesthesia. Time of arrival in the anaesthetic room, times of last drink and last solid intake and patient demographics were recorded.

Results
Complete data was collected for 58 out of 65 children attending for procedures under general anaesthesia. One child was excluded as they were unable to swallow preoperatively. 57 children of average age(±SD) 6.3(±4.8) years and average weight(±SD) 26.0(±17.2) kg were analysed.

Overall the median (range) liquid fasting time was 4.9(2.1-20.1) hours and the median (range) solid fasting time was 12.8(3.3-20.3) hours.

For morning lists, median (range) solid fasting times were 13.8(6.1-19.3) hours and 14.3(12.8-19.8) hours for elective and emergency patients respectively. Median (range) liquid fasting times were 4.3(2.1-19.3) hours and 13(3.3-15.5) hours for elective and emergency patients respectively.

For afternoon lists, median (range) solid fasting times were 7.7(6.2-20.3) hours and 7.2(6.2-17.9) hours for elective and emergency patients respectively. Median (range) liquid fasting times were 4.6(2.1-3.4) hours and 5.5(3.2-7.7) hours for elective and emergency patients respectively.

Discussion & conclusion
Fasting times remain in marked excess of the recommended minimum fasting times, despite communication and documentation.

Morning patients are experiencing much longer food fasts with nearly double the fasting duration compared to afternoon patients. However, it is difficult to reduce the solid fasting time for these patients without waking children overnight to feed. This is unlikely to be possible to achieve.

Patients attending morning emergency lists are experiencing the longest liquid fasts with a median time nearly three times that of morning elective patients.

Many of these patients are sent home from the emergency department overnight and instructed to “fast from midnight” despite the likely time for the procedure being known.

Preoperative fasting instructions have been redeveloped to produce a clear, unified, prescriptive approach to fasting at home and in hospital. Finally, children will be given a small carton of fruit juice immediately on arrival to the ward if this has not been given at home. Timely rehydration using glucose containing oral fluids may reduce liquid fasting times and improve patient well being. Once these changes have been fully implemented, re-audit will be completed.

References
1. Perioperative fasting in adults and children. An RCN guideline for the multidisciplinary team - 2005
Patient safety audit: Why are we still getting residual drugs in paediatric cannulae?
James Montague, Matthew Julian
Salisbury District Hospital, Salisbury, UK

Introduction and aims
Despite an update from both the National Patient Safety Agency (NPSA) in 2009 and the Safe Anaesthesia Liaison Group (SALG) in 2012 adverse incidents involving the flushing of residual anaesthetic drugs continue to occur. We suffered an adverse incident whereby atropine was required for non-hypoxic bradycardia in recovery. It was felt to be due to residual suxamethonium flushed from a cannula. This prompted a survey of practice and an audit designed to raise awareness and prevent reoccurrence.

Methods
A survey was carried out of all the consultants involved in paediatric anaesthesia regarding their practice and attitudes to cannula care. This was preceded by an audit in the recovery area of residual propofol in cannulae as a surrogate marker of flushing. The standard set by the NPSA in their 2009 signal alert was that 100% of cannulae were to be flushed prior to transfer to recovery.

Results
In the audit 15/41 (36.5%) of cannulae examined still had propofol visible in recovery. 21 consultants responded to the survey: 80% of anaesthetists in our institution flush cannulae after insertion, 52% flush after administering a drug, 52% flushed at the end of the case before transferring to recovery, 52% always removed extensions and unnecessary connections and valves, 71% supported the concept of removing cannulae, extensions or dead space with no clinical indication. 100% supported a formalized process to ensure cannulae were flushed prior to discharge from recovery.

Free text responses highlighted 4 further cases whereby residual drugs led to adverse patient outcomes which could not be accounted for in any existing reports.

Discussion and conclusion
This audit demonstrates a divergence of intention of action and what actually happens in clinical practice. Many anaesthetists acknowledge that distraction at key moments occurs and this will probably never change. We would suggest multiple flushes at different time intervals to minimise this risk. In addition it highlights that this is almost certainly an underreported event. As a result of this audit we designed patient appropriate posters in anaesthetic rooms and modified charts to include aide memoires. Recovery practitioners were encouraged to have a check out flush prior to discharge as a safety net. We presented the audit at the regional paediatric meeting to discuss and compare practice.

References
1. Residual anaesthetic drugs in cannulae - Signal 1140E
   http://www.nrls.npsa.nhs.uk/resources/?EntryId45=65333
Alexander Simpson, Graham Bell
Yorkhill Royal Hospital for Sick Children, Glasgow, UK

Introduction and aims
Prescription of simple analgesia is frequently performed by Foundation doctors. There is a confusing array of protocols and at times the national bodies' advice has been contradictory. Evidence shows optimal dosing of simple analgesia in children is 15mg/Kg QID for Paracetamol and 10mg/Kg TDS for Ibuprofen, and that doses of less than 10mg/kg QID of Paracetamol are sub-therapeutic in terms of analgesic effect (1). Evidence also suggests that there is nothing intrinsically about the young liver that makes it less able to metabolise paracetamol. Conversely, some evidence suggests that children may be less prone to paracetamol-induced hepatotoxicity than adults (2). This suggests age-based protocols do not provide a reliable means of dosing. This audit aims to evaluate the typical doses of Paracetamol and Ibuprofen prescribed on discharge to surgical patients at Yorkhill RHSC by FY1s.

Methods
The Immediate Discharge Letter (IDL) of 101 patients were examined retrospectively, with the dose of Paracetamol and Ibuprofen being noted. The patients’ age and weight were noted and their mg/kg dose for each drug was calculated. The patient's actual weight was compared to their “estimated weight" (calculated using the Resus Council's "(age+4) X 2" formula). This allowed a "Weight-for-Age" Ratio (WfAR) to be calculated for each patient (actual weight / estimated weight). A ratio >1 indicates a patient is heavier than the Resus Council's formula would estimate.

Results
The average doses prescribed were 12.98mg/Kg for Paracetamol and 6.56mg/Kg for Ibuprofen. In children weighing >33Kg the averages were 11.38mg/Kg and 6.38mg/Kg respectively. The average WfAR was 1.27. In children with a WfAR >1.2 the averages were 11.95mg/Kg and 6.24 mg/Kg respectively. 92 Patients received paracetamol with 28 (31%) of these receiving less than 12.5 mg/kg and 9 (9.7%) receiving less than 10 mg/kg. 27 of the 28 underdosed patients had a WfAR >1.2.

Discussion and conclusions
Ibuprofen is under-dosed by FY1s on the IDL. Paracetamol is commonly under-dosed in heavier children although obesity is a confounding factor. It appears weight and age are both considered in dosing practices given lower dosing in patients with higher WfARs. Currently used formulae underestimate the weight of our patient population.

References
Peri-operative paracetamol prescribing practice in paediatric patients
Richard Stoddart, Jacinda Hammerschlag
Guy's & St Thomas' NHS Foundation Trust, London, UK

Introduction and aims
Paracetamol is one of the most frequently prescribed drugs administered to children peri-operatively. Erroneous dosing is common, as highlighted by frequent incident reports completed within the trust relating to this matter. We performed an audit of peri-operative paracetamol prescribing within our department to identify the frequency of errors and factors influencing their occurrence.

Methods
64 observational forms were collected over a fortnight. Data was obtained from individual patient’s drug and anaesthetic charts. We recorded when paracetamol was administered (pre/intra/post operatively), how this was documented on the drug chart, the route of administration, and individual and cumulative doses. Prescribed dosages were compared against the trust formulary, the BNF and APA guidelines.

Results
Paracetamol was prescribed pre-operatively for 3/64 (4.6%) patients, intra-operatively for 54/64 (83%) patients and post-operatively for 63/64 (98%) patients. Of the patients given paracetamol intra-operatively, 35/53 (67%) had regular post-operative prescriptions, while 18/53 (33%) had PRN post-operative prescriptions.

Of the group given intra-operative paracetamol with regular paracetamol post-operatively, 17% of the intra-operative doses were recorded in the STAT section alone and 14% of cases did not have the dose recorded on the drug chart at all. For those given intra-operative paracetamol with a PRN post-operative prescription, 11% were recorded in the STAT section alone. Potential for drug error to occur due to method of documentation of theatre dose occurred in 24% of charts.

Failure to adjust the timing of post-operative doses had the potential to result in error in 66% of cases; 18% of which would result in the subsequent dose being given early (less than 4 hours after the intra-operative dose) and 47% late (after 6 hours). Errors in drug dose (over or under-dosing) occurred in 14% of cases.

Discussion and conclusion
Documentation was at times ambiguous or absent and had the potential to give rise to errors through confusion in recovery or the wards. Errors consisted of omissions in documentation, timings and errors in actual dose amounts. Errors in doses consisted of over zealous rounding up or down and actual errors in dose allowances for different weight brackets. The allowed doses registered in the BNF, the Evelina Trust Handbook and the dose recommended by the APA are not the same. For the purpose of this audit doses greater than 75mg/kg/day were considered an overdose. Electronic prescribing is due to commence at The Evelina. Standardisation of documentation and the recommended dose of paracetamol may be helpful although human error can never be completely eradicated.

Conflicts of interest
None

References
2. BNF for Children, BMJ Group, January 2015.
Paediatric anaesthesia: A survey of pre-operative information delivery, parental anxiety and overall parental satisfaction
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Introduction and aims
Paediatric surgery accounts for a significant proportion of the operative workload in our hospital. Royal College of Anaesthetists guidelines suggest that parents should receive full written information before admission and that children benefit from the timely provision of information regarding anaesthesia [1]. In our hospital parents receive a standard admission letter containing a link to the paediatric day-case unit (PDU) website and additional information is given by an anaesthetist on the day of admission. We conducted a survey of parental anxiety and overall satisfaction before and after anaesthesia.

Methods
We surveyed parents of all children admitted to PDU for surgery under general anaesthesia during a three-week period in October 2014. We asked parents to complete a questionnaire documenting and rating the information received before admission, their anxiety before anaesthesia and their experience on the day. We rated anxiety and satisfaction using a Likert scale (strongly agree, agree, neither, disagree, strongly disagree) and information received and overall satisfaction using a rating scale (1 = not at all informative or very negative; 10 = very informative or very positive).

Results
We surveyed the parents of 79 children; all completed the pre-operative questionnaire and 68 (86%) completed the post-operative section. Mean age (range) of patients was 8 years (6 months-15 years). Seven surgical specialities and 24 anaesthetists were involved.

Thirty-five parents (44%) were worried about the anaesthetic; 23 (29%) were not worried at all. Fifty-two (66%) wanted to know as much as possible about the anaesthetic; 11 (14%) did not want any information. The mean score (range) for information provided before admission was 7.1 (1-10) and was 9.2 (5-10) for information given on the day.

Seventy-seven parents (97%) said that the anaesthetist put their child at ease and felt supported by staff throughout. Parents rated their overall experience positively - mean score (range) 8.6 (1-10), and were happy to recommend our hospital based on their child’s experience - mean score (range) 9.0 (6-10).

Discussion and conclusion
This survey found that overall care is rated highly. The approach and demeanour of anaesthetic staff was widely praised and the overall hospital experience was very positive. Although parental anxiety varied widely, most parents wanted to receive as much information as possible prior to admission. The information provided before admission was rated less favourably than that provided on the day. Although parents received a standard admission letter with a link to the PDU website we believe that very few accessed this information. Therefore we plan to introduce a parent information leaflet that will be sent to parents before admission.

References
Respiratory adverse events in post-anaesthesia care unit (PACU) as a quality outcome measure
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Introduction and aims
Adverse respiratory events remain one of the major causes of morbidity during anaesthesia, especially in children [1]. The purpose of this study was to determine the incidence and nature of respiratory adverse events after paediatric surgery, as part of early postoperative outcome measures and to identify management strategies and options to improve patients' safety.

Methods
Retrospective review of postoperative respiratory complications in patients admitted to PACU. Data were collected quarterly and randomly as part of an established prospective anaesthetic clinical outcome measures reporting.

Results
1438 patients admitted to PACU over a two year period were included (8% or our institution's case load). Sixty-five patients (4.52%) developed a postoperative respiratory complication. Complications were: airway obstruction (41% n=24), desaturation <90% (36%, n=21), laryngospasm (32%, n=19) and stridor (24%, n=14). Twenty-one (36%) occurred after ENT surgery, 7 (12%) after general surgery and 6 (10%) after MRI. Twenty-three (39%) children were aged 2-5, 18 (31%) younger than one, 14 (24%) 5-12 and 3 (5%) older than 12. After adjustment for the proportion of children in each group the respiratory complication rate was highest for children having undergone cardiac angiogram (22%), spinal surgery (21%), orthopaedic surgery (6.1%) and ENT (9%). The age group with the highest complication rate was children younger than 2 (5.2%) followed by age 5-12 years (3.6%), 2-5 years (3.4%) and older than twelve (2.3%). All children recovered with simple measures such as opening airway maneuvers, oxygen administration, PEEP, suction, adrenaline and saline nebulisers. Most children required more than one intervention. Overall the anaesthetist was called back to PACU in 35% of the cases but more frequently (52%) in children that had ENT surgery. ENT patients were younger (median age 2 years vs 3) and the majority (57%) had undergone a microlaryngobronchoscopy. None of the children required intubation or admission to Intensive care.

Discussion and conclusion
In our large cohort of children the overall incidence of adverse respiratory events in PACU was less than 5%. We consider this to be the reflection of safe paediatric anaesthetics practice. Children under two and those undergoing cardiac angiogram, spinal surgery, orthopaedic surgery and ENT surgery were at increased risk. We have recently introduced capnography in PACU, as recommended by the NAP4 report [2]. We hope that this will further improve safety and outcomes especially in remote areas like cardiac angiography suite and MRI.

References
Anaesthesia for removal of foreign body from the respiratory tract: A review of practice in a tertiary referral centre
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Introduction and aims
Tracheobronchial foreign body (FB) aspiration is a significant cause of morbidity and mortality in childhood. The management of these cases using rigid bronchoscopy has a reported mortality of 0.42% [1]. Opinions vary regarding the optimal anaesthetic technique for this procedure. [1, 2]. We present the anaesthetic practice and complication rate from our tertiary referral institution.

Method
A 5 year, retrospective case note review of children who had a FB removed from the respiratory tract. Demographics, anaesthetic technique and complications were noted.

Results
Demographics
A total of 64 cases were identified. 70.3% were male. Median age was 1.6 y (range 7 mo-13.5 y), median length of stay in hospital was 1 day. 2 children were admitted intubated to the paediatric intensive care unit (PICU). The location of the FB was: left main bronchus 43%, right main bronchus 40%, trachea 8%, larynx 5% and other 4%. Half of FBs were organic (40% nuts, 9% apple) and half were inorganic (plastic FB 10%, hair pin 8%, other 33%). The median duration of FB in the airway was 1 day (range 6h to 7 months).

Anaesthetic technique
83% of children had an inhalational induction with sevoflurane, 5% an intravenous induction with propofol, 7% a mixed induction; sedation was continued for two children transferred already intubated and ventilated from PICU. Vocal cords were sprayed with local anaesthetic in 90% cases and antimuscarinic agents were administered in 34%. Neuromuscular blocking agents were used in 3 cases (5%). Anaesthesia was maintained with either sevoflurane (46%) or sevoflurane and propofol (43%) in the majority of patients. Intraoperative airway management before insertion of the ventilating bronchoscope involved use of face mask and nasopharyngeal airway (NPA) and laryngeal mask airway followed by NPA.

Complications
Fifteen (25%) children experienced perioperative complications. These included desaturation (n=5), respiratory distress in recovery (n=5), laryngospasm (n=3), bronchospasm (n=1), persistent left lower lobe collapse (n=1). Two children returned intubated to PICU, 1 of those developed chest sepsis, poor lung compliance and required ventilatory support for 72 hours.

Discussion and conclusion
In our cohort of children undergoing removal of foreign body from the respiratory tract, the overall morbidity rate was 25%, we did not report any deaths. An induction and maintenance that maintains spontaneous ventilation is commonly practiced, but controlled ventilation combined with IV drugs and paralysis also allows for suitable operative conditions.

References
A novel web based device for patient feedback in paediatrics
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Introduction and aims
All NHS Trusts are currently tasked with undertaking Quality Improvement exercises some of which are outlined within the 2014/15 Commissioning for Quality and Innovation guidance (CQUIN)\(^1\). One of the CQUIN domains for acute service providers concerns the Friends and Family Test (FFT) for patient feedback.

Our aim is to introduce a novel web/tablet based survey system (NPToolkit Orovia Research Ltd) designed to allow better response from children and carers in a number of areas concerning patient experience including some standard Friends and Family questions.

Methods
We have designed a number of patient experience surveys all of which include at least three FFT questions. This survey concerns preoperative anaesthetic assessment and postoperative pain experience including discharge information. We aim to ask all surgical paediatric patients and their carers to participate in the survey prior to discharge on the Children's Day Care Ward within the Oxford Children's Hospital. Currently an anaesthetist not involved in direct patient care on the day of surgery is approaching patients and carers throughout the day to ask them to participate in the survey. The survey identifies patient age, surgical speciality and then has 12 questions which can be answered with or without cartoon commentary. The survey takes between 1 and 5 minutes to complete.

Results
Having commenced the survey towards the end of January 2015 we have 49 responses to date with no one refusing to participate. The median patient age is 7 years (mode 4 years, range 1 to 16 years) across a wide range of surgical specialties. All of the patients were visited by an anaesthetist preoperatively and had their questions answered. The majority of patients and carers said they had enough information regarding pain relief and felt that pain was well controlled. The FFT response was very encouraging with 92% of respondents indicating they would:

1. Recommend the ward to family or friends
2. Felt they were looked after well
3. That we listened to their questions.

Discussion and conclusions
We feel that this technology allows for instant analysis of results within the software package with the ability to upload results as JPEG charts, Word documents or Spreadsheets for further analysis. The technology allows us to bridge the gaps when obtaining feedback from children of all ages and their carers making it more likely that the Patient feedback CQUIN targets can be achieved and patient care can be improved through feedback of results to staff. We plan to continue to use this device in other areas of the Children's Hospital including Paediatric Intensive Care.

References
1. Commissioning for Quality and Innovation (CQUIN) 2014/15 Guidance

Conflicts of interest
None
Paracetamol in paediatrics: What's happening, why and what to do about it?
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Introduction
The 2010 MHRA Alert1 highlighted the dangers of intravenous (IV) paracetamol in children, and the NPSA Signal Alert2 reinforced this the same year. In 2013, the RCoA highlighted specific pitfalls for Anaesthetists3. Following the occurrence of an inadvertent x10 overdose of IV paracetamol in our hospital theatres in 2014, we decided to review all paracetamol incidents, hospital-wide, reported on our Datix system, in order to reduce the number of incidents occurring and reduce patient harm.

Methods
We reviewed all paracetamol incidents reported from January 2009 - December 2014. IV and oral errors were included. All reports were anonymous.

Results
A total of 57 errors were reported - 30 IV (52.6%) and 27 oral (47.4%). Reasons for these errors were:

1. Intravenous
   - Incorrect dose per kilogram (dose too high) - most commonly in infants, with two x10 overdoses occurring (8/30)
   - Double dosing - inadequate documentation and failure to review previous dosing (6/30)
   - Simple miscalculation (3/30)
   - Incorrect programming of infusion pumps (3/30)
   - Miscellaneous (10/30)
2. Oral
   - Simple miscalculation (7/27)
   - Double dosing (5/27)
   - Mislabelled take-home drugs (2/27)
   - Wrong patient sticker on charts (2/27)
   - Miscellaneous (11/27)

All incidents occurred sporadically with no associated time-pattern. Anaesthetists contributed to 22.8% of all incidents, most commonly due to double dosing, followed by using an incorrect weight to calculate dose and using an out-dated BNFc. When reviewing reported patient outcome, 69% of all cases had a severity scoring of "insignificant", 21% "minor", 8.5% "moderate", 1.5% ungraded, with none graded as "major" or "catastrophic". However on consequence scoring (the potential outcome if the incident were to occur again), only 17.4% were graded "insignificant", whilst 47.4% were "minor", 28.1% were "moderate", 1.8% were "major" and 1.5% were graded as potentially "catastrophic" (3.5% were ungraded).

Discussion
Paracetamol is commonly prescribed in anaesthesia and whilst often categorised as a simple analgesic, it can have significant morbidity and mortality in overdose. Of note, the main paediatric prescribing reference, the BNFc, has modified the dosing regimen for paracetamol on 12 occasions since 2010. Reviewing these incidents provides baseline data for paracetamol quality improvement and formulation of a driver diagram with the aim of reducing the number of paracetamol incidents and patient harm. Key primary drivers identified include increased staff education (paracetamol prescribing, alert posters with recommended paracetamol doses, second-checking/cross-checking), drug standardisation (pre-filled paracetamol syringes, standardised dilutions and volumes available) and improved culture (increased pharmacy interaction, regular audit and development of the weighing policy).

References
1. MHRA Drug Safety Alert, July 2010
2. Overdose of paracetamol in infants and children, NPSA Signal Alert, October 2010
3. Intravenous Paracetamol, SALG, May 2013
A retrospective audit of analgesia for NUSS procedures in RHSC, Glasgow
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Background and aims
The Nuss operation is a minimally invasive technique for repair of pectus excavatum. (1) Pain following the Nuss procedure is severe and difficult to control. (2) Thoracic epidurals are thought to be a superior method for providing analgesia post operatively. (2) The aim of this audit was to review our analgesia practice for children undergoing Nuss procedures.

Methods
This was a retrospective analysis (2010-2014) of medical records of patients attending for NUSS procedures. We reviewed our post-operative analgesia management of these patients and their pain scores where available. We then compared the two epidural groups: those with levo-bupivacaine alone or levo-bupivacaine with an additive. The primary outcome measure was the number of hours that pain scores were ≥ 2. The secondary outcome measure was mean morphine consumption (mg/kg) for 3 days post op. Pain scores were measured on a scale of 0-3, as is our normal practice in our hospital. (0 indicating no pain and 3 severe pain).

Results
18 patients were analysed in two groups: Children with levo-bupivacaine alone (group 1)(n=10) and those with levo-bupivacaine containing additives (group 2)(n=8). All of the children had thoracic epidurals. Groups were comparable for age, gender, weight and ASA. 3 children in group 1 had open procedures, the remaining procedures were thoracoscopic. Levo-bupivacaine 0.125% or 0.25% was used for the epidural infusion in both groups. Regarding additives 2/7 children had diamorphine 0.05mg/ml and 6/7 had clonidine 0.75mcg/ml -1.5mcg/ml. All but 3 children had a morphine PCA post-op (1-group 1, 2-group 2).

The median (range) number of hours that pain scores were recorded during the first 3 postoperative days was 22(0-24) in group 1 and 22(0-24) in group 2. The group with epidural additives had a lower median (range) number of hours with a pain score ≥ 2, 0(0-8) as opposed to 2(0-10) in the levo-bupivacaine alone group. Mean (±SD) morphine consumption (mg/kg) over the first three postoperative days was also lower in group 2 (0.4 ± 0.1 in group 2 and 0.6 ± 0.2 in group 1).

Discussion and conclusions
Median number of hours with pain scores ≥ 2 and mean morphine consumption (mg/kg) was less in the epidural additive group. However we cannot make any conclusions regarding the significance of this as pain scoring measurements were incomplete. Using this audit as a pilot study we are able to recommend that 40 patients would need to be recruited into each group in order to adequately power a double blinded randomized control study comparing these two groups (2 sample t-Test).

References
Audit of paediatric day surgery pain assessment
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Introduction and aims
Frequent, documented pain assessment, using validated, age and cognitive level appropriate tools is essential to facilitate safe, timely and effective analgesia. Diverse age, cognitive development and individual needs demand that this process is standardised and reproducible.

We determined that 100% of children should have:
- an appropriate pain tool identified and documented
- a documented pain assessment on return from theatre
- documented reassessment of pain following any analgesic intervention
- documented pain assessment at discharge.

Methods
We retrospectively reviewed notes of children having day case surgery over a two week period in January 2012. We audited record keeping of peri-operative pain assessment, including the pain tool used, additionally noting patient age, operation undertaken, and any analgesic intervention.

Examination of this data highlighted that our day surgery paperwork pathway was not user-friendly, especially with regards to pain assessment. We participated in its re-design, and undertook pain education for nursing, recovery and medical staff, reinforcing the importance of pain tool choice, regular assessment and documentation. A repeat audit was completed in January 2014.

Results
In the 2012 audit, 60 children had surgery. Eight were excluded due to missing paperwork. 52 cases were analysed, with an age range of one month to 16 years. In 2014, 50 children had surgery. Seven were excluded due to absent paperwork. 43 were analysed, with an age range of ten months to 17 years.

The 2012 audit demonstrated 82.7% compliance with pain documentation on return to the day unit from theatre. In no case was there documentation of the pain scoring tool used, therefore we were unable to determine whether it was age or cognitive level appropriate. 88.5% were reassessed following analgesic intervention, highlighting six children with potential, unresolved pain. 80.8% had documented pain assessment at discharge. Ten children may have been discharged with a positive pain score.

The 2014 audit demonstrated 83.8% compliance with documented pain assessment on return to the day unit. 97.7% had reassessment of pain following analgesic intervention. 95.4% had a discharge pain score recorded. The most dramatic improvement was seen with use of pain assessment tools. The tool was identified in 91%, and was age and cognitive level appropriate in 97.7%.

Discussion and conclusions
To achieve best care in a busy, challenging environment, pain assessment must be understood, prioritised and user-friendly. Our paperwork quality improvement, in conjunction with education of healthcare staff has allowed accurate review and optimisation of pain management strategies in paediatric day-case surgery.

References
Pectoralis block in paediatric practice. A case series
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Introduction
Pectoralis (pecs) block is a block used for postoperative analgesia in breast surgery[1]. It relies on local anaesthetic (LA) placement between pectoralis major & pectoralis minor muscles. To our knowledge there are no published cases of its use in the paediatric population. Although paravertebral and epidural blocks are well established in paediatrics, they are generally unsuitable for minor day case surgery. We hypothesized that the pecs block may give good postoperative analgesia for operations involving the anterior chest wall.

Our institution regularly performs day case minor procedures involving the anterior chest wall including insertion of cardiac devices, tunnelled venous catheters and excision of superficial lesions. The analgesia regimen typically includes paracetamol, NSAIDs and LA infiltration. Post-operative rescue analgesia is frequently required and may lead to poorer patient satisfaction, increased likelihood of delayed discharge and exposure to opioids.

Aims
Our aim was to determine if the pecs block might provide effective postoperative analgesia in the paediatric population undergoing minor anterior chest wall surgery.

Methods
The population included was heterogeneous with ages ranging from 3 months to 11 years. 6 males and 1 female were included. Standard verbal consent for LA use was attained from parents preoperatively. Blocks were performed following induction of general anaesthesia. Ultrasound guidance was employed using described adult landmarks. The LA dose ranged from 5-15mL 0.25% levobupivicaine depending on the patient’s weight. Parameters recorded included postoperative pain severity, dermatomal sensory effects and time to breakthrough analgesia.

Results
Invariably the block was associated with good analgesia of the anterior chest wall. Dermatomal block levels were variable between cases. No patients required additional analgesia in the recovery room. The time to request for first analgesia varied widely from short in one case (90 minutes (not chest wall pain)) to no additional analgesia requirement. No adverse events were reported.

Conclusion
We conclude that pecs block may be an effective and reliable block in the paediatric population for surgery involving the anterior chest wall. It is quick to perform and learn. Pecs block provides the anaesthetist with a technique to block a region not routinely blocked in paediatric patients.

References
Audit of post-operative analgesia following cleft lip and palate surgery after the withdrawal of codeine phosphate
James Montague, Juliette Lee
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Introduction and aims
In our unit post-operative analgesia for cleft lip & palate surgery previously centred on a multimodal approach combining paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs) and codeine phosphate. Since its withdrawal, our patients no longer receive codeine, nor are sent home with it. We therefore decided to audit post-operative analgesia following cleft palate surgery and parental satisfaction following these changes. In particular we wanted to know whether there was a role for sending children home with oramorph. We aimed for 100% parental satisfaction.

Methods
A questionnaire was attached to the notes of patients attending for cleft palate surgery over a 10 week period. It came in 2 parts with a section for the anaesthetist and ward nurse looking after the patient. Mode of analgesia was assessed, a subjective assessment was then asked of the ward nurses and parents if they were satisfied with the level of analgesia achieved. A pain score was then recorded using the FLACC system. We recorded the number of patients requiring rescue oramorph on the ward and details regarding those sent home with oramorph.

Results
25 completed questionnaires were returned during the audit window. The age range was 0-6 years of age with a mean age of 8 months. Of those surveyed 100% received paracetamol 20mg/kg QDS PO and NSAIDs (96% ibuprofen 5mg/kg TDS PO; 4% diclofenac 1mg/kg TDS PO). 87% of patients received dexamethasone 0.1mg/kg as part of their anaesthetic with 54% prescribed postoperative dexamethasone at the same dose. 29% of patients received postoperative rescue oramorph at 200mcg/kg. On the postoperative ward 92% of nurses felt the children had sufficient analgesia. Mean pain score at 6hrs was 1/10, at 12hrs 0.32/10, at 18hrs 0.52/10 and at 24hrs 0.12/10. Parents were satisfied with postoperative analgesia in 96% of cases with those unsatisfied citing high dose intervals as the reason for their dissatisfaction. Only 2 patients were sent home with 100mcg/kg oramorph; one of these patients had cleft lip repair with no block and the other repair of cleft soft palate. During the audit window we identified one patient with high pain scores attributable to a postoperative bleed which required reoperation.

Discussion and conclusion
The level of satisfaction for analgesia in this patient group was high. We identified a number of patients requiring rescue opiates following surgery; however it was rare to need to continue this after discharge. Parents were satisfied with the use of paracetamol and NSAID only and we subsequently do not plan to use 100mcg/kg oramorph as a take home medication.

References
Cardiac arrest in a heart transplant patient receiving dexmedetomidine during cardiac catheterisation

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Introduction
Dexmedetomidine is an alpha-2 agonist who sedative and cardiopulmonary profile makes it an attractive anaesthetic in paediatric cardiac patients. Cardiac transplant patients may be at increased risk due to the conduction effects of dexmedetomidine.

Case results
An adolescent female heart transplant patient presented to the catheterisation suite, one day after suffering a syncopal episode. She was sedated with dexmedetomidine for the procedure. After one hour, the patient awakened complaining of discomfort. She received an additional small bolus of dexmedetomidine and suffered 3rd degree heart block and cardiac arrest, requiring CPR and emergent placement of transvenous pacemaker. The patient required an aggressive resuscitation in the cath lab and ICU, but recovered with good neurologic outcome. She was treated empirically for acute transplanted organ rejection, and returned in 2 months for diagnostic catheterisation which revealed diffuse coronary artery vasculopathy and normal muscle biopsies. A permanent transvenous pacemaker was placed, and the patient relisted for transplant.

Discussion
Dexmedetomidine promotes a natural, non-REM sleep while maintaining airway patency and respiration. While it is recognised that dexmedetomidine does possess cardiovascular side effects resulting in bradycardia, hypotension, and hypertension, it is generally felt that these effects are self-limiting and usually clinically insignificant. These properties make it particularly attractive in the anaesthetic management of patients with a history of congenital heart disease.

Providers must be aware of its potential dangers in certain patient subsets. Dexmedetomidine is believed to affect the cardiac conducting system at the sinus and atrioventricular nodes. Bradycardia and syncope has been described in heart transplant patients presenting with cardiac allograft rejection involving the cardiac conducting system. These patients maybe otherwise asymptomatic, demonstrate normal ventricular function, and have normal findings on endocardial muscle biopsies. However, dexmedetomidine may have a dangerous adverse effect on patients whose conduction system is injured due to acute cellular rejection.

Conclusion
Our patient's presenting event was likely due to heart block secondary to acute cardiac allograft rejection involving the conduction system. Dexmedetomidine given to this patient led to heart block and cardiac arrest. Because acute rejection involving the cardiac conduction system maybe difficult to diagnose, dexmedetomidine should be used with extreme caution in paediatric heart transplant patients.

References
Blood loss in spinal scoliosis correction in children and adolescents: A retrospective analysis
Mark Ross, Suzanne Boyle, Mairi Crawford, Emma Dickson
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Introduction
Shapiro (1) highlighted the significant haemorrhage associated with scoliosis correction in 2004, particularly in those with neuromuscular conditions. Ten years on, we report our experience from the Scottish National Spinal Deformity Centre.

Methods
Retrospective case review of 119 patients following posterior spinal fusion between 2005-2014. Ethical approval was not required as this was an analysis of current practice.

Results
Mean age was 13.8 years (range 3-19 years) with 65% female and 35% male. Mean weight 49.1 kg (range 18.8 to 93.0 kg). Adolescent idiopathic scoliosis (AIS) accounted for 67 (55%) cases. Others comprised cerebral palsy 11 (9%), other neuromuscular disorders 7 (6%), juvenile idiopathic arthritis 6 (5%), Scheuermann disease 3 (2%) and other syndromes 27 (22%) including Friedrich’s ataxia and Jacobsen’s syndrome. Mean duration of surgery was 4.6 hours (range 2 to 9 hours). Cobb angle, fusion limits, costoplasty and pelvic bone grafts were available in 48 patients. Fusion limits ranged from T2 to pelvis. Most frequent limits were T2 to L3 or L4 (n=6, 12%). Mean Cobb angle among single curves was 51.2 degrees (range 22 to 87 degrees) and in double curves were 59.3 and 43.7 degrees (range 10 to 93 degrees). Twenty-eight (58%) underwent pelvic bone grafting. Five (10%) underwent costoplasty. Mean estimated blood volume across all 119 patients was 3441 mL (range 1500 to 6510 mL). Mean estimated blood loss (EBL) was 1401 mL (range 137 to 8000 mL) equivalent to 44.6% of total blood volume (range 5 to 346%). Nine patients (7%) sustained EBL in excess of total blood volume (>100%). EBL was greater in those with neuromuscular conditions compared to those with AIS (33% versus 59%). Tranexamic acid was administered in 88 (72%) patients. EBL was higher in those who received tranexamic acid loading and infusion (46.8% versus 38.6%). Cell salvage was utilised in 117 patients (98.3%). Mean cell salvage return was 317 mL (range 15 to 1020 mL). Intra-operatively 93 units of packed red cells were given to 47 (39%) patients (range 1 to 8 units). Twenty-five patients received fresh frozen plasma (FFP), of which three received 2 units and seven received 3 units. Four patients received platelets and one patient received cryoprecipitate. Post-operatively 25 patients received packed red cells. Sixteen received one unit, 8 received 2 units and one patient received 3 units. One also received platelets post-operatively.

Conclusion
Blood loss remains multi-factorial however our reported blood loss remains within the range previously reported with greatest loss in those with underlying neuromuscular conditions.

References
The incidence of neurodevelopmental issues following neuraxial ketamine in children: A 9-year retrospective analysis of 690 administrations of ketamine
Mark Ross, Alistair Baxter, Kevin McCarthy
Royal Hospital for Sick Children, Edinburgh, UK

Introduction
There have been significant concerns raised in the literature regarding the safety of ketamine and the possibility of neurodegenerative effects in infants following observations made in rodent studies in 1999 1. Translating the relevance of findings in animal models into clinical practice has been the subject of much debate and divided opinion, not only with respect to the effects of ketamine, but anaesthesia in general upon learning and behaviour 2 3. We report our experience of neuraxial ketamine and the possibility of associated neurodevelopmental problems.

Methods
We performed a retrospective case note review following 684 administrations of preservative free racemic neuraxial ketamine from August 2006-February 2014 in 632 children.

Results
Case records could be located for 575 patients. The mean age of children at the time of ketamine administration was 3 years (range 1 day to 18 years). The most common ages to receive ketamine were 1-2 years (n=204, 29.8%), 0-6 months (n=8412.3%) and 2-3 years (n=74, 10.8%). Ketamine was given most frequently for hypospadias repair (n=228, 39.7%), osteotomy (n=81, 14.0%), general surgery (n=78, 13.7%) and for repair of anorectal malformation (n=42, 7.3%). Dose given was 0.5 mg/kg and mean dose was 8.12 mg (range 0.9 to 30 mg). Of 575 patients, 486 (84.5%) had no reported neurodevelopmental impairment following administration of ketamine. 67 (11.7%) patients had complex neurodevelopmental conditions or syndromes prior to the administration of ketamine. Seven (1.2%) died and 3 (0.5%) were autistic. Twelve (2.0%) individuals attended the outpatient neurodevelopmental clinic with new or unexplained neurodevelopmental delay or learning difficulties following ketamine exposure. The frequency of ketamine administration decreased during the study period from 129 in 2007 to 56 in 2013.

Discussion and conclusions
Although our analysis has limitations, a large randomised controlled trial would be impractical therefore we must interpret our experience judiciously and cautiously. In our cohort we did not identify a specific neurodevelopmental problem following the administration of neuraxial ketamine.

References
An audit of post-operative analgesia prescribing and pain assessment in major paediatric craniofacial surgery

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Introduction and aims
Oxford University Hospitals NHS Trust carries out 60 to 80 major paediatric craniofacial operations per year. All of the patients are cared for in the Paediatric High Dependency/Intensive Care Unit (PHDU/PICU) postoperatively before returning to the ward for ongoing care. Post-operative analgesia and pain assessment guidelines are used to ensure appropriate analgesia is provided for these patients. Following the withdrawal of codeine for children our unit changed to a regime of paracetamol, ibuprofen and Oramorph analgesia on the ward.

The aims of this audit were to establish adherence to these guidelines including analgesia prescriptions and administration. In addition, documentation of pain scores, sedation and nausea and vomiting scores was assessed.

Methods
The notes of 24 patients undergoing major craniofacial surgery between May and September 2014 were reviewed. Data collection started from the arrival to the ward post-operatively until discharge. Observation charts, prescription charts and anaesthetic charts were analysed and compared with the standards outlined in the prescribing and assessment guidelines.

Results
23 patients were included and 1 patient was excluded due to a prolonged PICU admission.

The mean age was 18 months (8-54 months), and mean weight was 11.3kg (8.6-15kg). Patients stayed a mean of 40 hours on the PHDU before returning to the ward (24-72 hours).

100% of patients had analgesia prescribed as per the guidelines. 75% were prescribed NSAIDS appropriately. Patients received an average of 2 doses of Oramorph (range 0-8) during their ward stay.

19% (3/16) had a pain score of 2 on the ward in the first 48 hours, and 1 patient had a pain score of 2 documented subsequent to this. These were all responded to with additional analgesia within 30 minutes.

70% of patients did not have documented nausea and vomiting score, and 43% of patients had no sedation score documented daily.

Discussion and Conclusion
All patients had prescribed analgesia which adhered to the guidelines and all patients had pain scores documented. The majority of patients appear to be comfortable (pain scores of 0 or 1) and those who scored higher received appropriate analgesia. Documentation of sedation and nausea assessment was poor in this group of patients. We conclude that postoperative analgesia guidelines are useful to ensure high quality care in this group of patients however further training is needed to improve assessment of side effects.

References

Conflict of Interest
None
A case of difficult intubation in a paediatric patient with I-Cell disease, Mucolipidosis type II

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Case report

We report a case of difficult airway management in a 2 year old child with I-Cell disease (Mucolipidosis type II) being treated on a ward with severe chest sepsis. I-Cell disease (Mucolipidosis) represents an airway challenge to the Anaesthetist. The mucolipidoses (ML) are a group of inherited metabolic diseases that affect the body's ability to carry out the normal turnover of materials within cells, namely lipid and carbohydrates\(^1\). Accumulation of abnormal amounts of carbohydrates and fatty materials lead to cell damage and therefore the typical orofacial features making face mask oxygenation, the use of supraglottic airways and endotracheal intubation difficult.

We were called to assess this child with severe sepsis (tachycardia and reduced level of consciousness) and episodes of desaturation. Due to failed attempts to assist with breathing using airway adjuncts and airway manoeuvres, a rapid decision was made to proceed to endotracheal intubation of this child with the Anaesthetic, ENT and Paediatric consultants present in theatre. The theatre team were mobilised and a difficult airway trolley was prepared to include a paediatric glidescope and a range of front of neck access equipment.

In theatre, with the child rapidly deteriorating we attempted an emergency intubation of this child with a rapid sequence induction. Following three unsuccessful attempts at laryngoscopy using different sized laryngoscopes and the glidescope, a rigid laryngoscopy was performed by the ENT consultant which gave a grade IV view. A needle cricothyroidotomy was performed and we successfully ventilated with a manujet. Finally we were able to intubate this child blindly with indirect laryngoscopy giving a Grade IV view.

Discussion

The presence of hypertrophic gums, a large tongue and a short head and neck make it particularly difficult to intubate these children.

In addition to the typical orofacial features associated with the Mucolipidoses group, typically these children may exhibit mental retardation, low birth weight, coarse facial typically presenting at 6-8 months of age. Other features include joint stiffness, dislocated hips, and tight, thickened skin, umbilical and or inguinal hernias, hepatomegaly and aortic insufficiency. The atlanto-axial joint is unstable in I-cell disease due to an incompetent transverse ligament infiltrated by storage cells. A cartilaginous, rather than calcified odontoid process may contribute to the instability.

Several weeks prior to this case, a front of neck access workshop was held at our local audit day. The anaesthetic team found it particularly useful when confronted in gaining front of neck access in this child. It is evident that training in the form of an airway workshop improve our technical skills for procedures we rarely perform. We also highlighted the importance of early referral to the Anaesthetic team and tertiary centres of children with known disorders associated with a difficult airway or which are rapidly deteriorating.
Fluid overload is associated with late poor outcomes in neonates following cardiac surgery
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Introduction and aims
Acute kidney injury (AKI) is a severe complication of cardiac surgery associated with increased morbidity and mortality yet AKI classification for neonates remains challenging. We sought to characterise the pattern of post-operative fluid overload (FO) and evaluate the degree of FO, a surrogate marker for AKI, as a predictor of poor post-operative outcomes in neonates undergoing cardiac surgery.

Methods
A retrospective cohort study of all neonates undergoing cardiac surgery requiring cardiopulmonary bypass at the University of Michigan from 2006 through 2010 was performed. Medical records including demographics, surgical and clinical data were reviewed. Daily weights and serum creatinine (SCr) levels were recorded. A composite poor clinical outcome including death, need for renal replacement therapy (RRT) or extracorporeal life support (ECLS) within 30 days of surgery was considered as a primary outcome in the analysis.

Results
Of 436 neonates included in the analysis, 22 (5%) had a composite poor outcome; 8 (2%) required RRT, 8 (2%) required ECLS, and 15 (3%) died within 30 days of surgery. Neonates with a composite poor outcome had significantly higher max FO (>20%) and SCr ≥ 0.9 on post-operative day 3 were slower to diurese. A receiver-operator characteristic curve determined that FO ≥ 16% and SCr ≥ 0.9 on post-operative day 3 were the optimal cutoffs for significant discrimination on the primary outcome (area under the curve = 0.72 and 0.76, respectively). In multivariable analysis, FO ≥ 16% (adjusted odds ratio [AOR] = 3.3) and SCr ≥ 0.9 (AOR = 8.1) on post-operative day 3 remained independent risk factor for poor outcome. FO ≥ 16% was also significantly associated with cardiac arrest requiring CPR, prolonged intensive care unit and re-exploration of the chest.

Conclusions
This study highlights the importance of monitoring fluid balance in the neonatal cardiac surgical population, and suggests that daily FO, a readily-available, non-invasive marker of renal function, may be a sensitive and specific predictor of adverse outcomes.
Inflation pressures during hand ventilation – where do we really peak?
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Introduction and aims
Royal Manchester Children’s Hospital is a tertiary paediatric centre with a high turnover of anaesthetic trainees whose previous exposure to paediatric anaesthesia is highly variable. It has been noted that the degree of understanding of the significance of airway pressures during induction of anaesthesia in children, and the methods to minimise airway pressure, is also variable. We conducted an audit to quantify this issue to facilitate safer patient care through feedback and education.

Our aim was to monitor the peak airway pressures during hand ventilation with a facemask at induction of anaesthesia. In addition we monitored the incidence of complications of elevated pressures, for instance, gastric insufflation.

Our agreed standards, based upon evidence from Lagarde S et al (1) and consultant opinion, were;
- 100% of patients should have peak airway pressure ≤15 cmH2O.
- 100% of patients with persisting airway pressures >15 should have appropriate manoeuvres to reduce airway pressure.
- 100% of patients with significant gastric insufflation should have their stomach deflated via an orogastric tube.

Methods
Prospective data collection including grade of anaesthetist, previous paediatric anaesthesia experience, patient demographics, peak airway pressures during hand ventilation using a facemask and incidence of complications.

Results
26 proformas were completed observing 18 trainees (grades ST4-ST6), one ODP and seven consultants. Prior paediatric experience of trainees varied from 1 week to 1 year. Patient age ranged from 3 weeks (and 3.17kg weight) to 15 years (weight 91kg). All patients were ASA 1-3 and only 2 had noted airway disease, with a further 2 having chronic chest conditions.

Peak pressures ≤15 cmH2O were achieved in 19.2%. However, 15.3% had pressures of 16-20 cmH2O, 34.6%, had pressures of 21-25 cmH2O and 19.2% exceeded pressures of 26 cmH2O. In three instances pressures were not documented. Of note, airway adjuncts / two-handed holds were not used to reduce airway pressure in any of the patients with pressure >15.

There was no correlation between paediatric experience, patient weight or gas flow rate with peak pressures.

Discussion and conclusion
No complications were identified despite raised pressures. This raises the question as to whether the universally agreed pressure limits between 15-20 cmH2O is actually valid and what pressure is truly required for adequate hand ventilation?

Of note adjuncts were not used, either illustrating the practitioner was unaware or unconcerned by the peak pressure generated. We recommend an educational package to raise the awareness of peak airway pressures during hand ventilation in children.

References
Anaesthetic management of a large anterior mediastinal mass in a child with Tumor Lysis Syndrome
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Introduction
Anterior mediastinal masses in the paediatric population present unique challenges to the anesthesiologist due to the potential for life threatening events under anaesthesia. Preoperatively, a multidisciplinary approach is best to determine an appropriate anaesthetic plan for obtaining tissue biopsy and other necessary invasive procedures.

Case report
An 11 year old male presented for biopsy of a large anterior mediastinal mass in addition to bone marrow biopsy, lumbar puncture, and placement of a dialysis catheter. He was sitting upright in obvious respiratory distress, tachypneic, tachycardic, hypertensive, and had significant perioral plethora. Preoperative CT scan revealed a large homogenous anterior mediastinal mass that displaced the heart to the left and caused a degree of compression of the trachea, left mainstem bronchus, and right middle lobe bronchus. Additionally, echocardiography revealed significant right ventricular outflow tract obstruction and moderate pericardial effusion.

The child was brought to the operating room and standard monitors were initiated. Intravenous access was established and oxygen via nasal cannula was administered. He was kept in a head-up supine position for most of the procedure and intravenous ketamine was given in 2 mg increments based upon level of sedation. Paediatric cardiac surgery was on standby in the event of cardiopulmonary collapse to initiate cardiopulmonary bypass.

The child tolerated the procedure without any adverse events. The mass was diagnosed as T-cell acute lymphoblastic leukemia. He was discharged home on hospital day 13.

Discussion
The risks associated with sedation and general anaesthesia for children with anterior mediastinal masses are well known. Anghelescu et al. summarised in Pediatric Anesthesia in 2007 the signs and symptoms associated with greatest anaesthetic risk - orthopnea and upper body edema, compression of the great vessels or heart, or reduction of the tracheal cross sectional area or mainstem bronchus compression. Furthermore, Stricker et al. presented their experience with children with anterior mediastinal masses in the Journal of Clinical Anesthesia in 2010. Of the 46 children in the retrospective review only 5 had mild intraoperative complications. In summary, the child with an anterior mediastinal mass should have a thorough cardiopulmonary workup prior to sedation or general anaesthesia. The use of sitting or lateral decubitus position when appropriate and maintenance of spontaneous respirations can contribute to a decrease in adverse events in this population. Lastly, limiting invasive procedures to only those that would direct management and having resources available such as cardiopulmonary bypass should be considered.

References
Mapping the 'MEPAT' paediatric anaesthesia simulation course to the Royal College of Anaesthetists UK (RCoA) training curriculum
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Introduction
The RCoA Certificate of Completion of Training (CCT) in Anaesthesia is competency based, with an emphasis on achieving competencies within units of training (1). Units of training are broken down into coded competencies and evidence for achievement of these can be drawn from several sources including completion of the Fellowship of the RCoA exam, workplace based assessment (WBA) and simulation (2,3). 'Managing Emergencies in Paediatric Anaesthesia for Trainees' (MEPAT) is an international course consisting of a series of literature based, expert peer reviewed high fidelity simulation scenarios which aims to give trainees the opportunity to develop skills in the management of paediatric anaesthetic emergencies (4).

Completing MEPAT offers a chance to evidence several areas of the CCT curriculum. However, curricula are wide ranging and extensive and this can be challenging for the trainee to navigate. We have produced a curriculum map linking the MEPAT course to the RCoA curriculum.

Methods
Anaesthesia trainees who had recently completed both their paediatric anaesthesia unit and a MEPAT course reviewed the MEPAT scenarios. Learning objectives were reviewed alongside the RCoA curriculum (2,3) and a list of coded competencies was matched to each scenario to create a map. This map was then reviewed by a MEPAT trainer and submitted for comments to MEPAT faculty.

Results
Visual representation of the map has been produced with competencies in the units of 'Management of respiratory and cardiac arrest in adults and children', 'Critical Incidents', 'Paediatrics', 'Airway Management' and 'Improvement Science, Safe and Reliable systems'.

Discussion
Mapping of the MEPAT simulation course to the RCoA curriculum has not yet been done but mapping of the MEPA for Consultants course to the RCoA Continuing Professional Development matrix has been completed and can be used for appraisal (4).

During this mapping process we identified areas of the curriculum in addition to paediatric anaesthesia which are covered in the MEPAT scenarios. Without using our map trainees may miss the opportunity to include these additional areas in their portfolio. So far, feedback on our map from trainees and specialist paediatric anaesthetists has been positive.

EPAT is delivered in a number of countries including the USA, Canada and Australasia. This mapping process could be easily replicated, using the local anaesthesia training curriculum.

A further development of this work is the inclusion of WBAs during the MEPAT course – we have developed template RCOA case based discussion (CBD) forms for each scenario and this will be presented separately.

References
4. www.mepa.org.uk
In-situ simulation in the paediatric cardiac catheterisation laboratory: A useful tool to prepare for potential disasters
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Introduction and aims
The paediatric catheterisation laboratory is a unique and challenging environment for anaesthesiologists. Dark rooms, limited access to the patient, bulky fluoroscopy equipment, cold temperatures and radiation exposure are characteristic features. Patients are often medically complex with limited physiological reserves resulting in frequent hemodynamic instability or cardiac arrests. Often located far from the main operating rooms and additional support, successful response to sudden adverse event depends on effective teamwork and communication between members of a multidisciplinary staff. We describe the use of a novel in-situ simulation-based curriculum to improve crisis resource management (CRM), establish protocols, and test existing equipment and resources.

Methods
Since 2007, we have implemented regularly scheduled 3-hour multidisciplinary CRM courses delivered in-situ for cardiac teams of 5-7 participants: cardiologists, anaesthesia providers, nurses and technicians. Each year 8-9 multi-model courses, comprised of games, lectures, trigger videos, in-situ simulation and team debriefing, run in the interventional labs and adjacent imaging suites (cardiac MRI and Echo). Scenarios range from simple arrhythmias to complex ECMO cannulations during E-CPR.

Results
Over 7 years, 42 courses for over 160 different participants were delivered to multidisciplinary teams focusing on effective management of low frequency, high acuity events in each venue. We developed and practiced new protocols for code team and ECMO activation and a resuscitation algorithm for the cardiac MRI suite. In-situ simulation detected multiple (>15) latent safety threats including deficient equipment, logistical flaws and inadequate resources. Supported by multidisciplinary leadership, systematic integration of in-situ simulation in the busy workflow of a tertiary teaching hospital allowed for completion of 86% of all scheduled courses.

Discussion and conclusion
Simulation based CRM courses are rapidly approaching a "standard of care" status for effective team training but are often restricted to dedicated simulation centers. For complex clinical environments such as a paediatric cardiac catheterisation laboratory, point of care, in-situ simulation offers unique opportunities to fully leverage fidelity and realism to optimize learning. Despite organisational challenges, we demonstrate that regular training can be achieved in "real" workspaces within a busy hospital to improve team performance and resource management. Further studies are necessary to determine if regularly scheduled in-situ simulation courses will decrease the frequency of cardiac arrests in the paediatric cardiac cath lab or improve the outcomes after these events.

References

The authors have no conflict of interest.
High fidelity simulation for revalidation in paediatric anaesthesia - Linking the tertiary unit with a local district general hospital (DGH)
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Introduction
To hold a licence to practice in the UK all doctors must complete annual appraisal, using supporting evidence to demonstrate they continue to meet the principles and values set out in Good Medical Practice (1,2).

The Department of Health Report – ‘The acutely or critically sick or injured child in the district general hospital - A team response’ emphasises a ‘whole-team approach’ and a ‘need for training, scenario practice and maintenance of standards’ (3).

The anaesthetic department at the Royal Hospital for Sick Children in Edinburgh worked closely with St John’s Hospital, Livingston (a DGH providing elective and emergency paediatric anaesthetic services) in piloting the use of a high fidelity, ‘in-situ’ paediatric emergency course to provide: support for evidence for appraisal (for Consultants and SAS anaesthetists who undertake occasional paediatric practice) and training for acute paediatric emergencies.

‘Managing Emergencies in Paediatric Anaesthesia for Consultants’ (MEPA FC) provides a comprehensive update in resuscitation of the sick child for those who undertake an occasional paediatric list or provide out of hours paediatric care. The course covers all aspects of paediatric codes recommended in the RCoA Level 2 matrix (2,4).

Methods
Simulation Leads from the tertiary unit and DGH worked closely together in the development and delivery of the course. Scenarios were adapted for local use. Scenarios were run ‘in-situ’ (Theatres/Intensive Care Unit) - allowing for ‘systems testing’ in addition to training.

Results
3 MEPA FC courses were delivered. 12 consultants and 2 SAS doctors from the DGH attended. Faculty included tertiary unit paediatric anaesthetists/intensivists and a DGH anaesthetist with an interest in paediatric anaesthesia

100% of participants "agreed" or "strongly agreed" that they had improved confidence in managing paediatric emergencies. Free-text comments stated that the scenarios were “relevant” and “realistic” delivered by “expert” and “approachable” trainers. 100% of participants thought the training would positively affect patient safety and 100% of participants would recommend the training to colleagues.

Discussion
Participant feedback suggested many factors behind the success of this training programme:
- MEPA FC aligns with RCoA appraisal requirements.
- Running MEPA FC in-situ allows realistic simulation and ‘systems testing’.
- Links between the tertiary unit and the DGH are strengthened by training together.

Future work
Participants have expressed a desire that MEPA FC be incorporated into a regular revalidation cycle. Outcomes from ‘systems testing’ will be presented at a future date.

References
2. http://www.rcoa.ac.uk/revalidation-cpd
3. ‘The acutely or critically sick or injured child in the district general hospital A team response Department of Health Report 2006.
Magnesium use in paediatric cardiac surgery, an evaluation of our practice
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Introduction and aim
Postoperative arrhythmias are an important cause of morbidity and mortality after cardiac surgery for congenital heart disease (CHD). Magnesium is an essential cofactor for the maintenance of myocardial trans-membrane potential and magnesium deficiency decreases the threshold for arrhythmias\(^1\). We aimed to evaluate our practice of magnesium administration and its effectiveness during surgery for CHD.

Methods
We prospectively collected data on 49 randomly selected paediatric patients undergoing cardiac surgery over 6 months. The project was registered as service evaluation project with the clinical audit department. Data was stored on a secure departmental website and patient identity protected.

Results
Data was analysed from 48 patients due to lack of complete date from one of the patient. The mean dose of magnesium administered in our patient group was 115mg/Kg (Range 59-235mg/Kg). The mean total serum magnesium level on admission to PICU was 1.28mmol/L and 1 patient had hypomagnesaemia (2%) (Institutional range: 0.75 - 1.2mmol/L). 10 patients (20%) from our group had arrhythmias perioperatively. The mean serum albumin level on arrival to PICU was 20mg/dl.

Discussion
In our practice, the perfusionist administers 50% magnesium sulphate into the CPB machine as a bolus injection on initiation of bypass on the anaesthetist's instruction. The dose of magnesium administered is decided by the anaesthetist. This service evaluation has shown the incidence of hypomagnesaemia in our group both preoperatively and on arrival in PICU is low compared to other studies\(^1\). In our patient group, total serum magnesium concentration is measured. Ionised magnesium is a better predictor of intracellular magnesium concentration. In presence of hypoalbuminaemia there is poor correlation between the total serum magnesium and ionised serum magnesium levels\(^2\). From the available literature we know that total and ionised magnesium are closely related in marked hypermagnesaemia (> 1.2 mmol/L), but correlation was poor in samples with slightly elevated total concentration or in hypomagnesaemia (<0.65 mmol/L).\(^2\) 10 (20%) of our patients had some form of rhythm disturbance perioperatively. 1 patient had junctional ectopic tachycardia, 1 recurrent ventricular fibrillation, 3 in heart block requiring pacing and others had transient self-terminating supraventricular arrhythmias. In these patients the mean total serum magnesium on arrival in PICU was 1.36mmol/L. The high incidence of hypoalbuminaemia in this group of patients emphasises the need for considering routine use of serum ionised magnesium as a marker for estimating serum magnesium concentration perioperatively.

References
Anaesthesia for non-bypass surgery in children with Berlin Heart Excor VAD - a 10 year case series
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Background
The Berlin Heart is a paracorporeal ventricular assist device implanted as a bridge to transplantation, decision, recovery and, increasingly, candidacy. It provides short to medium term mechanical support and has emerged as an alternative to ECMO in these patients. It provides the only biventricular assistance available. Considering its increasing use for long term bridging patients, there is a paucity of literature on anaesthetic technique for non-cardiac surgery. This review aims to draw on the GOSH experience to provide guidance on safe anaesthetic technique, and risk factors for instability.

Method
A retrospective case series was conducted of children who received a Berlin Heart EXCOR (BH) device at our institution between November 2004 and September 2014. Data collected included: patient demographics; BH device details; preoperative cardiac status; anaesthetic details and complications for all non-bypass procedures performed, and outcome following BH insertion.

Results
One hundred and twenty nine procedures were performed during 126 anaesthetics in 49 children. The commonest adverse event was hypotension, experienced during 52 anaesthetics (41%). Development of hypotension during induction was statistically unrelated to anaesthetic technique or other risk factors. Maintenance use of propofol TCI rather than inhalational agents appeared protective.

Discussion
This is the largest case series of anaesthesia for children with a BH in situ undergoing non-bypass surgery. Preoperative stability does not predict intraoperative stability in this group of patients. The most common induction agent was propofol (84.5%), which was well tolerated despite its capacity to reduce SVR. Furthermore, the use of propofol TCI for maintenance was associated with a reduced risk of intraoperative hypotension, although total numbers using this technique were low. The majority of episodes of hypotension were successfully treated with fluids and there were no arrests or perioperative deaths, suggesting that anaesthesia may be provided safely to this potentially challenging group of patients with a variety of techniques.
Audit of post-operative pain relief following tonsillectomy
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Introductions and aims
The Medicines and Healthcare Products regulatory Agency advised in June 2013 that codeine should not be used in any child with a history of sleep apnoea who is undergoing tonsillectomy. Codeine should only be used in children over the age of 12 years.

We have started to prescribe “when necessary” oral morphine to children, along with regular Paracetamol and Ibuprofen following tonsillectomy.

Methods
We audited the use, subjective efficacy and ease of oral morphine by either a postal or a telephone questionnaire from the participating parent.

All children were given medicines to take home that included regular paracetamol (15 mg/kg six hourly), regular ibuprofen (max 10 mg/kg eight hourly) and oral morphine as “when necessary” (100 micrograms/ kg, max 4 hourly upto 4 times a day)

Results
We audited 41 patients between the age of 3 and 16 years. All patients used regular Paracetamol and Ibuprofen. Seven patients (17 %) did not use any morphine.

Of the 34 patients who used morphine at home, 25 (73%) used only 1-2 doses per day and 9 (27%) used 3-4 doses per day.

Nineteen patients provided pre morphine pain scores. These varied from 6-10 for 16 patients and from 2-4 for the remaining 3 patients.

Fifteen of the 34 patients who received morphine had their last dose on POD 2, but 4 patients continued use until POD 7 necessitating 3 of them to obtain a repeat prescription. We noted a trended decrease in use of morphine at POD2 but a dose increase again at POD 5 for those still using it.

The surgical team prescribed 5 patients with a course of post-op antibiotics and 3 of these were in the POD 5 group requiring extra analgesia.

Comments from parents
Most parents who gave morphine to their children were pleased to have a rescue drug and believed it helped the children. One parent who did not give any morphine to their child thought there was no need for morphine and that it is inappropriate to prescribe morphine to children. Most parents thought it was easy to administer the morphine with regards to volume as well as taste of the drug.

Three parents said it made their children drowsy but helped with the pain. One child vomited and one experienced nausea after the first dose of morphine on POD1. Two parents thought the morphine worked but onset of analgesia was not quick enough.

Conclusion
We believe that morphine is a valuable alternative to codeine for rescue analgesia following tonsillectomy in children. Most of the children requiring morphine for longer duration was most likely reflective of technical difficulty at the time of surgery and localised infection.
Development of a paediatric theatre ticket
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Introduction
Pre-operative theatre checklists are essential for patient safety during the peri-operative period.[1] Checklists contain vital information, however often don’t involve the patient in the pre-operative process. They can be difficult to read and can be overlooked due to the volume of paperwork accompanying the patient. In Ninewells Hospital, we have developed a paediatric theatre ticket with the aim of involving parents and children in the process, which includes the preoperative checklist.

Methods
An adult theatre ticket had recently been launched in Ninewells Hospital. This incorporated aspects of the previous theatre checklist, but was separated into components to be completed by the patient, the ward nurses and anaesthetic nurses. In the development of the paediatric theatre ticket, the checklist was modified and trialled using Plan, Do, Study, Act (PDSA) cycles. The first page of the paediatric theatre ticket was developed to be a child and family friendly page and the second page was a checklist for nurse completion.

Results
PDSA cycles
Cycle 1: A paediatric friendly version of the theatre ticket was introduced. This was trialled with 5 patients undergoing elective surgery. Whilst the ticket was child friendly, it was found to be difficult for children and staff to complete.

Cycle 2: The information on the checklist was rationalised. The order of the checklist was altered to enable the questions on the ticket to flow better for the patient journey. This cycle was trialled with 20 patients, with feedback from inpatient paediatric ward and theatre teams.

Cycle 3: Staff feedback was collected and implemented. Awareness was raised among paediatric anaesthetists about a section requiring fasting and other instructions. This cycle was extended to both inpatient and day case paediatric wards, and was tested on 40 patients.

Cycle 4: This was the final cycle prior to widespread use of the paediatric theatre ticket. It was tested on 50 patients both in day surgery and inpatient wards. Feedback from patients, parents and staff was generally positive. Specific sections for documenting pregnancy testing were added. Following the PDSA cycles the paediatric theatre ticket has been implemented for use throughout inpatient and day surgery paediatric wards in Ninewells Hospital.

Conclusion
The development of an interactive paediatric theatre ticket has been positively received by both patients, parents and staff. This quality improvement project has clarified and rationalised the pre-operative checklist in addition to allowing the child to become engaged in the ‘trip to theatre’. It has enhanced interaction with children and families by highlighting children’s likes and preferences, and alleviating fears and anxieties at induction of anaesthesia.

References
The model of effective theatre utilisation
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Introduction
Effective theatre utilisation is a topical challenge for NHS managers. Inadequate use of theatre capacity has financial implications and can affect quality of care and productivity. Good planning and time management can enable more elective and emergency work to be done in sociable hours. This has a knock-on effect in improving the patient’s experience and staff morale.

We would like to share our model for theatre utilisation and demonstrate how teamwork and good communication between theatre staff can manage a reasonable number of emergencies in elective theatres. Evelina London Children’s Hospital is the paediatric hospital at GSTT (Guy’s and St Thomas’ NHS Foundation Trust). The unit has half a day allocated priority theatre. Cancellations on the elective lists are commonplace either because children are or because of lack of paediatric intensive care (PICU) beds on the day.

We wanted to audit our utilisation of elective theatres to accommodate emergency work and if by doing so we were able to achieve surgical targets and perform high risk surgeries in daylight hours.

Methods
A prospective audit was conducted in October 2014 for 4 weeks. We looked at number of paediatric emergency cases, patient’s demographics, ASA grades, case priority classification (immediate, <6 hrs, <24 hrs, <72 hrs) timing of cases to achieve surgical targets, percentage of high risk cases in daylight hours, percentage of emergency cases performed in elective theatres and supervision of junior anaesthetists. Data collection tool was audit form filled by theatre staff and galaxy (electronic data collection system).

Results
135 emergency cases were performed during this period. Fifty children (37%) aged < 2 years, 44 (33%) ASA 3/4 underwent emergency surgery. Elective theatres accommodated 39 (29%) cases. Sixty percent cases were performed in daylight hours, 109 (81%) of cases met surgical targets. 34/44 (77%) of ASA 3 and 4 cases were done in daylight hours. Consultant Anaesthetist was present 100% of ASA 3 and 4 patients.

Conclusion
Our model demonstrates effective utilisation of elective theatres in the event of unplanned cancellations. We were able to meet majority of surgical targets despite having only half a day priority theatre allocation. With flexible working practices, more high grade ASA children were operated in daylight hours.

We recommended that clinicians and managers identify the specific clinical needs to the institution in dealing with priority cases. Paediatric elective theatre schedules may need a degree of flexibility to expect untoward cancellations and to accommodate emergency cases.

"Short Notice Protocol" may be adopted where operations are arranged at short notice to fill in theatre slot in events of unplanned cancellations.

References
Waiting times for paediatric emergency surgery
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Introduction
There has been a focus on improving Paediatric emergency surgery. Guidelines exist around the timing of urgent cases, the length a child should wait and when these cases are performed. A document released by the Royal College of Surgeons, advises that children should not wait for more than 12 hours¹. NCEOPD reports have issued guidance on the volume of work that should take place out of hours in paediatric surgery. It is suggested that only NCEPD category 1 cases be done after midnight.

Our unit is a large tertiary centre with dedicated Paediatric emergency lists. An audit was conducted to assess the utilisation of the emergency lists and our compliance with standards set out for safe surgery. We have a 5 category emergency list with category 1 cases requiring immediate intervention. Category 5 cases should be done within 24 hours.

Method
Data was collected prospectively. We used a 1 month period to collect data. A proforma was designed and data was added from the theatre emergency booking folder and the theatre computer system, ORMIS. Audit forms were completed for all emergency work that was booked through the theatre system.

Results
During the 1 month period 114 cases were booked on the Paediatric emergency list, 16 cases were cancelled. The majority of the cases fell in to category 4 and 5 (18 and 24 hours respectively). One case was booked as a category 1 case and was performed within the target time. The results reveal that 27% of children waited for more than 12 hours for a procedure (n=31). Two cases were performed after midnight, one of these was a NCEPOD category 1 case the other was a category 3 case. Our audit revealed that procedures peaked at the beginning of the week and then again towards the end of the working week. Booking of cases also revealed this.

Conclusion
We are currently missing the national target for Paediatric emergency surgery, with more than a quarter of our patients having to wait more than 12 hours for their procedure. Further exploration of the data shows that many cases are booked out of hours, when it is not practical to operate. This then automatically increases the waiting time. We are in discussion with our surgical and theatre colleagues to develop an improved booking strategy. This would include a ‘stop-the-clock’ feature that would allow the case to be re-booked if it is apparent that the case will not be performed within the 12 hour period. This would allow children to be fed if allowable and prevent complications.

No funding was received for this audit

References
Pregnancy testing in paediatric surgery
Andrew Dalton, Helen Dunne, Suzie Byer, Deirdre Cameron, Grant Rodney
Ninewells Hospital, Dundee, UK

Introduction and aims
Over a third of females will have been sexually active by the age of 16\textsuperscript{1}, with a conception rate of 7 per 1000 in the UK.\textsuperscript{2} It is vital to identify any pregnancies before undertaking interventional procedures, and this is recognised in the Royal College of Paediatrics and Child Health guidance.\textsuperscript{2} The established practice in our hospital has been enquiry based testing. However, this was on occasion omitted due to staff feeling ‘uncomfortable asking’ paediatric patients. Additionally, there were 3 adult cases where a pregnancy was ‘discovered’ in theatre despite negative enquiry based testing. Therefore, we changed to routine pre-operative testing for all females over the age of 12, with a target of >95% compliance, and >95% patient and staff satisfaction with the process.

Methods
With the stated targets of both compliance and satisfaction, it was essential to have full engagement from all stakeholders prior to implementation. Therefore, the proposal was put to the staff, the child protection team, and the young person consultation group. Emphasis was placed on the national guidelines and the risks associated with undiagnosed pregnancy. Following this, the leaflet was tested on the user group, which resulted in a revision of the document. The revised leaflet was then tested for 1 week, and following this successful process it was embedded into the theatre ticket that all patients attending theatre have.

Results
11 children were tested and asked for their opinion in the 1 week trial. Of these, 7 were very positive. The other 4 were surprised by the process, but felt happy after reading the leaflet and consented following this. All the staff were happier with the new system, as they found being able to say "this is what we do for everybody of your age" much easier to undertake than the potentially embarrassing questioning of the child with their parent(s) present.

Discussion and conclusion
We feel this new system is an improvement, and can become part of the routine pre-operative surgical checklist that needs to be completed before anaesthesia is undertaken. Consent from the patient/parent is implicit, and is underpinned by verbal and written information. The positive feedback from both patients and staff is equally encouraging. We feel that ensuring stakeholder engagement prior to the implementation of the process was essential for ensuring this. However, it is important to remember the limitation that very early gestation pregnancy may be unrecognised in this process.

References
Post-list debriefing in paediatric surgery
Andrew Dalton, Suzie Byer, Cath McGee, Deirdre Cameron, Grant Rodney
Ninewells Hospital, Dundee, UK

Introduction and aims
Effective teamwork and communication lies at the heart of providing safe surgical care. Through the implementation of the 5 step approach to safer surgery (briefing, three stages of the WHO Surgical Safety Checklist, debriefing)\(^1\), and by paying attention to human factors in peri-operative practice, significant improvements in outcomes for patients as well as a better working environment for staff can be realised.

Following the successful implementation of pre-theatre briefing and the WHO surgical checklist\(^2\) we introduced a post-list debrief, with the aim of aiding communication, teamwork, and highlighting areas for improvement.

Methods
Post theatre debriefs were introduced for all elective lists in our single paediatric operating theatre. These are held prior to the last patient leaving theatre, in the presence of multidisciplinary team members (a ward nurse, surgeon, anaesthetist and theatre nurses). A communication diary was initially established to capture any issues identified. This has since been upgraded to a formalised proforma for mandatory completion. We reviewed the debriefing process, both in terms of compliance and also what issues have been identified.

Results
Prior to its introduction, there was no debrief culture. Since introduction in April 2013 the compliance rate has steadily increased. There was initially a poor uptake, with a compliance of around 10%. With the introduction of a debrief diary which allowed documentation of issues raised, and further multidisciplinary engagement, the compliance rapidly increased until a 100% completion rate was achieved by November 2013. On the basis of this engagement and overall staff enthusiasm, this was considered a useful process in improving the overall theatre environment. A mandatory debrief proforma was established, which continues to achieve 100% compliance.

Discussion and conclusion
The debrief diary and proforma have identified issues relating to both organisational and patient specific issues. These include lack of equipment, wrong order of patient lists, potential wrong site surgery (the consent form and skin marking were different) and the absence of signed consent (only noted after induction). Debriefs have lead to overall improved communication and team working, with the process of highlighting factors that have gone well/not well generating useful discussion. It is our view that with this improved debrief culture, the overall safety of lists will be improved, as problems identified will be incorporated into future pre-list briefing/checklists to minimise the chance of recurrence. The process does however rely on ongoing monitoring and continued education to ensure that this service improvement becomes part of the long-term routine care that will contribute to overall safer peri-operative care.

References
Near-infrared spectroscopy - the next step in neonatal perioperative monitoring?
Christopher Kelly, Deborah Fradkin, Jan Owen
Royal Manchester Children's Hospital, Manchester, UK

Introduction and aims
Monitoring is essential to the provision of safe anaesthesia, with the minimum monitoring requirements of the AAGBI allowing the anaesthetist access to real time information on their patients’ physiology. Difficulties remain with shortfalls in our understanding of neonatal physiology and lack of universal definitions for issues as common as hypotension. (1) Imperfect information about the state of patients’ perfusion and oxygen delivery has been implicated as a potential source of harm. (2) Use of near-infrared spectroscopy (NIRS) has been posited as a method of measuring organ, or region specific blood flow, further guiding the anaesthetist to avoid ischaemic states. (3) We aimed to identify how the use of NIRS influenced the decision making process and conduct of anaesthesia, facilitating and enhancing the safe perioperative anaesthetic care of neonates in our tertiary paediatric centre.

Methods
NIRS was employed in 40 varied cases, such as gastroschisis and hernia repairs, by different anaesthetists in our tertiary paediatric hospital. Data was recorded from the monitor during the case, tabulated and then correlated with the anaesthetic chart. These two sources were evaluated by an anaesthetist not involved in the case. Specific attention was paid to triggers to action and intervention of choice in different scenarios.

Results
The cerebral NIRS provided a vital monitor during periods of difficulty obtaining non-invasive blood pressure (NIBP) readings. It lead to the identification and management of hypotension in circumstances that may otherwise have been attributed to temperamental NIBP equipment.

A decrease in cerebral perfusion also appeared to lower the threshold for treating hypotension at levels that would otherwise have been tolerated were they not associated with an identified drop in the NIRS cerebral monitor.

NIRS highlighted the importance of preventing relative hypocapnia, with decreases in cerebral perfusion frequently being reversed by reducing ventilation and increasing the end tidal carbon dioxide level.

Discussion and conclusion
NIRS provides a more instantaneous monitor to facilitate appropriate management of blood pressure and ventilation during neonatal anaesthesia. Although NIRS is an emerging technology with a growing evidence base there is little published data on its use within non-cardiac neonatal perioperative anaesthesia. We hope to add to the literature with these worked examples of tertiary paediatric anaesthetists using NIRS to provide a more accurate, non-invasive monitor to assist in everyday practice.

References
2. Thomas J. Reducing the risk in neonatal anesthesia Pediatric Anesthesia 24 (2014) 106–113
Post-operative opioid analgesia for children in Scotland
Karen Pearson, Simon Crawley, Grant Rodney
Ninewells Hospital, NHS Tayside, Dundee, UK

Introduction and aims
Following MRHA restriction of codeine use [1] our hospital has introduced Oramorph as the post-operative opioid of choice for children. We were aware of changes in practice in other centres and wanted to compare this with our own practice and experiences.

Methods
A survey was distributed via SurveyMonkey to members of the Scottish Paediatric Anaesthetic Network (SPAN) distribution list. Questions included: choice of opioids, changes in opioid analgesia practice for children, opinions on efficacy, dosing regimes for in-hospital and take home opioids (particularly for post-tonsillectomy children) and provision of information leaflets.

Results
There were survey returns from anaesthetists working within 11 of the 14 NHS health boards in Scotland. The remaining 3 health boards cover remote and rural regions, with limited paediatric surgical practice. 44% (33/75) of SPAN members responded to the survey request. The majority (79%, 26/33) of respondents had changed their practice since the MHRA statement. Of those whose practice had not changed, most had not used codeine previously. Previous first choice of post-operative oral opioid had been codeine (85%, 22/26), the remainder using dihydrocodeine. All 22 respondents whose practice had changed, had converted from codeine to oramorph. Of the 22 respondents who had switched to oramorph the majority (77%, 17/22) ranked it as similar to or better than their previously-used opioid, the remainder felt unable to comment due to lack of current information regarding analgesic efficacy. The majority (73%, 16/22) used in hospital oramorph within the dosage range 100-300micrograms/kg (min: 20micrograms/kg 3 hourly; max: 500micrograms/kg 4 hourly). Take home oramorph ranged from 3 to 10 doses and did not exceed 200 micrograms/kg per dose. Over half of respondents (57%) provide take home opioids to post-tonsillectomy patients under 12 years without obstructive sleep apnoea (OSA), 41% for children with OSA. Take home dosing for those with OSA tended towards the lower end of the range (100 micrograms/kg). Only 45% of respondents were providing information leaflets on their current post-operative analgesic regime.

Discussion
The MHRA statement has resulted in a significant change in practice, with codeine no longer used as a first-line post-operative analgesia in children throughout Scotland. Nearly all respondents have switched oral opioid analgesia to oramorph, both in-hospital and to take home, with a small minority using dihydrocodeine. Less than half are currently providing specific take home analgesia information leaflets, though these may be in progress. Further audit and research is needed for side effects and efficacy, including optimum dosing and frequency. There is potential for collaboration under SPAN auspices to share practice and evaluate the transition to oramorph.

References
1. MHRA. Codeine: restricted use as analgesic in children and adolescents after European safety review. Drug Safety Update June 2013. vol 6, issue 11
Nursing perspectives on changes to oramorph use in children
Karen Pearson, Simon Crawley, Grant Rodney
Ninewells Hospital, NHS Tayside, Dundee, UK

Introduction and aims
Following MRHA restriction of codeine use [1] our hospital has introduced oramorph as the post-operative opioid of choice for children, both in-hospital and for take home analgesia. We wanted to gauge opinion of the nursing staff about administration practicalities, efficacy, patient and parental acceptance, and to highlight any issues arising from the recent change in practice.

Methods
A survey was distributed to paediatric nursing staff requesting their opinion three months following the change in practice. Comparison of oramorph to codeine was sought using a five-level Likert scale, (1=much worse, 2=worse, 3=similar, 4=better, 5=much better) in relation to: ease of administration, effectiveness as post-operative analgesia and associated side effects. Information was also collected regarding frequency of parental concerns regarding oramorph use.

Results
All nursing staff (n=7) working on our paediatric day case surgical ward completed the survey, with a focused sample (n=9) collected from those working on the in-patient paediatric ward who are most frequently involved in post-operative care. 83% of those surveyed (13/16) felt that they had received adequate information regarding the change in practice, with those who felt they had not, all working on the general paediatric ward. Ease of administration was ranked as similar, better/much better by 81% with a scale median of 3 (IQR 3-4). Effectiveness was ranked as better/much better by 75% with a scale median of 4 (IQR 3.25-4.75) and associated side effects as similar or better/much better by 94% with a scale median of 3 (IQR 3-4). Frequency of parental concerns about their child’s opioid use was recorded as ‘occasionally’ by 44% regarding in-hospital use, 29% regarding at home use and ‘never’ by the remainder. Concerns raised included safety aspects associated with the drug, potential for over-sedation and the stigma attached to morphine.

Discussion
The majority of nursing staff surveyed felt well informed of the recent change in practice, though focus with further education could be directed towards the general paediatric ward and those less routinely involved in post-operative care. Despite initial apprehension with regards to routine use of a previously controlled drug (raised in the free-text section) this survey has demonstrated a generally positive opinion of oramorph administration in the post-operative period. Encouragingly, effectiveness for post-operative analgesia and side effect profile were regarded as at least similar or better than codeine using the introductory dosing regime (100micrograms/kg every 4 hours). This was implemented following collaboration of the paediatric pain team with pharmacy. Parental concern may be alleviated over time via on-going staff education/communication and newly implemented information leaflets, although public perception regarding stigma remains challenging.

References
1. MHRA. Codeine: restricted use as analgesic in children and adolescents after European safety review. Drug Safety Update June 2013. vol 6, issue 11
Anaesthetic management of a child with Allgrove's Syndrome
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Keywords
Allgrove Syndrome; achalasia; autonomic dysfunction; neuropathy; general anaesthesia technique

Introduction and aims
Allgrove's syndrome is a rare autosomal-recessive disorder characterised by alacrima, achalasia, and ACTH insensitivity among other features.1 There are various concerns regarding administration of general anaesthesia to these patients. We describe the range of anaesthetic techniques used to safely anaesthetise a child with this condition.

Methods
A 10 year old child with Allgrove's Syndrome presented to the anaesthetic team on 5 different occasions, for various surgical procedures.

Results
Before the diagnosis of Allgrove's Syndrome, TIVA with propofol and remifentanil was used for muscle biopsy and GI endoscopies. By the time he underwent Hellers myotomy, fundoplication & PEG insertion, formal diagnosis of the condition had been made.

Following pre-oxygenation in the semi-recumbent position, anaesthesia was induced with Propofol & fentanyl. Hydrocortisone 100mg was administered IV. Trachea was intubated (6.5 cETT) without muscle relaxant. Anaesthesia was maintained with Sevoflurane. Remifentanil infusion was commenced for analgesia and suppression of breathing. Analgesia was supplemented with paracetamol & morphine. IV fluids were given intra-operatively. Simple eye ointment was applied to the cornea, eyes closed & taped shut.

Discussion
There is a risk of pulmonary aspiration during induction of general anaesthesia due to the achalasia. Induction in semi-recumbent position reduces this risk. Gentle mask ventilation with low inflation pressures allows oxygenation without the risk of gastric inflation and aspiration.2 Patients with known or suspected AI should receive adequate supplementation.3 Blood sugar homeostasis is often impaired. Monitoring of blood sugars peri-operatively is essential. The absence of a protective tear film exposes the cornea to damage. Steps to protect the cornea under general anaesthesia should be in place. Patients with autonomic dysfunction may have impaired cardiovascular responses under general anaesthesia.4 This may be particularly important at certain key steps of laparoscopic surgery. Patients with Allgrove syndrome may present with features of progressive neuromuscular disease. When volatiles and neuromuscular blockers are used, reduction of doses along with monitoring of neuromuscular blockade is advisable.

Conclusion
Allgrove Syndrome is a rare condition with various challenges but can be safely anaesthetised paying keen attention to the aspects discussed above.

References
Supraventricular tachycardia on induction of anaesthesia in paediatric electrophysiology studies
Colleen Woo, Mary Avanis, Richard Martin
Great Ormond Street Hospital NHS Foundation Trust, London, UK

Introduction
In otherwise healthy children, supraventricular tachycardia (SVT) is the commonest arrhythmia, with a prevalence between 0.001% and 0.004%.1 No studies currently investigate SVT on anaesthetic induction in children predisposed to arrhythmias but it is anticipated that they are more susceptible to developing spontaneous tachyarrhythmias with associated haemodynamic instability.2 Majority of SVTs in children are re-entrant types amenable to radiofrequency catheter ablation in electrophysiological (EP) studies.3 General anaesthesia should facilitate easy and reproducible arrhythmia induction to enable ablative therapy. This study's aim was to establish the prevalence of SVTs on induction in children predisposed to arrhythmias.

Methods
Following registration with the audit department, we retrospectively analysed medical records of children presenting for EP studies at Great Ormond Street Hospital from January 2009 to July 2014 for demographics and anaesthetic techniques utilised. Tachyarrhythmia episodes with heart rates (HR) above 150 beats per minute (bpm) occurring within 15 minutes of anaesthetic induction were recorded and characterised for their onset and duration.

Results
Of the 216 EP studies analysed, 170 (79%) were healthy children and majority (81%) were diagnosed with re-entrant tachycardias. A standard anaesthetic technique, utilising agents and airway manoeuvres driving a sympathetic response was employed in 128 (59%) cases. This involved induction with propofol or sevoflurane with nitrous oxide and oxygen, followed by maintenance with desflurane, nitrous oxide and oxygen. Tracheal intubation was facilitated by atracurium. Cyclizine and ondansetron were administered at induction. Fentanyl and dexamethasone were excluded.

We identified four (1.9%) cases of definite SVT triggered on anaesthetic induction. They occurred suddenly, unrelated to any preceding stimulus, lasted between 5 and 15 minutes, had a maximum HR of 214 bpm and were not associated with significant hypotension. By comparison, two further episodes of general tachyarrhythmia displayed more gradual onset, longer duration and lower maximum heart rates and were thought to be related to cyclizine administration.

Conclusion
This study demonstrates that SVTs occurring on anaesthetic induction are not common in children predisposed to arrhythmias. This was observed despite the omission of anti-arrhythmic medications prior to the procedure and an anaesthetic technique designed to facilitate arrhythmia development being most commonly utilised. Paediatric anaesthetists should be encouraged and reassured by these findings when such children present for general anaesthesia for other procedures at local hospitals.

References
What's that smell in children's theatre? The use of essential oils to promote inhalational induction of anaesthesia
Charlotte Targett, Craig Cumming
Ninewells Hospital, Dundee, UK

Introduction
Inhalational induction of anaesthesia can be made difficult by the pungent smell of sevoflurane. Historically in Tayside we have used scented facemasks to facilitate inhalation induction in paediatrics but we now have unscented facemasks. Information from Mehta et al (ref 1) and colleagues in London suggested that applying essential oils to the breathing filter can mask the smell of sevoflurane.

Methods
Essential oils in a variety of flavours were obtained. Children were identified for whom inhalational induction was the chosen method of anaesthesia. Play specialists, ward nurses or the anaesthetist invited them to choose from a range of samples which scent of essential oil (or none) they would like added to the anaesthetic gas. 1-2 drops of essential oil was placed on the machine side of the breathing filter just prior to induction. The anaesthetist was asked to record the flavour of oil used and to rate the quality of induction. Post-op (if possible) the child was asked about their experience.

Results
77 Children were surveyed. Mango was the favourite essential oil chosen. Use of an essential oil improved the anaesthetist rated quality of induction ("good" 85.4% with essential oil vs 79.3% without). Significantly more children rated the smell of the mask as "nice" (47.9% vs 13.9%) and would be prepared to undergo this method of induction of anaesthesia again (62.5% vs 44.8%). Of the small number of children (3) for whom this was a repeat inhalational induction, all considered it to be more pleasant than the previous time.

Discussion
Peri-operative anxiety in children is a significant issue. 60% of children having surgery experience anxiety in the anaesthetic room and up to 60% will display new dysfunctional behaviour in the 3 weeks following surgery. Up to 12% still display this behaviour 1 year post surgery (ref 2, 3). Interventions which make induction of anaesthesia more pleasant can help to alleviate this. Our experience suggests that the addition of an essential oil to the breathing filter is a safe and cost-effective method of achieving a calmer inhalational induction which a child is more likely to chose again.

References
3. SPAN November 2012 - POEMS presentation
Paediatric neuroanaesthesia and the difficult airway
Melinda Same, Su Mallory
Great Ormond Street Hospital, London, UK

Introduction
The incidence of difficult mask ventilation and difficult intubation (0-2%) in children is significantly lower than that reported in adults (1.5-8%) [1]. Paediatric maxillofacial and cardiac surgeries are known independent predictors of difficult laryngoscopy [1]. In neurosurgery, we propose that associated pathologies, potential cervical spine instability and presence of spinal stabilisation devices might predispose these patients to a greater prevalence of airway difficulty. We aimed to identify the prevalence and characteristics of difficult airways amongst these patients at our institution and improve reporting to the hospital’s difficult airway database.

Methods
Information was obtained prospectively on airway management for all elective and emergency neurosurgical cases over a 5-week period. Details collected included anticipated difficulty, attempts and success at ventilation and intubation, view obtained on direct laryngoscopy. If difficulty was encountered, the use of adjuncts or the difficult airway trolley and incidence of any complications were recorded. Approval for the audit was obtained through the hospital’s audit committee and ethics approval was not required.

Results
52 patients were included in the audit. Of these patients, 5 (10%) were already intubated, had a tracheostomy in-situ, or had airway management with a laryngeal mask only. The remaining 47 patients were aged between 2 days and 16 years and weighed 2 to 73kg. 40 of these underwent cranial surgery whilst the remaining 7 had spinal surgery. None were anticipated to have a potentially difficult airway and 45/47 (96%) had a normal airway assessment. Easy bag mask ventilation was reported in all patients, except one who was recorded at moderately difficult, however a guedel airway was used in 7/47 (15%) cases and desaturation was observed on mask ventilation in 2/47 (4%). 46/47 (98%) patients had direct laryngoscopy performed at initial attempt, with all patients obtaining a best Cormack and Lehane view of 1. In 44/47 (94%) patients, successful intubation was achieved in less than 2 minutes, the other 3 patients requiring at least 2 attempts and 2-5 minutes to achieve success. There were no failed intubations and apart from 3 episodes of desaturation, no other complications noted.

Discussion
There did not appear to be any increased incidence of airway difficulty in patients undergoing neurosurgery at our institution. The few who required multiple attempts or experienced complications are likely to reflect that seen in the population in general. Despite not demonstrating a higher incidence of difficulty, the sample size was relatively small. However it is worth remembering that these patients do present with unusual pathologies, varied neurological and spinal conditions and occasionally immobilisation devices, all of which have the potential to increase airway difficulty.

References
Using what you’ve got - difficult paediatric intubation in a child with Dandy Walker Syndrome in status epilepticus
Shelley Barnes, Helen Davies, Richard Craig
Great Western Hospital, Swindon, UK

Background
A 4 year-old male with Dandy Walker syndrome presented to our A&E department in status epilepticus at 3am. The child had significant medical problems including hydrocephalus with ventriculostomy, cranial cernstosis with obvious skull deformity, Anton's Syndrome, severe developmental delay and epilepsy. He required nocturnal NIV for central hypoventilation, and was PEG fed.

The child had undergone a number of anaesthetics in a tertiary centre, but notes were unavailable. The mother thought that intubation had been achieved via the conventional route, but had been "difficult".

Case description
On admission the child was fitting. Seizure duration was approximately 1 hr 45 min. Blood glucose was 3.9mmol/L. The airway was patent and supported with a Water’s circuit to maintain adequate oxygenation. A left tibial interosseous needle was inserted, and 2.7mg of midazolam and 39 ml of 10% dextrose administered. Despite treatment, seizures continued. Loading doses and subsequent weight appropriate doses of Phenytoin and Phenobarbitone were administered. It became apparent the child would need anaesthesia for seizure control, airway management, to facilitate CT scan and PICU retrieval.

Result of Intervention
A difficult airway was predicted, however, limited paediatric difficult airway equipment was available. The ENT team have paediatric nasendoscopes, and were contacted for assistance.

The child was pre-oxygenated. We were unable to aspirate the PEG due to lack of the appropriate equipment. 30mg Propofol and 30mg of Suxamethonium were given. Good air entry and EtCO2 was achieved with a Guedel airway and BVM ventilation. Anaesthesia was maintained with Propofol boluses. Intubation was attempted with a size 2 McCoy blade, but failed. Rocuronium was administered, and two further attempts at intubation were made using a size 2 straight blade and a bougie (the second by a consultant anaesthetist) without success. A size 2 LMA was inserted with good effect. Saturations remained above 98% throughout.

After discussion the ENT team assisted. A flexible nasendoscope was passed through the LMA, and a bougie passed alongside it and through the vocal cords under direct vision. A size 4.0 un-cuffed ETT was passed over the bougie and its position checked with the nasendoscope. Anaesthesia was maintained with morphine and midazolam infusions.

A CT head showed no change in intracranial appearances. Seizures terminated after approximately 5 hours. The child was transferred to the nearest PICU by the paediatric retrieval team.

Learning points
Children with known and predicted difficult airways can present to hospitals without tertiary paediatric services. In an emergency situation it is necessary to plan how to manage a potentially difficult airway with the equipment and skills available. Safe management may require input from multiple disciplines. It is imperative that doctors with the appropriate seniority and skills are contacted early for safe and appropriate management in these cases.
Audit of paediatric airway assessments
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Background and aims
Pre-assessment of the adult airway through simple observation of external facial features and measurements has been validated and used to minimise the risks associated with general anaesthesia and a difficult airway. Multiple studies have shown that although specific airway tests alone are not useful, the combination of 2 or more tests used pre-operatively can reduce the risk in adult patients.¹-² Despite the knowledge that children can present with a difficult airway, actual airway assessment in paediatrics is reportedly performed poorly and less regularly than in adults, as the literature supplies little information for anaesthetists to be confident of which tests to use and their relevance.

We conducted an audit in order to examine how the paediatric airway is assessed at a busy, tertiary paediatric hospital with a large population of difficult paediatric airways.

Methods
Following registration with the audit department, we conducted a prospective audit of 150 paediatric patients undergoing general anaesthesia over a 6-week period. The anaesthetic chart was examined for each patient and data was collected on:

- the presence of an airway assessment
- the type of airway tests that were performed
- the grade of anaesthetist performing the assessment

Results
Thirty-seven assessments were carried out by consultants and 113 by trainees. 28% of the children did not receive an airway assessment; 28% of the trainees and 27% of the consultants did not assess their patient’s airway. During the assessment, 54% of anaesthetists performed one test, 25% performed two tests and 14% three tests. The most commonly performed test involved ticking a box on the anaesthetic chart labeling the airway as normal (81%); in 35% of cases information had been taken from previous anaesthetic charts and in 27% the neck was reported as having a normal range of movement.

Discussion and conclusions
Our results demonstrate that airway pre-assessment was not performed in a significant proportion of paediatric patients. When a pre-operative airway examination was carried out, most anaesthetists performed one test; an overall assessment of a normal looking airway. Adult based literature has continually questioned the use of pre-assessment airway tests but even those less enthused by airway assessment do not deny that thinking about the issues raises awareness and with that safety.³

References
3. Yentis SM. Predicting difficult intubation – worthwhile exercise or pointless ritual? Anaesthesia. 2002; 57(2): 105
Predicting a paediatric difficult airway – a pilot study
Mary Claire Avanis¹, Lizanne O'Donohoe², Nadine Dobby², Kar-binh Ong²
¹Whittington Hospital, London, UK, ²Great Ormond Street Hospital, London, UK

Introduction and aims
Difficult airways are associated with morbidity and mortality in general anaesthesia. Predicting a potentially difficult airway is paramount to ensure patient safety.

Most children with difficult airways have an associated syndrome, but the incidence is unknown in the general population. Airway assessment in paediatrics is performed poorly and infrequently compared with adults. To date, there are no validated tests for pre-assessment of the paediatric airway.¹

Our main aim is to develop an airway pre-assessment tool for children and to identify the incidence of difficult airways in the general paediatric population. Based on information from the GOSH database, 10,000 assessments are required to sufficiently power this study. Given the large volume of data required, we carried out a pilot study to determine feasibility of data collection and to identify potential problems with study design.

Methods
The project was registered with the audit department. The airway assessment tests incorporated in the tool resulted from a combination of literature reviews, expert opinion and a survey of APA members. Any patient requiring intubation could be included in the study.

The airway pre-assessment was conducted in a standardised manner by a member of the study team. An independent, blinded anaesthetist managing the case documented the ease of mask ventilation and intubation according to American Society of Anesthesiology Task Force definitions.²

Results
Data was collected from 150 patients over a 6-week period, with approximately 10-25 per day; each assessment taking up to 2 mins. Overall assessment compliance was greater in children above the age of 2.

We identified:

- trends of normal measurements of assessment parameters for different age ranges eg mouth opening, thyromental distance
- all difficult intubations occurred in children with a syndrome; each had multiple anomalies with their airway
- difficult mask ventilation was associated with syndromes and maxillary hypoplasia in older children; the infants did not have any obvious airway anomalies

Discussion and conclusions
Our results confirm that the airway pre-assessment tool is applicable in children over 2 years. Adjustments to the assessment tool are required for younger children due to non-compliance. In terms of the feasibility of our future study, whilst airway pre-assessment is quick, overall data collection from multiple patients is time consuming. In order to achieve the large volume of data collection required, we plan to involve pre-assessment clinics and collaborate with other institutions in addition to applying for funding for dedicated staff.

References
Service evaluation of adenoidtonsillectomies to improve quality of care delivered at a tertiary referral centre
Smita Bapat, Navjot Panesar, Bejal Patel, Karen Wouters
Evelina London Children's Hospital, London, UK

Introduction
The Royal College of Surgeons England (RCSE) have identified that children undergoing adenoidectomy and/or tonsillectomy (AT) who develop perioperative problems have established risk factors. It is recommended that this group and those with severe obstructive sleep apnoea (OSA) undergo AT at a specialist centre where paediatric high dependency (PHDU) and intensive care facilities (PICU) are available\textsuperscript{1}. Data estimates respiratory complications arise in 20 - 25 % of children with comorbidities and severe OSA following AT. However, there is a paucity of data to guide postoperative care in children with severe OSA alone.

Aim
To establish prevalence of OSA, risk factors present and utilisation of PHDU and PICU so that we may better plan our service.

Methods
We conducted a retrospective review of all ATs performed between March 2013 and February 2014 using Galaxy theatre and Electronic Patient Records systems.

Results
There were a total of 875 ATs; 259 adenoidectomies, 79 tonsillectomies and 537 adenoidtonsillectomies. A clinical diagnosis of OSA was made in 78 % of children with a median age of 45 months at surgery. Established high risk factors present included age < 24 months (75), cerebral palsy (16), obesity (9), craniofacial abnormalities (5), neuromuscular disorder (3), mucopolysaccharidosis (1), ECG or echocardiogram abnormality (4) and other significant comorbidity (72). Admissions were day cases (41.5 %), monitored overnight (49 %) or had > 1 night stay (9.5 %). PICU was required in 3 and PHDU in 55 children. Unavailability of PHDU or PICU led to 10 cancellations. Oximetry was undertaken in 65.5 % requiring PHDU or PICU facilities. Of these, 36/55 and 0/3 admitted to PHDU and PICU respectively had an oxygen saturation nadir of < 80 %.

Discussion
Our institution has a prevalence of OSA, comorbidities and length of stay similar to another comparable centre\textsuperscript{2}. Not all children admitted to PHDU and PICU had severe OSA as defined by RSCE criteria. We demonstrated destination for postoperative care is also guided by comorbidities rather than oximetry alone and believe this reflects current clinical practice. Cancellations were minimal but greatest demand was for PHDU care. We propose improved list management and establishment of an extended and overnight recovery programme to mitigate this. Lastly, we require a validated risk assessment tool that takes into account severity of OSA and established high risk factors enabling us to more reliably predict the need for PHDU and PICU and improve quality of care delivered.

References
A study of intra-operative regional analgesia for paediatric hypospadias repair over a 5-year period
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Brighton and Sussex University Hospitals NHS Trust, Brighton, East Sussex, UK

Introduction and aims
Hypospadias occurs in 1:350 male births. Corrective surgical management is recommended between six to eighteen months of age. General anaesthesia with supplemental caudal block is usually the technique of choice to provide optimal operating conditions and superior post-operative analgesia. We present a study of intra-operative analgesic technique and outcomes for hypospadias repair over a five-year period.

Methods
We queried the Paediatric Surgical Database to capture all cases of hypospadias repair from August 2009 to October 2014. All children aged up to 18 years were included. Retrospective data were collected from the anaesthetic chart, drug chart, surgical care pathway and operative notes.

Results
252 cases of hypospadias repair were performed over the five-year period. 249 cases were included, as three sets of case notes had incomplete data. The majority of surgery was performed in children under 5 years of age (0-2 years: 53%; 2-5 years: 37.3%; 5-18 years: 9.6%).

242 patients had a single-shot caudal block using 0.25% Levo-Bupivacaine, of which 7 patients received ketamine or clonidine as additives. Ultrasound was not used in any of the cases. Caudal block was abandoned in 2 patients due to technical difficulties (1 had blood in the cannula and was rescued to a penile block; 1 had multiple attempts and was abandoned), resulting in a technical-failure rate of 0.8%. Overall, 5 patients had a penile block and 2 patients did not receive any block. 39.25% of children receiving a caudal block did not receive intra-operative opioids. 72% of children receiving a block did not receive post-operative opioids (caudal block: 71.9%; penile block: 80%)

Discussion
Our institution’s almost universal use of caudal blocks as the analgesic approach appears consistent with available literature1. Although ultrasound-guided caudal blockade is becoming increasingly popular2, we report a high success rate without use of ultrasound. Our caudal block failure rate of 0.8% was lower than the 2% quoted in the literature1.

A significant proportion of children did not require intra-operative opioids. Similarly, the majority of children receiving blocks did not require post-operative opioids. We believe that the reduction in use of opioids translates into fewer side effects for our patients.

Conclusion
Use of intra-operative regional analgesia can facilitate delivery of opioid-sparing anaesthetics with a better patient experience. Given the success rate of caudal blocks in this study, use of ultrasound may not provide additional benefits.

References

Funding & competing interests
None.
One year of anaesthesia for MR Scans - a service evaluation
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University Hospital of South Manchester, Manchester, UK

Introduction and aims
The University Hospital of South Manchester established a new service one year ago. This was to accommodate children requiring magnetic resonance (MR) scans under general anaesthetic. The framework for this service was based on visits to other hospitals with established, regular, lists. A list of three to six children was provided once per month, with the aim of completing an MR scan under anaesthesia as a day case.

We aimed to evaluate, retrospectively, the first year of the service. This included patient characteristics, typical patient journey, unanticipated complications and parental satisfaction with the experience.

Methods
Case notes for each child undergoing MR scan in the first year of the service were retrospectively evaluated. Patient age and indication for MR scan were recorded. Times of arrival, scan and discharge were taken with any complications recorded by anaesthetic staff, ward or recovery nurses. Parental satisfaction surveys were given out to a sample of parents to gauge their opinion on various aspects of the service.

Results
52 patients underwent anaesthetic for MR scan, all had successful imaging. Ages ranged from fourteen months to sixteen years with an average age of three years and ten months. The most common indication for the scan was developmental delay in 48% of patients; this was followed by seizures accounting for 19%. Other indications were varied and included headaches, microcephaly, macrocephaly, tuberosclerosis and spina bifida.

All patients arrived to hospital between 7:30am and 9:00am with scans running from 8:45am to 12:00pm. Average time from scan to discharge was 1 hour 47 minutes with a range of 1 hour 10 minutes to 6 hours 40 minutes. Only two patients had a time from scan to discharge greater than 3 hours 50 minutes; one of which was the only recorded patient to have nausea and vomiting. No other complications were recorded and no patients required readmission after discharge.

All parents surveyed rated the service as excellent. All parents felt adequately prepared for the day and felt that the explanations they received were excellent. Individual aspects of the day fairied equally well with no one giving any complaints or negative comments.

Discussion and conclusion
This is a new service provided by a non-specialist paediatric hospital. Detailed examination of case notes for all patients listed in the first year demonstrated an efficient and effective service. In spite of a complex and varied case load there were no complications of anaesthesia save one case of anaesthesia induced nausea and vomiting. This performance has resulted in a service that parents have been very satisfied with.
A review of equipment and strategies available for intraoperative ventilation in neonates
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The Evelina London Childrens Hospital, London, UK

Introduction and aims
We initiated a review of all equipment and ventilation strategies available for intraoperative ventilation in neonates at our institution.

The review was stimulated by concern regarding a number of neonates who had poor postoperative blood gas results. This was most notable in neonates <2 kg and with ASA grades 3-5. The gases seen commonly had a mixed respiratory and metabolic acidosis. We felt we could improve on the respiratory acidosis component caused by hypercarbia reflecting intraoperative hypo ventilation. We acknowledge intraoperative ventilation in neonates is challenging and its difficulties multi factorial.

We were particularly interested to review and modify the breathing circuit and HME/F’s (Heat and Moisture Exchange /Microbial Filters) to minimise dead space.

Prior to this review our standard practice was to use Drager Primus Anaesthetic Machines, a Intersurgical paediatric breathing circuit, a Intersurgical clear therm micro HMEF or a Drager twinstar 10a/8 HMEF or a Teleflex humidifier and a Intersurgical clear guard midi breathing filter at the expiratory port on the Drager primus machine. Ventilation strategy options were selected by Consultant Paediatric Anaesthetists and included PC (Pressure Control), VC (Volume Control) and Vol AF (Volume AutoFlow ~ volume guarantee pressure regulated) and PS (Pressure Support).

We felt this system had significant dead space and could be reduced by modifying equipment and ventilation strategies.

Methods
1. We designed a breathing circuit specifically for neonates with the intersurgical team. Features include:
   - 10mm diameter tubing
   - Length options: 1.6m and 3.2m
   - Ported Y piece for gas sampling with luer elbow
   - Angle piece with minimal dead space
   - Patient use: 0-10kg.
2. A review of all HME/F’s available at our institution and we contacted manufacturers regarding the following parameters: minimal tidal volume required, weight, resistance, dead space.
3. Literature Review of intraoperative ventilation strategies available with the Drager Primus Options: PC/VC/VolAF/PS

Results
A literature review supports the use of VolAF (Volume Guarantee Pressure Regulated) for neonatal ventilation. There are very few studies related to intraoperative ventilation compared to the neonatal intensive care setting.

Our institution suggests the following strategy for ventilating neonates <3 kg intraoperatively:
- Intersurgical neonatal breathing circuit
- Teleflex humidifier (no microbial filter)
- Gas sampling via luer port on circuit.
- Fresh microbial filter on the expiratory limb of the circuit at the machine end
- VolAF mode on the Drager Primus
- Consider disposal of circuit after single patient use
- We have noted considerable improvement in postoperative gas sampling since the introduction of these strategies.

Discussion
We plan to conduct some formal studies in the future.

References
1. www.intersurgical.co.uk
2. www.draeger.com

Conflict of interest
None to declare
Challenges for the provision of paediatric anaesthetic services in a large, non-specialist centre
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Introduction and aims
Paediatric surgical services in the UK are classified as general and specialist\(^1\), usually defined as district general and specialist or tertiary hospitals. However, some hospitals fall between the two. Anaesthesia and intensive care work in our trust is split across two sites. The acute site receives paediatric emergencies and has paediatric HDU, short-term ICU and neonatal ICU provision, alongside some specialist surgical services. Acute paediatric care is delivered by the acute anaesthesia and ICU consultant rotas with an additional 1:5 paediatric anaesthetist rota supporting them for infants, neonates and seriously ill children. We surveyed consultants, to review current provision and identify development opportunities.

Methods
All 68 consultants were invited to complete an anonymous survey, comprising closed questions and free text responses. This explored current practice, service needs, competence in relation to patient age and attitudes to developing responsibility for paediatric cover.

Results
29 complete responses were received. 76% of respondents anaesthetised/stabilised children as part of their day-time work and 55% worked as the acute or ICU consultant. 34% provided no paediatric care, with 10% providing dedicated paediatric cover. 79% viewed the current paediatric rota as ‘an absolute requirement to provide a safe service’ and 21% as ‘useful but not essential’. 21% expressed interest in developing as paediatric anaesthetists, whereas only one wanted to join the paediatric rota. 55% agreed that ‘every anaesthetist should be able to anaesthetise/stabilise children aged 1 year and above’, whereas 45% disagreed.

Discussion and conclusion
The paediatric rota is a highly valued service and the majority wanted it to continue or evolve, citing an increase in paediatric specialists to facilitate a 1:8 rota. There seems to be a reluctance to care for young children. This may reflect changes in the Anaesthesia CCT, de-skilling from sub-specialist working or over-reliance on dedicated paediatric cover. Some felt that responsibility for paediatrics had unnecessarily been removed from them previously, due to heightened governance and a lack of opportunity to maintain their skills. Consultants were open to providing more day-time paediatric care with support, but few felt able to join the rota. This enthusiasm is rarely capitalised upon and often superseded by service provision, despite recommendations that this be encouraged and supported\(^2\). We recommend introducing measures to support consultants who wish to develop as paediatric anaesthetists, whilst ensuring that everyone has the opportunity to maintain their paediatric skills. This should include enhanced training relationships with regional centres.

References
2. Guidelines for the provision of anaesthetic services: Paediatric anaesthesia. Royal College of Anaesthetists. 2014
Won’t someone think of the children? A survey of consultant exposure to anaesthetising infants in a large district general hospital
David Marriott, Matthew Walters
Derby Hospitals NHS Foundation Trust, Derby, Derbyshire, UK

Introduction
The Royal College of Anaesthetists requires that "Wherever and whenever children...undergo anaesthesia...they must be looked after by staff with relevant experience" and "should be led and organised by consultants who maintain competencies". District general hospitals are expected to be able to provide resuscitation and stabilisation of babies and children for transfer¹ ². District general hospitals face difficulties maintaining this required competency and experience following increasing regionalisation of specialist anaesthetic services. In our department, identification of specific paediatric anaesthetists ensured relevant experience, but decreasing cases have reduced exposure.

We aimed to determine the infant caseload of paediatric anaesthetic consultants at our centre.

Methods
The records contained upon the theatre management software (ORMIS) at Royal Derby Hospital were scrutinised from November 2010 to April 2014 for all children under one year.

Results
In 42 months, 464 infants were anaesthetised. Six monthly case numbers varied from 87 cases initially to 45 in the last time period. Nine consultants were identified as having a specialist paediatric interest. Non-specialists anaesthetised 50 infants; 38% of the cases during the first six months, reducing to 10% or less over the remainder of the time representing 0.5 cases per month. Of the nine specialists, only four averaged over one case per month, the highest rate being 1.8. The other specialists averaged 0.6-0.9 cases per month.

Discussion
Caseload varied between consultant and over the period. It is difficult to use caseload to describe a "consultant who maintains competencies" as no defined minimum exists¹. Current opinion is split regarding the use of numbers to represent skill³; using such markers may misrepresent continual development of a competent professional⁴.

Decreasing numbers due to regional reorganisation may threaten the skills of the district general paediatric anaesthetist in stabilisation of the seriously unwell child. This is important in Derby as our regional hub and spoke model requires this. Case number variation between individuals also implies variable experience within the on call rota.

Options to ensure experience include simulation, temporary contracts in tertiary centres, charity and overseas work.

In conclusion, increasing specialisation may lead to variation in experience of caring for infants in district general hospitals impacting upon the safe care of these patients in emergency settings.

References
2. Royal College of Surgeons. Ensuring the provision of general paediatric surgical services in the district general hospital. 2010.
Closing the loop and maintaining the standard - a re-audit of the rate of PONV after paediatric strabismus surgery following the introduction of an anaesthetic protocol

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PONV is common after paediatric strabismus surgery. Locally ophthalmic surgery for children is performed as a day case procedure. Our hospital has no capacity for admitting paediatric patients without transfer to a neighbouring hospital so it is very important that PONV is minimised.

A previous audit following the introduction of a multimodal anaesthetic pathway for these patients included pre-emptitive anticholinergics to avoid vagal response during surgery, multi-modal simple analgesia with no opiate analgesia, intraoperative administration of antiemetic and intravenous fluids. This showed that adhering to an anaesthetic protocol could result in low PONV rates, high patient satisfaction and timely day case discharge. Since then patients have also been encouraged to drink water and/or jelly up until 6am on the morning of admission.

We re-audited compliance with the anaesthetic protocol to ensure standards are being maintained.

Methods
All paediatric patients undergoing strabismus surgery over a 9 month period were included. The incidence of vomiting and compliance with the pathway was audited. Gold Standards were 10% and 100% respectively. The POVOC score was calculated to assess risk of PONV. Incidence of PONV was recorded in recovery and at 24hrs with a follow-up phone-call that also determined patient/parental satisfaction. Prolonged recovery or inpatient admission was also audited.

Results
56 children were included. 7 patients (12.5%) experienced PONV of whom 1 (1.8%) vomited and 0 (0%) required antiemetic in the recovery period. These results were compared to those from the original audit where 12% experienced PONV, 6% vomited and 5% received rescue antiemetcs.

38 patients (68%) received intravenous fluids (100% in original audit) and 52 patients (93%) received anti-emetics intra-operatively with 43 (83%) receiving both ondansetron and dexamethasone (100% and 76% respectively in original audit). Anticholinergics were given in 27 cases (48%), a significant fall from 71% in original audit. 53 patients (95%) received simple analgesia, with 44 (83%) receiving both paracetamol and diclofenac, which is an improvement compared to 73% previously. 12 patients (21%) received additional opiates, up from 6% previously.

Only 57% of patients had water that morning with 36% having jelly.

All parents were satisfied with anaesthetic care, no children required prolonged recovery or inpatient admission.

Discussion
Introduction of an anaesthetic pathway resulted in low PONV rates, high patient satisfaction and timely day case discharge.

Our re-audit has shown that low rates of PONV have been maintained, combined with a lower rate of vomiting. Satisfaction remains high. Although fewer patients received IV fluids and anticholinergics a higher % of patients received multi-modal antiemetics and analgesics. Having water or jelly on the morning of surgery should be encouraged further and steps taken to re-inforce adherence to all aspects of the protocol.
National survey of perioperative pain management for Adolescent Idiopathic Scoliosis (AIS)
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Introduction and aims
Pain management for Adolescent Idiopathic Scoliosis (AIS) is complex. Recent literature review suggests a multimodal approach with Continuous Epidural analgesia (CEA) being both efficacious and safe. The aim of this survey was to review current UK practice in light of recent evidence.

Methods
An online survey tool was used. Anaesthetists from 18 UK centres doing regular spinal surgical lists were invited to participate in an 11 -part questionnaire via email. Completed responses were collated and analysed using standard tabulations.

Results
We received 56 responses. Of 46 completed responses 44 respondents (95.4%) use intravenous opioids for patient or nurse controlled analgesia (PCA/NCA). Regarding neuraxial technique, 13(28.3%) use CEA and 4 dual catheter. 9(19.6%) respondents use pre or intraoperative intrathecal (IT) opioids. Amongst the adjuvants, Ketamine is commonest and used by 25(54.3%), alpha agonists by 21(45.6%), Magnesium by 12(26%) and Gabapentin by 20(43.5%) respondents. Majority (41) use NSAIDs started on Day 0 or 1 except 4 who don’t use NSAIDs.

Discussion and conclusion
Intravenous opioids have traditionally been the mainstay of perioperative pain management in AIS, as also reflected in our survey.

Our survey showed that 48% never use neuraxial techniques. This is surprising given that there is reasonable evidence to support the use of CEA and IT opioids. CEA is safe and beneficial in providing better postoperative pain control, higher patient satisfaction and possibly early return of bowel function (1,2). Safety, inability to perform neurological assessment and surgical preference could be plausible explanations for their limited use.

Interestingly, adjuvants are widely used particularly Ketamine and Gabapentin, despite paucity or lack of evidence to support their use in AIS. Analysis of 6 RCTs mostly revealed Ketamine to be neither opioid sparing nor affecting the pain and sedation scores (3).

A limitation of this survey was the inability to use the APA database as adult anaesthetists also regularly anaesthetise for AIS thus making it difficult to know the total number to target. Despite this, we had 56 responses and interesting findings.

In conclusion, a wide variety of pain relief options are used. IV opioids continue to be predominant; adjuvant analgesics are popular whilst neuraxial techniques are used by less than 50%. Further studies are needed to evaluate the use of adjuncts.

References
Paediatric emergence delirium: An evaluation of cases at Southampton University Hospital
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Introduction
Emergence delirium (ED) is commonly seen in paediatric anaesthesia, reported as affecting 2-80% of cases.\(^1\) Defined as “a dissociated state of consciousness in which the child is irritable, uncooperative, incoherent and inconsolably crying”, it can have immediate consequences, including disruption of surgical repair, injury to the child or staff, as well as being distressing to observe. Furthermore, it is associated with behavioural changes for up to two weeks following surgery such as tantrums, separation anxiety and enuresis.\(^2\)

Our project aimed to determine the incidence of emergence delirium in our hospital, as well as look at some factors traditionally associated with it.

Method
Anaesthetists completed a form for all children between 18 months and 15 years undergoing anaesthesia. Data was collected on age, sex, surgical speciality, induction and maintenance technique, use of pre-medication, and anxiety.

Recovery staff completed the remainder of the form 10 minutes after the child awoke. Each child was scored on the PAED emergence delirium scale (the only ED scale to be reliability and validity tested)\(^3,4\) and on the WATCHA scale, suggested to be more sensitive and specific than the PAED scale.\(^4\)

Results
Data was recorded for 74 children. 46% male, mean age of 7.3 years, range 1-15 years. Using the PAED scale (score ≥10) 11 cases of ED (15%) were identified. 10 cases (12%) were identified with a WATCHA score ≥3. 14 cases (19%) had either a positive PAED or WATCHA score.

We found no link between type of surgery, maintenance technique or pre-op anxiety and ED. There was a correlation between sevoflurane induction and ED (used in 86% of cases) compared to 38% of non-ED cases.

There was also an inverse relationship between age and ED, with the mean age of cases 4.4 years, compared to 8 years in the non-ED group.

Discussion
Emergence delirium is a frequently occurring issue, affecting between 15 and 20% of our cases. We did not identify a link between our cases and the usual risk factors identified with ED. We did identify a link between sevoflurane induction and ED, and also younger age and ED. However, this may be a confounding factor as sevoflurane induction is more commonly used in younger children. We plan to implement strategies to reduce ED and then re-evaluate.

References
The paediatric acute pain service at the Great North Children’s Hospital: A survey of patient/parent satisfaction
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The Great North Children’s Hospital, Royal Victoria Infirmary, Newcastle-upon-tyne, UK

Introduction and aims
The National Service Framework (NSF) for Children states that children have a right to appropriate assessment and control of their pain. At the Great North Children's Hospital, there is only one Paediatric Specialist Pain Nurse and no Consultant Anaesthetist allocated to a session in paediatric acute pain. We wanted to evaluate the current service from a patient perspective, in order to highlight areas for improvement.

Method
We designed a survey to be completed by the patient (if old enough to do so), or by their parent as proxy. The survey consisted of 9 questions with pre-determined responses that the patient/parent could choose.

The survey was distributed by the ward nurse, post operatively, to any child with patient controlled analgesia, nurse controlled analgesia, an epidural or a nerve catheter. The patient/parent then completed the survey, which was later collected by ward staff.

Results
107 questionnaires were completed. 3 were omitted from analysis as page 2 of the questionnaire was not completed. Therefore, 104 questionnaires were analysed, however, not every patient completed all questions.

77/103 patients/parents stated that written information (given to them pre-operatively) about pain control would be valuable.

With regard to visits by the pain nurse, only one child reported they were not visited, 5/103 answered “don’t know” and 5/103 answered “infrequently”. Of those visited, the vast majority (92/103 patients), were happy or very happy with their visit.

Regarding visits by the pain doctor, (anaesthetist), 9/104 patients were not seen at all, and 6 /104 said they were seen infrequently. 12/104 reported that they didn’t know if they had seen a pain doctor. Of those visited, 60/104 found the visit of great value.

Overall, 96/104 reported their pain control as good or excellent.

Discussion
Some of the NSF goals are being met, but improvement is needed. Analysis of the results highlighted a fragmentary pain service out of hours and at weekends. During these times it falls to the on call registrar to deliver the service, whilst also trying to cover emergency theatre work.

More staffing is required, ideally, 2 full time paediatric pain nurses, supported by a Consultant session in paediatric acute pain.

We have now introduced a paediatric pain nurse on Saturday mornings. Child and parent friendly written information leaflets have been produced to be given to patients pre-operatively. We also intend to carry out further work to specifically look at surgical procedure and post-operative pain scores.

Reference
A survey of analgesic practice amongst anaesthetists for adenotonsillectomy/tonsillectomy surgery in the North West Deanery
Matthew Bowler¹, Jacques Diacono²
¹Royal Blackburn Hospital, Blackburn, Lancashire, UK, ²University Hospital of South Manchester Foundation Trust, Manchester, Greater Manchester, UK

Following the MHRA Drug Safety Update (July 2013) advising on restriction of codeine use in children, many anaesthetists have changed their practice with perioperative analgesia use including “take-home” analgesia. This is particularly an issue for tonsillectomy/adenotonsillectomy surgery. We assessed current analgesic practice amongst all anaesthetists in the UK North-West training deanery.

With an online survey website we surveyed the tonsillectomy/adenotonsillectomy analgesic practices of 77 consultants, 31 trainees and 5 SAS anaesthetists in hospitals from small DGHs up to a large tertiary paediatric hospital.

Children with all degrees of sleep apnoea were anaesthetised. The frequency of anaesthetising for such a list was normally distributed, and most commonly monthly. 25% did not prescribe preoperative analgesia. Where preoperative paracetamol was prescribed, a 20mg/kg loading dose was given in only 50% of cases. Similarly, where preoperative ibuprofen was given, 7.5 mg/kg was given in only 9% of cases. Various perioperative opioids were used; combined IV fentanyl and IV morphine the commonest (45%), followed by IV morphine alone (34%) and fentanyl alone (14%) and a number of other combinations including tramadol, oxycodone and alfentanil. Oral morphine solution was the principle postoperative opioid analgesic. In children under 12 years, where postoperative oral morphine was prescribed, 48% of oral morphine prescribers utilise lower doses (50-190 micrograms/kg) and 51% use higher doses (200-300 micrograms/kg). Conversely, over 12 years higher dose oral morphine was predominantly used (61%), although 19% of all responders also/only prescribed codeine phosphate. In the majority of units surgeons prescribe take home analgesia, making practice difficult to assess.

The use of codeine in all age groups has declined. Despite still being licensed in individuals over 12 years of age without sleep apnoea, its use is minimal. The treatment of moderate postoperative pain has been replaced by oral morphine at varying doses. Despite a consensus guideline from the major colleges (RCOA, 2013) there is an absence of definite best practice evidence and guidance for adenotonsillectomy/tonsillectomy surgery. In addition, a lack of a commonly used moderate opioid analgesic has led to a variability in drug choice and dosing based on non-evidence based experiences. Considering 59% of individuals surveyed anaesthetised such cases monthly or less, there is a need for targeted evidence-based guidance.

References
Audit of the anaesthetic management and patient outcomes of endoscopic tympanoplasty compared with open tympanoplasty surgery
Emily Johnson, Joy Abbott, Evripidis Tokidis, Kate Thomas, Konstance Tzifa
Birmingham Children's Hospital, Birmingham, UK

Introduction and aims
Endoscopic surgery is increasingly used for tympanoplasty surgery at Birmingham Children's Hospital as an alternative to an open procedure. There are a number of advantages to endoscopic surgery including improved surgical access, lower infection rates and improved cosmetic results. Increased likelihood of discharge home on the day of surgery is also perceived to be an advantage.

The aim of this audit was to assess whether there was an improved perioperative outcome in endoscopic surgery that would support the development of a day case pathway (for appropriate patients).

Methods
We audited the management of 17 endoscopic cases in 2014, comparing a number of outcome measures to 17 open cases performed over the same time period.

Results
The demographic details of both groups were similar and all of the cases were performed by consultant surgeons and consultant anaesthetists. The endoscopic group had a greater percentage of ASA1 patients (82%) compared to 53% in open group.

The majority of endoscopic procedures lasted between 1-2 hours (range 45 to 285 minutes). In comparison, the majority of open procedures lasted over 3 hours (range 30 to 225 minutes). All children undergoing open surgery stayed in hospital for at least one night postoperatively, whereas only 65% of endoscopic procedures needed an overnight stay. 35% of the endoscopic group were day case.

Techniques of induction of anaesthesia were similar for both groups. Total intravenous anaesthesia was used more frequently in the open group than endoscopic group (6% endoscopic, 35% open). Those undergoing an open procedure were more likely to receive local anaesthetic infiltration by the surgeon (47% endoscopic, 81% open).

Post-operatively, analgesia requirements were lower in the endoscopic group. The mean number of doses of simple analgesics in the endoscopic group was 3.6 doses compared with 5.5 doses for open surgery. Opioid administration intra-operatively was comparable for both groups (53% endoscopic, 47% open) but postoperative requirements significantly lower following an endoscopic approach (31% vs 63%).

Both groups received ondansetron and dexamethasone routinely for anti-emesis intra-operatively. The proportion of children requiring further doses of anti-emetics post-operatively on the ward (59% endoscopic, 50% open) and total number of doses was similar for both groups.

Discussion
This audit demonstrates the successful performance of paediatric endoscopic tympanoplasty as a day-case procedure. Two of the main factors affecting successful day case surgery are likely to be the shorter duration of surgery and lower post-operative analgesic requirements. The differences in outcome could in part be explained by the potential bias introduced by the selection of appropriate cases for an endoscopic approach.
Adenotonsillectomy for sleep disordered breathing - an audit of peri-operative practice
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Royal Manchester Children’s Hospital, Central Manchester University Hospitals NHS Foundation Trust, Manchester, UK

Introduction and aims
Sleep disordered breathing (SDB) is a continuum of upper airway obstruction from snoring to obstructive sleep apnoea (OSA). The decision to operate on children with SDB is based on symptom severity and overnight oximetry (OOX) results. Whilst adenotonsillectomy may benefit these children, those with OSA have increased incidence of postoperative respiratory complications. We aim to compare current peri-operative practice with local standards.1

Methods
A 3 month retrospective audit was undertaken. Adenotonsillectomies cases were identified via clinical coding and notes reviewed using a proforma. Local standards were as follows: (1) All listed for adenotonsillectomy suspected to have SDB need preoperative OOX study; (2) Patients judged to be severe OSA or high risk warrant consideration of postoperative critical care; (3) High risk cases require consultant presence in theatre; (4) High risk cases should be appropriately highlighted on the theatre management system (ORMIS). We categorised high risk using RCPCH consensus criteria2 and severe OSA using oxygen desaturation index (ODI).

Results
130 cases were identified. SDB was the documented surgical indication in 81 cases, which were reviewed. The mean age was 6 years (21 months - 16 years) and mean weight 28.6kg (8-154kg). 70 patients (87%) underwent preoperative OOX with 15(21%) found to have severe OSA. 22 patients were categorised high risk based on aforementioned criteria, and postoperative critical care was considered in 16 (72%). While all lists containing high risk cases were assigned a consultant surgeon and anaesthetist, their actual intraoperative presence was uncertain. We noted significant under-utilisation of ORMIS alert functions to indicate high-risk cases. 12 cases identified as high risk were admitted to critical care postoperatively and 3 unplanned critical care admissions occurred due to unanticipated intraoperative airway difficulties.

Discussion and conclusion
Good overall guidance compliance was demonstrated. Unanticipated identification of 3 differing OOX programmes with varying reference criteria was however concerning and consequent plans to rationalise such are in progress.

In 2014, our Paediatric Extended Recovery Unit (PERU) opened enabling overnight postoperative level 2 care. Analysis of the 12 elective critical care admissions within our audit revealed an uneventful postoperative course. We therefore suggest increased utilisation of PERU thus maintaining critical care bed availability.

References
A good match? A comparison of paediatric anaesthesia consultant jobs at specialist centres with the number of specialty training posts available

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Introduction and aims
Working as a specialist paediatric anaesthetist (where workload consists of >50% paediatric anaesthesia) normally requires at least 12 months training in a specialist centre. This training can take place in the UK or overseas. Within the UK most specialist centers offer 6-12 month placements or fellowships. The total number of placements offered varies between the tertiary centres and are not recorded nationally. Likewise, there is no current formal method of recording consultant paediatric anaesthesia posts advertised and filled in specialist or district general hospitals.

Methods
Data on the number of consultant posts advertised per year in tertiary paediatric centres in the British Medical Journal during the period 2001 – 2013 was collected. Additional data on district general paediatric anaesthesia consultant posts and PICU consultant posts was also noted. Centres offering paediatric anaesthetic fellowships were contacted and the number of fellowships offered annually was clarified. A comparison was drawn between the number of consultant posts advertised annually and the number of paediatric anaesthetic trainees emerging from suitable training posts eligible to apply for those posts.

Results
From 2001 - 2013 a total of 275 specialist paediatric anaesthesia consultant posts were advertised in the British Medical Journal. The numbers tended to be fairly consistent annually and amounted to an average of 21 jobs advertised annually. From contacting the individual departments offering specialist paediatric anaesthesia fellowships, we found that there were approximately 29 12- month fellowships offered annually.

Discussion
In the interests of efficient workforce planning, and to prevent the unnecessary creation of expensive training posts it is important that the consultant posts available align with the number of trainees emerging who are suitable to take up these posts. Our data, although caveats exist in the collection thereof, shows that there is a reasonably good match between the two.
Post-operative analgesia following adenotonsillectomy - a telephone survey
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Introduction and aims
Tonsillectomy is a common paediatric day case procedure indicated for recurrent infection and obstructive sleep apnoea (OSA). In response to deaths in America from morphine toxicity, the Medicines and Healthcare Products Regulations Agency published guidelines (2013) prohibiting codeine for children under 12 years, or any child having tonsillectomy for OSA.

We audited compliance with the above guideline for paediatric tonsillectomy and reviewed efficacy of the perioperative analgesia provided by telephoning parents one week post discharge.

Methods
We prospectively reviewed 50 cases at University Hospital of North Midlands. Consent to follow up was obtained at the preoperative visit. Data collection was on a proforma completed by the anaesthetist, ward nursing staff and at follow up.

Results
Most children received simple analgesia perioperatively (49/50 received paracetamol, 46/50 received ibuprofen). 37 children also received an opiate. None of the five cases of post operative vomiting (PONV) had received intra-operative fentanyl but two had oramorph preoperatively. There were three readmissions for infection or vomiting. Eleven sought medical advice post discharge for antibiotics, analgesia or because of vomiting. 30/50 reported no significant pain postoperatively with regular paracetamol and ibuprofen. Of those reporting significant pain, most experienced it 5 or more days postoperatively. 32/50 children had five doses of oramorph (0.1mg/kg) in take-home medication (TTO). This was not required by 9; 23 found it beneficial but 7 thought the quantity was insufficient. Of 18 that did not have oramorph TTO, only 4 felt they would have benefitted from this prescription.

Discussion and conclusions
Regular simple analgesia should commence as premedication and continue post operatively. This provides sufficient analgesia for most children and could avoid the risks of opiates post discharge.

However, half of our cohort used oramorph at home and felt it was beneficial. We discovered the most significant pain was experienced at 5+ days postoperatively, perhaps because this correlates with the oramorph TTO supply running out, suggested by seven requiring more than the amount dispensed, although most parents gave nightly doses for 1-2 days only. Therefore, five doses is sufficient for the majority and should be included in the TTO.

The majority of the children readmitted were from the cohort given oramorph; therefore, it is possible that the aetiology of some complications (vomiting, infection) relates to oramorph. Our results do not suggest that fentanyl use causes PONV; it seems reasonable to administer this as indicated on an individual basis.

Overall, practice at UHNM complies with the MRHA guideline and use of alternative analgesia is effective for children undergoing day case tonsillectomy.

References
Development of a paediatric scoliosis surgery service: The first 18 months at The Royal London Children’s Hospital
Simon Matthews, Naomi Edmonds
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Introduction and aims
The Royal London Children’s Hospital opened a brand new scoliosis service in February 2013. This summary of a retrospective review of the first 18 months provides firsthand insights into this period of rapid service development. It shows the improvements, and the complications, seen in this exciting time.

Methods
Parameters for review were decided with the surgical, anaesthetic and critical care teams. Patient notes were then manually reviewed and results collated within an Excel spreadsheet.

Results
27 procedures were eligible, of these 25 notes were available. 20 patients were female and 5 male; average age was 14.1 years (range 11-17); average weight was 51.9kg (range 39.9-70.0) and 80% were ASA 1. 24 of the patients were being treated for idiopathic scoliosis with mainly posterior corrections and instrumented fusions.

Average anaesthetic time was 91min: for the first five patients this was 114min; the most recent five 83min (a 27% reduction, p-value 0.06). Similarly, average surgical time was 338min: first five patients 441min; most recent five 304min (a 31% reduction, p-value 0.03). Average admission was 8.0 days: first five 8.2 days; last 7.8 days. Critical care admission was 20h on average: first five 15h; last five 25h. 4 patients were extubated on critical care rather than in theatre, none of these in the final six months. 11 patients required post-operative vasopressor/inotrope support: this was spread throughout the cohort.

Cell salvage was used in 21 of the cases. The average amount returned was 291ml. Patients spent an average of 4.2 days using a PCA.

Complications
No post-operative venous-thromboembolic complications or wound site infections were observed. There were two incidences of possible nerve damage. Three individuals had grade 1 pressure areas noted post-operatively, all resolved. One respiratory tract infection, and one presumed urinary tract infection were seen. One patient required a general anaesthetic for drain removal.

Discussion
During the first 18 months of this service there was a reduction in anaesthetic and surgical times. However, this was not matched by a similar reduction in inpatient stays. This may be due to a minimal requirement for high-level inpatient analgesic support while regaining mobility.

Critical care appears necessary post-operatively for circulatory support, but this is not true for invasive ventilation once anaesthetic techniques are adjusted to achieve timely extubation.

Cell-salvage should be a part of any scoliosis service, returning approximately a unit of blood to each patient it is used on.

Finally, the rates of complications seen during the initiation of this new surgical service are low. This is reassuring both for clinicians starting similar services elsewhere and for their patients.
Management of paediatric difficult airways at the Evelina London Children’s Hospital
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Introduction and aims
With many options available for the anaesthetist to manage a paediatric difficult airway we wanted to establish which techniques are being used in a busy London teaching hospital and the outcome of these different techniques.

Methods
The Evelina has three difficult airway trolleys. We audited their use over a six month period from August 2014 to January 2015. Data was gathered using a form to be completed by any anaesthetist using the difficult airway trolley. The data collected included patient demographics, grade of anaesthetist, whether the airway was predicted to be difficult, ease of mask and/or LMA ventilation, grade of laryngoscopy, if additional help from another anaesthetist was asked for, a free text box for a description of how the airway was managed, whether the intended surgery was completed, adverse patient outcomes and any problems with the equipment used.

Results
We received 24 completed forms. Ages ranged from 12 weeks to 13 years. A consultant anaesthetist was present in all cases of difficult airway management. Equipment used in these cases included the Glidescope®, Airtaq®, Bonfils® Intubation Endoscope, and a Seldinger technique involving an LMA, bronchoscope, guidewire, Cook® airway exchange catheter and endotracheal tube. The most frequently used piece of equipment was the Glidescope®. There were however several comments describing a good view of the larynx when using the Glidescope® but passing the endotracheal tube required multiple attempts.

There were 3 cases of failing to secure an airway with the first chosen piece of equipment from the difficult airway trolley. The Glidescope failed to secure an airway twice and the Bonfils once. In these cases the technique then used to secure the airway was the Seldinger technique described above. There were no reported cases of this technique failing to secure an airway either when used as the primary method or following failure of another difficult airway technique. Problems with equipment that were identified included a dim or failing light source of the Glidescope® and bronchoscope.

There were two episodes of difficult mask ventilation and no instances of “can't intubate can't ventilate”. There was one unplanned ventilated PICU admission as a result of airway management, with no long term adverse sequelae.

Discussion and conclusion
Problems with the Glidescope® and bronchoscope light source were addressed and remedied. The LMA, fibrescope, wire, Cook® exchange technique never failed to secure an airway and has become the ultimate fall back position for management of the paediatric difficult airway at The Evelina London Children’s Hospital. Having demonstrated the above we are now promoting this technique and running mannequin based teaching sessions for consultants, registrars and ODPs. We plan to re-audit the use of our difficult airway trolleys following these teaching sessions.
Use of a modified WHO checklist for corrective cleft surgery during an overseas outreach project: a safety improvement initiative
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Introduction and aims
Northern Cleft Foundation (NCF) is a UK based charity that undertakes outreach projects to India providing free cleft lip and palate operations. Since 2001 the charity has provided surgery for over 1000 patients. The NCF offers high quality anaesthesia and surgery led by UK based consultants and continually seeks to improve the quality of its service. The charity runs an annual outreach project to the Mure Memorial Hospital in Nagpur, India. Results from a 2014 audit suggested the introduction of a WHO checklist as one area of improvement. Following this intervention, a repeat audit was carried out with the aim of improving patient safety.

Methods
Data on all operated patients was collected prospectively. This consisted of basic demographics, type of surgery, associated syndromes, peri-operative management including induction, airway management, analgesia and incidence of immediate complications and critical incidents.

Results
The 2014 NCF team operated on 134 patients, aged 3 months to 37 years (mean 4.5 years), and weight range of 3.9kg to 67kg (mean 10.6kg). In 2015 the total number of patients was 105, aged 3 months to 30 years (mean 3.2 years) and weight range of 3kg to 53kg (mean 12.2kg). Both groups were comparable in terms of performed surgery (80% primary cleft repairs), co-morbidities and syndromes. The experience of both teams was consistent. The checklist compliance was 100%. We noted a similar incidence of difficult airway, accidental extubation and desaturation events. Whilst in 2014 inadvertent retention of a throat pack occurred on one occasion, no incidents were observed after introduction of the checklist.

Discussion and conclusions
The use of a modified surgical checklist for cleft surgery has been advocated by other outreach teams.¹ To our knowledge, we are first to assess the impact of this safety initiative. One of the essential objectives for safe surgery is preventing retention of swabs and instruments.² Following the introduction of the checklist we have reduced this event. We feel that engagement with the checklist has also improved teamwork and communication within a new team, in an unfamiliar environment. Successful implementation of the checklist requires continued engagement from the whole operating team. We plan to continue using this checklist on future outreach visits and further promote global surgical safety.

Acknowledgements
We would like to express our gratitude to NCF anaesthetists who helped with this audit (http://www.northerncleftfoundation.co.uk/about-us/) with special thanks to: Drs George Teturswamy, Pattabiraman Venkataraman, Mike Tremlett and Imogen Billingham.

References
Parental satisfaction survey - a quality assurance process
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Background and aims
Quality care has been in the agenda of most healthcare systems and the NHS Next Stage Review makes organisations accountable for quality by focusing on the measurement and reporting of care quality indicators. (1) Patient satisfaction is a central and frequently reported outcome measure of quality of care. Surveys and feedback are highly effective in measuring quality and quality improving strategies. (2) This survey of parental satisfaction reports the quality assurance indicator and the usefulness as an effective quality improvement tool at a tertiary paediatric centre.

Methods
This voluntary satisfaction survey consisted of a questionnaire, distributed to the parents of children undergoing surgery at RACH. It explored parental level of satisfaction along with effective communication of staff in areas that included preoperative anaesthetic information, fasting time, induction of anaesthesia, analgesia and overall care of the child in operation theatre and wards. A separate part enquired about the parents’ concerns about pain, nausea/vomiting and emergence delirium. An open-ended question permitted comments regarding any other issues.

Results
100 children undergoing surgery as day a case or extended day case were included. 60-70 % of the parents were extremely satisfied and 20% were satisfied with most aspects of care. 2 (2%) parents were dissatisfied with the waiting time to theatre while 1 (1%) was unhappy about and anaesthetic room respectively. Minor concerns were reported with respect to pain management (5%), nausea and vomiting (4%), emergence delirium (12%) and feeding (3%). 1 patient commented on the staff communication when her child’s operation was cancelled due to overrun of theatre time and was upset.

Discussion and conclusions
Patient surveys provide feedback about the quality of care provide and helps in quality improvement strategies. Achieving high standards of quality care is a vision at this tertiary referral center. Although our survey showed that patient care is optimal and safe, areas such as fasting and update to parents whilst waiting in the ward could still be improved. The survey also showed that the impact of the high incidence of postoperative delirium reported previously (3) does extend beyond early recovery and causes parental concerns contradictory to locally established views. This survey tool very acceptable to parents and staff and is an important instrument to enhance optimal and effective patient centred care. It is very acceptable to parents and staff.

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Improving standards in paediatric recovery and documentation in the University Teaching Hospital (UTH), Lusaka, Zambia: First audit cycle of practice following recovery nurse education

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Dr Rachel McKendry* et al (ST7 Anaesthetic Registrar Belfast City Hospital, NI)

Introduction
Avoiding adverse incidents during the postoperative period should be central to care provision in a paediatric surgical unit. 10% of all anaesthetic incidents occur during this time and adverse incidents in recovery are almost double that occurring intra-operatively. Standards vary globally and at the University Teaching Hospital, Lusaka, there are many avoidable incidents involving patient morbidity and mortality.

Methods
After the introduction of a recovery guideline and patient chart, compliance was audited over ten days. Following this, a recovery nurse education session using simulated recovery scenarios, the ABCDE approach and a logbook of training was implemented. This was then re-audited by the local anaesthetic trainees to close the first cycle.

Results
Compliance with completing the recovery chart dropped from 86% to 22%. Of the completed charts, though, documentation of name, procedure, saturations off oxygen, heart rate and conscious level remained over 90% compliant. Some areas improved such as documentation of handover time (86.6% to 95%) and documentation of temperature (88.3% to 90%), but documentation of pain level dropped from 91.6% to 86%. Time spent in recovery could be calculated in only 9.5% of completed forms in the re-audit in comparison to 53% in the initial audit. Areas requiring improvement have consistently been: pain relief given in recovery, time of discharge and signature of nurse. Feedback from the 10 attendees of the education session was positive, rating on average (0 not useful to 10 extremely useful) the introductory lecture 9.1, airway skills practice 9.3, scenarios 8.8 and overall training 9.5, and using comments such as “essential”, “very necessary” and “very important”.

Discussion and conclusion
This highlights a common problem in developing countries concerning safety awareness, documentation and guideline implementation. Adherence commonly decreases without an outsider “auditor” presence in theatre and recovery. Is this because without reinforcement, continuing education and governance, staff tend to resort to previous practices and habits? There is limited incentive for improving patient care and the environment is extremely challenging due to lack of equipment and skeleton staff. We have demonstrated that recovery nursing staff recognise the importance of training to improve the safety of their patients, but any change introduced must be sustainable. This can only happen with continued support, education and professional development.

References

Acknowledgements
The authors would like to acknowledge the ongoing financial support of THET and UK aid to the Zambia Anaesthesia Development Project.
Airway topicalisation for neonatal and infant microlaryngoscopy and bronchoscopy
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Introduction and aims
Airway topicalisation is required for microlaryngoscopy and bronchoscopy (MLB). There is scant evidence to support the dose used and how long a child should be kept nil by mouth for following topicalisation. The aim of our survey was to examine local airway topicalisation practice for MLBs in neonates and infants weighing <10 kg.

Methods
Ethical approval not required for this survey. Consultant anaesthetists at a tertiary paediatric centre were surveyed regarding their MLB topicalisation practice. Data collected included concentration of lidocaine used, dosage regimen, delivery device, anti-sialagogue use, fasting time after topicalisation and routine use of post-operative fluids.

Results
Eighteen consultant anaesthetists completed the survey (18/18, 100%). Seventeen (94%) anaesthetists use 1% lidocaine and one (6%) uses 2% lidocaine. All use a Mucosal Atomization Device for lidocaine delivery. There was a variation in practice regarding the calculation of lidocaine dose. Five (28%) use 2ml, 4 (22%) use 1ml, 1 (6%) uses 1-2ml, 3 (17%) use 2mg/kg, 2 (11%) use 3mg/kg, 1 (6%) uses 4mg/kg and 1 (6%) uses 0.1ml/kg. The anaesthetist who uses 2% lidocaine uses 1mls for neonates and 2mls for older children. No anaesthetist routinely uses an antisylagogue for MLBs. 16 (89%) anaesthetists choose to keep the patients fasted for 2 hours following topicalisation. One anaesthetist uses a 1 hour post-topicalisation fasting time, and one keeps them fasted for 4 hours. Twelve (67%) anaesthetists don’t routinely administer intravenous fluids after MLB. Of those who do use intravenous fluids, 5 (28%) use dextrose-containing fluids whilst one (6%) uses Plasmalyte.

Conclusion
Although some aspects of topicalisation practice for MLBs are similar between anaesthetists, there remains some variation. This may be due to the lack of published evidence to support the dosage for MLB topicalisation and necessary fasting times post-topicalisation. One must consider the risk of aspiration due to airway topicalisation and the risk of hypoglycaemia and patient suffering from prolonged fasting. A national consensus to guide practice is desirable.
The impact of emergence delirium on subsequent behaviour 2 weeks postoperatively
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Introduction
Emergence delirium (ED) is a type of early postoperative negative behaviour. Although self-limiting it can cause distress and physical harm to the child at the time. Following an episode of ED little is known about the post-operative behaviour changes that may ensue. The aims of this audit project were to compare the incidence of ED in our unit with that published in the literature. (10-80%) ¹ Patients with ED would be followed up at 2 weeks to assess behavioural changes.

Methods
Using an audit tool data was collected on all children having a general anaesthetic in the children’s theatres of Derriford Hospital over one week. Age, surgical specialty, pre-medication, cooperativeness at induction, induction agent and maintenance agent were recorded. Recovery staff recorded pain scores using an age-appropriate method. The Watcha score was used to detect ED. ED was defined as a Watcha score of ≥3. Patients with ED were followed up by telephone 2 weeks postoperatively. The parents were questioned about their child’s sleep, eating, school performance, daytime irritability, separation anxiety, and enuresis.

Results
Data was complete on 59/67 patients, median age 4.5 years (IQR 4-6 years). ED occurred in 10 patients (17%), 8 of whom were ≤ 6 years (80%). ENT and orthopaedics had the highest incidence of ED at 33% each. 2/6 patients developed ED who were uncooperative at induction (10%) 3 patients with ED (30%) had a pain score of >5. The correlation between pain and ED scores was 0.56. 7 out of 10 patients with ED were followed up at 2 weeks. Increased daytime irritability was the most common reported adverse change, 5 patients (71%). Sleep disturbance and worsening school performance occurred in 2 patients (29%). One patient had developed enuresis.

Discussion and conclusion
Our incidence of ED is similar to other studies (2). Those who are uncooperative at induction are at high risk of developing ED. High pain scores may have confounded results in 3 patients. We found that children who have ED are likely to have behavioural changes which impact on the child and parent up to 2 weeks following the episode of ED.

Proposed changes in practice:
1. Routine Watcha scoring in recovery to identify ED
2. Trial of Nurse protocol to treat ED using low-dose IV Fentanyl
3. Improve information regarding behavioural changes after discharge

References
Improving the experience of children with autism and their families in the perioperative period- 
work in progress
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Children with autism are very sensitive to changes in their daily routine. They may exhibit behaviours 
that can put them and others in danger. Unfortunately, the perioperative period is a perfect example of 
an unstructured and unpredictable time period for these individuals.

The aim is to develop a program that will improve the perioperative experience for children with 
autism and their families by creating a very patient specific approach and individualised care for every 
child. It is an effort of a multidisciplinary team, including nurses from the preoperative area and the 
recovery room, anaesthesiologists, CRNAs and child life specialists.

Methods
1. Predoperative preparation- We have developed an addendum to the preoperative interview 
for children with ASD. The questionnaire collects information about their baseline behaviour, 
comforting measures and important negative triggers that need to be avoided in the care of 
these patients and help the perioperative care team prepare better for their visit. Based on the 
preliminary data, in some cases a child life specialist makes a contact with the families in 
advance and work with them and in some cases even with the child’s teacher to help with 
preparation for his/her hospital visit.

An anaesthesiologist contacts the family to discuss in details previous experiences 
and formulate an anaesthetic plan, which will be communicated to the anaesthesiologist of the 

2. Admission to the hospital – In many cases private rooms are given to patients with ASD and 
their families. Patients are provided with favourite toys and activities.

3. Intraoperative period – A selected group of anaesthesiologists with interest in working with 
children with behavioural problems are assigned to the cases.

4. PACU - these patients are given a private room in PACU and parents usually are there on 
arrival from the OR, decreasing agitation and fear from the new environment in the early 
post-anesthesia period. Based on data collected from the perioperative interview the 
necessary measures are taken to minimise the agitation during the period of emergence from 
anesthesia that very often is observed with patients with autism especially the non-verbal 
one and the patients on the lower spectrum.

Additional work on the project
We are developing a survey that will evaluate the different aspects of the perioperative care and it will 
be given to the families to complete before leaving the hospital. We see this as a way to improve our 
programme.

We believe, this patient-specific approach will improve the quality of care for these patient population.

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Ensuring essential clinical experience in a paediatric anaesthesia fellowship

Bistra Vlassakova, Carlos Munoz, Richard Blum
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Introduction
In USA ACGME accredited paediatric anaesthesia fellowship programmes must ensure trainees manage a minimum number of complex high intensity/index cases during fellowship training. Simulation provides a versatile, supervised platform for systematic supplemental training, providing safe and reproducible conditions where trainees can practice the essential technical and behavioral skills without endangering real patients.

Background
Our attention to Simulation as a possible teaching module was brought by a retrospective survey, where former graduates (74%) shared that involvement in clinically oriented simulation would have benefited them in their current practices.

Needs-assessment was conducted with fellows to evaluate needs.

The mandated by ACGME cases log was also used to help with case selection.

Structure
Paediatric Anaesthesia Fellowship at Boston Children’s Hospital is the largest fellowship in the country. This simulation programme was created as an attempt to increase the exposure of our paediatric anaesthesia fellows to a wide range of clinical cases and to improve their decision-making skills in a safe environment.

The program has 3 modules. Each module is conducted over the course of a day and provides a graded case complexity designed for formative feedback. Scenarios were created by an anaesthesia simulation team with diverse expertise. Clinical scenarios involved the entire spectrum of perioperative care. The emphasis of this programme is the knowledge and technical skills required to care for complex paediatric patients. Scenarios were also designed such that critical behavioural and communication skills are thought and exercised. Module one has half day hands on workshop and 2 simulation scenarios, module 2 has 5 clinical scenarios and module 3 has 4 clinical scenarios. So far 50 fellows have completed the programme.

Evaluation
Fellows completed an 8 questions survey at the end of each module to reflect on their experience for future programme improvement (four-point Likert scale). Survey results include: 100% strongly agree or agree for both modules that the scenarios “met their expectations;” “scenarios were clinically relevant;” “high degree of realism;” “high quality of debriefing;” and “supportive environment.” The excellent debriefing skills of the faculty was seen as major benefit.(eval. graphs on the poster)

Conclusions
The rigorous curriculum design made the program successful in meeting educational goals. Simulation will likely play an increasing role in performance assessment in certification and recertification and our programme will aid trainees in preparation for such assessments.

Future plans
A survey is prepared and will be send to all former fellows that have participated in the programme to evaluate the possible impact the simulation had made on their current practice.

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Neonatal vital sign deviations during general anaesthesia: Developing consensus on what represents significant change
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Introduction and aims
The potential neurotoxic effects of general anaesthetic agents is recognised as a risk to cognitive function at the extremes of age. Given that general anaesthesia in the neonatal population cannot be avoided, it is important to minimise factors that may further impact anaesthesia-induced neurotoxicity. We have previously reported on vital sign changes from continuously recorded data collected in 431 neonatal cases undergoing general anaesthesia between 2010 and 2013. Thirteen rules identifying vital sign deviations were applied using thresholds or relative percent changes. Using results of a survey of staff anaesthesiologists, five of these 13 rules were deemed most relevant: 1) hypoxemia (SpO2 <85 % for >15 sec), 2) hypotension (MAP <35 mmHg for >120 sec), 3) hypothermia (Temp <36˚C for >30 sec), hypocarbia (etCO2 <25 mmHg for >60 sec), and bradycardia (HR <60 bpm for >30 sec). These five rules were weighted using a cost function to determine the relative severity of each parameter. The parameters ranked from highest to lowest were; bradycardia, hypoxemia, hypotension, hypocarbia, and lastly hypothermia. The severity score assigned half of the cost for the first occurrence of a deviation (did it occur?) and the other half proportional to percent case spent with that detected deviation (for how long did it occur?). The severity scores for 431 neonatal cases were presented at the APAGBI meeting in 2014.

Methods
We plan to redefine the scoring system based on larger survey sample size. Many questions regarding vital sign changes during neonatal anaesthesia remain unanswered, such as:

- What represents a significant deviation in any particular vital sign?
- Does a change in vital sign/s have a long-term impact on neuro-developmental outcome?
- How should each vital sign change be weighted in importance?
- Does a change in more than one vital sign have more of an impact than just one?
- What period of time is important when a vital sign changes?
- Are vital sign changes more important in neonates of lower gestational age?

Results
We will present our survey questions and severity scoring process for discussion and feedback prior to submission of the survey to APAGBI for approval to send to its members.

Discussion
Using results from an improved survey with much larger sample size, we plan to redefine the scoring system, and apply this process to our existing data and encourage collaboration with other centres to implement these as ongoing quality improvement strategies for our neonatal population.

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Congenital complete atrioventricular block (CCAVB) in newborn. Permanent pacemaker implantation. Multidisciplinary management

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Introduction
Congenital Complete Atrioventricular Block (CCAVB) is not common, but is associated with high risk (> 80% mortality if congenital cardiac disease is present). The most frequent etiology is the presence of maternal autoimmune disease and its circulating antibodies (Anti-Ro and Anti-SS-A).

Case report
We present a newborn at 38 + 4 weeks gestation with bradycardia diagnosed at 23 + 3 weeks probably due to CCAVB treated with corticosteroids at 26 weeks who developed severe oligohydramnios. Fetal Echocardiogram suggested signs of aortic and pulmonary stenosis at 37 + 4 weeks. The mother, 34-year-old showed polyarthritis with anti-Ro + antibodies, essential mixed cryoglobulinemia and Raynaud syndrome followed by rheumatology. Scheduled cesarean section was indicated to deliver the baby. A multidisciplinary team was available in the operating room (O.R.) for pacemaker implantation.

Patient weight 3000g and Apgar scores 9/10/10, heart rate (HR) 45-50 bpm, normal oxygen saturation without heart failure signs. Patient was transferred to PICU where was umbilical vein canalized and monitored. EKG at birth demonstrated CCAVB and prolonged QTc interval. After stabilisation with isoproterenol (0.1 g/kg/min) patient was transferred to O.R. for pacemaker implantation.

At O.R. arrival, bradycardia (35bpm) worsened and isoproterenol infusion was increased to 0.4 g/kg/min improving HR and blood pressure (BP). After pre-oxygenation patient was induced with etomidate (1.5mg/kg) and cys-Atracurium (0.1mg/kg). Maintenance of anesthesia was provided with sevofluorane (0.1-0.4 MAC), O₂-N₂O (30-70%), fentanyl (3-5mcg/kg), Tramadol (1.5mg/kg), metamizol (40mg/kg). Isoproterenol infusion at 0.2g/kg/min was used to support the hemodynamics. The antibiotic prophylaxis consisted in Ampicillin + Gentamicin. Pacemaker implantation was performed via left mini-thoracotomy, epicardic leads in the right ventricular wall, connected to a VVI-R Mircony St. Jude ® generator at 120 bpm. Chest drainage was inserted under local anaesthetic infiltration. At the end of surgery, there was recurrent bradycardia and low cardiac output due to losing A-V synchrony. It was resolved by increasing the pacemaker sensitivity. The baby was extubated in the O.R. with no complications and transferred to PICU, oxygen saturation 100% (nasal cannula), BP 77/52 mmHg. There was not any perioperative complication.

CONCLUSION
Pacemaker implantation in newborns with CCAVB could become an anaesthetic challenge. Isoproterenol, epinephrine and transcutaneous pacing are alternative to support circulation until permanent pacing is stablished.
Facilitating timely non-elective surgical intervention in children – clinical audit and recommendations
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Introduction
Reducing the waiting times for emergency surgery is crucial, particularly in vulnerable patient groups such as children. The Children’s Surgical Forum (comprised of representatives from the RCS, RCoA, DoH and Patient Liaison Group) suggest that children requiring emergency (but not immediate) surgery should be operated on within twelve hours of the decision to operate. A clinical audit was designed to investigate whether this target is being achieved.

Method
Fifty-two structured data collection forms were filled out contemporaneously by attending clinicians between May 2013 to July 2014 for any child (<18 years of age) undergoing emergency surgery. Thirteen forms were excluded due to not containing sufficient information for analysis.

Results
Data for thirty-nine children aged 1 to 15 years of age revealed that 59% of children were operated on within twelve hours.

Discussion
Despite the majority of children being operated on within twelve hours, there is still room for improvement. The primary cause for delay appeared to be late booking time. Cases booked between 0730 – 1130 had a 92% chance of being operated on with twelve hours, but only 20% of cases booked between 1630 – 2030 met the target. The authors intend to present these findings to our surgical colleagues, and reaudit in 12 months time.

Permission obtained from Clinical Audit Department YGC. No competing interests to declare.

References
A quality improvement project for discharge analgesia in children undergoing adenotonsillectomy

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Introduction and aims
Adenotonsillectomy is associated with moderate to severe postoperative pain for up to 8 days and requires adequate take-home analgesia to be prescribed.¹ Following the Medicines and Healthcare Products Regulatory Agency (MHRA) recommendation that codeine should not be administered to children under the age of 12 or in children undergoing adenotonsillectomy with a history of obstructive sleep apnoea,² codeine was removed from our hospital formulary. Take-home analgesia for children undergoing adenotonsillectomy in our institution was reduced to regular paracetamol and ibuprofen only. We aimed to evaluate whether this was adequate.

Methods
ASA I and II children undergoing adenoidectomy, tonsillectomy or adenotonsillectomy at the University Hospital of Wales, Cardiff were recruited. Parents recorded their child's worst pain score using a visual analogue scale or the Wong-Baker faces scale each day, for 10 days postoperatively. Parents also recorded presence of nausea or vomiting, the number of doses of paracetamol and ibuprofen administered daily and whether they felt their child would have benefited from additional analgesia at any time. Phone calls were made to the parents on the third and tenth postoperative days to collect the data.

Results
51 children, ranging from 3 to 15 years old, undergoing adenoidectomy (10%), tonsillectomy (59%) and adenotonsillectomy (31%) were recruited. Despite regular paracetamol and ibuprofen being administered, median pain scores remained between 4/10 and 8/10 for the first 7 postoperative days. During this period, pain scores of 10/10 were seen in 18% of children, occurring most frequently on postoperative days 5-7. On questioning, 59% of parents expressed that the current discharge analgesic regimen should be supplemented with an additional analgesic, with night-time being the period of most need. Nausea or vomiting was seen in only one child postoperatively.

Discussion and conclusion
Good postoperative analgesia in children is vital and anaesthetists have a responsibility to ensure patients are discharged with an adequate analgesic regime. This service evaluation demonstrated that following adenotonsillectomy in children, regular paracetamol and ibuprofen alone is frequently inadequate analgesia. Children should be discharged with the addition of an opioid based analgesic, unless contraindicated. Our new take home regimen now includes 5 'as required' doses of oral morphine (0.1mg/kg). In a future audit, we hope to demonstrate an improvement in post-operative pain scores in children undergoing this procedure and improved patient and parent satisfaction.

References
How useful is audit? Our experience of completing an audit cycle....
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Introduction
Undertaking quality improvement projects, including audits, continues to be expected of anaesthetists and departments. Indeed, many audits are scheduled as compulsory and completion is necessary before hospitals are able to receive certain financial rewards. Following the conduct of a complete audit cycle, looking at anaesthetic chart documentation, we discuss the impact of this method of quality improvement and discuss barriers to change in clinician behaviour. We suggest that audit should only be undertaken in the knowledge that these constraints exist and that more is often required to institute change.

Aims
To conduct an anaesthetic chart audit, complete the cycle by repeating the audit, and to review the results in the context of an expected improvement. To discuss the limitations of using audit as a tool to institute change.

Methods
Anaesthetic charts for all paediatric cases were reviewed over a single day at our institution. Compliance with completion of all available domains was reviewed. After the initial audit, feedback was given to those anaesthetists involved, with emphasis placed on the importance of comprehensive documentation. The audit was repeated one year later and a comparison of results made.

Results
We found very little change in compliance with completion of anaesthetic charts. Any changes were only moderate, and only one out of the ten anaesthetists involved appeared to have changed his practice.

Discussion
Documentation is an important component of an anaesthetist's work, conveying information for future procedures and providing a contemporaneous record of events, which may be medico-legally scrutinized at any time.

Anaesthetic charts do not have a standard format, and what individuals choose to record would also not seem to be uniform. Our intention was that the feedback following our initial audit would encourage improvement in documentation and lead to more consistent completion of charts. However, the lack of significant change in practice can be attributed to a number of issues. These include: the timeliness of the feedback, who delivers it, and whether it was active or passive. The perceived relevance of the audit content and level of clinician buy-in are major influencing factors to behaviour change.

Conclusion
We encourage those undertaking audits to consider the barriers to change in clinician behaviour and focus on these at the time of feedback. We have learnt from our results that using audit to institute change is not as straightforward as we had believed.

References
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Parental satisfaction with perioperative arrangements
Rupinder Pal Kaur, Daniel John Taylor, Anamika Agrawal, Anna Janowicz
Evelina London Children’s Hospital, London, UK

Royal college of anaesthetists guidance(1) recommends involvement of children and their parents and carers to allow the child-centred care. The guidance makes recommendations regarding the provision of written and verbal information to be provided prior to surgery as well as the provision for physical presence of parents and carers in the anaesthetic room and recovery areas. We conducted a survey of parental satisfaction with the arrangements to provide family-centred care during perioperative period. The prior survey in 2013 had revealed a high satisfaction rate, however the need for more information about fasting times was identified. Information sheets were updated with visual clues and clarification of drinking times made a part of team briefing prior to operating lists.

Methods
The survey was registered with the clinical audit team in our trust. Questionnaires were distributed preoperatively over a two week period. The survey collected anonymous demographics, questions regarding preoperative information and fasting and then a third section focussed on parental satisfaction with perioperative arrangements. Satisfaction with the experience in the anaesthetic room and overall perioperative experience were then rated on a scale of 1 to 10 (10 being the most satisfied). We included a space for older children to comment if they so wished.

Results
45 completed questionnaires were returned. Information regarding fasting times was received by 44 (98%) parents. Three parents said they would have liked more information about what was to happen in anaesthetic room. One of them had not received the anaesthesia information leaflet, second did not specify and third was informed about the caudal block on the day of surgery rather than pre operative assessment visit in clinic but felt all questions were answered adequately on the day. All the parents felt supported in the anaesthetic room and all of them felt it was helpful for them to come to anaesthetic room. All except one were satisfied with the waiting arrangements while their child was undergoing surgery. The median rating for experience in anaesthetic room and overall anaesthetic experience was 10 each. Two parents felt they should be given an opportunity to be in recovery area before the child is awake. Comments from parents and children were extremely positive and encouraging.

Discussion
This repeat survey shows that the overall satisfaction with family arrangements remains high. The information about fasting times has improved from previous survey (93 to 98%). The expectation for parents to be present in recovery before the child wakes up needs to be balanced against safety concerns during emergence from anaesthesia. Future surveys will aim to improve response rate and perhaps seek greater detail so as to better identify areas for improvement.

References
Development and evaluation of a theory driven, evidence based, online intervention to prepare young children for general dental anaesthesia
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Introduction and aims
Online interventions are increasingly used to deliver healthcare as they enable and promote patient self-management, and can deliver information, education, and behavioural support. Benefits include, increased access [86% of households have access to the Internet in the United Kingdom (ONS)] and outreach (by increasing access to healthcare for those who might find it harder to attend appointments), cost-effectiveness, convenience and flexibility. The purpose of this paper is to detail the rationale, development and initial evaluation of a custom-designed, web-based intervention, tailored to the unique needs of young children with early childhood caries requiring multiple dental extractions under a general anaesthetic (GA) and their families. The intervention aims to prepare young children (5-7 years old) for dental GA and complement practitioner delivered interventions by reinforcing the messages delivered.

Methods
In line with current recommendations, intervention planning combined deductive and inductive approaches, synthesising existing evidence, theory, and the views of potential users (and their carers) and health care professionals to create an intervention which would be effective and widely adopted into practice.

Results
The intervention includes simple cartoons with animation and a degree of interactivity with two imbedded role-modelling videos. It shows a child coping with the GA visit to undergo tooth extraction, later recovery, and finishes with family oral health messages.

Discussion and conclusion
A theory driven, evidence based, online intervention was developed which proved feasible and acceptable to users and stakeholders. The efficacy of the intervention was later evaluated in a randomised controlled trial.

References

Acknowledgement
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Continuous local anaesthetic (LA) infusion in the transversus abdominis plane (TAP) using an elastomeric pump: post-operative analgesia regimen for abdominal surgery in children
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Introduction
Analgesia for laparotomy can be provided by epidural, morphine infusion or LA infusion in the TAP. Beside a limited number of case reports there are no published data on the use of TAP infusions in children. By avoiding an epidural and minimising opiate consumption, neuraxial and respiratory complications can be avoided. It can also reduce nursing demands, promote mobilisation, reduce nausea and provide good patient satisfaction.

Methods
With approval from our hospital's New Interventional Procedures Advisory Group, 12 consecutive patients undergoing abdominal surgery, aged 9 months to 17 years were consented to receive unilateral or bilateral TAP infusions. Surgeries included urological procedures using a subcostal flank incision, midline laparotomy, unilateral transverse incision for stoma closure and one laparotomy with transanal pull-through. TAP catheters were placed after induction of general anaesthesia, by a consultant anaesthetist under ultrasound guidance using PAJUNK Rectus sheath kit. All patients received a bolus of 0.25% levobupivacaine prior to incision. Additionally, patients also received IV paracetamol ± NSAID ± ondansertron. Intravenous morphine was titrated to requirements intra-operatively. 0.1-0.4ml/kg/hour of 0.125% levobupivacaine was commenced at end of surgery for 48 hours using Dosifuser Multiflow disposable elastomeric pump. Post-operatively, patients received regular paracetamol ± NSAID and were prescribed PRN oramorph, PCA morphine or morphine infusion as rescue analgesia. Pain was evaluated using FLACC, FACES or numeric rating scale. Pain scores were recorded hourly for 4 hours and 4 hourly thereafter until the Dosifuser was discontinued. Total dose of opiate used in the first 48 hours, time to mobilisation, nausea, and patient satisfaction were recorded.

Results
One patient was excluded from analysis due to early post-operative surgical complications. The median pain score was 0. Seven patients required no rescue analgesia and one patient needed one dose of oramorph. The patient who had the laparotomy with transanal pull-through required 7 doses of oramorph. Two had intravenous morphine equivalent to 10mcg/kg/hour. Eighty percent mobilised within 24 hours. There was no nausea and all patients were satisfied with analgesia. There were no complications related to nursing or the Dosifuser device.

Conclusion
In this small cohort of children, a continuous infusion of 0.125% levobupivacaine through unilateral or bilateral TAP catheters using a Dosifuser Multiflow elastomeric pump was an optimal and safe technique of postoperative analgesia after lower abdominal and flank surgery with no reportable adverse effects. Further work is needed to verify this conclusion.

References
Parental survey evaluating opinions of providing a drug chart for analgesia administration at home
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Introduction
The purpose of this survey was to determine existing parental knowledge about providing analgesia at home, and their opinion regarding the provision of a drug chart, outlining the times and dosage for post-operative analgesics to administer to their child at home.

Methods
A paper survey and a simplified version of the NHS in-patient drug chart, were distributed to 50 parents whose child was about to or had recently undergone surgery over 5 a day period at St George's University Hospital NHS Foundation Trust. The survey evaluated the parental knowledge regarding analgesia administration and their opinion on using the sample drug chart to aid delivery of post-operative analgesia at home.

Results
All parents responded to the questionnaire (N=50). The children underwent surgery under a number specialities and there was a wide distribution of age range of patient.

56% of respondents anticipated giving post-operative analgesia every 4 hours, 18% every 6 hours, however 14% were unsure how often analgesia could be administered. The majority of respondents would give a combination of paracetamol and ibuprofen (49%) in combination rather than each drug alone, however 10% were unsure which medication to give at all. 70% felt they knew the maximum dose of analgesic that can be delivered.

Parental beliefs regarding the number of days needed for post-operative pain management was mixed, some parents believed one day would be sufficient (16%) whereas others believed 3-4 days would be required (34%)

When shown the proposed drug chart, most respondents found it easy to understand (94%) and 86% would use the drug chart at home. 70% believed they would not encounter difficulties using the chart, although 20% mentioned that sleep and feeding times would interfere with the administration schedule. A dosage written in mL was preferred by 84% of parents rather than mg, sachet or other options. Suggested improvements included, more information on timing, whether to take with food, end date and maximum dosage details. When asked only 26% parents would use an electronic application for pain management purposes.

Discussion and conclusion
The proposed post-operative drug chart for parents to use with the aim of improving analgesia at home was well received by the majority of parents surveyed. Because a significant number of parents were unsure of some aspects of their child’s post-operative pain relief, our sample drug chart may be used to educate parents regarding the dosage and administration of analgesia. The drug chart provided was understandable to the majority of parents, however further information including timing of dosage and use of an electronic application may be considered.
Peri-operative airway complications in children - a comparison of volatile anaesthesia and TIVA techniques
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Introduction and aims
Total intravenous anaesthesia (TIVA) is a recognised alternative to volatile anaesthesia yet remains an unpopular choice in paediatric anaesthesia\(^1\). This is despite a perceived reduction in airway-related complications, in particular laryngeal spasm\(^2\).

The aim of this analysis was to determine if the incidence and nature of airway-related complications was lower in children receiving a TIVA anaesthetic, compared with a volatile-based technique.

Methods
The Department of Anaesthesia at Birmingham Children’s Hospital (BCH) keeps a database of anaesthetic information for cases undertaken, including the occurrence of perioperative complications.

We interrogated the database for a 6 year period between November 2008 and December 2014 identifying all cases where a complication during anaesthesia had been reported.

Complications were analysed further to identify those primarily involving the respiratory system. Those deemed unrelated to the type of anaesthesia were excluded. The remaining complications were then divided into two groups; laryngeal spasm, and other respiratory complications. Data were analysed statistically using Pearson’s Goodness of Fit Chi-Square Test and Fisher’s Exact Test.

Results
Over the 6-year period, 54,532 procedures were entered onto the database. 52,460 (96.2%) of cases involved volatile-based anaesthesia. The remainder used exclusively TIVA (928, 1.7%) or included some propofol for maintenance purposes. The latter were small numbers and excluded from the analysis to enable valid comparison of the two groups. Both groups were broadly similar with regards to demographic characteristics.

The incidence of overall complications was 1.4% in the volatile group, but higher at 5.2% in the TIVA group (P<0.001). When non-respiratory complications were excluded from the analysis, there was no significant difference in incidence of respiratory complications between the two groups.

Of the 176 respiratory complications in the non-TIVA group, 104 (59%) specifically mentioned laryngeal spasm. There was one laryngeal spasm out of 11 respiratory complications in the TIVA group (9%). This demonstrated a significant difference between the two groups (P=0.04).

Discussion and conclusion
This audit suggests that the use of TIVA does not reduce the overall incidence of peri-operative respiratory complications in children, but does significantly reduce the occurrence of laryngeal spasm. These respiratory complications caused significant morbidity in the volatile group with a high incidence of intervention including the need for re-intubation, abandoning the procedure, PICU admission, overnight stay and cardiac massage, none of which occurred in the TIVA group. Clearly, any technique that has the potential to limit such serious outcomes could be hugely beneficial.

The main limitations of this work are that data analysis was retrospective, data entry voluntary and dependent upon the quality of self-reporting, and the majority of the TIVA anaesthetics were administered by a single anaesthetist.

References
Audit of anaesthetic approaches to tracheo-oesophageal fistula repair at a paediatric tertiary referral centre in the UK
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Introduction and aim
Congenital tracheo-oesophageal fistula (TOF) is a communication between the trachea and oesophagus estimated to occur in approximately 1 in 3,500 births in the UK and often associated with low birth weight, prematurity, and other congenital abnormalities (1). A potentially fatal condition, surgical correction is often carried out in the neonatal period. From an anaesthetic perspective, patients undergoing TOF repair present a number of challenges, and there are a number of anaesthetic approaches used (2).

The aim of this audit was to examine anaesthetic practices for TOF repair at a large specialist children's hospital in the north of England.

Methods
This was a retrospective audit of children undergoing TOF repair at Royal Manchester Children's Hospital. Cases were identified over a five-year period to the end of 2014 by searching the hospital's coding system. Paper-based case notes were then hand-searched for details of anaesthetic procedures.

Results
Twenty-six TOF repairs were identified and reviewed. Four cases were excluded as non-TOF and one additional anaesthetic chart was missing (final n = 21). All repairs were carried out within 72 hours of birth; gestational age ranged from 30-42 weeks; and birth weights were between 1.3 and 5.2kg. Twelve of the babies were male and 38% had abnormal cardiac anatomy (three of whom had VACTERL).

The majority of repairs (20/21) were carried out in-hours and all were performed by consultants. Three babies were intubated on NICU prior to surgery and of those intubated by the anaesthetic team, the majority (15/18) had a sevoflurane-based gas induction. All neonates received atracurium, but at various stages of the procedure/anaesthetic. Standard monitoring was used in the majority of cases (19/21) and ventilation was adequate in all cases.

There was no attempt to visualise the fistula by bronchoscope in six cases. Where the fistula was large or near the carina, the endotracheal tube tip was positioned distal to the fistula where possible. No right main bronchus intubations were intentionally used.

Post-operatively all neonates returned to the NICU ventilated. Analgesia was achieved via intravenous opiate infusion.

Discussion and conclusion
Whilst there are common features in all the approaches used for infants undergoing TOF repair, no one approach dominated. The number of cases identified was felt to be an under-estimate and may have been due to factors such as coding errors and the hospital's major restructure and geographical relocation during the period audited.

References
Blood loss and insertion of central lines for early-onset scoliosis surgery
Jutta Scheffczik, Richard Rogers
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Introduction
Early onset scoliosis is most commonly idiopathic, but can also accompany other congenital abnormalities and diseases. Surgical treatment is the insertion of growth rods, which require repeated surgical procedures as the child grows out of them.

MAGEC rods are inserted in the same way as conventional growth rods, but have a distraction element by which the length of the rod can be modified remotely without the need for further surgery.

We looked at age, blood loss and transfusions, to determine whether a different anaesthetic approach was appropriate for MAGEC and conventional growth rods, especially in respect to insertion of central venous lines for haemodynamic management.

Methods
We assessed all patients with early onset scoliosis who had either an insertion of a conventional growth rod system or a MAGEC rod insertion in the last 3 years. We found 29 patients in total, 11 patients for conventional growth rods and 18 patients for MAGEC rods.

Results
We analysed all 29 patients and found no significant differences between patients with conventional growth rods and MAGEC rods in the parameters studied (t-test, Fisher's exact test, two-sided p-value).

All patients had a Cell Saver system set up, no patient needed allogenic blood transfusions, neither intra- nor postoperatively.

Mean blood loss was 20.68% (SD 12.7%) of circulating volume, with a range of 5%-49.68%.

6 patients lost less than 10% of their circulating volume, 5 patients lost 10-15%, 3 lost 15-20%, 5 lost 20-25%, 2 lost 25-30%, 4 lost 30-35%, 1 lost 39% and 2 lost 49%.

Only 9 patients (32%) lost more than 25% of their circulation volume, 3 from the MAGEC group and 6 from the conventional group.

Mean age for growth rod patients was 6.8 +/- 3.8 years, mean age for MAGEC rod patients was 7.4 +/- 3.6 years.

Discussion
There were no significant differences in blood loss and other parameters between growth rods and MAGEC rods.

One reason for insertion of central venous lines in early onset scoliosis children is CVP monitoring and guiding fluid management for blood loss. As shown, the mean blood loss is 20% of circulating volume, which might not justify the routine insertion of CVP lines for healthy children with early onset scoliosis regardless of the growth rod system put in.

However, in syndromic children the use of CVP line might be indicated for additional reasons other than blood loss.
Evaluation of quality of pain relief following discharge of paediatric surgical patients
Vaidyanathan Ramanathan, Jonathan Whitton, Aideen Maguire
Queens Medical Centre, Nottingham, UK

Introduction and aims
We wanted to find out about the quality of pain relief provided for the paediatric surgical patients following discharge. As per RCOA¹ no child should be assessed as being in severe pain at home.

Methods
Data was collected from the admission units for the paediatric patients at Queens Medical Centre, Nottingham. The parents were met by the anaesthetists preoperatively and consent was obtained for data collection. The parent was called after 10 days post discharge, by telephone. Information regarding age, procedure, pain medication used at home for ten days post discharge, issues with pain control and contact with GP, side effects and parent's satisfaction with pain control were collected.

Results
During the audit period we collected data form for 84 patients. Five patients were not followed up since they could not be contacted. The total of 79 patient data were analysed for this audit. The specialties included ENT (17 patients), Urology (30), Ophthalmology (1), Plastics (3), Max-facial (4), General Surgery (21) and Orthopaedics (4). There were 31 girls and 48 boys.

97.5 % of patients received paracetamol, 92.4% of patients received ibuprofen and 25.3% of patients received morphine.

84.6% of patients (11 out of 13) who had tonsillectomy or adeno-tonsillectomy required morphine for post op pain control. All patients received regular paracetamol and ibuprofen for varying periods. Three out of nine patients (33.3%) who had circumcision also required morphine in addition to paracetamol, ibuprofen and instillagel.

63.3% of patients had a pain score of 5 or more at home postoperatively. Out of this 68% (34/50) did not receive any morphine.

50% of children who had morphine were sick at home compared to 13.6% in the group without morphine.

The incidence of constipation in the group which received morphine was 35% against 8.5% in the group which did not receive morphine.

The incidence of drowsiness at home was 15% for the morphine group against 15.3% in the group without morphine.

Parental satisfaction with pain control was high at 87% scoring 8 or more on a ten point scale.

Discussion and conclusion
The incidence of pain at home after surgery in children is still high at our hospital compared to the standards¹²

We need to be more proactive to identify children who require morphine and also have in mind the need for prophylaxis against side effects due to opioids.

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Pre-operative paediatric anxiety - novel ways to tackle it
Deepak Rangappa, Ratidza Danha, Sharon Sykes, Antonia Mayell
University Hospital of Coventry and Warwickshire NHS Trust, Coventry, UK

Introduction
Preoperative anxiety is well documented in children attending the hospital.\textsuperscript{1,2} Distraction techniques have proven to reduce the anxiety and discomfort in children.\textsuperscript{2,4} Perioperative anxiety is directly linked with postoperative dysfunctional behaviour. Eg: eating, sleeping disorders. Recent use of computed tablets have proven to be a useful distraction tool.\textsuperscript{3,4} A lot of research is taking place on techniques and their suitability to reduce stress and anxiety.

Methods
We devised a survey along with play therapy in our day surgery unit at UHCW. Distraction tools used in the anaesthetic room were: IPAD, Bubbles and Where's Wally? The play therapist selected the distraction tool and could change to another tool at their discretion. The play therapist asked the anaesthetist and ODP of their satisfaction with the distraction provided. 115 patients were assessed over a four week period.

Results
A total of 115 children were observed in the day case unit with the majority aged 4-9 yrs. 86 (75%) children used IPAD, 18(16%) children mainly 1-3yr olds used the bubbles and 11(9%) children used Where's Wally? 100% of the children using bubbles, 95% of the children using IPAD and 91% of children using Where's Wally? were satisfactorily distracted.

Discussion
We noticed that 75% of children used IPAD and 95% of them were distracted satisfactorily. The play therapists using their experience can tailor the apps and games to suit the age and mental development of the child.\textsuperscript{3} We did not group the children into with or without learning or behavioural difficulties or look into the aspect of parental anxiety and separation. Technological based distraction can deliver multisensory, novel, cognitive and physically engaging activities appropriate to the age and psychological development of the child. It has demonstrated a positive impact on the child's pain tolerance and anxiety levels during medical procedures.

Conclusion
Play in the anaesthetic room compliments the package of peri-operative care. The play therapist provides a vital support in both human interaction and facilitating distraction with appropriate tools. IPAD have been popular, successful and delivered satisfactory distraction in 95% of the children.

References
The investigation of a “near-miss incident” to improve patient safety in the theatre environment
Christine Vimalanathan, Stephanie King
Evelina London Children's Hospital, London, UK

Introduction and aims
We describe a “near miss” critical incident which has led us to investigate the process of checking the equipment used for each surgical case.

A six year old boy was anaesthetised for repair of a congenital ptosis. Prior to skin incision the team performed the WHO surgical ‘time out’ checklist. The surgeon then noticed that the Wright’s ptosis needle was missing; this was a vital piece of equipment. A spare needle could not be located in the theatre or in sterile services and it could not be sourced from any other institution nearby. The procedure was abandoned and the child was woken safely.

We later discovered that the sterile set was labelled as missing the ptosis needle. The scrub nurse and the nurse assisting the checking of the set had both mis-read the label, however the labelling did not seem clear to the whole theatre team.

We wanted to improve the human factors\(^1\) associated with this labelling and make it obvious when there was a problem with a set. This prompted us to survey the theatre nurses in order to discover whether the labelling of the sets was perceived to be a problem by the users.

Methods
We undertook a survey of 17 nurses working in theatres at the Evelina London Children’s Hospital.

Results
When asked what they would do if they knew an item was missing from a sterile set, the majority would try and find another item and inform the sterile services and the theatre sister. Only 12% would inform the surgeon and anaesthetist. In answer to “When would you check the set?” 47% would check the set before induction of anaesthesia, 21% during induction and for 32% it would depend on the case. The majority, 65% of the nurses surveyed, did not think that the labelling of the sterile sets was adequate.

Discussion and conclusion
The majority of nurses do not feel that the labelling of the sterile sets is adequate. We have subsequently submitted a proposal to sterile services to introduce a red card as a label if an item is missing. The sterile services checklist for this procedure has been updated so that this set is not returned if the Wright’s ptosis needle is missing. Ideally all sets should be checked before induction of anaesthesia however mistakes during checking may still occur. We should endeavour to design our equipment and processes to minimise error.

Reference
Robotic paediatric urology: anaesthetic implications. A case series
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Leeds General Infirmary, Leeds, UK

Introduction and aims
Many paediatric urological procedures are performed laparoscopically and the past decade has seen significant advances in this field with the advent of robotically-assisted surgery (RAS). The surgical advantages of this technique of improved dexterity, three-dimensional view and an improved degree of freedom, particularly in children, are described in the literature. However little data exists on the outcomes of paediatric urological patients who have undergone RAS and whether the considerable cost of these procedures, the longer surgical and anaesthetic times and the risk of limited intra-operative access to the patient can be justified.

Our centre, Leeds General Infirmary, is the first to have instituted major robotic paediatric urology surgery (hemi- or total nephrectomy, pyeloplasty) in the UK. We have observed that these patients demonstrate less post-operative pain, do not require blood transfusion, have shorter recovery times and shorter post-operative hospital stays with many being discharged home the same or following day. We aim to demonstrate this through retrospective case note review.

Method
A retrospective casenote review of 35 patients looking at post-operative pain scores, analgesic and blood product requirements, the incidence of post-operative nausea and vomiting and length of hospital stay.

Results
We will present the data in both graphical and tabular form on analgesic requirements, recovery times, any transfusion of blood products within 24 hours of surgery and length of hospital stay. The 35 patients in this cohort have ages from 1 to 16 years.

Discussion and conclusion
Shorter recovery times, shorter post-operative hospital stays, lower post-operative analgesic requirements and lack of blood product transfusion provide a cost saving to the health service. We have noted that operative times have decreased with surgeons increased experience of robotic surgery and pre-operative group and save blood tests are no longer routinely performed.

but also support a lower human cost. Patients experience a better quality of life sooner after the procedure, less school days are missed and working parents have to take less additional time off work for to care for the recovering child.

Acknowledgements
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Conflict of Interest
None.

References
Anaesthetic management of laparoscopic nissen fundoplication in a child with bilateral cavopulmonary shunts for Hypoplastic Left Heart Syndrome
Ahmed Mesbah, Karl Thies
Birmingham Children’s Hospital NHS Foundation Trust, Birmingham, UK

Case report
A 4-year-old boy with hypoplastic left heart syndrome (HLHS) presented for gastrostomy and laparoscopic Nissen fundoplication. A Norwood procedure had been performed in his first week of life followed by bilateral superior cavopulmonary shunts at 3 months. Since surgery, he suffered recurrent chest infections, some requiring invasive ventilation, and significant feeding difficulties with weight loss. A barium meal confirmed gastro-oesophageal reflux disease.

Preoperatively, cardiac catheterisation revealed slightly elevated mean pulmonary pressures which prompted an increase in his sildenafil and captopril dosages. Other medications included furosemide and anti-platelet drugs. Echocardiography showed good right ventricular function with no tricuspid or aortic regurgitation, an unrestricted atrial septectomy and good pulmonary venous flow bilaterally. Oxygen saturations in air were 70-80%.

Anaesthesia was induced with propofol 1 mg/kg, ketamine 1.5 mg/kg, rocuronium 1 mg/kg. Venous pressures in the superior and inferior vena cava were monitored via right internal jugular and right femoral venous catheters, respectively, and arterial pressure via a left radial intra-arterial catheter. Anaesthesia was maintained with fentanyl 1 mcg/kg boluses, rocuronium and sevoflurane 1% in oxygen and air to maintain SpO2 >90%. High peak inspiratory pressures were avoided and minute ventilation manipulated to maintain a pCO2 of approximately 5 kPa. Peritoneal insufflation pressure was limited to 10 mmHg. Gelofusine 15 ml/kg and maintenance crystalloids were given. Dobutamine 0.12 mcg/kg/min was commenced during the pneumoperitoneum. The patient was extubated on the intensive care unit 1 hour postoperatively.

Discussion
Patients with HLHS are initially palliated shortly after birth with the Norwood procedure. At 3-10 months of age, the superior vena cava (SVC) is connected to the pulmonary artery to become the only source of pulmonary blood flow, thus reducing ventricular volume overload and improving function. It also creates a cardio-cerebro-pulmonary circulation whereby cerebral blood flow becomes the main determinant of SVC flow and in turn pulmonary flow. During laparoscopic surgery, pulmonary flow is compromised by high peritoneal insufflation pressures, rising pCO2, acidosis, low lung volumes and hypothermia. Thus to maintain adequate pulmonary flow and avoid desaturation, hyperventilation was avoided to maintain a pCO2 of approximately 5 kPa, thereby striking a balance between maintaining adequate cerebral flow, and in turn pulmonary flow, while avoiding increases in pulmonary vascular resistance. Additionally, hypothermia and high peritoneal and airway pressures were avoided while maintaining adequate filling with colloids.

Although laparoscopic surgery presents challenges in the management of HLHS patients with cavopulmonary shunts, a careful anaesthetic technique that optimises pulmonary blood flow, will help patients reap the benefits of reduced pain and pulmonary complications compared to open procedures.

References
Which children need critical care admission after adenotonsillectomy for obstructive sleep apnoea?
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Introduction and aims
Adenotonsillectomy is the first line treatment for most children with obstructive sleep apnoea (OSA). Anaesthetic pre-assessment should attempt to identify children at increased risk of post-operative complications so that care can be planned appropriately. It is well established that patients with risk factors for post-operative respiratory complications should have in-patient monitoring following surgery[1] and current UK guidance is that such patients should have surgery in centres with direct and immediate access to paediatric high dependency/intensive care if required[2]. However, there is no evidence to inform which patients require planned critical care admission. Routine post-operative admission to critical care impacts on its capacity and risks last-minute cancellations.

We aimed to identify pre-operative factors which predict the need for significant intervention (invasive or noninvasive ventilation, nasopharyngeal (NP) airway or desaturations to <80%), necessitating critical care admission, following adenotonsillectomy for OSA.

Methods
Retrospective casenote review of all patients admitted to a tertiary paediatric hospital critical care unit following adenotonsillectomy for OSA for 38 consecutive months (1/7/10-30/9/13).

Results
79 children (71% male, median age 3.6 (1.0-15.2) years) were admitted to critical care, 74 (94%) as pre-booked admissions according to existing hospital guidelines. 33 (42%) had relevant significant co-morbidity[2] (neurodisability n=15, chromosomal abnormality including trisomy 21 n=13, obesity n=2, ex-preterm n=2, airway malacia n=1). 36 (46%) had documented severe OSA (SpO2 nadir <80% and/or obstructive apnoea/hypopnoea index >10/hour).

36 (46%) cases required no post-operative intervention at all. 25 (32%) cases required significant intervention (intubation and ventilation n=6, NP airway n=7, desaturations to <80% managed with repositioning +/- soft collar n=12). Only 1 unplanned admission was ventilated (intraoperative airway fire). Univariate analysis identified co-morbidity as the only significant risk factor for significant intervention (P=0.05). In multivariate analysis, co-morbidity (OR 4.3, P=0.008) and age <2 years (OR 7.7, P=0.04) predicted need for significant post-operative intervention. Gender, weight, cardiorespiratory sleep study parameters and presence of severe OSA were not associated with need for significant intervention.

If only patients with co-morbidity and/or age <2 years had been electively admitted to critical care, there would have been 33 fewer critical care admissions, with a reduction in bed days from 101 to 73 days, at a cost of 2 extra unplanned admissions (neither of whom required invasive ventilation).

Conclusion
In a tertiary setting, significant co-morbidity and young age are the only identified pre-operative factors which predict the need for critical care intervention post-adenotonsillectomy for OSA. Other children, including those with severe OSA, could be monitored post-operatively in a regular ward setting.

References
Audit of analgesia for paediatric adenotonsillectomy
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Introduction
Pain following adenoid and/or tonsillar surgery in children is common and varies with the surgical technique, perioperative analgesics used and patient factors. A previous audit at our institution revealed that 37% of children suffered moderate to severe pain postoperatively. Subsequently, a new departmental guideline for the perioperative management of paediatric adenotonsillectomy was introduced recommending:

- **Preoperatively:** oral Paracetamol 20 mg/kg and oral Ibuprofen 10 mg/kg.
- **Intraoperatively:** Fentanyl 0.5 mcg/kg boluses up to a maximum of 2 mcg/kg or Morphine 50 mcg/kg boluses. Additionally, if no premedication was given, intravenous Paracetamol 15 mg/kg and rectal diclofenac 1mg/kg.
- **Postoperatively:** Paracetamol 60 mg/kg/day, Ibuprofen 30 mg/kg/day, PRN oral Morphine solution 200-300 mcg/kg 3 hourly.
- Codeine is to be avoided perioperatively.

Aim
To evaluate the adoption of the new guideline and highlight any obstacles in its implementation.

Methods
147 children, between 2 and 16 years of age, undergoing elective adenoidectomy and/or tonsillectomy were analysed retrospectively following the introduction of our new guideline in April 2014.

Results
Only a few children were premedicated with either Paracetamol 20 mg/kg (15.65%) or Ibuprofen 10 mg/kg (4.08%) yet, these children did not always receive these analgesics intraoperatively either; 17.06% and 40.14% of children were not given any Paracetamol or NSAID at all, respectively. All children received either intraoperative fentanyl or morphine per the guidelines, but 12.24% received a combination of intraoperative fentanyl and codeine. The dosage of postoperative analgesics was variable, with a median dose of 15 mg/kg for Paracetamol, 5 mg/kg for Ibuprofen [IQR 5-6 mg/kg] and 200 mcg/kg for oral morphine solution [IQR 122.5-200 mcg/kg], however, 19.05% of children were prescribed too large a dose of oral Paracetamol (80 mg/kg/day) even though they had received it intraoperatively.

Discussion
Our new analgesic guidelines were introduced to provide a safe multi-modal approach to children presenting for adenotonsillectomy who frequently have symptoms of obstructive sleep apnoea as well as postoperative nausea and vomiting, yet our audit revealed that simple analgesics were not always used, or prescribed incorrectly, resulting in a primarily opioid-based analgesic plan. Furthermore, it highlighted:

- Few children received analgesic premedication, possibly due to difficulty in arranging the timely administration of these drugs and thus the preference of anaesthetists to administer them intraoperatively.
- Codeine continues to be administered despite the 2013 MHRA guidance\(^1\) restricting its use in children undergoing adenotonsillectomy with symptoms of obstructive sleep apnoea.
- The postoperative prescription of Paracetamol and Ibuprofen was frequently incorrect. 19.05% of patients were prescribed more than the recommended 60 mg/kg/day of Paracetamol while 93.88% received less than the recommended 30 mg/kg/day of Ibuprofen perhaps due to concerns about postoperative bleeding.

References
Harlequin ichthyosis child - anaesthetic management: A case presentation
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Introduction
Harlequin ichthyosis (HI) is the rarest and more severe form of congenital ichthyosis. Inherited in an autosomal recessive manner HI is associated with a mutation in the gene for protein Adenosine triphosphate Binding Cassette A12 (ABCA12). At birth, neonates with HI are covered by a thick hyperkeratotic plate-like covering of stratum corneum with deep dermal fissures looking like a harlequin costume, thus giving the name. Other findings common with this disorder include severe ectropion and eclabium, alopecia, digital contractures and growth delays. Infants with HI have historically succumbed in the perinatal period to sepsis, respiratory failure and infections, poor nutrition and electrolyte imbalances. In the past 20 years, however, the prognosis of HI infants has improved due to advances in neonatal intensive care and targeted oral retinoid therapy. We report a case of HI treated with Acitretin presented for treatment for ectropion.

Case report
A 3months old male infant with a history of HI presented for treatment for ectropion. He had red and cracked skin which was lubricated with a hydrophilic cream and covered with elastocast prior to surgery.

To prevent heat loss, theatre temperature was kept at 24°C. With gas induction, venous cannulation was unexpectedly easy but was very challenging to secure, due to his lubricated thick skin. All other routine monitoring applied but ECG monitoring was difficult to place as we expected.

Intubation proved to be uneventful, even though the child had some degree of limited mouth opening. The oral ET tube was carefully secured with a gauze tie due to the greasy, slippery quality of the child's skin. He tolerated the procedure well. We gave IV paracetamol and LA for analgesia. No complications were noted aside from difficult IV placement and the challenge of securing catheters and tubes. He was transferred to surgical ward for ongoing monitoring and analgesia and discharged the next day.

Discussion
Children with HI possess unique clinical features that introduce a number of anaesthetic challenges. Because treatment is aimed at reducing or softening the scale by applying lubricants or keratinolytic agents, the oily base of these agents prevents adhesives from sticking to the skin. Peri-operatively, tubes and catheters may need to be sewn or tied into place. Because of thick skin, peripheral IV access may be difficult.

In severe HI, temperature regulation is impaired. Severe restrictive lung disease, difficulty intubating due to limited mouth opening and facial distortion, protein and electrolytes losses, dehydration, malnutrition and risk for development of sepsis are all potential complications related to anaesthesia in these patients. HI is an exceedingly rare condition; thus we wanted to share our experience to highlight the unique risks and complications specific to this disease process in the perioperative setting.
Perceived impact of interprofessional paediatric simulation on anaesthetist compared with paediatricians
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Introduction
The validated SPRinT (Simulated interPRofessional Team Training) programme delivers embedded 2-hour in-situ courses throughout the paediatric cardiorespiratory department and critical care areas. Anaesthetic trainees, not based on PICU but expected to attend paediatric emergencies, have been incorporated into the programme, to improve team realism and derive training for themselves. The anaesthetic trainees are predominantly from an adult anaesthetic background and the impact of this simulation programme, geared for paediatric staff, is unknown.

Aim
To evaluate the perceived impact of interprofessional paediatric simulation-based team training on anaesthetic trainees, compared with paediatric intensive care trainees.

Methods
SPRinT courses were conducted over a 6-month period. Simulated critical events were derived from real events to obtain well-staged realistic scenarios with clinical relevance and optimal authenticity. High fidelity mannequins and video-assisted debriefing was used. Post course self-evaluation questionnaires indicated level of agreement (0-100 scale) with statements related to course impact. Positive impact set at >60, highly positive impact >80. Data from anaesthetic and paediatric trainees (ST3+) were analysed. Statistical significance was calculated using the Chi-squared test.

Results
All 32 participants (14 anaesthetic and 17 paediatric) answered the questionnaire between June and December 2014.

11(79%) anaesthetic and 16(94%) paediatric trainees indicated highly positive impact on the usefulness of the interprofessional paediatric simulation.

Similar levels of positive impact were seen in relation to: improved non-technical skills/crisis resource management- 14(100%) anaesthetic, 16(94%) paediatric; improvement in communication skills-12(86%) anaesthetic, 16(94%) paediatric; improvement in situational awareness- 12(86%) anaesthetic, 16(94%) paediatric; improved confidence to manage future events- 12(86%) anaesthetic, 16(94%) paediatric; ability to provide future safer patient care- 11(79%) anaesthetic, 16(94%) paediatric.

A significant difference was seen with 7(50%) of anaesthetic trainees indicating a positive impact to improved technical skills post-simulation compared to 14 (82%) paediatricians (p<0.05).

Discussion
SPRinT courses were perceived by both groups as highly positive. Despite a focus on paediatric critical care events and paediatric staff, anaesthetic trainees reported the same positive benefits on team training/non-technical skills as the paediatric trainees.

Although improvement in technical skills is not a primary goal of SPRinT simulation, a significant difference in the groups’ perceptions of this was seen; far fewer anaesthetic trainees perceived any improvement in their technical skills compared with the paediatric trainees. This may be accounted for by the specific set of technical skills of the anaesthetist, which is likely better improved by anaesthetic-targeted simulation.

While it is not known whether these results will translate into subsequent clinical practice, there is evidence to suggest that providing an authentic learning experience does enhance transferability.
In conclusion, our results show that including anaesthetic trainees in an interprofessional paediatric simulation programme is worthwhile and positively impacts their practice.

Conflicts of interest
None declared.
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Quality of analgesia following elective day surgery at an Irish Children's Hospital
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Introduction
Day case procedures are progressively increasing in number and complexity over the past decade. Pain at home is often poorly managed, and post operative pain is associated with slower recovery and increased morbidity. This prospective audit was conducted to assess the severity of postoperative pain in children during the first two days following selected elective day case procedures.

Methods
Children undergoing general, urological, and eye surgical procedures were assessed for study inclusion during a 5-week period. Baseline demographics, premedication administration, intraoperative data, rescue analgesia, and validated age appropriate postoperative pain scores (FLACC, VAS) were recorded in recovery and the day ward. Parents were given an information sheet regarding analgesia at discharge. They were contacted 48 hours post discharge and administered a 17 variable, partially validated, structured questionnaire.

Results
77 children from 479 planned surgeries met the study inclusion criteria, and 73 parents consented for their children to participate in the audit. Four families were uncontactable by phone 48 hours post discharge leaving 69 participants for analysis. Surgical categories included orchidopexy (26), circumcision (15), hernia repair (13), other urological procedures (8), and squint surgery (7).

The mean age and weight was 4.3 years and 18.4 kg respectively. Oral midazolam was administered to 17% for pre operative anxiolysis. Perioperative multimodal analgesia included NSAIDs (91%), paracetamol (78%), fentanyl (61%), clonidine (49%), and tramadol 3% supplemented with peripheral nerve blocks (64%), local anaesthetic wound infiltration (28%), and caudal blocks (12%). Post operative rescue fentanyl and clonidine was required for 14% and 7% of participants respectively.

At discharge, 84% of children were pain free, and the remaining 16% had pain scores of 1 or 2 out of 10. There was a statistically significant decrease (p<0.05) in the number of children who were reported to be pain free in the first 24 hours (41%) and the second 24 hours (54%) compared to at discharge. Pain on day 1 was described as mild 30%, moderate 22%, severe 7% and described on day 2 as mild 12%, moderate 30%, severe 4%. Only 16% of children received the maximum doses of analgesia permitted in the first 24 hours and 9% of children in the second 24 hours.

No statistical difference was found between circumcisions, hernia repairs, or orchidopexies in terms of rescue analgesia, analgesia taken at home and pain scores. Parental satisfaction was very high, with 94% of parents satisfied with the information provided and analgesic regimen administered.

Conclusion
Good quality pain relief is being achieved in our institution while children are in hospital. Increased pain at home has been seen in similar studies. It remains to be seen whether emphasis on pre-emptive analgesia and further parental education would decrease pain scores when compared to the PRN schedule delivered.
Review of tranexamic acid use and analgesia for paediatric scoliosis surgery
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Introduction and aims
Correction of scoliosis is one of the commonest surgical procedures performed in children. Two important priorities for the anaesthetist are limitation and management of bleeding and post operative pain management.
We aim to conduct a retrospective data analysis of posterior fusion operations. Our principle considerations are intraoperative bleeding and perioperative analgesia.

Methods
The case notes of patients who had posterior fusion surgery in 2013 were examined and a standard proforma completed.

Results
Sixteen patients had posterior fusion for scoliosis in 2013. Mean age was 12.9 years, mean weight was 47.2kg. Five patients were ASA 1, 6 were ASA 2 and 5 were ASA 3. The mean estimated blood loss was 18.0 ml/kg (median 19.9 ml/kg). Thirteen patients received tranexamic acid intraoperatively and 8 patients received a bolus of 100 mg/kg and infusion of 10 mg/kg/hr. The median blood loss in those who received tranexamic acid was 18.2 ml/kg and in those who did not was 20.1 ml/kg. 25% of patients received a blood transfusion.

Intraoperatively 11 patients received morphine, 1 received fentanyl, 1 received ketamine and 9 patients received paracetamol. Postoperatively 13 patients had an intravenous patient/nurse controlled analgesia system (PCA/NCA) and 3 patients had an epidural.
Of the 3 patients with a post operative epidural all patients were converted to PCA/NCA analgesia at day 2, 3 and 4 respectively. Reasons for conversion were found in 2 patients: 'no block' and 'high pain scores'.

Of the 13 patients with PCA/NCA as initial form of analgesia, 9 had morphine 2mg/kg with ketamine 2mg/kg or 4mg/kg. Two patients had morphine 2mg/kg alone and one patient had fentanyl PCA/NCA because of previous post operative delirium attributed to morphine. Nine PCA/NCA were stopped from day 6 onwards. Two patients had PCA/NCA stopped on day 2 and day 4 secondary to hypercarbia and drowsiness respectively.

Two patients with epidurals had the lowest pain scores on day 1 but this effect was lost thereafter. Nausea scores were available for 12 patients and most patients had no nausea or vomiting in the first 5 post operative days.

Discussion and conclusion
Blood loss in our group was significant at approximately 20% estimated blood volume. Tranexamic acid reduces perioperative blood loss and transfusion in paediatric scoliosis surgery however it was not given to all of our patients1. Few patients had epidural analgesia post operatively and all were converted to PCA/NCA. In two instances this was unintentional and due to epidural failure. As numbers are small one form of analgesia cannot be recommended over another however a guideline for the administration of tranexamic acid is required.

Reference
Paediatric tonsillectomy
Daniel Celnik, Pamela Farquharson, Grant Rodney
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Introduction and aims
Tonsillectomy is associated with significant postoperative pain and side effects (1). Our previous audit data showed that pain was significant up to 7 days postoperatively, affecting function (inability to eat and drink). Despite this, many patients did not take maximum doses of simple analgesics. PONV and haemorrhage were not found to be a significant problem. Following recent MHRA (2) restrictions on the use of codeine in children, we now use oramorph postoperatively, including after discharge. We also provide parents with advice on postoperative analgesia. The aim of this audit is to evaluate pain management, analgesic use, function and complications following these changes in practice (replacing codeine with oramorph and improving our discharge information leaflets).

Methods
Premedication, analgesic and antiemetic drugs were documented by the anaesthetist. Pain, sedation and nausea scores were documented by ward nursing staff during hospital stay and by parents at home. Parents were provided with an information sheet and diary and asked to record pain scores using a simple 4 point verbal rating scale (none, mild, moderate, severe), quantity of analgesia given and whether their child was eating and drinking normally. They were also encouraged to report any other concerns. Nursing staff also provided telephone follow up.

Results
Preoperative paracetamol was given universally and ibuprofen to 95% of patients. Intraoperative opioids were used for all cases (50% fentanyl, 20 % fentanyl and tramadol, 15% fentanyl and morphine, 15% morphine). Anti-emetics were given to 95%, (70% dexamethasone and ondansetron, 25% triple anti-emetics). In hospital, 50% reported having mild/no pain. In the first 7 days postoperatively, 80% reported moderate or severe pain. Pain was worst on day 4 with 60% having moderate/severe pain. On this day only 30% received maximum doses of paracetamol and ibuprofen. On day seven, 25% were still reporting pain as moderate/severe. 65% used morphine during the postoperative period. No patients were eating and drinking normally for the whole study period, but there were no reports of nausea and vomiting following discharge. There were 2 cases of secondary haemorrhage and 2 prescriptions of antibiotics. No parents contacted their GP for further doses of morphine.

Discussion
These results are similar to the results of our previous audit and confirm that, regardless of the choice of opioid, tonsillectomy is a painful procedure which impairs function postoperatively. Overall these data suggest that postoperative analgesia with oramorph is comparable to analgesia with codeine. Despite advice and education, administration of simple analgesia is not been given in optimum doses and this may be contributing to the high levels of pain experienced and reduced oral intake. Further intervention, therefore, could focus on education of parents with regard to the importance of regular simple analgesia.

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