

# Pediatric Anesthesia

## The state of UK paediatric anaesthesia: a survey of National Health Service activity.

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# The state of UK paediatric anaesthesia: a survey of National Health Service activity

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A national survey by the 5<sup>th</sup> National Audit Project of the Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland

For Peer Review

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Key points:

- a) What is already known: There are hardly any reliable current data on national anaesthesia activity for infants and children.
- b) What this article adds: This is a unique and very large data set that provides details of the numbers of children, according to age and ASA grade having various types of procedures and anaesthesia techniques. It amounts to a census of paediatric anaesthesia.
- c) Implications for translation: The data will help those planning research and services and should stimulate other national audits to help compare and improve anaesthesia services around the world.

For Peer Review

## Abstract

### *Background*

This secondary analysis of the 2013 United Kingdom National Health Service (NHS) Anaesthesia Activity Survey of the Fifth National Audit Project (of the Royal College of Anaesthetists and Association of Anaesthetists of Great Britain and Ireland) shows paediatric anaesthesia activity in detail.

### *Methods*

A local coordinator (LC) in every NHS hospital collected data on patients undergoing any procedure managed by an anaesthetist. Questionnaires had 30 question categories. Each LC was randomised to a 2-day period. The paediatric age groups were infants, (<1y), pre-school age (1y to 5y) and school age children (6 to 15y).

### *Results*

The median questionnaire return rate was 98%. The annual caseload was estimated to be 486,900 children: 36,500 infants, 184,700 pre-school age and 265,800 school age children. Almost 90% of children (1-15 y) were ASA 1 or 2 and the substantial majority underwent routine non-urgent ear nose and throat, dental, orthopaedics or general surgery procedures; 65% were "day cases". One in 6 children were managed outside operating theatre sites compared with 1 in 12 adults. Forty one per cent was in district general hospitals. Almost all ASA 4 and 5 children (89%) and infants (92%) were managed in specialist hospitals. "Awake" cases and sedation accounted for only 2% of cases. There were notable differences in demography and anaesthetic care compared with adults and between different age groups of children.

### *Conclusion*

These data enable analysis of the current state of UK paediatric anaesthetic practice and highlight differences between paediatric and adult services.

Keywords: audit; anaesthesia, paediatric, airway, level of consciousness, technique

**Background**

In 2013, an Anaesthesia Activity Survey (AAS) was undertaken to estimate the annual caseload of peri-procedural anaesthetic activity administered within the United Kingdom National Health Service (UK NHS) and was part of the Fifth National Audit Project (NAP5) of the Royal College of Anaesthetists and Association of Anaesthetists of Great Britain and Ireland [1, 2]. The survey provided much detailed information about population characteristics, including main procedures, patient management (time of day and seniority of the anaesthetist), as well as the anaesthesia drugs and techniques used, and was used as the denominator to interpret reports of accidental awareness during general anaesthesia (AAGA) in NAP5. Initial data from this survey gave broad summary statistics of paediatric anaesthetic activity presented within an overview of total NHS activity [1, 2] but secondary analysis [3] of the same AAS dataset can describe, compare and contrast the anaesthetic care of children in three age groups (infants, pre-school age and school age children). These data will be helpful in the planning for paediatric anaesthesia services and research projects and we present further analysis of this unique national dataset.

## Methods

The methods for the AAS have been published elsewhere [1]. Briefly, all NHS hospitals, Trusts and Boards in the UK in which surgical procedures are performed were represented by 267 local coordinators (LCs). LCs coordinated a survey within their own hospital group on every patient who underwent a procedure under the care of an anaesthetist: this included general anaesthesia (GA), sedation [4], or with the patient awake. Only NHS patients managed in NHS hospitals were included.

Data collection over a whole week was considered both too burdensome and too costly, and therefore each LC was randomised to two consecutive days within the chosen week 9th to 16<sup>th</sup> September 2013. A scaling factor (180.68) converted the number of forms returned from two days into the estimated number of cases for a whole year (i.e. annual caseload) [1]. Caseloads were rounded to the nearest 100. An estimated annual caseload of 200 or 400 represents 1 or 2 forms respectively. If the number of forms within a specified category was less than 20, the number of forms (n) is stated.

Data were captured on a paper questionnaire form and read automatically by 'optical character recognition' technology (DRS Data & Research Services plc., Milton Keynes, Buckinghamshire, UK). The form had 30 questions (Supplementary Figure 1). Uninterpretable answers were discarded so that results relate only to interpretable forms.

All calculations were made using Microsoft Excel 2010 and the 'PivotTable' facility. The paediatric age groups were infants, (<1y), pre-school age (1y to 5y) and school age children (6 to 15y). Data from adult patients (i.e.  $\geq 16y$ ) are shown for comparison where appropriate. Obstetric cases were excluded because they were considered atypical and unsuitable for comparison with children [2]. Hospitals were divided into two groups; district general (DGH, n= 202) and specialist hospitals (n=65). Specialist hospitals included Children's hospitals, Teaching and University hospitals and other specialist hospitals known to provide paediatric anaesthesia services.

Results

Returns by LCs

All 267 LCs took part in the survey and a total of 20,400 forms were returned. The median return rate was 98% (IQR 95% to 100%) [1]; three LCs reported that they had no cases. The percentage of uninterpretable forms, in respect of intended conscious level, was 1% for infants, 0.1% for pre-school age children, 0.4% for school age children and 1.4% for adults. The number of forms in which conscious level was known in each age group was 17221 adults and 2695 children (13.5% of caseload) of whom 202 were infants (7.5% of children), 1022 pre-school age children (37.9% of children), and 1471 school age children (54.6% of children) (Figure 1). From these numbers, the annual caseload was calculated to be 3,111,500 adults and 486,900 children of whom 36,500 were infants, and 184,700 and 265,800 were pre-school age and school age children respectively. The caseload across the week was similar for all age groups (Supplementary Figure 2) and lowest at weekends.

Type of caseload

Table 1 shows the distribution of ASA grade [5] in each age group: 16% of all infants were ASA 4 or 5 compared with 1%, 0.8% and 3.1% in pre-school age children, school age children and adults respectively but 88% of preschool and 90% of school aged children were ASA 1 or 2.

Figure 2 shows the caseload by main procedure within each age group. In infants the three most common specialties were general surgery, cardiac surgery and radiology. In pre-school age children ear nose and throat (ENT) procedures accounted for 29% of the caseload. In school age children ENT, dental, orthopaedics & trauma and general surgery accounted for 18%, 17%, 20% and 12% of the caseload respectively.

The caseload of ASA 4 or 5 children was 9,800 of whom 5,800 were infants, and 1,800 and 2,200 were preschool and school aged children respectively (Table 1).Thirty eight percent of ASA 4 or 5 infants underwent cardiac surgery or cardiology procedures.



### *Admission type, urgency and timing of anaesthesia care*

Pre-school and school age children had the highest percentage of day case care: 65% of caseload compared to approximately 50% for adults (Supplementary Table 1). Almost 40% of infants underwent emergency care compared with 16-22% in each of the other age groups. The percentage of elective care [6] was least in infants (Supplementary Table 2). The caseload was spread across the week similarly for all age groups (Supplementary Figure 2). Elective (day case and inpatient) caseload reduced considerably at weekends contrasting with emergency work which was spread almost uniformly across the week (Supplementary Figure 3). Less than 7% of activity took place outside the hours of 08:01 – 18:00 in any age group.

### *Staffing*

Consultant presence increased as age decreased (Figure 3): a consultant was present for 95% of infants compared with 74% of adults. In a specialist hospital, for all children, the most senior anaesthetist present was a consultant in 85%, "Other career grade doctor" in 3% and a trainee in 12%: this compares with 82.5%, 11.5% and 6% respectively in a DGH (Supplementary Figure 4).

### *Hospital Type*

Forty one per cent of the paediatric caseload was undertaken in DGHs. Almost all ASA 4 and 5 patients (89%) and infants (92%) were managed in specialist hospitals (Figure 4). Seventy per cent of the DGH caseload was in ENT, orthopaedics and trauma and dental specialties, and 57% of these procedures were undertaken in DGHs. The caseloads within the 10 most common specialties in DGHs are presented in Figure 5 together with caseloads within specialist hospitals for comparison.

### *Location*

Approximately 17% of infants and 13% of pre-school aged children, regardless of ASA grade, were induced in locations outside operating theatres (Supplementary Figure 5A): compared with 2% of adults. If only ASA 4 and 5 patients are considered, over 40% were induced outside theatre in each paediatric age group (Supplementary Figure 5B): 30% of infants were anaesthetised in an ITU. Irrespective of ASA grade, 20% of all infants are recovered in an ITU or HDU setting (Supplementary Figure 6A): in ASA 4 or 5 infants this rose to 60% (Supplementary Figure 6B).

*Conscious level*

Almost all patients received GA (Table 2). Only one infant (0.5%) and three children (0.3%) were reported to be managed awake: two had peripheral local anaesthesia block and two had a radiology procedure without opioid analgesia or local anaesthesia. Approximately 2% of each paediatric age group received sedation compared with 10% of adults but the numbers of forms were less than 20 in each paediatric group. Deep sedation was reported in 1.8% and 1.2% of pre-school and school aged children respectively, and propofol was the most common maintenance agent used. Radiology, gastroenterology and other minor procedures were the procedures in which deep sedation was used most commonly.

*Central neuraxial block*

Most central neuraxial blocks (CNB) were epidural (89%, Supplementary Table 3). The annual epidural caseload was 15400 (3.4% of the paediatric caseload), and of these 22% were in infants, 51% in pre-school age children and 28% in school aged children. In all age groups the most common surgical specialties in which CNB was used were general surgery, urology and orthopaedics & trauma. Considering only general surgery and urology, 24% of infants, 24% of pre-school aged children and 4% of school aged children had an epidural.

*Induction*

The induction agent varied markedly with age. Most infants and pre-school aged children received sevoflurane (80.3% and 53% respectively) whereas propofol was the most common agent in school aged children and adults (73% and 94%, Figure 4). Ketamine was used in 4.7% of infants but in less than 0.5% in the other age groups. Thiopental was used in 1% and 2.9% of pre-school and school aged children, respectively. Neither etomidate nor halothane was used. Only one infant (0.5%) was reported to receive rapid sequence intubation (RSI). RSI was used in 2% of pre-school aged children, and 7% of school aged children and adults. Propofol was used in 65% of RSI cases in children and in adults.

*Maintenance*

Sevoflurane and isoflurane were the most common maintenance agents: used in approximately 70% and 15-20% of cases respectively (Figure 7). Nitrous oxide was used in 31% of infants and 25% of

adults but used more frequently in pre-school and school aged children (51% and 44% respectively) (Supplementary Figure 7). If there was an inhalational induction, nitrous oxide was used in 59% of pre-school and 62% of school aged children.

Propofol maintenance was used in 3.5% of GA cases and 89% of sedation cases (caseloads 16,600 and 5,800 respectively). The common main procedures in which propofol was used to maintain sedation or GA were “minor procedures” (22%), gastroenterology (16%), dental (15%), ENT (12%) and Radiology (13%).

#### *Remifentanyl and other opioid infusions*

The caseload of children receiving a remifentanyl infusion was 16,400: 70% were school age children and the predominant surgical specialties were ENT (26%), neurosurgery (15%), other minor procedures (13%), orthopaedics & trauma (11%) and general surgery (11%). Other opioid infusions were used infrequently across the specialties except in infants and pre-school aged children undergoing cardiac surgery (caseload 2,300). When propofol was the maintenance agent remifentanyl was used in 34% of cases compared with only 2% of cases maintained with a volatile agent.

#### *Main airway device*

A tracheal tube (TT) was used in 35.5% of all paediatric GA cases (caseload 156,600), a supraglottic airway device (SAD) in 56% (caseload 247,200), a facemask in 6.4% (caseload 28,400) and tracheostomy in 0.7% (caseload 2,900). In infants, a TT was used in 74%. Supplementary Figure 8 shows the caseload of children managed with a TT, SAD or facemask according to the specialty. ENT and general surgery accounted for 50% of TT caseload. Two thirds of the TT caseload had their TT removed awake, compared with 86% of adults.

#### *Neuromuscular blockade, monitoring and reversal*

Twenty five per cent of children receiving GA had a neuromuscular blocking agent (NMB) (caseload 116,200). Suxamethonium was used in 15% of the NMB caseload. Of children receiving a non-depolarising NMB, 18% were monitored with a peripheral nerve stimulator (compared with 41% of adults) and 59% received neostigmine reversal (compared with 67% of adults): sugammadex was not used in children. Almost all (97%) children receiving an NMB were intubated. However, of children

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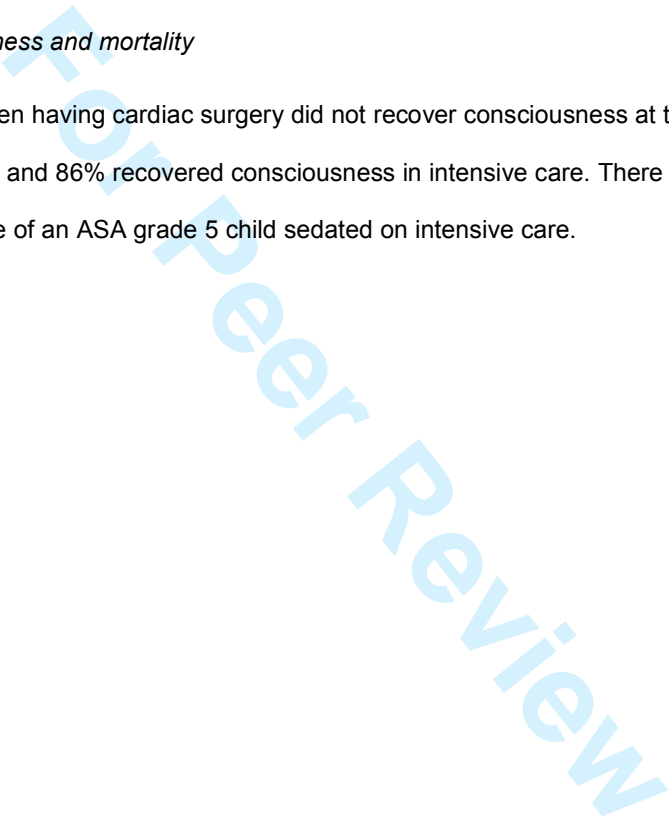
managed with a TT 33% did not receive a NMB, and 41% received a NMB for induction only. Only 1% of the SAD caseload received a NMB.

*Depth of Anaesthesia monitoring*

Depth of anaesthesia (DOA) monitors were used in 1% of all GA cases (n=23, of which 10 were Bispectral Index (BIS) and 7 were unspecified); if a NMB was used the proportion increased to 2%; if a NMB and propofol TIVA technique was used the proportion was 33%. DOA monitoring was not used in infants. There were no reports of the use of the isolated forearm technique.

*Return of consciousness and mortality*

Almost 50% of children having cardiac surgery did not recover consciousness at the time that the form was completed, and 86% recovered consciousness in intensive care. There were no deaths related to GA but one of an ASA grade 5 child sedated on intensive care.



## Discussion

These data, collected from children from all over the UK, provide a rich resource and enable analysis of the current state of UK paediatric anaesthetic practice. The estimated annual caseload of children having a procedure managed by an anaesthetist in the NHS was almost half a million: representing 1 in 7 of all cases under anaesthetic care. Not only were there notable differences in demography and anaesthetic care compared to adults but, importantly, also between different age groups of children.

Almost 90% of children (1-15 y) were classed as ASA 1 or 2 and, in these, the substantial majority underwent routine non-urgent ENT, dental, orthopaedics & trauma or general surgery procedures; 65% were 'day cases'. One in six children were managed outside operating theatre sites compared with 1 in 12 adults. Anaesthesia in Radiology, and other remote areas, is now commonplace and, worryingly, has a higher proportion of sick children than in the operating theatres (33% of Radiology children were ASA 3, 4 or 5, compared with just 12% in operating theatres). Whereas the radiology procedures themselves may be considered to be painless or minimally invasive, many of these children have complex medical problems and will need an experienced paediatric anaesthetist.

The data from infants were striking. Almost all infants (92%) were managed in specialist hospitals. Sixteen per cent were sick (ASA grade 4 or 5) compared with <5% of older children. Indeed, infants were proportionately higher risk than patients >86 y old, of whom only 10% were ASA 4 or 5. Nearly 40% of sick infants underwent a cardiac procedure, 30% had anaesthesia in ICU and 60% recovered in an ICU.

"Awake" cases were rare and sedation accounted for only 2% of cases. Neuraxial anaesthesia was always combined with GA and the annual epidural caseload was 15,400 (the type of epidural was not captured, but it is likely that most were caudal epidurals). Spinal anaesthesia was rare.

Anaesthesia techniques were markedly different between children and adults. An inhalational induction (all with sevoflurane) rather than an intravenous induction was preferred for infants and pre-school age children but not in school age children. Thiopental and ketamine inductions were uncommon but were in the drug armamentarium, unlike etomidate which was not reported. Halothane has become obsolete but nitrous oxide remained a common component of an inhalational technique. Sevoflurane, and not isoflurane, was the most frequent maintenance agent and we suggest this was

because both a spontaneous breathing technique via a SAD was common, and sevoflurane is less irritant to the airway [7, 8]: the questionnaire did not capture information on spontaneous breathing. More children were managed without a NMB than adults (74% v 50%) although this does not necessarily indicate the type of breathing. A TT was used in 35% of the caseload and, of these, 33% did not receive a NMB. Nevertheless, virtually all NMB cases had a TT (i.e. suggesting mechanical ventilation via SAD was rare) and 45% of these were ENT or general surgery cases. Suxamethonium was used in 15% of NMB cases. Fewer children than adults who received NMB were monitored with a peripheral nerve stimulator (18% v 41%). DOA monitors were used in only 1% of all paediatric GA cases. Two thirds of the TT caseload had their TT removed awake. It is reassuring that no deaths were reported under GA but the upper 95% confidence interval of zero in this series is 3 (of 2695) which equates to approximately 1.1 per thousand [9].

There are two other recent estimations of paediatric surgical activity, and to a large extent, anaesthesia activity may be assumed from these data. Analysis of English NHS Hospital Episode Statistics (HES), over the period 1994-95 to 2004-05, showed that although the number of operations stayed near to 520,000 per year the activity in DGHs decreased from 410,000 to 325,000 [10]: these numbers are higher than ours probably because they include activity in children up to age 18 y. The National Confidential Enquiry into Perioperative Deaths (NCEPOD) surveyed 178 NHS hospitals performing surgery in children (<18y) in 2008/9 and the estimated activity was approximately 410,000 of which 210,000 cases were undertaken in DGHs: these are broadly similar to ours considering that data were missing from some hospitals and that the NCEPOD survey did not include Scotland [11]. The size of the UK population helps to put these numbers in perspective. The 2011 UK census showed there were 11.1 million children (<15y old) out of a total population of 63.2 million (approximately 84% in England, 8% in Scotland, 5% in Wales and 3% in Northern Ireland) [12].

Our definition of “specialist” hospital has been broad, by necessity, because some LCs collected activity reports from a group of hospitals which included both teaching and paediatric hospitals: finer distinction of where the activity took place was therefore not possible. Nevertheless each DGH was checked, on-line, to determine that ‘specialist’ or ‘referral’ paediatric services were not provided.

There are other published national paediatric anaesthesia datasets but these lacked details of anaesthesia techniques and are of historical interest. Clergue and colleagues estimated there were

6.5 million anaesthetics in France in 1996, of which 14% were in children (<14 y) and less than 2% were ASA 4 or 5 [13]. In a much older study, in 1988, a Survey of Anaesthetic Practice (SOAP), organised by the Association of Anaesthetists, reported on 10,666 anaesthetics of which 12.4% were in children less than 15 y old [14]. This survey, however, was of practitioners and their practice, and provided limited information about patients. The number of neuraxial blocks performed annually in children in the UK in 2006 was estimated by NAP3 to be 21,500 (> 70% were caudal epidurals) [15]. This is appreciably more than 15,400 in our current survey and may reflect changes in practice or sampling variation.

Our survey of >2,500 is large enough to provide robust estimates of caseload and practice. However estimations of caseloads from smaller subgroups are less reliable. Confidence intervals (CIs) for small numbers, in these circumstances, are important (presented for reference in Supplementary Table 5: for example, in the infant group (n= 202) the 95% CI of 30% is 24 to 37%). Moreover, the annual caseload of ASA 4 or 5 infants was 5,800, but was based on only 32 interpretable returned forms; analysis within this subgroup is less reliable but we have presented the data for completeness.

Clinical research projects need large data sets to answer important questions. The NAP5 project found the incidence of AAGA reports, within a month of the incident, was surprisingly low (n=8) [16] compared to other studies relying on direct postoperative questioning [17]. That the NAP5 reports were infrequent, may either be due to avoidance of reporting of an extremely distressing experience or that the experience was not distressing. Interestingly, there were more late NAP5 AAGA reports (n=13) from incidents many years previously: four of the late reports by adults were about tonsillectomy as a child. Our dataset could help guide research to increase our knowledge and confidence about the seriousness and true incidence of AAGA in children. If it is assumed that the most serious cases of AAGA are associated with the use of NMBs, we estimate that, currently, the number of children (age 6-15y) having ENT procedures in which a NMB was used is approximately 10,000 per year. A survey focused on this group may be worthwhile because it is sufficiently large.

The two most common anaesthesia drugs used in our survey, sevoflurane and propofol, have many advantages over other drugs but are not without their problems. Many children suffer from emergence delirium [18] and injection pain [19] and our data show where large projects can be undertaken to test interventions or new drugs.

A substantial paediatric caseload (approximately 200,000, 41% of the total) was undertaken in DGHs, and this should interest those who plan paediatric services. The number of UK consultant paediatric anaesthetists, based on membership of the Association of Paediatric Anaesthetist (APA) is approximately 690 (personal communication with APA secretariat April 2015), and, if 40% are employed in DGHs, there will be an average of 1.3 per hospital. Fewer than 1 in 12 cases were performed out of routine operating hours or at weekends which, separated according to hospital type, amounted to 14,300 cases in DGHs and 11,700 cases in specialist hospitals (36% of out of hours cases in DGHs were orthopaedics & trauma compared with 12% in specialist hospitals). This means that, on average, each DGH may manage approximately 70 cases out of hours per year (~ 1.4 cases per week) compared with 180 per year in each specialist hospital (~3.5 per week). The provision of “on-call” paediatric anaesthetists in every DGH, with appropriate support services and equipment, may therefore be difficult. The NCEPOD study showed that not all DGHs provide paediatric surgery and that others are part of networks [10], nevertheless, our survey shows that the majority (57%) of ENT, dental and orthopaedics and trauma workload take place in DGHs, and this is a strong reason to support the maintenance of paediatric anaesthesia services outside specialist hospitals. Consultant presence was similar between the DGH and specialist hospitals but there were differences for non-consultant grades: more non-training career grade doctors were present in DGHs.

This survey is only part of the current “picture” of the state of paediatric anaesthesia in the UK. Other important missing ‘pieces of the jigsaw’, including safety, quality of recovery and patient and parent feedback, are needed to help guide our efforts to improve the delivery to individual patients and to the whole population.



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## Authors contribution

Michael R J Sury – Design of survey, main analysis of results, first and final draft of paper.

Renuka Arumainathan - Analysis of results, first and final draft of paper

Alla M Belhaj - Analysis of results, first and final draft of paper

James H MacG Palmer - Design of survey, analysis of results, writing of paper.

Tim M Cook – Design of survey, analysis of results, writing of paper.

Jaideep J Pandit - Design of survey, analysis of results, writing of paper.

## Potential conflicts

Michael R J Sury – Member of Editorial Advisory Board of Pediatric Anesthesia

Renuka Arumainathan - No interest declared

Alla M Belhaj - No interest declared

James H MacG Palmer - No interest declared

Tim M Cook – No interest declared

Jaideep J Pandit - No interest declared

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For Peer Review

Tables

Table 1: ASA grade and age group

% of caseload within each age group. Numbers of forms (n) are quoted if less than 20. ASA grades = Physical status classification system according to American Society of Anesthesiologists [5].

ASA grade	Infants	Pre-school Children	School children	Adults
1	32.8%	66.0%	69.7%	31.6%
2	19.0%	21.7%	19.8%	44.6%
3	31.8%	11.3%	9.7%	20.5%
4	15.4%	0.9% (n = 9)	0.6% (n = 9)	3.0%
5	1.0% (n = 2)	0.1% (n =1)	0% (n = 3)	0.3%

Table 2: *Intended conscious level*

% of caseload within each age group. Numbers of forms (n) are quoted if less than 20. Conscious level definitions were those published by the ASA [4].

Intended conscious level	Infants	Pre-school children	School children	Adults
<b>General Anaesthesia</b>	97.5%	98.2%	98.4%	73.5%
<b>Deep sedation</b>	1.5% (n=3)	1.8% (n=18)	1.2% (n=17)	1.9%
<b>Moderate sedation</b>	0.5% (n=1)	0.0%	0.1% (n=1)	3.6%
<b>Minimal Sedation</b>	0.0%	0.0%	0.1% (n=2)	4.2%
<b>Awake</b>	0.5% (n=1)	0.0%	0.3% (n=4)	16.8%

Supplementary Tables

Supplementary Table 1: Admission type

% of caseload within each age group

Admission type	Infants	Pre-school children	School children	Adults
Elective day cases	27.4%	66.7%	64.6%	44.9%
Elective inpatients	29.4%	15.6%	11.4%	28.6%
Emergency	38.8%	16.4%	23.2%	23.2%
Other	4.4%	1.3%	0.8%	3.3%



*Supplementary Table 2: NCEPOD priority*

% caseload within each age group. Numbers of forms (n) are quoted if less than 20. NCEPOD priority definitions have been published by the National Confidential Enquiry into Perioperative Deaths[6]

<b>NCEPOD Priority</b>	<b>Infants</b>	<b>Pre-school children</b>	<b>School children</b>	<b>Adults</b>
<b>Immediate</b>	4.6% (n=9)	1.1% (n=11)	1.9%	2.7%
<b>Urgent</b>	33.0%	13.8%	20.4%	21.3%
<b>Expedited</b>	15.5%	4.9%	4.7%	6.2%
<b>Elective</b>	46.9%	80.2%	73.0%	69.7%

Supplementary Table 3: Central neuraxial local anaesthetic techniques

% caseload within each age group. Numbers of forms (n) are quoted if less than 20.

Neuraxial technique	Infants	Pre-school age children	School age children	Adults
Epidural	10.3% (n=19)	4.6%	1.7%	1.8%
Spinal	0.5% (n=1)	0.1% (n=1)	0.2% (n=3)	8.0%
Neuraxial + other block	0.5% (n=1)	0.2% (n=2)	0.2% (n=2)	0.7%

Supplementary Table 4: Confidence intervals

	Sample size	% of sample	lower CI %	upper CI %
<b>Pre-School children</b>	1022	1	0.4	1.6
		5	3.6	6.4
		10	8.1	11.9
		30	27.1	32.9
<b>Infants</b>	202	1	0.0	2.4
		5	1.9	8.1
		10	5.8	14.2
		30	23.5	36.5
<b>ASA 4 or 5 infants</b>	32	1	0.0	4.6
		5	0.0	13.0
		10	0.0	21.0
		30	13.3	46.7

**Figure captions**

*Figure 1: Percentage of total caseload according to age group*

*Figure 2: Annual caseload according to specialty or main procedure*

*Figure 3: Most senior anaesthetist present*

“Other” includes career and training grade anaesthetists. % = % of caseload within each age group.

*Figure 4: Distribution of caseload between hospital type according to ASA grade*

DGH = District General Hospital. Specialist hospitals included Children’s hospitals, Teaching and University hospitals and other Specialist hospitals known to provide paediatric anaesthesia services.

ASA grades = Physical status classification system according to American Society of Anesthesiologists [5].

*Figure 5: Distribution of specialty caseload between hospital type*

DGH = District General Hospital. Specialist hospitals included Children’s hospitals, Teaching and University hospitals and other specialist hospitals known to provide paediatric anaesthesia services.

*Figure 6: Induction agent*

% = % of caseload within each age group. Other = midazolam or etomidate

Figure 7: Maintenance agent

% = % of caseload within each age group

Supplementary Figure 1: Survey questions

Supplementary Figure 2: Distribution of caseload across the week

Supplementary Figure 3: Distribution of admission type caseload across the week

All children (<16y), % = % of caseload within each admission type.

Supplementary Figure 4: Most senior anaesthetist present according to hospital type

All children (<16y). DGH = District General Hospital. Specialist hospitals included Children's hospitals, Teaching and University hospitals and other specialist hospitals known to provide paediatric anaesthesia services.

Supplementary Figure 5: Induction location outside operating theatres

A: All patients, irrespective of ASA grade. % = % within each age group.

B: ASA 4 or 5 patients only. % = % within each age group.

n = 30 infants, 10 pre-school age children, 11 school aged children, 469 adults

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*Supplementary Figure 6: Site of return of consciousness outside recovery rooms*

A: All patients, irrespective of ASA grade. % = % within each age group.

B: ASA 4 or 5 patients only. % = % within each age group.

*Supplementary Figure 7: Nitrous oxide*

% = % within each age group.

*Supplementary Figure 8: Main airway device*

% = % of caseload (all children <16y) within specialty group (or type of main operation). Numbers over bars are caseload \*1000.

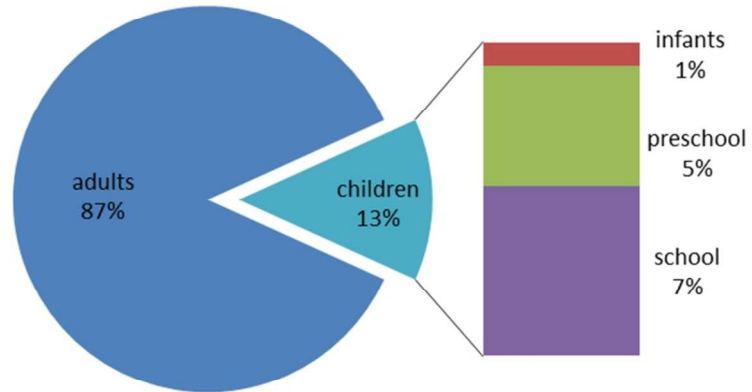


Figure 1: Percentage of total caseload according to age group  
76x41mm (300 x 300 DPI)

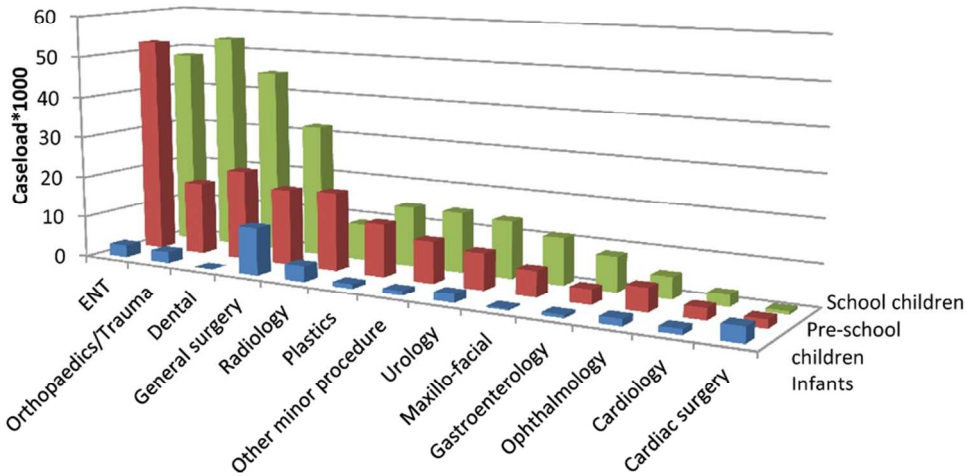


Figure 2: Annual caseload according to specialty or main procedure  
85x46mm (300 x 300 DPI)



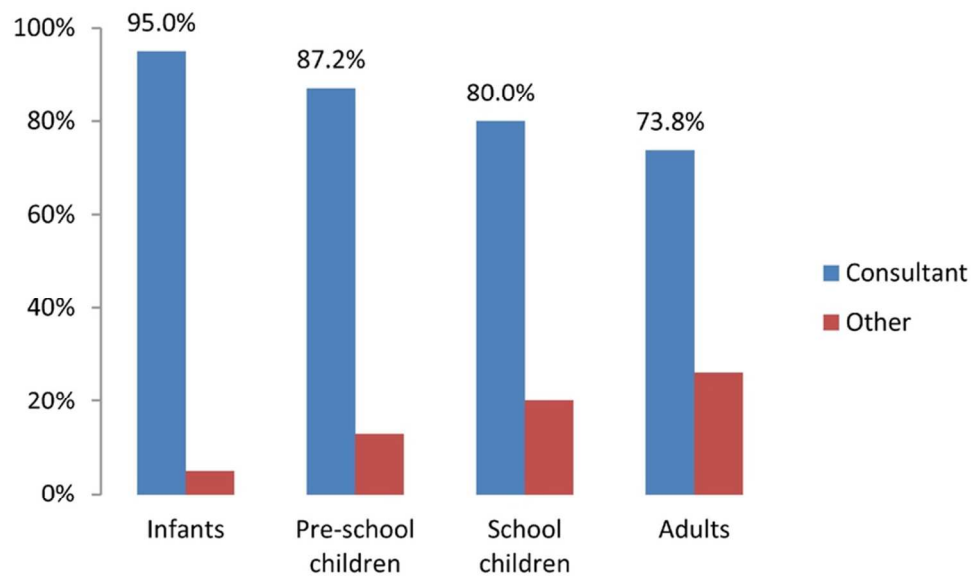


Figure 3: Most senior anaesthetist present  
"Other" includes career and training grade anaesthetists. % = % of caseload within each age group.

76x45mm (300 x 300 DPI)

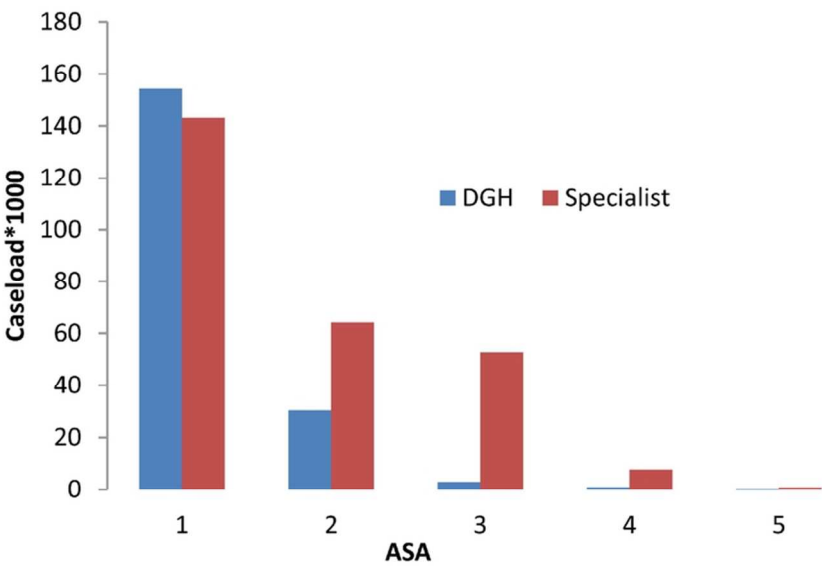


Figure 4: Distribution of caseload between hospital type according to ASA grade  
DGH = District General Hospital. Specialist hospitals included Children’s hospitals, Teaching and University hospitals and other Specialist hospitals known to provide paediatric anaesthesia services. ASA grades = Physical status classification system according to American Society of Anesthesiologists [5].

78x49mm (300 x 300 DPI)

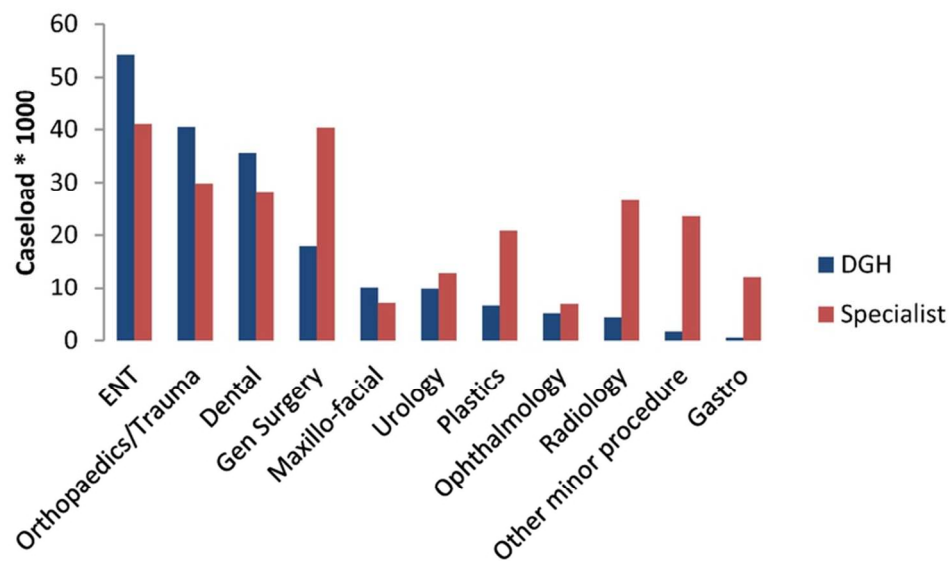


Figure 5: Distribution of specialty caseload between hospital type  
 DGH = District General Hospital. Specialist hospitals included Children's hospitals, Teaching and University hospitals and other specialist hospitals known to provide paediatric anaesthesia services.

75x44mm (300 x 300 DPI)

Review

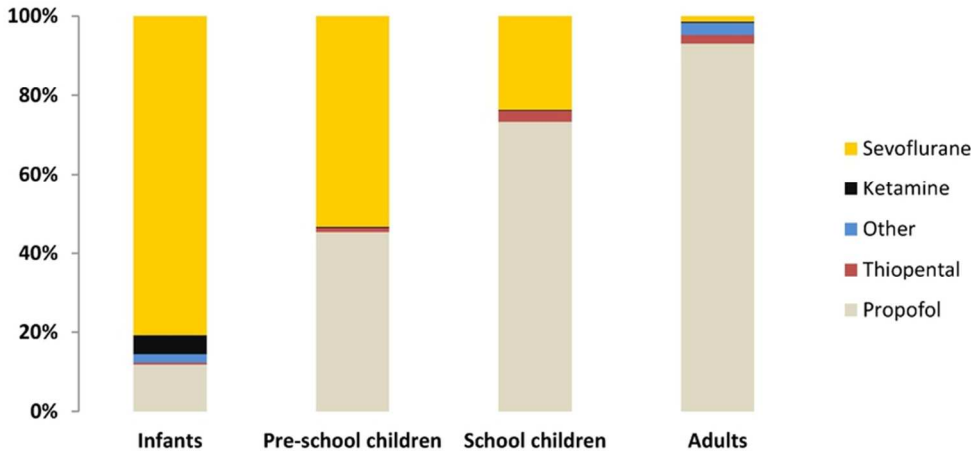


Figure 6: Induction agent  
% = % of caseload within each age group. Other = midazolam or etomidate

74x35mm (300 x 300 DPI)

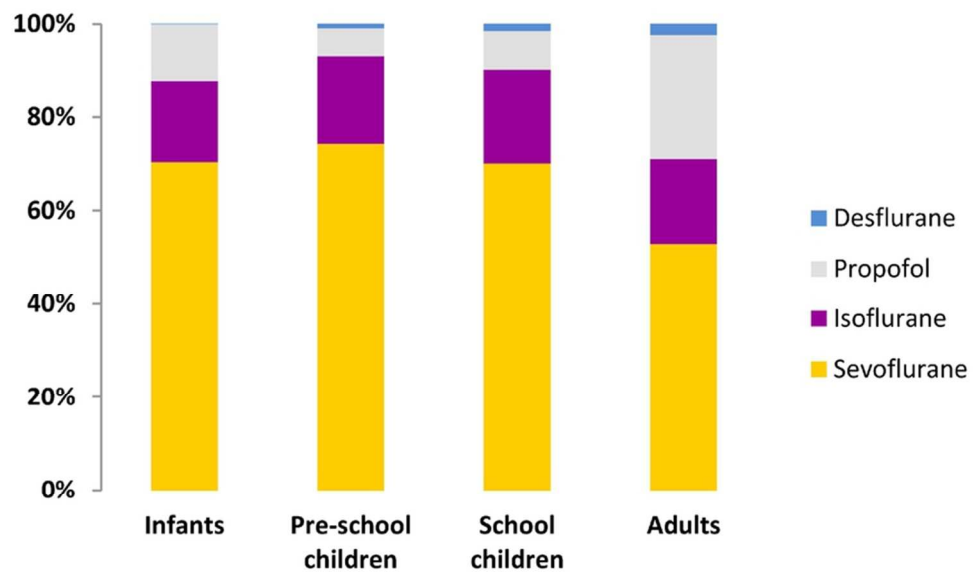

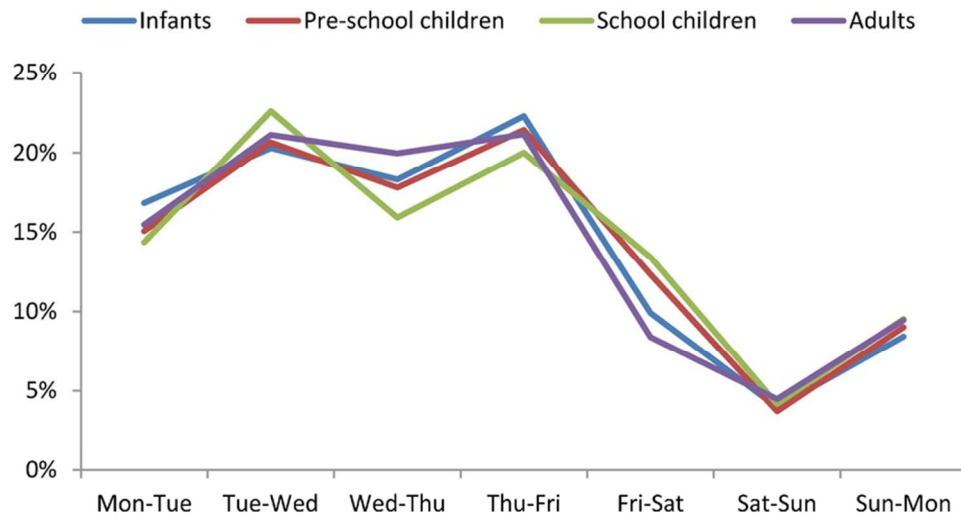


Figure 7: Maintenance agent  
% = % of caseload within each age group  
76x45mm (300 x 300 DPI)

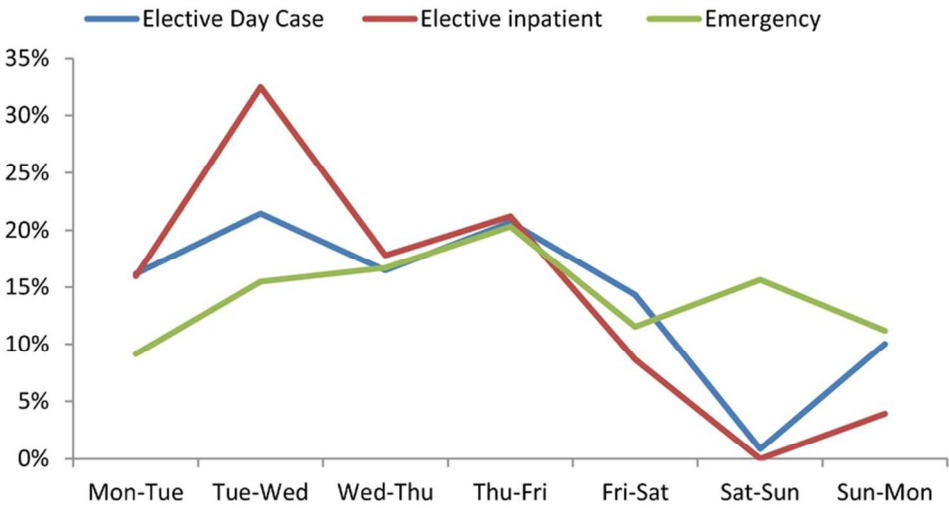
<h1>UK Anaesthetic Society Survey</h1> <h2>Phase 3 of National Audit Project 5</h2>		
<p>Please complete this form for all patients where anaesthesia care is provided by an <b>Anaesthetist</b> during the two day survey period.</p> <p>PLEASE SELECT ONLY <b>ONE</b> BOX IN EACH CATEGORY</p> <p>Mark boxes like this <input checked="" type="checkbox"/> or this: <input checked="" type="checkbox"/> not like this: <input type="checkbox"/> or this: <input type="checkbox"/> <input checked="" type="checkbox"/></p>		<p>Date: _____</p> <p>Hospital: _____</p> <p>Theatre number/Location: _____</p>
<p>NAP5 Hospital Code: _____</p> <p>Order on list: _____</p>		
<p><b>1. ADMISSION TYPE</b></p> <p><input type="checkbox"/> Elective Day Case</p> <p><input type="checkbox"/> Elective inpatient</p> <p><input type="checkbox"/> Emergency</p> <p><input type="checkbox"/> Other</p> <p><input type="checkbox"/> Unknown</p>	<p><b>8. INDUCTION LOCATION</b></p> <p><input type="checkbox"/> Theatre anaesthetic room</p> <p><input type="checkbox"/> Theatre</p> <p><input type="checkbox"/> Radiology or Cath-lab</p> <p><input type="checkbox"/> ICU</p> <p><input type="checkbox"/> Emergency Department</p> <p><input type="checkbox"/> Other</p> <p><input type="checkbox"/> Unknown</p>	<p><b>16. OPIOID</b></p> <p><input type="checkbox"/> Bolus <input type="checkbox"/> Infusion</p> <p><input type="checkbox"/> Bolus &amp; Infusion</p> <p><input type="checkbox"/> None <input type="checkbox"/> Unknown</p>
<p><b>2. AGE OF PATIENT (y)</b></p> <p><input type="checkbox"/> &lt;1</p> <p><input type="checkbox"/> 1-5</p> <p><input type="checkbox"/> 6-15</p> <p><input type="checkbox"/> 16-25</p> <p><input type="checkbox"/> 26-35</p> <p><input type="checkbox"/> 36-45</p> <p><input type="checkbox"/> 46-55</p> <p><input type="checkbox"/> 56-65</p> <p><input type="checkbox"/> 66-75</p> <p><input type="checkbox"/> 76-85</p> <p><input type="checkbox"/> &gt;86</p> <p><input type="checkbox"/> Unknown</p>	<p><b>9. INTENDED CONSCIOUS LEVEL</b></p> <p><input type="checkbox"/> General Anaesthesia</p> <p><input type="checkbox"/> Deep sedation</p> <p><input type="checkbox"/> Moderate sedation</p> <p><input type="checkbox"/> Minimal Sedation</p> <p><input type="checkbox"/> Awake (no sedation)</p> <p><input type="checkbox"/> Other</p> <p><input type="checkbox"/> Unknown</p>	<p><b>17. MAIN AIRWAY DEVICE</b></p> <p><input type="checkbox"/> None</p> <p><input type="checkbox"/> Oxygen mask or nasal specs</p> <p><input type="checkbox"/> Face Mask (+/- Guedel)</p> <p><input type="checkbox"/> Supraglottic airway</p> <p><input type="checkbox"/> Tracheal tube (oral/nasal)</p> <p><input type="checkbox"/> Tracheostomy</p> <p><input type="checkbox"/> Other <input type="checkbox"/> Unknown</p>
<p><b>3. SEX OF PATIENT</b></p> <p><input type="checkbox"/> Male <input type="checkbox"/> Female</p> <p><input type="checkbox"/> Unknown</p>	<p><b>10. ANAESTHESIA START TIME</b></p> <p><input type="checkbox"/> 00.01-08.00</p> <p><input type="checkbox"/> 08.01-18.00</p> <p><input type="checkbox"/> 18.01-24.00</p> <p><input type="checkbox"/> Unknown</p>	<p><b>18. LOCAL ANAESTHESIA</b></p> <p><input type="checkbox"/> None <input type="checkbox"/> Peripheral block</p> <p><input type="checkbox"/> Epidural <input type="checkbox"/> Spinal <input type="checkbox"/> CSE</p> <p><input type="checkbox"/> Neuraxial PLUS other block</p> <p><input type="checkbox"/> Local infiltration <input type="checkbox"/> Unknown</p>
<p><b>4. ASA GRADE</b></p> <p><input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6</p> <p><input type="checkbox"/> Unknown</p>	<p><b>11. MAIN INDUCTION AGENT</b></p> <p><input type="checkbox"/> Propofol <input type="checkbox"/> Thiopentone</p> <p><input type="checkbox"/> Etomidate <input type="checkbox"/> Midazolam</p> <p><input type="checkbox"/> Ketamine <input type="checkbox"/> Sevoflurane</p> <p><input type="checkbox"/> Halothane <input type="checkbox"/> Not applicable</p> <p><input type="checkbox"/> Other <input type="checkbox"/> Unknown</p>	<p><b>19. NEUROMUSCULAR blocker</b></p> <p><input type="checkbox"/> None</p> <p><input type="checkbox"/> Induction (or intubation) only</p> <p><input type="checkbox"/> Induction and maintenance</p> <p><input type="checkbox"/> Other <input type="checkbox"/> Unknown</p>
<p><b>5. Either NCEPOD PRIORITY</b></p> <p><input type="checkbox"/> Immediate <input type="checkbox"/> Urgent</p> <p><input type="checkbox"/> Expedited <input type="checkbox"/> Elective</p> <p><input type="checkbox"/> Unknown</p> <p><b>or Caesarean Category</b></p> <p><input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4</p> <p><input type="checkbox"/> Unknown</p>	<p><b>12. RAPID SEQUENCE intubation</b></p> <p><input type="checkbox"/> Yes, no opioid</p> <p><input type="checkbox"/> Yes, + opioid</p> <p><input type="checkbox"/> No <input type="checkbox"/> Unknown</p>	<p><b>20. Which neuromuscular blocker?</b></p> <p><input type="checkbox"/> Suxamethonium</p> <p><input type="checkbox"/> Non-depolariser (NDP) <input type="checkbox"/> Other</p> <p><input type="checkbox"/> Both Sux &amp; NDP <input type="checkbox"/> Neither</p> <p><input type="checkbox"/> Unknown</p>
<p><b>6. BODY HABITUS (BMI):</b></p> <p><input type="checkbox"/> Underweight (&lt;18.5)</p> <p><input type="checkbox"/> Normal (18.5-24.9)</p> <p><input type="checkbox"/> Overweight (25-29.9)</p> <p><input type="checkbox"/> Obese (30-34.9)</p> <p><input type="checkbox"/> Morbidly obese (&gt;35)</p> <p><input type="checkbox"/> Unknown</p>	<p><b>13. MAINTENANCE AGENT</b></p> <p><input type="checkbox"/> Halothane</p> <p><input type="checkbox"/> Isoflurane</p> <p><input type="checkbox"/> Sevoflurane</p> <p><input type="checkbox"/> Desflurane</p> <p><input type="checkbox"/> Propofol infusion (not TCI)</p> <p><input type="checkbox"/> Propofol infusion (TCI)</p> <p><input type="checkbox"/> Propofol infusion + volatile</p> <p><input type="checkbox"/> Intermittent bolus Propofol</p> <p><input type="checkbox"/> Other <input type="checkbox"/> Unknown</p>	<p><b>21. NERVE STIMULATOR USED</b></p> <p><input type="checkbox"/> Yes, during surgery</p> <p><input type="checkbox"/> Yes, end of surgery only</p> <p><input type="checkbox"/> No <input type="checkbox"/> Unknown</p>
<p><b>7. ETHNICITY</b></p> <p><input type="checkbox"/> White Caucasian</p> <p><input type="checkbox"/> Asian/Asian British/Indian</p> <p><input type="checkbox"/> Black/Afro-Caribbean</p> <p><input type="checkbox"/> Chinese/Japanese/SE Asian</p> <p><input type="checkbox"/> Mixed <input type="checkbox"/> Other</p> <p><input type="checkbox"/> Unknown</p>	<p><b>14. NITROUS OXIDE USED?</b></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p>	<p><b>22. WAS REVERSAL USED?</b></p> <p><input type="checkbox"/> Yes, Neostigmine</p> <p><input type="checkbox"/> Yes, Sugammadex <input type="checkbox"/> No</p> <p><input type="checkbox"/> Yes, other <input type="checkbox"/> Unknown</p>
	<p><b>15. REMIFENTANIL INFUSION?</b></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p>	<p><b>23. DEPTH OF ANAESTHESIA (DoA) MONITOR USED?</b></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No, or only end-tidal</p> <p><input type="checkbox"/> Unknown</p>
		<p><b>24. MAIN DEPTH MONITOR USED?</b></p> <p><input type="checkbox"/> BIS <input type="checkbox"/> Narcotrend</p> <p><input type="checkbox"/> E-Entropy</p> <p><input type="checkbox"/> Auditory evoked potentials</p> <p><input type="checkbox"/> Isolated forearm technique</p> <p><input type="checkbox"/> Unknown <input type="checkbox"/> Other</p>
		<p><b>25. MOST SENIOR ANAESTHETIST PRESENT?</b></p> <p><input type="checkbox"/> Consultant</p> <p><input type="checkbox"/> Other career grade doctor</p> <p><input type="checkbox"/> ST4-7 <input type="checkbox"/> ST3/CT3</p> <p><input type="checkbox"/> CT2 <input type="checkbox"/> CT1</p> <p><input type="checkbox"/> Other (e.g. research fellow)</p> <p><input type="checkbox"/> Unknown</p>
		<p><b>26. Is this person a LOCUM?</b></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p>
		<p><b>27. MAIN PROCEDURE</b></p> <p><input type="checkbox"/> Cardiac surgery</p> <p><input type="checkbox"/> Cardiology</p> <p><input type="checkbox"/> Dental</p> <p><input type="checkbox"/> Maxillo-facial</p> <p><input type="checkbox"/> ENT</p> <p><input type="checkbox"/> Gastroenterology</p> <p><input type="checkbox"/> General surgery</p> <p><input type="checkbox"/> Gynaecology</p> <p><input type="checkbox"/> Neurosurgery</p> <p><input type="checkbox"/> Obstetrics</p> <p><input type="checkbox"/> Ophthalmology</p> <p><input type="checkbox"/> Orthopaedics/Trauma</p> <p><input type="checkbox"/> Pain</p> <p><input type="checkbox"/> Plastics</p> <p><input type="checkbox"/> Psychiatry</p> <p><input type="checkbox"/> Radiology</p> <p><input type="checkbox"/> Thoracic</p> <p><input type="checkbox"/> Urology</p> <p><input type="checkbox"/> Vascular</p> <p><input type="checkbox"/> Other minor procedure</p> <p><input type="checkbox"/> Other major procedure</p> <p><input type="checkbox"/> Unknown</p>
		<p><b>28. AIRWAY REMOVED AWAKE?</b></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Airway not removed</p> <p><input type="checkbox"/> Not applicable</p>
		<p><b>29. RETURN OF CONSCIOUSNESS?</b></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown <input type="checkbox"/> Died</p>
		<p><b>30. If conscious returned, WHERE?</b></p> <p><input type="checkbox"/> Theatre <input type="checkbox"/> Recovery</p> <p><input type="checkbox"/> High Dependency Unit</p> <p><input type="checkbox"/> Intensive Care Unit</p> <p><input type="checkbox"/> Other <input type="checkbox"/> Unknown</p>

**PLEASE RETURN THIS FORM TO YOUR NAP5 LOCAL COORDINATOR**

Supplementary Figure 1: Survey questions  
276x379mm (300 x 300 DPI)



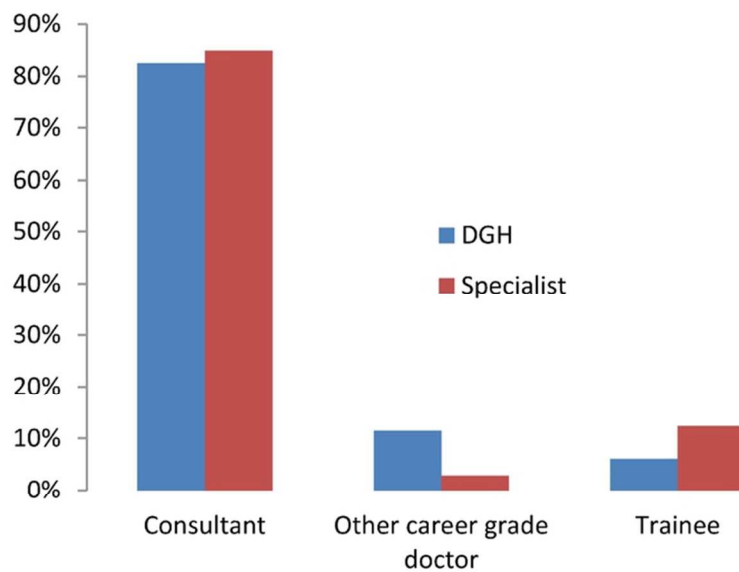
Supplementary Figure 2: Distribution of caseload across the week  
75x41mm (300 x 300 DPI)



Supplementary Figure 3: Distribution of admission type caseload across the week  
All children (<16y), % = % of caseload within each admission type.

76x42mm (300 x 300 DPI)

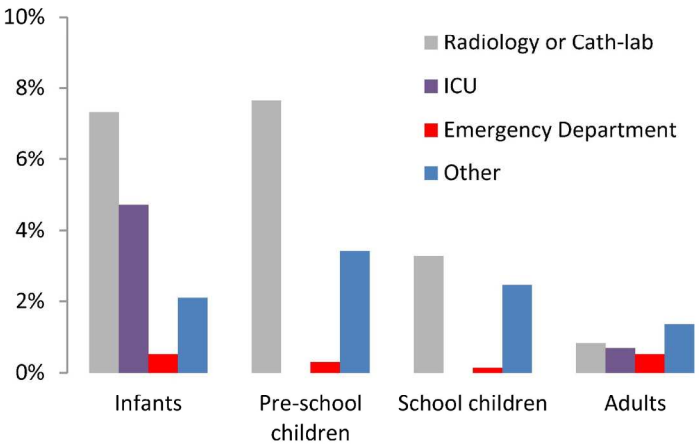




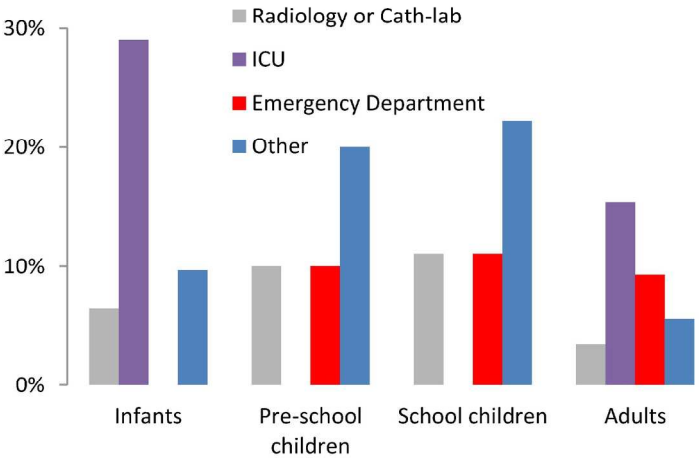
Supplementary Figure 4: Most senior anaesthetist present according to hospital type  
All children (<16y). DGH = District General Hospital. Specialist hospitals included Children's hospitals, Teaching and University hospitals and other specialist hospitals known to provide paediatric anaesthesia services.

76x45mm (300 x 300 DPI)

A:



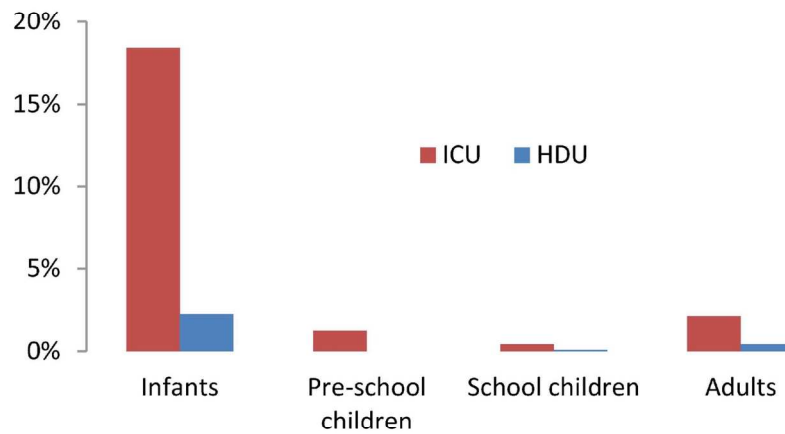
B:



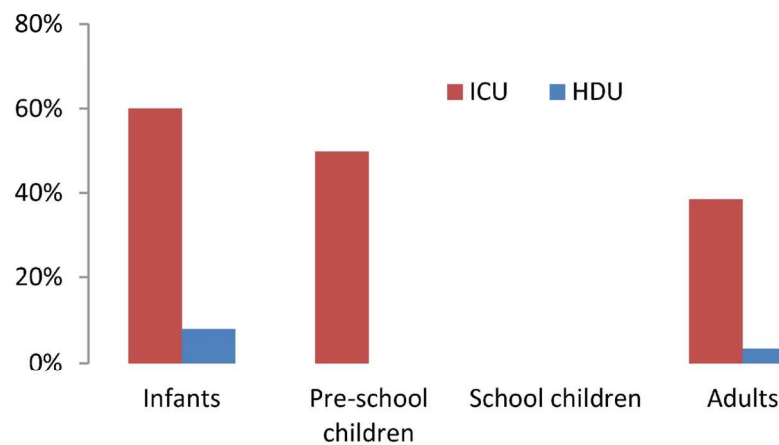
Supplementary Figure 5: Induction location outside operating theatres  
A: All patients, irrespective of ASA grade. % = % within each age group.  
B: ASA 4 or 5 patients only. % = % within each age group.  
n = 30 infants, 10 pre-school age children, 11 school aged children, 469 adults

175x242mm (300 x 300 DPI)

A:



B:

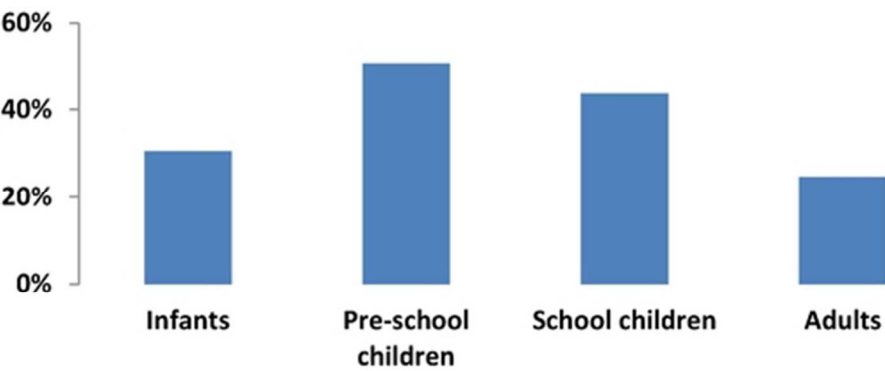


Supplementary Figure 6: Site of return of consciousness outside recovery rooms

A: All patients, irrespective of ASA grade. % = % within each age group.

B: ASA 4 or 5 patients only. % = % within each age group.

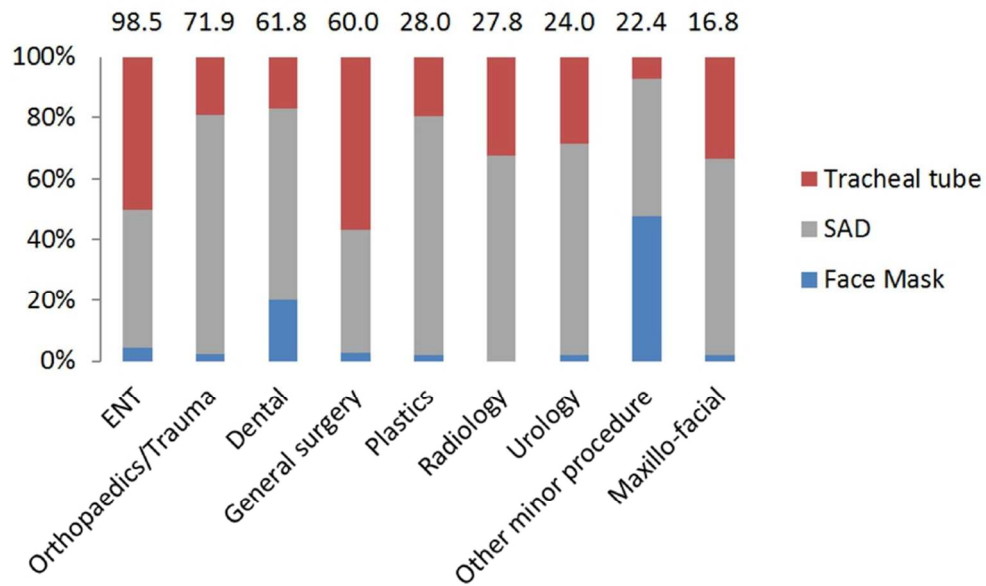
144x163mm (300 x 300 DPI)



Supplementary Figure 7: Nitrous oxide  
% = % within each age group.

48x19mm (300 x 300 DPI)

Peer Review



Supplementary Figure 8: Main airway device

% = % of caseload (all children <16y) within specialty group (or type of main operation). Numbers over bars are caseload \*1000.

82x51mm (300 x 300 DPI)