Original Article

Advanced airway training in the UK: A national survey of senior anesthetic trainees

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Abstract

Background and Aims: High-quality training in advanced airway skills is imperative to ensure safe anesthetic care and develop future airway specialists. Modern airway management skills are continually evolving in response to advancing technology and developing research. Therefore, it is of concern that training provisions and trainee competencies remain current and effective.
Material and Methods: A survey questionnaire based on the airway competencies described in the Royal College of Anaesthetists' curriculum and Difficult Airway Society guidelines was posted to all United Kingdom (UK) National Health Service hospitals to be completed by the most senior anesthetic trainee (ST 5–7, resident).
Results: A total of 149 responses were analyzed from 237 hospitals with eligible anesthetic trainees (response rate 63%), including 53 (36%) and 39 (26%) respondents who had completed higher and advanced level airway training respectively. Although clinical experience with videolaryngoscopy was satisfactory, poor confidence and familiarity was identified with awake fiberoptic intubation, high frequency jet ventilation, at risk extubation techniques, and airway ultrasound assessment. Only 26 (17%) respondents had access to an airway skills room or had regular airway emergency training with multidisciplinary theater team participation. Reported barriers to training included lack of training lists, dedicated teaching time, experienced trainers, and availability of equipment.
Conclusions: This national survey identified numerous deficiencies in airway competencies and training amongst senior anesthetic trainees (residents) in the UK. Restructuring of the airway training program and improvements in access to training facilities are essential to ensure effective airway training and the capability to produce future airway specialists.

Keywords: Difficult airway algorithm, nasal fiberoptic intubation, practice standards: definition, training

Introduction

The ability to manage an airway reliably and safely is an absolute necessity for all anesthetic, critical care, and emergency care physicians.[1-3] Failure to manage the anesthetized patient's airway appropriately can result in a can't intubate, can't oxygenate (CICO) scenario. Although rare, this can result in hypoxic brain damage and death.[1] The Fourth National Audit Project of the Royal College of Anesthetists (NAP4) and the Difficult Airway Society (DAS) have identified lack of training in advanced airway skills such as awake fiberoptic intubation (FOI) as a contributing factor to major complications in airway management.[1,4] The Royal College of Anesthetists (RCoA) defines the curriculum for trainee anesthetists and stipulates airway skills that should be achieved during basic, intermediate, higher, and advanced level training.[5] Furthermore, the DAS guidelines for management of unanticipated difficult intubation and tracheal extubation recommend training and competence in skills including videolaryngoscopy, fiberoptic guided intubation via a supraglottic airway device (SAD), surgical cricothyroidotomy,

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and advanced extubation techniques.[4,6] There are a wide range of necessary technical and nontechnical competencies in airway management.[7,8] Structured training in advanced airway management skills is therefore of high importance.

Awake FOI is an important technical skill, but for several reasons has become less commonly practiced.[9-11] In addition, training in the clinical environment has been further restricted due to changes in working patterns and service provision demands.[12-14] Advancing technology has introduced new techniques and expected competencies.[9,15,16] Appropriate training and sufficient practice with new equipment and techniques is imperative to allow safe and effective application. A previous United Kingdom (UK) national survey evaluated the provision of airway training from a trainer's perspective and found a wide variation in the content and delivery of out of theater airway workshops.[17] Since then changes to the structure of airway training including collaboration with surgical specialties, assisting with procedures such as tracheostomies, and multidisciplinary training has been suggested.[18,19]

We aimed to determine whether UK senior anesthetists in training are able to achieve necessary competencies in airway management skills as specified in the RCoA curriculum and DAS guidelines, determine their access to training facilities, and identify barriers to training. We therefore surveyed senior anesthetic trainees in the UK to assess their training and competencies in advanced airway skills.

Material and Methods

Formal UK Health Research Authority approval was not required for this type of study; however, we sought *a priori* advice from our local Research and Development department regarding the conduct of this study.

A questionnaire based on the RCoA curriculum and the DAS 2015 guidelines was designed using Microsoft Word®.[4-6] The questionnaire was piloted with anesthetic trainees in the local school of anesthesia and amended as necessary based on its results and feedback received from respondents. The questionnaire asked respondents' their professional demographics, time spent in airway modules, competence and self-rated confidence level in advanced airway techniques (on a scale of 1–10, 1 being not at all confident and 10 being highly confident), approximate number times a procedure had been performed to date, availability of training facilities including airway skills room, access to airway equipment, and barriers to training [Appendix 1].

A list of all of the anesthetic college tutors in the UK was obtained from the RCoA website (https://www.rcoa.ac.uk/schools-of-anaesthesia- accessed on 15 July 2017) and the postal address for each hospital obtained from a Google search. This identified 331 college tutors at 265 individual hospitals/NHS Trusts. Where hospitals had more than one college tutor, the tutor appearing first alphabetically was selected to avoid duplication. A college tutor at every hospital in the UK was sent a pack containing a covering letter, a paper questionnaire enclosed in a sealed envelope, and a prepaid return envelope. The covering letter instructed college tutors to give the questionnaire to the most senior anesthetic trainee within their department provided they were of specialist trainee year 5 or above. The trainee placed the completed questionnaire in a sealed envelope for return to the researchers and remained anonymous. Their responses were not accessible by seniors within their department. Each paper survey contained a unique ID. A second and third round of paper surveys were posted to nonresponding college tutors at six-week intervals. At 12 weeks, nonresponding hospitals were reminded by email or telephone call. The survey began in September 2017 and closed in December 2017. Duplicate replies were removed with the most recent reply discarded. The responses were compiled and analyzed using Microsoft Excel®, GraphPad Prism 5® (GraphPad Software, La Jolla California, USA), and SPSS (Version 24, IBM Corporation, Armonk, New York, USA). Differences in median confidence score and number of procedures performed between higher and advanced level trainees were compared using two-tailed Mann–Whitney U tests and statistical significance was taken as $P < 0.05$.

Results

Questionnaires were sent to 265 college tutors. 28 departments stated that they did not have specialist trainees in year 5–7. Therefore, the total number of hospitals with senior anesthetics trainees was 237. A total of 166 completed replies were received; however, 17 were removed as they were duplicate forms from the same hospital and so 149 responses were included in the final analysis. The response rate was therefore 63%. The response rate was equal across the nations of the UK and hospital sizes. There were 100 responses from ST5-6 trainees and 49 from ST7 trainees.

The time spent in a dedicated airway rotation varied from less than a month to 1 year [Figure 1]. Five (3%) respondents did not report the amount of time they had spent in a dedicated airway rotation. The number of dedicated airway block rotations completed by respondents was variable. Nine (6%) respondents stated they had done no rotations in a formal airway block. Twenty-nine (19%), 38 (25%), 15 (10%), and two (1%) respondents had completed one, two, three, and four rotations in

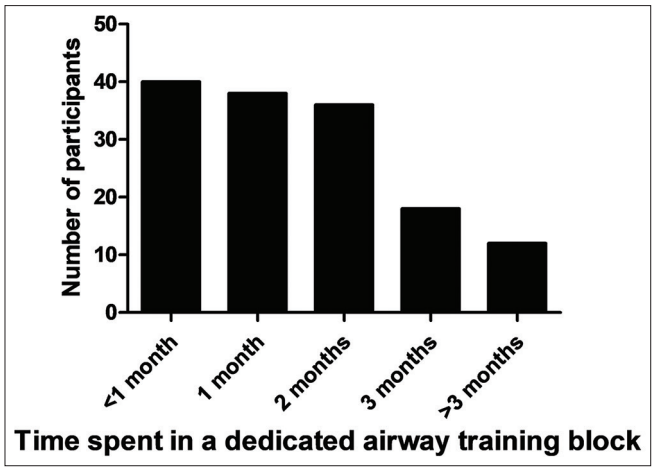

Figure 1: Time senior anesthetic trainees had spent in a dedicated airway training block

formal airway blocks respectively. Fifty-six (36%) respondents did not state how many airway blocks that had completed.

Self-rated competence, confidence, and number of times advanced airway techniques were performed are summarized in Table 1. These varied greatly by technique, for example there was low confidence in the use of ultrasound for airway assessment and high confidence with videolaryngoscopy.

The median (Interquartile range (IQR) [range]) confidence score in anesthetic list management for airway related surgery was 7 (5–8 [1–10]) and the number of lists managed ranged from 0 to 30. The median (IQR [range]) confidence score in front of neck access (surgical cricothyroidotomy) was 5 (3–6 [1–10]) and 29 (19%) respondents stated they have had an opportunity to assist with a formal surgical tracheostomy in theater.

A minority of respondents (58 [39%]) stated they received regular high-fidelity simulation training in airway emergencies and 26 (17%) of the respondents had training in airway emergencies with full theater team participation. Only 26 (17%) had access to an airway skills room in their current departments. The airway training workshops attended by respondents over the past two years is summarized in Table 2 with manikin-based workshops being the most commonly attend (127 [60%]). The availability of airway equipment for clinical and training purposes was variable as represented in Table 3.

With regard to videolaryngoscopy, 62 (36%) respondents had the most experience with the CMAC®, 49 (29%) with the Glidescope®, 40 (23%) with the McGrath, 16 (9%) with the Airtraq®, 2 (1%) with the Venner APA®, and 2 (1%) did not answer the question. Lack of learning opportunities and lack of training lists were the most commonly reported barriers to training [Table 4].

Table 1: Competence and confidence of senior anesthetic trainees in advanced airway techniques and the number of procedures performed to date

	Competence (*n* [proportion of total])					Confidence (1-10)		Number of procedures performed*	
	n	Direct supervision	Indirect supervision	Independent	Teach others	*n*	Median (IQR [range])	*n*	Median (IQR [range])
Advanced intubation techniques									
Nonchanneled videolaryngoscopy e.g., CMAC, Glidescope	149	3 (2%)	8 (5%)	35 (23%)	103 (69%)	149	10 (9-10 [2-10])	135	30 (20-50 [0-100])
Channeled videolaryngoscopy e.g., Airtraq, KingVision	147	8 (5%)	12 (8%)	48 (33%)	79 (54%)	149	8 (7-9 [1-10])	139	15 (2-25 [0-100])
Fibreoptic intubation in anaesthetized patient	149	9 (6%)	38 (26%)	58 (39%)	44 (30%)	149	8 (7-9 [2-10])	145	15 (8-20 [2-70])
Fibreoptic intubation in an awake patient	147	46 (31%)	52 (35%)	29 (20%)	20 (14%)	149	7 (5-8 [1-10])	145	10 (4-15 [0-70])
Fibreoptic intubation via a SAD	146	35 (24%)	50 (34%)	41 (28%)	20 (13%)	148	7 (6-9 [1-10])	143	2 (1-5 [0-30])
Advanced extubation techniques									
Remifentanil technique	149	14 (9%)	41 (28%)	67 (45%)	27 (18%)	149	8 (6-9 [1-10])	137	10 (4-20 [0-50])
LMA exchange technique	148	20 (14%)	31 (21%)	76 (51%)	21 (14%)	149	7 (5-8 [1-10])	141	5 (2-10 [0-50])
Airway exchange catheter technique	147	72 (49%)	45 (31%)	24 (16%)	6 (4%)	149	4 (2-6 [1-9])	143	1 (0-2 [0-20])
Other techniques									
High frequency jet ventilation	147	61 (41%)	48 (33%)	31 (21%)	7 (5%)	147	6 (3-8 [1-10])	141	8 (2-17 [0-40])
Use of ultrasound for airway assessment	146	103 (71%)	24 (16%)	13 (9%)	6 (4%)	149	2 (1-6 [1-10])	142	0 (0-3 [0-40])
Double lumen tube placement	147	30 (20%)	43 (29%)	55 (37%)	19 (13%)	149	7 (6-8 [1-10])	145	20 (12-30 [0-75])
Percutaneous tracheostomy	147	92 (63%)	35 (24%)	14 (10%)	6 (4%)	149	5 (3-7 [1-10])	139	5 (2-8 [0-25])

**Respondents were asked to approximate the number of times they had performed a procedure. Competence: direct supervision=requires direct supervision; indirect=can perform the skill with distant supervision; independent=can perform the skill without supervision; able to teach others: in addition to being able to perform the skill independently, can teach the skill to others*

There were 53 (36%) respondents who had completed solely higher level airway training. This included 31 (58%) ST5-6 and 22 (42%) ST7 level trainees. Their competence in airway skills is summarized in Table 5.

In relation to advanced level airway training, 39 (26%) had completed or were currently undertaking training, 38 (26%) were planning to complete, and 71 (48%) had no plans to complete. One respondent did not answer the question. The confidence and number of times trainees had performed advanced airway procedures is compared between higher and advanced level trainees in Table 6. For all skills, advanced level trainees had performed more airway procedures and demonstrated greater confidence compared to trainees who had completed only higher level of training. This difference was statistically significant for several skills, including channeled videolaryngoscopy and FOI in awake patients and via a SAD. Significantly greater confidence was also demonstrated by advanced level trainees compared with higher level trainees for advanced extubation using the remifentanil technique ($P = 0.0100$) and the airway exchange catheter technique ($P = 0.0244$). Advanced level trainees had significantly greater confidence than higher level trainees in surgical cricothyroidotomy ($P = 0.0256$) and airway list management ($P = 0.0060$). Advanced level trainees had undertaken anesthetic list management of complex airway patients ($P = 0.0322$) and airway ultrasound assessment ($P = 0.0491$) significantly more frequently that higher level trainees.

Table 2: Types of airway training workshops attended by senior anesthetic trainees in the past 2 years. Values are number (proportion of respondents)

Workshops	*n* (%)
Manikin	127 (60%)
Cadaver	34 (16%)
Tracheostomy	31 (15%)
Animal	5 (2%)
Other	5 (2%)
None	5 (2%)
N/A	6 (3%)

Respondents could select more than one option

Discussion

This national survey has evaluated advanced airway skills and airway training amongst senior anesthetic trainees in the UK. We have also evaluated their training opportunities, barriers to training, and provision of advanced airway equipment. A previous national survey addressed airway training from a trainer's perspective,[17] however our survey has evaluated advanced airway skills and training directly at a trainee level. To our knowledge this represents the first national survey of its kind in which anesthetic trainees in UK have rated their competence, experience, and confidence across a wide range of advanced airway techniques, and in addition appraised the provision of training facilities, airway equipment, and barriers to training.

We have demonstrated a marked variability in exposure to formal airway training and completion of advanced level training modules. Similarly, trainee competence and experience were variable across the advanced airway skills investigated. Competence with videolaryngoscopes was high, as was confidence and experience. Encouragingly, more than half of trainees felt competent enough to teach others. A high confidence level was also seen with FOI in anesthetized patients and more than half were able to perform this skill independently. However, FOI in awake patients and FOI via a SAD were performed infrequently and with poor competence. This is a worrying finding given that awake FOI is the preferred technique in the majority of anticipated difficult intubations and NAP4 has identified many cases where awake FOI may have prevented harm occurring to patients.[1] Despite this, FOI is performed uncommonly[10,11] and the application of videolaryngoscopy appears to have influenced this.[20,21] This is likely to have impacted upon trainee exposure and therefore contributed to the poor trainee competence found in our survey. Poor competence and experience with advanced extubation techniques was also seen; notably the laryngeal mask airway (LMA) exchange and airway exchange catheter techniques. Furthermore, few trainees could independently use high frequency jet ventilation, perform percutaneous tracheostomy, or use ultrasound for airway assessment. All of these skills are recommended in the

Table 3: Availability of airway equipment to senior anesthetic trainees in their current departments. Values are number (proportion)

Equipment	*n*	Not available	Available for ONLY when clinically necessary	Available for use clinically AND for training purposes
Nonchanneled videolaryngoscope e.g., CMAC, Glidescope	146	18 (12%)	24 (16%)	104 (70%)
Channeled videolaryngoscope e.g., Airtraq, KingVision	141	36 (24%)	30 (20%)	75 (50%)
Fiberoptic scope	148	0 (0%)	54 (36%)	94 (63%)
Airway exchange catheter	142	8 (5%)	89 60%)	45 (30%)
High frequency jet ventilation	143	22 (15%)	103 (69%)	19 (13%)

DAS 2015 guidelines. These worrying results are again likely due to the limited clinical opportunities available to practice and acquire this skill.

The limited exposure and competence with these infrequently performed techniques highlights the need for training outside of the clinical environment utilizing models and simulation. However, our survey has shown that the availability of simulation training, airway skills rooms, and airway equipment for training was sparse with many trainees having no access at all. The availability of airway training facilities was not universal and appears inadequate for many trainees nationally. This is concerning given our survey findings of poor competence and clinical experience with many advanced airway skills. It is known that regular training in any sphere of work is considered key to maintaining competency in skills performed infrequently.[22] Locally accessible airway skills rooms allow for regular practice of these skills and enable focused and tailored training to meet the needs of individual trainees. In the UK, it is recommended that every department of anesthesia have an airway lead with a designated role for overseeing local airway training, designing local policies, and ensuring standardization of airway equipment.[23] They could also play a role in setting up a local airway skills room. Although these carry immediate cost implications, they are likely to represent a long-term cost-effective training modality. With restricted study leave time and budgets, attending distant national courses may further compromise time spent in the clinical environment; highlighting the importance of a local airway skills facility.[14] In addition to restricted availability of equipment, our survey identified additional barriers to airway training. The two most commonly reported barriers were lack of learning opportunities and lack of appropriate training lists. From a trainee's perspective, possible explanations for reduced learning opportunities in the clinical environment could be professional commitments outside of the clinical environment (e.g., class room teaching, mandatory training), the effect of the European Working Time Directive, and service provision commitments.[13,14,24] From a trainer's perspective, lack of time for teaching has been reported in a previous study[17] and further supported by the 2017 GMC national survey.[17,22,25]

Table 4: Barriers to airway training identified by senior anesthetic trainees

Barrier	*n* (% of respondents)
Lack of learning opportunities	92 (62%)
Lack of training lists	83 (56%)
No dedicated teaching time	56 (38%)
Lack of experienced trainers	36 (24%)
Nonavailability of equipment	29 (19%)
Not enough enthusiasm amongst trainers	14 (9%)

Respondents could select more than one option

Regular multidisciplinary training in managing emergency situations, such as failed intubation and CICO scenarios, is necessary to develop and maintain expertise.[4,19] Recent recommendations encourage multidisciplinary collaboration and airway training.[18,19] Despite this, we found just 26 (17%) participants had training sessions with multidisciplinary theater team involvement. Targeted training for all specialties involved in managing airway emergencies is known to improve team dynamics and familiarity with the emergency airway management algorithms.[19]

Table 5: Competence in advanced airway techniques of senior anesthetic trainees who had completed higher level airway training only

		Competence (*n* [proportion of total])			
	n	Direct supervision	Indirect supervision	Independent	Teach others
Advanced intubation techniques					
Nonchanneled videolaryngoscopy e.g., CMAC, Glidescope	53	1 (2%)	3 (6%)	17 (32%)	32 (60%)
Channeled videolaryngoscopy e.g., Airtraq, KingVision	53	2 (4%)	6 (11%)	19 (36%)	25 (47%)
Fiberoptic intubation in anesthetized patient	53	1 (2%)	8 (15%)	27 (51%)	17 (32%)
Fiberoptic intubation in an awake patient	53	10 (19%)	23 (43%)	15 (28%)	5 (9%)
Fiberoptic intubation via a SAD	53	10 (19%)	19 (36%)	18 (34%)	5 (9%)
Advanced extubation techniques					
Remifentanil technique	53	4 (8%)	17 (32%)	23 (43%)	9 (16%)
LMA exchange technique	53	8 (15%)	14 (26%)	25 (47%)	5 (9%)
Airway exchange catheter technique	53	22 (42%)	20 (38%)	8 (15%)	1 (2%)
Other techniques					
High frequency jet ventilation	53	19 (36%)	18 (34%)	12 (23%)	4 (8%)
Use of ultrasound for airway assessment	53	37 (70%)	8 (15%)	6 (11%)	2 (4%)
Double lumen tube placement	53	10 (19%)	17 (32%)	15 (28%)	11 (21%)
Percutaneous tracheostomy	53	33 (62%)	12 (23%)	6 (11%)	2 (4%)

Competence: direct supervision=requires direct supervision; indirect=can perform the skill with distant supervision; independent=can perform the skill without supervision; able to teach others: in addition to being able to perform the skill independently, can teach the skill to others

Table 6: Comparison between senior anesthetic trainees who had completed higher or advanced level airway training in airway technique confidence and number of procedures performed to date

	Confidence (1-10) Median (IQR [range])			Number of procedures performed# (Median (IQR [range])		
	Higher level *n*=53	Advanced level *n*=39	*P*	Higher level *n*=53	Advanced level *n*=39	*P*
Advanced intubation techniques						
Nonchanneled videolaryngoscopy e.g., CMAC, Glidescope	10 (9-10 [7-10])	10 (10-10 [2-10])	0.0519	30 (20-50 [5-100])	38 (21-75 [0-100])	0.1485
Channeled videolaryngoscopy e.g., Airtraq, KingVision	8 (7-9 [1-10])	9 (8-10 [1-10])	*0.0427	10 (5-20 [0-50])	20 (11-30 [0-100])	*0.0303
Fiberoptic intubation in anesthetized patient	8 (8-9[5-10])	8 (8-10 [7-10])	0.1046	20 (10-20 [2-65])	20 (10-30 [4-70])	0.1611
Fiberoptic intubation in an awake patient	7 (6-8 [2-10])	8 (7-9 [5-10])	**0.0078	10 (6-16 [0-50])	15 (9-20 [3-70])	0.1564
Fiberoptic intubation via a SAD	7 (5-8 [1-10])	7 (6-8 [1-10])	**0.0075	2 (1-5 [1-10])	2 (2-10 [0-30])	0.1922
Advanced extubation techniques						
Remifentanil technique	8 (6-8 [1-10])	8 (7-10 [2-10])	**0.0100	10 (2-20 [0-50])	20 (8-38 [0-50])	*0.0125
Laryngeal mask exchange technique	7 (5-8 [1-10])	8 (7-9 [4-10])	0.0738	5 (2-10 [0-35])	5 (3-20 [0-50])	0.1089
Airway exchange catheter technique	4 (2-6 [1-8])	5 (4-7 [1-9])	*0.0244	1 (0-2 [0-20])	2 (0-4 [0-20])	0.1015
Other techniques						
High frequency jet ventilation	6 (4-8 [1-10])	6 (5-8 [1-10])	0.9546	10 (5-20 [0-40])	10 (4-20 [1-40])	0.7980
Use of ultrasound for airway assessment	2 (1-6 [1-10])	4 (2-6 [1-10])	0.0771	0 (0-2 [0-30])	0 (0-5 [0-40])	*0.0491
Double lumen tube placement	8 (7-9 [2-10])	8 (5-7 [3-10])	0.7343	20 (13-30 [2-70])	20 (15-30 [0-75])	0.9770
Surgical cricothyroidotomy	5 (3-6 [1-10])	6 (5-7 [1-9])	*0.0256	0 (0-0 [0-5])	0 (0-0 [0-5])	0.9512
Percutaneous tracheostomy	5 (3-7 [1-10])	6 (5-7 [1-10])	0.3167	5 (2-10 [0-25])	5 (2-10 [0-20])	0.9965
Airway list management	7 (5-8 [4-10])	8 (7-9 [5-10])	**0.0060	5 (3-10 [1-40])	10 (5-20 [1-30])	*0.0322

**P<0.05, **P<0.01. #Respondents were asked to approximate the number of times they had performed a procedure*

We have reassuringly demonstrated that advanced level trainees have greater confidence in advanced airway procedures and have performed them more frequently than higher level trainees. This difference was statistically significant for a number of the skills investigated. Our survey supports the notion that advanced level airway training allows trainees to gain greater exposure to complex airway skills and develop expertise.

In clinical practice, opportunities for training in complex airway skills and exposure to difficult airways is sporadic and are often emergent in nature. A trainee's placement may not match their learning requirements, therefore limiting training opportunities. The probability of encountering a difficult airway can be low.[1] The overall FOI rate in a UK teaching institution has been reported as just 1.2% of total tracheal intubations[11] and the rate of awake FOI as 1.71% of all general anesthetics.[10] There is a significant negative correlation between the rate of complications associated with awake FOI and experience of the operator.[10] Therefore, well-structured training supplemented by teaching modalities outside the operating theater such as endoscopy simulators, nasendoscopy in the ENT clinic, and endoscopy in bronchoscopy clinics is essential. Teaching time is always precious as the trainer and trainee have to strike a balance between training time and service provision demands. Heavy workloads remain a concern with more than 40% of trainers reporting their working day as heavy.[25] Once a competency is achieved, regular practice is essential to prevent skill deterioration. Deliberate practice, evaluation of performance, modification of behavior, and regular opportunities to practice are key elements in gaining expertise in advanced airway skills such as awake FOI and at risk extubation techniques.[26] The learning curve for technical skills is biphasic in nature, with roughly 80% competency achieved over approximately 30 cases, but for continued improvement in performance over 100 cases may be required.[27] Adequate clinical exposure is therefore imperative.

Limitations

The main limitation to our study is the selection bias inherent to this type of survey methodology. Whilst we have obtained a reasonable response rate for this national survey, the nonresponders form a sample not represented in our data. Furthermore, the methodology of the college tutor passing on the survey to a senior anesthetic trainee may have generated a selection bias. This however, was the best practical solution to eliminate duplicate responses and gain an authentic representation required of a national survey. We recognize that the survey results depend on the accuracy of information provided by the respondents. We asked respondents to state the approximate number of procedures performed during their training career. An acceptability bias is possible within these responses; possibly amplified in those completing advanced level training. The risk of this was reduced by ensuring the survey was anonymized. Detailed definitions of the

techniques were not provided and hence individual trainee's understanding of some procedures may have influenced their responses. We also recognize that there is a possibility of interindividual variability in rating their confidence.

Conclusion

Our survey highlights the deficiencies in advanced airway skills amongst senior anesthetic trainees in the UK. Confidence, competence, and practical experience were satisfactory for some skills such as videolaryngoscopy and asleep FOI. However, sufficient experience with awake FOI, FOI via a SAD, high frequency jet ventilation, and at risk extubation techniques was lacking amongst a majority of senior anesthetic trainees; particularly those who had not completed advanced level airway training. Lack of multidisciplinary training, coexistent deficiency of dedicated airway skills rooms, lack of learning opportunities, and lack of teaching time were identified as the key barriers to training.

With limited availability of training resources, it is a challenge to ensure that trainees have uniform and adequate competencies in all advanced airway skills. Therefore, it may be necessary to restructure the existing airway training program to produce future airway specialists. There is a precedent for this after the revealing NAP4 report and resulting widely accepted recommendations.[1,4,17,23] Perhaps this could be achieved with enhanced and targeted training at the advanced airway level, along with improved provision of airway skills rooms and equipment for training purposes.

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Conflicts of interest
There are no conflicts of interest.

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Appendix 1

Higher level airway training –a national survey

We would be grateful if you could complete this survey, which is based on RCoA syllabus and DAS 2015 guidelines for higher level airway training. Through this survey, we hope to evaluate the degree to which these skills are practically achievable and the results will help us to improve the structure of airway training programmes.

Please identify your position: ST 5-6 □ / ST 7 □ other……

1. **Have you completed a higher training module in Airway Management?** YES □/NO □
2. **What is your status regarding advanced training in Airway Management?**
   Completed or currently undertaking □/Planning to complete □/No plans to complete □
3. **Amount of time spent in airway block (module) in each rotation <1 month □ 1 month□ 2 months□**
   Other (please specify)…… number of **total** rotations in airway blocks **till date**……
4. **How would you rate your competence in performing the following procedures in the clinical environment? (Please tick the relevant box.** *Only tick one box for each procedure)*

	Need direct supervision	Able to use under indirect supervision	Able to use independently	Able to teach others
Intubation techniques:				
Non-channelled videolaryngoscope (e.g. McGrath, Glidescope)				
Channelled videolaryngoscope (e.g. Airtraq, King Vision)				
Fibreoptic intubation in anaesthetised patient				
Awake fibreoptic intubation				
Fibreoptic intubation via a Supraglottic Airway Device				
Advanced extubation technique				
Remifentanil technique				
LMA exchange technique				
Airway exchange catheter technique				
Other techniques				
High frequency jet ventilation				
Use of ultrasound for airway assessment				
Double lumen tube placement				
Percutaneous tracheostomy				

5. **Please rate your confidence and the approximate number of times you have used the devices or performed the following procedures:** *Confidence on a scale of 1 to 10, 1 being not at all confident and 10 being highly confident*

	Confidence 1=not confident 10=highly confident	Approximate number of times performed to date
Intubation techniques:		
Non-channelled videolaryngoscope (e.g. McGrath, C-Mac, Glidescope)		
Channelled videolaryngoscope (e.g. Airtraq, King Vision)		
Fibreoptic intubation in anaesthetised patient		
Awake fibreoptic intubation		
Fibreoptic intubation via a Supraglottic Airway Device		
Advanced extubation techniques:		
Remifentanil technique		
LMA exchange technique		
Airway exchange catheter technique		
Other techniques:		
High frequency jet ventilation		
Use of ultrasound for airway assessment		
Surgical cricothyroidotomy		
Percutaneous tracheostomy		
Double lumen tube placement		
Anaesthetic List Management involving multiple patients for airway related surgery, including patients with predicted difficult airway		

6. **Do you have regular training in airway emergencies on high fidelity simulation?** YES □/NO □
7. **Have you had an opportunity to assist with a formal surgical tracheostomy in the operating theatre?** YES □/NO □
8. **In the last two years which of the following advanced airway training workshops did you attend?**
   Cadaver based airway workshops □ Manikin based airway workshops □
   Tracheostomy care workshops □ Other (please specify)……
9. **In your CURRENT department, is there a dedicated airway skills training room or airway lab where fibreoptic endoscopy, videolaryngoscopy and surgical cricothyroidotomy training is available?** YES □/NO □
10. **Is there regular training in airway emergencies with full theatre team participation?** YES □/NO □
11. **Please name the videolaryngoscope you are most experienced with…….**
12. **Please assess the availability of the following equipment in your CURRENT department (Please tick the relevant box)**

	Not available	Available to use in theatre ONLY when clinically necessary	Available to use in theatre clinically AND for training purposes
Non-channelled videolaryngoscope (e.g. CMAC, Glidescope)			
Channelled videolaryngoscope (e.g. Airtraq, King Vision)			
Fibreoptic scope			
Airway exchange catheter			
High frequency jet ventilation			
Surgical cricothyroidotomy set			
Other advanced airway devices (please specify)			

13. **In your department, what are the barriers for advanced airway training (tick all that applicable)** (example: awake fibreoptic intubation, at risk extubation techniques)

Not availability of equipment
Lack of number of experienced trainers
Lack of number of training lists
Lack of learning opportunity (case mix, difficult airway cases)
Not enough enthusiasm amongst the trainers
No dedicated teaching time for trainers

14. **What improvements do you think should be made to the quality of airway training in your department?**

15. **Any further comments?**

Many thanks for taking the time to answer this questionnaire. Please return this in the addressed, pre-paid envelope.

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