



**QUEEN'S  
UNIVERSITY  
BELFAST**

## Critical Incident Analysis: Equip to avoid failure

Potts, N., Martin, D. S. E., & Hoy, L. (2017). Critical Incident Analysis: Equip to avoid failure. *Journal of Perioperative Practice*, 27(4), 77-81.

### Published in:

*Journal of Perioperative Practice*

### Document Version:

Publisher's PDF, also known as Version of record

### Queen's University Belfast - Research Portal:

[Link to publication record in Queen's University Belfast Research Portal](#)

### Publisher rights

© 2017 The Association for Perioperative Practice.

This work is made available online in accordance with the publisher's policies. Please refer to any applicable terms of use of the publisher.

### General rights

Copyright for the publications made accessible via the Queen's University Belfast Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

### Take down policy

The Research Portal is Queen's institutional repository that provides access to Queen's research output. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact [openaccess@qub.ac.uk](mailto:openaccess@qub.ac.uk).

**KEYWORDS** Critical incident analysis / Anaesthetic nurse specialist / Anaesthetic equipment / Unanticipated difficult airway / Root cause analysis

**Provenance and Peer review:** Unsolicited contribution; Peer reviewed; Accepted for publication July 2016.

# Critical incident analysis: Equip to avoid failure

by N Potts, DSE Martin and L Hoy

Correspondence address: DSE Martin, Lecturer (Education)/Pathway Leader Specialist Practice in Anaesthetic Nursing, School of Nursing and Midwifery, Queen's University Belfast, Medical Biology Centre, 97 Lisburn Road, Belfast BT9 7BL. Email: d.s.martin@qub.ac.uk

This work is set in the context of perioperative practice in difficult airway management. It integrates a root cause analysis and fish bone technique to investigate a critical incident in temporary yet crucial equipment failure. Risk management and incident reporting is analysed alongside human factors in the operating theatre environment. Finally, recommendations for risk reduction, vigilance and checking vital airway equipment are made in anaesthetic practice.

## Introduction

Critical incident reporting (CIR) is a tool for quality improvement, and is arguably a 'window to the system' (Staender et al 2011), revealing the weaknesses involved in an organisation. Staender et al (2011) argued that critical incident reporting and analysis is a beneficial resource for healthcare staff to gain experience and to learn from, in order to protect patients. Howell et al (2015) reported an analysis of approximately 5.8 million near misses and incidents that caused patient harm or death from the National Reporting and Learning System (NRLS) database over a ten year period. They concluded that 70.3% of incidents reported caused no harm to patients. Howell et al (2015) further stipulated that when staff are kept informed, receive feedback and when reporting systems are confidential, the number of critical incidents reported increases.

Critical incident analysis is used and greatly appreciated in the discipline of anaesthetics, yet it comes with obstacles such as personal lack of commitment to the process, fear of negative consequences and the potential for exposing vulnerabilities (Vachon & LeBlanc 2011). It is thus becoming increasingly important for the anaesthetic nurse specialist (ANS) and other healthcare professionals working in the role of anaesthetic assistant in

particular, to be aware of what a critical incident is and how to report it in order to provide safe patient care.

For this article, the authors will evaluate a critical incident of anaesthetic equipment failure during an unanticipated difficult airway in an operating theatre department using a root cause analysis (RCA) framework. The incident involves an elective patient scheduled for ear, nose and throat (ENT) surgery in which, despite intensive preoperative airway assessment by the anaesthetist, the patient's difficult airway for intubation went unnoticed. Also included in this article is discussion of the history and background of incident reporting and current implications to the speciality of anaesthetics.

## History of critical incident analysis

Incident reporting has its origins in military aviation and has derived from the work of Flanagan (1954), who developed the critical incident technique primarily to improve safety and performance among military pilots. However, Cooper et al (1978) are unquestionably the pioneers of incident reporting in anaesthesia. They published their landmark paper on the application of incident technique, used to examine causes and later prevention strategies for adverse anaesthetic outcomes. They utilised a 'modified critical incident technique'

to interview anaesthetists and obtain descriptions of preventable incidents. Over the years, aviation has developed a number of defensive strategies and has achieved remarkable success in improving safety, with Toff (2010) articulating that applying some of the lessons learnt in aviation has helped to make healthcare safer.

Anaesthesia was the first speciality to make use of the incident reporting technique in clinical care. Reed et al (2013) surveyed national reporting systems in six European countries and found that all reporting systems, whether at national or local level, are necessary for optimal and safe functioning of organisational systems. There has been an on-going debate as to why anaesthesia has evolved from aviation specifically in comparison to other specialities in healthcare. Toff (2010) suggested that the three-step analogues between aviation and anaesthesia are similar: take off, cruise and landing in aviation; induction, maintenance and emergence in anaesthesia. Toff (2010) further postulated that anaesthesia has always adopted aviation techniques and is highly proactive in the promotion of human factors in clinical practice.

This proactive approach is the strategy at the forefront of the World Health Organisation surgical safety checklist (WHO 2008), which was introduced with the support from National Reporting

## Critical incident analysis: Equip to avoid failure

*Continued*

and Learning system. Lingard et al (2008) highlighted that the WHO (2008) preoperative checklist briefings have been shown to reduce the number of communication failures and to promote collaborative teamwork. The objective was to reduce the number of surgical complications and deaths. Toff (2010) purported that the introduction of preoperative briefings has resulted in an improved atmosphere in theatre, with all staff feeling included and empowered. Furthermore, in the author's (NP) clinical area, the WHO checklist is mandatory and has been well received by all members of the perioperative team. This process, along with critical incident analysis, highlights the impact of human factors in healthcare and ultimately provides safer anaesthetic care.

### Background to the incident

During the incident in question a fibre optic screen failed during anaesthesia induction. Fasting and Gisvold (2002) suggested that 25% of equipment problems could be related to human error and furthermore that 18 of 29 cases were related to inadequate pre-use checks. Cassidy et al (2011) argued that it may be easier for a clinician to blame the equipment rather than to admit a misunderstanding or mistake. A 'human factors' approach (Reason 1990) can be utilised to focus on the organisational factors that led to the incident which occurred, rather than zoning individual blame (Mahajan 2010). The authors believe that latent human factors contributed to the situation of the unanticipated difficult airway in our theatre. The factors included an inadequate skill mix and the competency of staff, including the specialist anaesthetic nurse who had to troubleshoot technical issues with the anaesthetic equipment.

Cassidy et al (2011) drew attention to the National Patient Safety Agency (NPSA) which since 2006 has worked closely with clinicians in an attempt to extract useful lessons from incidents and to translate them into improvements in clinical practice. Since April 2016 a National Reporting and Learning System (NRLS) in the UK has been under the umbrella of NHS Improvement.

The NRLS is the largest reporting system in the world (Howell et al 2015). This e-forum aims to include all incidents related to anaesthesia and therefore to capture

a breadth of information. The result is a sharing forum of repeated problems that may not be immediately obvious to individual hospitals (Reed et al 2013). However, despite NRLS, patient safety in anaesthetics remains constrained in that critical incidents are only being shared primarily at local level and not regionally among health and social care trusts. Local trust level reports can lead to adjustment and changes to work practices thereby improving patient safety at departmental level (Tewari & Sinha 2013). Therefore incident reporting is a vital technique used in many disciplines including aviation, communications, military and home security, nursing, critical care, teaching and policing (Butterfield et al 2005).

### Incident reporting

An important aspect of incident reporting is safety cultures in the organisation. A no-blame culture is desired to embrace reporting, yet there is still the perception in healthcare that the reporting of problems might lead to disciplinary action from the employer or the threat of legal action from a patient. Haller et al (2011) argued that this leads to major difficulties in the reporting of incidents. Practical measures can be implemented to instil this no-blame culture, such as de-identification of reporters, protection of 'whistle blowers' from unwanted reprisals and providing meaningful feedback and change from reports (Howell et al 2015, Reed et al 2013). Staender (2011) argued that organisations must recognise and publicly acknowledge the inevitability of human error and adopt a non-punitive stance towards error, at both the individual and departmental level. This open-minded acknowledgement implies a strong potential for learning, which Staender (2011) argued is the primary idea behind the concept of incident reporting.

Tewari and Sinha (2013) suggested that turning these reported incidents into new learning will expedite changes in clinical management, thus optimising patient safety. In healthcare, critical incident analysis (CIA) has been used for continuous professional development in postgraduate nursing and medicine. Research has found it to be a process which enables professionals to access their feelings, engage new knowledge and examine values

(Vachon & LeBlanc 2011). This emulates the role of the ANS, whose advanced knowledge ensures involvement and competence in CIA.

### Root cause analysis

Within CIA, there are a number of frameworks and models available which help guide professionals in a variety of disciplines to analyse critical incidents. Popular frameworks include the conceptual model (Ochberg et al 2007) and root cause analysis (RCA) (Bowie et al 2013). Uberoi et al (2007) suggested that RCA is a tool to identify prevention strategies, a process that is part of the drive to build a safety custom and move away from a blame culture.

RCA has been defined by Bowie et al (2013) as a structured approach to the investigation of patient safety incidents that is commonly applied in modern health systems worldwide, particularly in acute settings. The goal of RCA is to find out what happened, why it occurred and how to prevent it happening again. In healthcare organisations, nurses and other healthcare professionals have a central role in patient safety and are integral in the RCA process. It is a framework that works well to encourage participation, the focus is taken away from the individual hence people are less likely to react defensively. However, despite the benefits of this approach, there has been insufficient evidence to suggest that RCA is a proven patient safety practice (Uberoi et al 2007). In fact, the limitations to the RCA process includes its lack of credibility in defining a true cause, as it is impossible to know if the root cause uncovered by the analysis actually caused the incident. Furthermore, RCA is labour intensive, which is off-putting in today's already constrained healthcare system.

The RCA process under the leadership of a facilitator involves an inter-professional team approach to direct the investigation, analysis of interviews and then building a timeline of events with goals to determine the underlying causes of the incident. The process can involve a five-way approach (Ohno 1988) in which teams elaborate on the root causes of the incident and develop an action plan to address these. Arguably this is an overly simplistic approach with the 'fishbone technique' being more favoured.

## An important aspect of incident reporting is safety cultures in the organisation

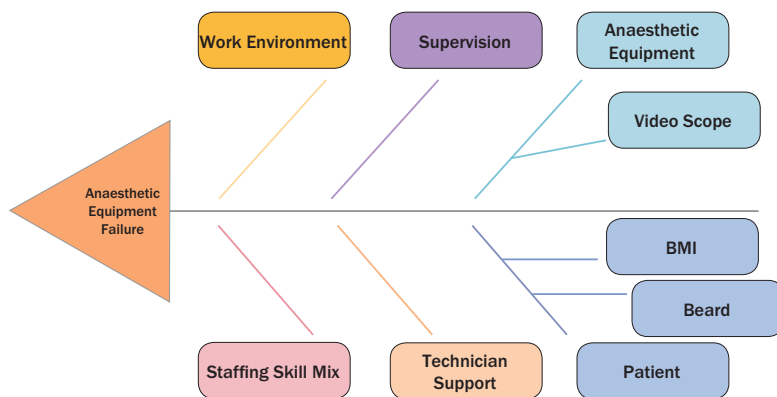


Figure 1 Fishbone technique implemented in practice

The fishbone technique displays a diagram perusing the possible causes and influences of the incident and improvements in practice to prevent recurrence (see Figure 1) (Ishikawa 1968). The belief of the RCA model is that multiple errors and system flaws often happen in a critical incident before there is an impact on a patient, hence the occurrence of latent factors (DH 2000). RCA helps to interlink the contributing factors and analyses how the incident occurred, providing suggestions to improve the system for the future.

In 2007, it was reported that more than 90,000 patients die and almost one million are harmed each year because of hospital blunders, with research findings suggesting that up to half of the mistakes are preventable (Mendick et al 2015). The success and quality of incident reporting is contingent upon the enthusiasm among staff (Tewari & Sinha 2013) with organisations playing a key role in ensuring that they deliver on effective and concise incident reporting. Notably, incident reports on their own tell little about the causes and prevention of a critical incident. Clinical expertise is required as well as a good understanding of the incident and its context by whoever is involved and is reporting (Vincent 2004). Lack of funding and time dedicated to incident analysis however remains an organisational hurdle. For the NHS to deliver a safer healthcare system, it is necessary to go beyond uncovering what happened in an incident but to reflecting on what the incident reveals, such as the gaps and inadequacies in the healthcare system (Vincent 2004).

Specialised equipment plays a central role in anaesthetic practice; an unintended consequence is the potential for malfunction or misuse (Cassidy et al 2011). The context of the critical clinical incident described below was an operating theatre department. RCA will be utilised in the analysis with particular emphasis on the fishbone technique.

### The clinical incident outlined

The critical incident involved an unanticipated difficult airway on a patient scheduled for elective, ENT surgery. A difficult intubation is defined by the American Society of Anaesthesiologists as tracheal intubation requiring more than three attempts, in the presence or absence of tracheal pathology (ASA 2003). Unanticipated difficult airways are always feared amongst anaesthetists (Norskov et al 2013) and ANS alike, yet difficult laryngoscopy and tracheal intubations occur in 1.5-8% of general anaesthetics (Lee et al 2006). For all patients receiving a general anaesthetic with an attempted intubation, an airway management score such as the Wilson Score (1988), is recorded (Norskov et al 2013).

Multiple tools are used in clinical practice, including Mallampatti scores, thyromental distance and neck mobility assessments. In acute healthcare settings multi-variate scoring systems are used which attribute values to certain clinical factors. An example is SARI (simplified airway risk index), where a score of more than three

is deemed a predicted difficult airway risk (Norskov et al 2016). There is on-going debate over the credibility of preoperative airway risk assessments with the Difficult Airway Society (DAS 2004) disputing their value. Yet The American Society of Anaesthesiologists (2003) recommends preoperative assessment of all patients' airways based on eleven anatomical parameters. Overall, there is no ideal airway assessment tool and the lack of statistical predictive power of individual airway tests is well accepted. Therefore airway assessments should utilise multiple components to increase their reliability, yet it must be remembered that even in combination, these tests are not diagnostic. It is the anaesthetic team's role to be competent and aware of the various airway assessments and airway emergency algorithms with their significance for safe anaesthetic delivery to all patients.

The consultant anaesthetist performed an airway assessment on each of the patients scheduled for the elective list and found no apparent or predicted difficulties. These assessments included Mallampatti scores, Wilson score and a thorough medical history from all patients prior to attendance at theatre. However, for the last person on the list an unanticipated difficult airway was identified when the anaesthetist performed laryngoscopy to visualise the vocal cords.

Endotracheal intubation and maintenance of airway patency protects the lungs from aspiration and creates a conduit for ventilation (Beaubien & Baker 2010). When this intubation was unsuccessful, a second attempt using a bougie failed. The anaesthetist required the difficult airway trolley to use a disposable fibre optic scope. The ANS, a recognised leader in theatre, remained with the anaesthetist and assisted in all steps of airway management. The timeline of events from this incident followed the difficult airway algorithm (DAS 2004). The patient was easily ventilated and thus remained well oxygenated throughout the procedure.

There are many clinical risk factors that may be associated with difficult intubation in adult patients such as increased age, male gender, high body mass index (BMI) and history of obstructive sleep apnoea (Schaeuble & Heidegger 2012). The potential risk factors of the patient in this incident included a slightly high BMI and

## Critical incident analysis: Equip to avoid failure

*Continued*

the presence of a beard, which has the potential to cause ventilation problems due to a less than optimal mask seal. These factors however, were considered low risk by the anaesthetist as other assessments presented normal findings.

When the difficult airway trolley arrived with the specialist equipment, the anaesthetist wished to use the fibre optic scope to assist intubation, but when the screen was turned on, it remained blank. The ANS checked all connections to no avail and began to feel a sense of anxiety and vulnerability, which she believed was felt by the rest of the team in theatre. The technical supervisor (N Ireland specific post) for anaesthetic equipment was not available which emphasised the reliance on support from other areas for troubleshooting technical equipment.

Anaesthetic equipment is important for the safe conduct of anaesthesia, but malfunction can contribute to morbidity and mortality (Fasting & Gisvold 2002). Frequent checking of specialist and emergency equipment is imperative for safe anaesthetic care. As the ANS repeatedly tried to fix the equipment with another staff nurse, the anaesthetist remained manually ventilating the patient through a laryngeal mask airway in place, which is safe practice. Eventually, after approximately five minutes, the screen came on and the anaesthetist was able to use the scope to assist in intubating the patient successfully. An incident report was completed and a debrief carried out, led by the ANS and including all nursing members involved in that patient's care.

### Fishbone technique

The fishbone technique of RCA is another name for cause and effect technique, which ultimately aims to identify many possible causes for a consequence or problem. The ANS initiated this technique (see Figure 1) as it allowed all team members to contribute to the solution. The first step is to define the problem as a team: anaesthetic equipment failure due to lack of daily checking of battery life, which led to an unnecessary delay in patient intubation. Although all equipment should be checked prior to use, it had not been routine practice to check the difficult airway trolley daily, even though it is established best practice to do so.

The next step suggested by using the fishbone technique is to assess the main factors of cause. Among those agreed were: possible malfunction of the anaesthetic equipment, training issues, troubleshooting when equipment fails, skill mix in theatre for that specific workload, poor location of the theatre (it was the farthest from the location of senior nursing assistance), and lack of supervision. When discussing the factors all team members agreed that a contributing factor was training in troubleshooting specialist intubation equipment.

According to the NMC code of conduct (2015), every registered nurse must keep knowledge and skills up to date throughout their working life and furthermore must take part in appropriate learning and practice activities that maintain and develop their performance and competence. Staffing issues were a contributing factor which the whole perioperative team agreed on. As allocated team leader on the day of the incident, poor skill mix and lack of senior staff members to assist with any difficulties was of concern. Skill mix and staff allocation is the senior nurse's responsibility, it was a feature over which the ANS felt they had no direct influence. As a new and developing leader in a theatre environment, the ANS had a heightened awareness of vulnerability and lack of confidence.

Leadership is essential especially in the operating department, which is regarded as a critical and complex environment, comparable to aircraft and air traffic control teams because we operate in hazardous environments where safety is paramount (Helmreich 2000). This experience enhanced the ANS's leadership capabilities and confidence. Feedback from other nursing colleagues and anaesthetists involved in this case was relatively positive. They believed that the ANS led and coped competently with the emergency situation despite her vulnerability and lack of leadership experience.

The final part of RCA is to create improvements in the system to reduce latent factors and reduce the chances of recurrence. Although some difficult airways can be predicted, even the most thorough assessment of the airway may not detect the possibility of a difficult intubation and associated problems with ventilation of the patient (Beaubien & Baker 2010).

Reducing risk in airway management has been introduced in various hospitals to include regular workshop training in airway management techniques (Kuduvalli et al 2008). Repeated individual training has been shown to improve performance, both initially and over time, with a recommended interval of six months to refresh each professional. Limitations to such training are organisational factors, lack of time, money and resources to provide training.

### Recommendations for future practice

Recommendations suggested by the inter-professional theatre team included simulated clinical emergency scenarios, which would build knowledge, confidence and competence to solve equipment problems in the future. Further suggestions were regular updates and training with the anaesthetic technician (a member of the anaesthetic team in N Ireland) who is heavily involved with all anaesthetic equipment and monitors.

Finally, as a result of this incident, the introduction of a daily checklist for the difficult airway trolley was implemented creating a safer patient and practitioner environment. Having a specific checklist enables the trolley and all equipment to be checked daily and it ensures that all the kit is working correctly for the next 24 hours. The ANS believes that by checking the trolley daily nursing staff will become more familiar with the equipment and how to use it in an emergency.

### Conclusion

Although anaesthesia is a medical speciality with a high level of uncertainty and variability due to the complexity and individuality of humans, it is now considered an ultra-safe system, a pioneer in the field of patient safety (Cuvelier et al 2012). Incident reporting is a key factor in achieving the above with evidence suggesting that anaesthetic critical incident studies plant ideas for other specialities, either directly or indirectly (Merry 2008). Anaesthetic nurse specialists and anaesthetists are proud of their reputation for safety in an improved learning culture. In an increasingly pluralistic health economy where patient safety is a key driver, UK

## Frequent checking of specialist and emergency equipment is imperative for safe anaesthetic care

hospitals might wish to use high reporting rates as one of the markers of success in the creation of a safer healthcare environment (Hutchinson et al 2009). However, Howell et al (2015) reminds us that the results from their analysis of over five million reports over a ten year period suggest 'that reporting rates should not be used to assess hospital safety' per se. The environmental culture requires adjustment if near misses and patient harm rates are to be reduced. This will need to include adjustments such as increased staffing numbers and encouraging a blame free culture with confidentiality and education at its core (Howell et al 2015).

### References

- American Society of Anaesthesiologists 2003 Task force on management of the difficult airway: practice guidelines for management of the difficult airway *Anaesthesiology* 98 (5) 1269-77
- Beaubien JM, Baker DP 2010 Management of unanticipated difficult intubation *Pennsylvania Patient Safety Advisory* 7 (4) 113-20
- Bowie P, Skinner J, De Wet C 2013 Training healthcare professionals in root cause analysis; a cross sectional study of post-training experiences, benefits and attitudes *Biomed Central* 13 (50) 1-10
- Butterfield LD, Borgen WA, Amundson NE, Maglio AT 2005 Fifty years of the critical incident technique 1954-2004 and beyond *Qualitative Research* 5 475-97
- Cassidy CJ, Smith A, Arnot-Smith J 2011 Critical incident reports concerning anaesthetic equipment; analysis of the UK National Reporting and Learning System (NRLS) data from 2006-2008 *Anaesthesia* 66 (10) 879-88
- Cooper J, Newbower RS, Long CD, McPeck B 1978 Preventable anaesthesia mishaps: A study of human factors *Anaesthesiology* 49 399-406
- Cuvelier L, Falzon P, Granry JC, Moll MC 2012 Managing unforeseen events in anaesthesia; collective trade-off between 'understanding' and 'doing' *IOS Press* 41 1972-79
- Department of Health 2000 **An organisation with a memory** London, Stationery Office
- Difficult Airway Society 2004 **Guidelines** Available from: [www.das.uk.com/guidelines/downloads.html](http://www.das.uk.com/guidelines/downloads.html) [Accessed September 2016]
- Fasting S, Gisvold SE 2002 Equipment problems during anaesthesia-are they a quality problem? *British Journal of Anaesthesia* 89 (6) 825-31
- Flanagan JC 1954 The critical incident technique *Psychological Bulletin* 51 (4) 327-58
- Haller G, Courvoisier DS, Anderson H, Myles PS 2011 Clinical factors associated with the non-utilisation of the anaesthetic incident reporting system *British Journal of Anaesthetics* 107 171-79
- Helmrich RL 2000 On error management: lessons from aviation *British Medical Journal* 320 781-85
- Howell A-M, Burns E M, Bouras G et al 2015 Can patient safety incident reports be used to compare hospital safety? Results from a quantitative analysis of the English National Reporting and Learning System Data *PLOS ONE* DOI:10.1371/journal.pone.0144107.
- Hutchinson A, Young TA, Cooper KL et al 2009 Trends in healthcare incident reporting and relationships to safety and quality data in acute hospitals; results from National Reporting and Learning Systems *Quality and Safety in Healthcare* 18 (5) 5-10
- Ishikawa K I 1968 **Cause and effect diagram** Available from: [www.sixsigmastudyguide.com](http://www.sixsigmastudyguide.com) [Accessed September 2016]
- Kuduvalli PM, Jervis A, Tighe SQM, Robin N 2008 Unanticipated difficult airway management in anaesthetised patients; a prospective study of the effect of mannequin training on management strategies and skill retention *Anaesthesia* 63 (4) 364-69
- Lee A, Fan LTY, Gin T et al 2006 A systematic review (meta analysis) of the accuracy of the Mallampati tests to predict the difficult airway *International Anaesthesia Research Society* 102 1867-78
- Lingard L, Regehr G, Orser B et al 2008 Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anaesthesiologists to reduce failures in communication *American Medical Association* 143 (1) 12-17
- Mahajan RP 2010 Critical incident reporting and learning *British Journal of Anaesthesia* 105 (1) 69-75
- Mendick R, Donnelly L, Kirk A 2015 Medical blunders cost NHS billions *The Telegraph* Available from: <http://www.telegraph.co.uk/news/health/news/11733719/Medical-blunders-cost-NHS-billions.html> [Accessed September 2016]
- Merry AF 2008 Safety in anaesthesia; reporting incidents and learning from them *Anaesthesia* 63 (4) 337-39
- Nursing Midwifery Council 2015 **The Code: Professional standards of practice and behaviour for nurses and midwives** Available from: <https://www.nmc.org.uk/globalassets/sitedocuments/nmc-publications/nmc-code.pdf> [Accessed September 2016]
- Norskov A, Rosenstock CV, Wetterslew J, Lundstrom LH 2013 Incidence of unanticipated difficult airway using an objective airway score versus a standard clinical airway assessment the DIFFICAIR trial-trial protocol for a cluster randomised clinical trial *Biomed Central* 14 347
- Norskov AK, Wetterslew J, Rosenstock CV et al 2016 Effects of using the simplified risk index vs usual airway assessment on unanticipated difficult tracheal intubation - a cluster randomised trial with 64,273 participants *British Journal of Anaesthesia* 116 (5) 680-89
- Ochberg FM, Cinti E, Goodman E et al 2007 The critical incident model presentation at the meeting for critical incident analysis at John Jay College of Criminal Justice Jan 4th
- Ohno T 1988 **Toyota Production System: Beyond Large-scale Production** Productivity Press, Portland, Oregon
- Reason JT 1990 **Human error** New York, Cambridge University Press
- Reed S, Arnal D, Frank O et al 2013 National critical incident reporting systems relevant to anaesthesia: a European survey *British Journal of Anaesthesia* 112 (3) 546-55
- Schaeuble JC, Heidegger T 2012 Strategies and algorithms for the management of the difficult airway; an update *Trends in Anaesthesia and Critical Care* 2(5) 208-27
- Staender S 2011 Incident reporting in anaesthesiology, best practice and research *Clinical Anaesthesiology* 25 207-14
- Tewari A, Sinha A 2013 Critical incident reporting; Why should we bother? *Journal of Anaesthesiology Clinical Pharmacology* 29 (2) 147-48
- Toff NJ 2010 Human factors in anaesthesia: lessons from aviation *British Journal of Anaesthesia* 105 (1) 21-25
- Uberoi RS, Swati E, Gupta U, Sibal A 2007 Root cause analysis in healthcare *Apollo Medicine* 4 (1) 72-75
- Vachon B, Le Blanc J 2011 Effectiveness of past and current critical incident analysis on reflective learning and practice change *Medical Education* 45 894-904
- Vincent CA 2004 Analysis of critical incidents; a window on the system not a search for root causes *Quality and Safety in Healthcare* 13 243-43
- World Health Organization 2008 **Surgical safety checklist and implementation manual** Available from: [http://www.who.int/patientsafety/safesurgery/ss\\_checklist/en/](http://www.who.int/patientsafety/safesurgery/ss_checklist/en/) [Accessed September 2016]

### About the authors

**Naomi Potts**  
RN, BSc (Hons), PGDip (Specialist Practice Anaesthetic Nursing)

Deputy Sister, Operating Theatre Department, Belfast City Hospital

**Daphne SE Martin**  
RN, RNT, MICH, DipEdNurs., Dip. Reflex., BSc, PGDip Specialist Practice Anaesthetic Nursing (Hons), MSc

Lecturer (Education)/Pathway Leader Specialist Practice in Anaesthetic Nursing, School of Nursing and Midwifery, Queen's University Belfast

**Leontia Hoy**  
RN, RCNT, RNT, PGCE, MSc

Lecturer (Education)/Course Director Specialist Practice in Nursing, School of Nursing and Midwifery, Queen's University Belfast

No competing interests declared

Members can search all issues of the BJPN/JPP published since 1998 and download articles free of charge at [www.afpp.org.uk](http://www.afpp.org.uk). Access is also available to non-members who pay a small fee for each article download.



**Disclaimer** *The views expressed in articles published by the Association for Perioperative Practice are those of the writers and do not necessarily reflect the policy, opinions or beliefs of AfPP.*

*Manuscripts submitted to the editor for consideration must be the original work of the author(s).*

**© 2015 The Association for Perioperative Practice**  
All legal and moral rights reserved.

**The Association for Perioperative Practice**

Daisy Ayris House  
42 Freemans Way  
Harrogate  
HG3 1DH  
United Kingdom

Email: [hq@afpp.org.uk](mailto:hq@afpp.org.uk)  
Telephone: 01423 881300  
Fax: 01423 880997  
[www.afpp.org.uk](http://www.afpp.org.uk)