26. Kleine-Brueggeney M, Greif R, Schoettker P, Salvodelli G, Nabecker S, Theiler L. Evaluation of six video-laryngoscopes in 720 patients with a simulated difficult airway -a multicentre randomised controlled trial. *Br J Anaesth* 2016; **116**: 670–9
27. Epaud A, Levesque E, Clariot S. Dramatic cervical spine injury secondary to videolaryngoscopy in a patient suffering from ankylosing spondylitis. *Anesthesiology* 2021; **135**: 495–6
28. Arai T, Asai T, Okuda Y. Standard of anesthesia care: possible dissociation from recommendations made by clinical practice guidelines. *J Anesth* 2022; **36**: 642–7
29. McNarry AF, Cook TM, Baker PA, O'Sullivan EP. The Airway Lead: opportunities to improve institutional and personal preparedness for airway management. *Br J Anaesth* 2020; **125**: e22–4
30. Mark L, Lester L, Cover R, Herzer K. A decade of difficult airway response team: lessons learned from a hospital-wide difficult airway response team program. *Crit Care Clin* 2018; **34**: 239–51
31. Ahmad I, El-Boghdadly K, Bhagrath R, et al. Difficult Airway Society guidelines for awake tracheal intubation (ATI) in adults. *Anaesthesia* 2020; **75**: 509–28
32. Badiger S, John M, Fearnley RA, Ahmad I. Optimizing oxygenation and intubation conditions during awake fibre-optic intubation using a high-flow nasal oxygen-delivery system. *Br J Anaesth* 2015; **115**: 629–32
33. Heidegger T. Videos in clinical medicine. Fiberoptic intubation. *N Engl J Med* 2011; **19**. 364: e42
34. Stringer KR, Bajenow S, Yentis SM. Training in airway management. *Anaesthesia* 2002; **10**: 967–83
35. Asai T, Heidegger T. Practical training method for fiberoptic intubation. *J Anesth* 2023. https://doi.org/10.1007/s00540-023-03211-6. Advance Access Published on June 8

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Lessons from aviation safety: pilot monitoring, the sterile flight deck rule, and aviation-style computerised checklists in the operating room

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Summary

Commercial aviation practices including the role of the pilot monitoring, the sterile flight deck rule, and computerised checklists have direct applicability to anaesthesia care. The pilot monitoring performs specific tasks that complement the pilot flying who is directly controlling the aircraft flight path. The anaesthesia care team, with two providers, can be organised in a manner that is analogous to the two-pilot flight deck. However, solo providers, such as solo pilots, can emulate the pilot monitoring role by reading checklists aloud, and utilise non-anaesthesia providers to fulfil some of the functions of pilot monitoring. The sterile flight deck rule states that flight crew members should not engage in any non-essential or distracting activity during critical phases of flight. The application of the sterile flight deck rule in anaesthesia practice entails deliberately minimising distractions during critical phases of anaesthesia care. Checklists are commonly used in the operating room, especially the World Health Organization surgical safety checklist. However, the use of aviation-style computerised checklists offers additional benefits. Here we discuss how these commercial aviation practices may be applied in the operating room.

Keywords: aviation; checklists; patient safety; pilot monitoring; sterile flight deck rule

Analogies between aviation and anaesthesia are well established.[1,2] Although there are limits to the similarities between flying and providing anaesthesia care, there are valuable lessons that can be learned by anaesthesia providers from the safety practices and the remarkable safety record of commercial aviation. This editorial describes key aviation safety practices (the pilot monitoring role, the sterile flight deck rule, and the use of computerised checklists) and shows how these practices might be applied to anaesthesia care provided by the anaesthesia care team or a solo provider.

The pilot monitoring role

For large commercial aircraft, aviation regulations require at least two pilots. There are a number of reasons for this, some of which are intuitively obvious, and some less so. Physical incapacitation of the pilot during flight, which can range from mild illness to complete incapacitation, is an obvious reason to have a second pilot. Another reason for a second pilot is division of labour during task-intensive phases of flight, such as during takeoff, landing, or during a crisis. Workload is shared during periods when cognitive overload and task saturation could occur with just one pilot. A less obvious but critically important reason is for the pilots to be able to check each other's work and by doing so maintain safety by preventing, interrupting, and correcting errors.[3] There is a common misperception that the first pilot's role is active while the second pilot's role is passive, but in fact both pilots have a formal set of prescribed duties, which are referred to as the 'pilot flying' and the 'pilot monitoring' (British Airways is an exception to this internationally used terminology and uses the terms 'handling pilot' and 'non-handling pilot'; the responsibilities of the non-handling pilot are equivalent to the pilot monitoring). Either the Captain in the left-hand seat or the First Officer (also known as Co-Pilot) in the right-hand seat can be the pilot flying or the pilot monitoring, and these roles can be exchanged between pilots at any time.

The pilot flying is responsible for managing the aircraft flight path, which might mean either flying the aircraft manually, or, when using the autopilot, operating the autopilot controls. The pilot monitoring is responsible for monitoring the flight path of the aircraft. The pilot monitoring also supports and assists the pilot flying. For example, the pilot monitoring operates the landing gear or flap controls when instructed by the pilot flying and maintains radio communications with air traffic control. The pilot monitoring must inform the pilot flying (or intervene if necessary) of any deviation from the intended flight parameters.

An important caveat is that success of these roles depends on minimising the authority gradient between the Captain and the First Officer. There are unfortunate examples in the accident records when the Captain, in the role of pilot flying, ignored inputs from the First Officer, made poor decisions, and led the flight single-handedly to tragedy. Although the Captain has legal responsibility and final authority for the safe conduct of the flight, either pilot, as pilot monitoring, is empowered to speak up about any issues or concerns. In addition to the Captain and First Officer, long-haul flights might have one or more additional pilots to give required rest and sleep breaks. These pilots are usually on the flight deck during takeoff and landing, providing additional expert monitoring during these critical phases of flight.

Anaesthesia care can be administered by a solo provider or by a team of two providers, the composition of which may vary depending upon the geographic location. When there is an anaesthesia care team, there are two anaesthesia providers present during portions of the procedure, especially during critical phases such as induction of anaesthesia and emergence from anaesthesia, which can be thought of as analogous to the takeoff and landing phases of flight. Minimum requirements for the supervisory role of the attending anaesthesiologist in the anaesthesia care team are specified by regulatory agencies and professional societies such as Centers for Medicare & Medicaid Services, American Society of Anesthesiologists,[4] Australian and New Zealand College of Anaesthetists,[5] and the Association of Anaesthetists of Great Britain and Ireland.[6] However, when two anaesthesia providers are present, formally designating roles of 'acting provider' (analogous to pilot flying) and a 'monitoring provider' (analogous to pilot monitoring) can increase the effectiveness of the anaesthesia team. The monitoring provider, regardless of whether they have higher authority (attending or consultant) or lower authority, would be explicitly empowered to anticipate, discuss, question, and correct, as appropriate, the actions of the acting provider. One of the limitations of the pilot monitoring analogy is that although all pilots can fly the aircraft, the operating room team members are not entirely interchangeable; not every operating room team member can perform all of the functions of an anaesthesia provider.

Several examples of possible useful roles of the monitoring provider are detailed below and in Supplementary Table S1.

- During procedures such as central venous catheter placement, the monitoring provider can ensure maintenance of sterile technique and removal of the guidewire.
- The monitoring provider facilitates two-person checklist performance, particularly during a crisis when the additional provider is needed to identify the appropriate crisis checklist and read checklist items (see Checklists below).
- During a crisis, such as difficult airway management, the monitoring provider can anticipate and correct, as appropriate, the actions of the acting provider, who might be dealing with significant cognitive overload.
- The monitoring provider can confirm correct tracheal tube placement.
- Intraoperative acquisition and interpretation of echocardiography is associated with increased cognitive load that might be difficult to carry out as a solo provider while also providing fundamental anaesthesia care. This applies particularly during times of haemodynamic instability, which occur frequently during cardiac surgery and catheter-based cardiac interventions. In the USA, a recent Centers for Medicare & Medicaid Services ruling regarding transcatheter edge-to-edge repair of the mitral valve requires that the anaesthesiologist performing the interventional echocardiography cannot bill for anaesthesia services performed at the same time, implying that a second anaesthesia provider should be present.[7]
- The monitoring provider can double check medication administration to reduce medication errors. Barcode scanning of vials and syringes is possible in the anaesthesia care setting and can reduce medication errors.[8–10] Barcode scanning essentially provides a second set of eyes, but a pilot monitoring approach in which a second provider independently double checks the actions of the pilot flying who is administering the medications might also be useful. Double checking can be especially beneficial for continuous infusions of medications, which are error prone even with the use of "smart" infusion pumps.[8,11] In most anaesthesia care settings, infusion pumps do not incorporate barcode scanning.

Adaptations for solo anaesthesia provider

Single pilot aircraft and solo anaesthesia practice make the pilot monitoring approach more difficult. However, even in solo anaesthesia provider settings, it is possible to emulate some aspects of the two-provider workflow. The solo anaesthesia provider is seldom truly alone as there may be personnel dedicated to providing technical assistance to the

anaesthesia provider. These people, along with the surgeons, surgical assistants, and operating room nurses, can fill the role of monitoring provider, especially in a crisis. The guidelines of the Association of Anaesthetists of Great Britain and Ireland explicitly state that 'The safe administration of anaesthesia cannot be carried out single-handedly; competent and exclusive assistance is necessary at all times'.[6] These roles can be formalised and scripted. For example, an anaesthesia technician could observe placement of a central venous catheter and provide verbal confirmation of central venous catheter checklist items including that the guidewire has been removed after catheter insertion. Again, an intentional statement inviting and empowering all participants to speak up with concerns helps to keep the authority gradient low in the room and goes a long way towards gaining the error-trapping and safety-enhancing benefits of a multi-crew environment.[12,13]

Sterile flight deck

In addition to the pilot monitoring approach to maintaining safety, commercial aviation has provided us with another valuable principle called the sterile flight deck. The sterile flight deck rule was adopted worldwide in 1980s in response to aviation accidents in which distractions produced by the crew themselves were an accident factor. The rule states that flight crew members should not engage in any non-essential or distracting conversation or activity during critical phases of flight (taxi, takeoff, initial climb, approach, and landing). Research has shown that contrary to our self-perception, humans are not true multi-taskers.[14] Non-critical conversations and distractions will inevitably divert our attention from critical tasks. Of course, there are plenty of potential distractions in typical operating rooms, including noisy equipment, multiple ongoing conversations among staff, not all of which pertain to the job at hand, music, phone calls, pager calls, and so on.[15] Our recommendation is that anaesthesia providers would be well served to enforce the sterile flight deck rule, and insist that distractions be minimised during critical phases of anaesthesia, including induction of anaesthesia and emergence from anaesthesia, and when checklists are being completed.

Computerised checklists

'Normal' (routine) and 'non-normal' (crisis) checklists are central to aviation safety. Most commercial aircraft have computerised checklists that are built into the avionics systems. When a fault is detected by the Engine Indicating and Crew Alerting System, the appropriate non-normal checklist is automatically displayed. Electronic checklists are generally considered more reliable and less error prone than paper checklists. The errors

Table 1 Aviation paper *vs* computerised checklists: error modes that result from paper checklist use and features of computerised checklist that address these error modes. (Modified from Boorman DJ. Reducing flight crew errors and minimizing new error modes with electronic checklists. *Proceedings of the International Conference on Human-Computer Interaction in Aeronautics*. Toulouse: 2000; 57–63).[16]

Paper checklist error mode	Computerised checklist feature
Both normal and non-normal checklist	
1. One or more items skipped in checklist	Current line item box jumps to incomplete item; 'CHECKLIST COMPLETE' indication will not display until all items complete
2. Place lost in checklist when crew distracted by higher priority task or checklist	Automatic place holding when returning to an incomplete checklist
3. Incorrect switch selected	Sensed line items will not turn green
4. Item incorrectly confirmed complete	Sensed line items will not turn green; 'CHECKLIST COMPLETE' indication will not display
5. Excessive psychomotor workload due to holding, turning/marking pages, recovering, dropped, or misplaced paper checklist	Panel mounted display and one-hand cursor controller
6. Checklist unreadable due to poor illumination	Display readable in any lighting condition
Normal checklist only	
7. Checklist skipped (subsequent checklist completed before critical flight phase)	Next checklist in sequence always displayed
8. Checklist omitted (all checklists related to critical flight phase are omitted)	Alert sounds and displays if checklist is not done when needed; Before Taxi, Before Takeoff, Approach, and Landing checklists are alerted
Non-normal checklists only	
9. Incorrect checklist completed for the annunciated condition	Correct checklist automatically placed in queue when airplane system fault message displayed
10. Checklist skipped or left incomplete	Checklist queue list incomplete or unassessed checklist; Amber 'NON-NORMAL' indication displayed
11. Incorrect steps accomplished in a branching checklist	Current line item box moves to next step in correct branch; incorrect branch displayed in cyan
12. Steps to be accomplished later in flight not accomplished	Deferred line items automatically attached to Approach or Landing checklist
13. Operational notes or revised limitations following a malfunction forgotten	Notes automatically corrected for review at any time; must be reviewed to complete Approach checklist
14. Wrong steps accomplished when multiple related failures have conflicting actions	Correct steps are collected in single checklist; consequential checklists inhibited
15. Omitted checklist or other errors due to excessive cognitive workload in multiple failure case	Cognitive workload and accomplishment times lower than paper

associated with paper checklists and the means by which the electronic checklist system in commercial aircraft prevents these errors are detailed in Table 1.[16] Aviation checklists for commercial aircraft are designed for use by two pilots. One pilot reads each checklist item aloud and either or both pilots, depending on whose area of responsibility the item falls under, responds aloud.[17] Similarly, two-person anaesthesia care teams are ideally suited to the application of checklists, using a similar flow. In the case of single-pilot aircraft or solo anaesthesia providers, reading the checklist aloud can be used to emulate the workflow of two pilots or anaesthesia providers.

Pre-anaesthesia checklist

Preflight checklists are ubiquitous in aviation (see video at https://www.youtube.com/watch?v=JG7SkOQDDt0). The analogous checklist in anaesthesia practice is the pre-anaesthesia checklist. A computerised version of the Anesthesia Patient Safety Foundation pre-anaesthesia checklist was created using an aviation-style computerised checklist engine and was evaluated in a clinical setting (Supplementary Fig. S1).[18] This computerised checklist was designed for completion by two anaesthesia providers; one provider reads the checklist items and the other provider responds to each item (see video at https://youtu.be/e2CG6q7xI_8; this video demonstrates the use of computerised pre-anaesthesia checklist in Checklist Navigator which is now available as an app for phone and tablet). The use of the aviation-style computerised pre-anaesthesia checklist reduced the proportion of cases with failure to perform all pre-induction steps from 10% to 6.4% and decreased the incidence of non-routine events from 1.2% to 0. Use of the checklist alerted anaesthesia providers to correct mistakes in pre-induction preparation.[18] The same approach has been used for creating computerised version of the World Health Organization surgical safety checklists which improved checklist performance in comparison with paper checklists.[19]

Procedural checklists

Central venous catheter placement is widely recognised as having risks of morbidity and mortality.[20] Vascular injury during central venous cannulation is largely preventable by the application of ultrasound guidance and pressure measurement to confirm venous placement.[21] Another complication of central venous catheter placement that has been

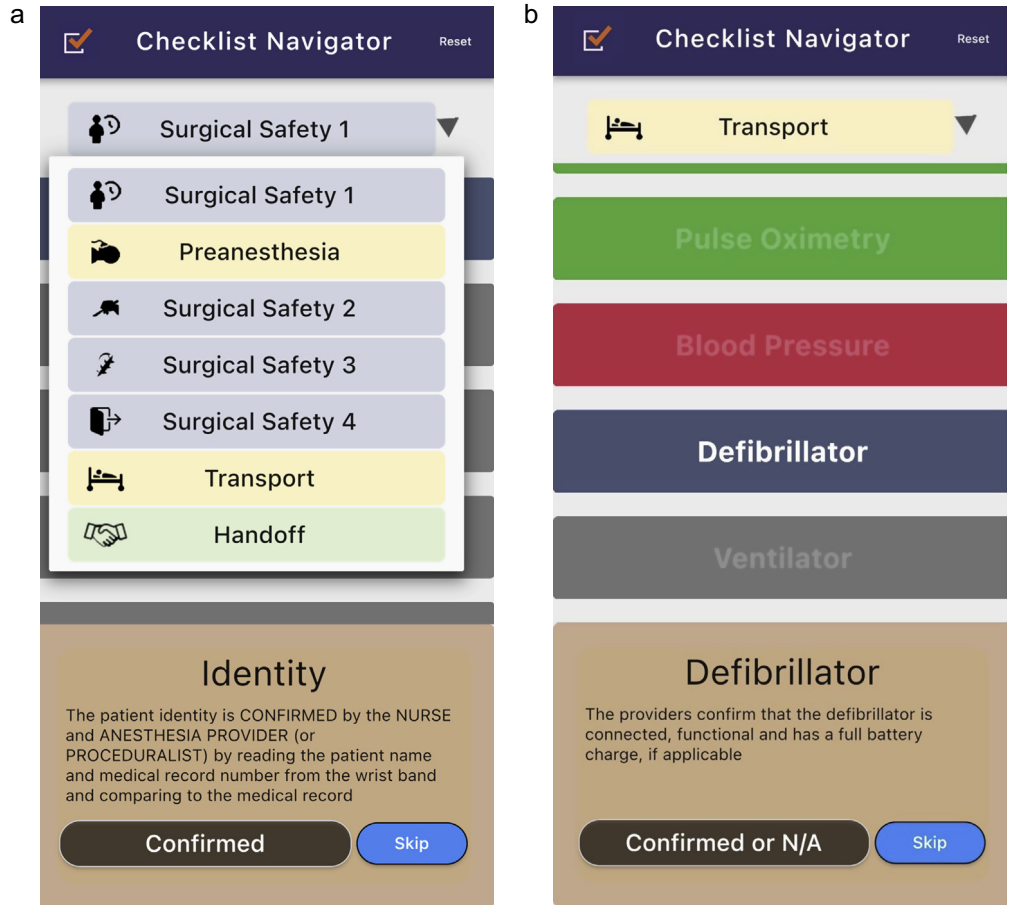

Fig 1. (a) Checklist Navigator app displaying the list of available normal checklists. (b) Checklist Navigator transport checklist showing completed items in green, skipped item in red, current item in blue, and not completed items in grey. The bottom of the images displays the current item ('Defibrillator'), a longer description of the item with a response button ('Confirmed or N/A'), and an option to skip the item.

difficult to eradicate is retention of the guidewire or a fragment of the guidewire.[22–24] Use of a checklist with an item for guidewire removal has been recommended since an engineering solution to prevent the guidewire from being left behind in the patient is not readily available (see an example of a central venous catheter checklist in Supplementary Fig. S2).[22,25] When there are two anaesthesia providers, the monitoring provider can read the checklist and closely observe the acting provider who is performing the procedure, thereby decreasing the likelihood of leaving a guidewire behind.

Crisis, handoff, and transport checklists

Other anaesthesia checklists include crisis, handoff, and transport checklists. Several sets of anaesthesia and surgery crisis checklists are available, typically provided in the form of individual paper checklists or bound checklist manuals,[26,27] the use of which might improve outcomes.[28] Computerisation of these checklists would be ideal for all of the reasons that computerised checklists are preferable to paper checklists (see an example of a Local Anaesthetic Toxicity and an Emergency Caesarean Delivery crisis checklists in Supplementary Fig. S3).[16] Transport checklists are intended to prevent mistakes and ensure capacity to respond to non-routine events in transporting critically ill patients from the operating room to the ICU and *vice versa* (see an example of a Transport checklist in Fig. 1). Similarly, handoff checklists are intended to improve communication during handoffs.[29,30]

Conclusions

Commercial aviation practices offer a number of specific safety measures that can be applied to anaesthesia practice, especially the role of the pilot monitoring, the sterile flight deck rule, and computerised checklists. We recommend designating specific duties for the monitoring provider when appropriate to complement the acting provider. Although pilot monitoring workflow is more challenging in a solo provider setting, other operating room team members can help to fulfil the role of a monitoring provider. Solo providers can also read checklists aloud to emulate the presence of a monitoring provider. Distractions should be strictly minimised during critical phases of anaesthesia care. The performance and value of checklists can be improved by utilising computerized aviation-style checklists. These practices all recognise the fact that while human beings make mistakes, effective teamwork, proper application of checklists, and minimising distractions can prevent mistakes from becoming tragedies.

Authors' contributions

Conception: AB
Writing and revision: all authors
Computerised checklist system design: BGN and AAN
Aviation checklist expert and retired test pilot: DJB
Patient safety expert and consultant anaesthetist: SJ, AB, and ME
Approved the final version of the manuscript: all authors

Declaration of interest

BGN holds equity in Perimatics LLC (Bellevue, WA, USA) and serves as a technology advisor for Perimatics LLC. Checklist Navigator is freely available as an app for phone and tablet.

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Appendix A. Supplementary data

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References

1. Kapur N, Parand A, Soukup T, Reader T, Sevdalis N. Aviation and healthcare: a comparative review with implications for patient safety. *JRSM Open* 2016; **7**, 2054270415616548
2. Webster CS, Henderson R, Merry AF. Sustainable quality and safety improvement in healthcare: further lessons from the aviation industry. *Br J Anaesth* 2020; **125**: 425–9
3. Helmreich RL, Klinect JR, Wilhelm JA. Models of Threat, error, and CRM in flight operations. In: *Proceedings of the Tenth International Symposium on Aviation Psychology*; 1999. p. 677–82
4. American Society of Anesthesiologists Committee on Anesthesia Care Team. *Statement on the anesthesia care team*. Available from: https://www.asahq.org/standards-and-guidelines/statement-on-the-anesthesia-care-team. [Accessed 30 May 2023]
5. Australian and New Zealand College of Anaesthetists. *ANZCA handbook for training v2.7*. Available from: https://www.anzca.edu.au/getattachment/6fc9618b-2476-47aa-b86a-5cc27671d4ec/ANZCA-Training-Handbook. [Accessed 30 May 2023]
6. Griffiths R, Abbott H, Barker P, et al. *The anaesthesia team 2018: guidelines*. Available from: https://anaesthetists.org/Portals/0/PDFs/Guidelines%20PDFs/Guideline_The%20Anaesthesia%20Team_2018.pdf?ver=2019-01-08-163915-087&timestamp=1546967138246&ver=2019-01-08-163915-087&timestamp=1546967138246. [Accessed 30 May 2023]
7. Centers for Medicare & Medicaid Services. *National coverage analysis decision memo on transcatheter mitral valve repair (TMVR) CAG-00438R*. Available from: https://www.cms.gov/medicare-coverage-database/view/ncacal-decision-memo.aspx?proposed=N&NCAId=297&bc=AAgAAAAACAAA&. [Accessed 30 May 2023]
8. Bowdle TA, Jelacic S, Nair B, et al. Facilitated self-reported anaesthetic medication errors before and after implementation of a safety bundle and barcode-based safety system. *Br J Anaesth* 2018; **121**: 1338–45
9. Jelacic S, Bowdle A, Nair BG, Kusulos D, Bower L, Togashi K. A system for anesthesia drug administration using barcode technology: the Codonics Safe Label System and Smart Anesthesia Manager. *Anesth Analg* 2015; **121**: 410–21
10. Merry AF, Webster CS, Hannam J, et al. Multimodal system designed to reduce errors in recording and administration of drugs in anaesthesia: prospective randomised clinical evaluation. *BMJ* 2011; **343**: d5543
11. Ohashi K, Dalleur O, Dykes PC, Bates DW. Benefits and risks of using smart pumps to reduce medication error rates: a systematic review. *Drug Saf* 2014; **37**: 1011–20
12. Lemke R, Burtscher MJ, Seelandt JC, Grande B, Kolbe M. Associations of form and function of speaking up in anaesthesia: a prospective observational study. *Br J Anaesth* 2021; **127**: 971–80

13. Rudolph JW, Pian-Smith MCM, Minehart RD. Setting the stage for speaking up: psychological safety and directing care in acute care collaboration. *Br J Anaesth* 2021; **127**: 3–7
14. Koch I, Poljac E, Müller H, Kiesel A. Cognitive structure, flexibility, and plasticity in human multitasking-an integrative review of dual-task and task-switching research. *Psychol Bull* 2018; **144**: 557–83
15. Gui JL, Nemergut EC, Forkin KT. Distraction in the operating room: a narrative review of environmental and self-initiated distractions and their effect on anesthesia providers. *J Clin Anesth* 2021; **68**, 110110
16. Boorman DJ. Reducing flight crew errors and minimizing new error modes with electronic checklists. In: *Proceedings of the International Conference on Human-Computer Interaction in Aeronautics*; 2000. p. 57–63. Toulouse
17. Degani A, Wiener EL. reportHuman factors of flight-deck checklists: the normal checklist. NASA Contractor Report 177549 1990. Available from: https://ti.arc.nasa.gov/m/profile/adegani/Flight-Deck_Checklists.pdf (accessed 17 May 2023).
18. Jelacic S, Bowdle A, Nair BG, et al. The effects of an aviation-style computerised pre-induction anaesthesia checklist on pre-anaesthetic set-up and non-routine events. *Anaesthesia* 2019; **74**: 1138–46
19. Jelacic S, Bowdle A, Nair BG, et al. Aviation-style computerized surgical safety checklist displayed on a large screen and operated by the anesthesia provider improves checklist performance. *Anesth Analg* 2020; **130**: 382–90
20. Domino KB, Bowdle TA, Posner KL, Spitellie PH, Lee LA, Cheney FW. Injuries and liability related to central vascular catheters: a closed claims analysis. *Anesthesiology* 2004; **100**: 1411–8
21. Bowdle A. Vascular complications of central venous catheter placement: evidence-based methods for prevention and treatment. *J Cardiothorac Vasc Anesth* 2014; **28**: 358–68
22. Cherara L, Sculli GL, Paull DE, Mazzia L, Neily J, Mills PD. Retained guidewires in the Veterans Health Administration: getting to the root of the problem. *J Patient Saf* 2018; **17**: e911–7
23. Steelman VM, Thenuwara K, Shaw C, Shine L. Unintentionally retained guidewires: a descriptive study of 73 sentinel events. *Jt Comm J Qual Patient Saf* 2019; **45**: 81–90
24. Vannucci A, Jeffcoat A, Ifune C, Salinas C, Duncan JR, Wall M. Special article: retained guidewires after intraoperative placement of central venous catheters. *Anesth Analg* 2013; **117**: 102–8
25. Williams TL, Bowdle TA, Winters BD, Pavkovic SD, Szekendi MK. Guidewires unintentionally retained during central venous catheterization. *J Assoc Vasc Access* 2014; **19**: 29–34
26. European Society of Anaesthesiology and Intensive Care. *The anaesthetic crisis manual v2*. Available from: https://www.esaic.org/patient-safety/anaesthetic-crisis-manual/. [Accessed 30 May 2023]
27. Emergency Manuals Implementation Collaborative. *General compendia*. Available from: https://www.emergencymanuals.org/tools-resources/free-tools/. [Accessed 30 May 2023]
28. Arriaga AF, Bader AM, Wong JM, et al. Simulation-based trial of surgical-crisis checklists. *N Engl J Med* 2013; **368**: 246–53
29. Jelacic S, Togashi K, Bussey L, et al. Development of an aviation-style computerized checklist displayed on a tablet computer for improving handoff communication in the post-anesthesia care unit. *J Clin Monit Comput* 2021; **35**: 607–16
30. Jaulin F, Lopes T, Martin F. Standardised handover process with checklist improves quality and safety of care in the postanaesthesia care unit: the Postanaesthesia Team Handover trial. *Br J Anaesth* 2021; **127**: 962–70

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Women in pain medicine

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Summary

In the UK more women than men are practicing medicine, and for the first time in the history of the Royal College of Anaesthetists (RCoA), the president of the RCoA, Dean of the Faculty of Pain Medicine, and Dean of the Faculty of Intensive Care Medicine are all women. However, within the subspecialty of pain medicine, there are significantly more men practicing than women, with the most recent UK estimates identifying that only 26.7% of current pain physicians are women. Both historical and modern perspectives illustrate how women often prefer to be cared for by other women, highlighting the importance of increased representation of women in pain clinics and interventional suites. We discuss current trends in pain medicine recruitment within the UK, where most pain physicians are recruited from anaesthesia training programs, including the barriers to women's representation and reasons women enter the subspecialty. We advocate for speaker gender quotas at conferences, diversity considerate workforce planning, peer support groups, adjustments to training programs, and further research to help narrow the gender gap.