Understanding the Human Factors Related to Unrecognised Oesophageal Intubation Using the SEIPS Framework

Melody Chen[1,2], B. L. William Wong[2]

[1]Te Whatu Ora, Health New Zealand, [2]Auckland University of Technology, New Zealand

SUMMARY

Unrecognised oesophageal intubation (UOI) is a medical procedural error in which a breathing tube is mistakenly placed into the oesophagus and not promptly identified or addressed. A literature review on the human factors relating to UOI was performed and findings presented in the Systems Engineering Initiative for Patient Safety (SEIPS) framework. Key themes relating to issues around intubation equipment factors were used to inform the design of a cognitive aid to improve human performance in this clinical context. A semantically meaningful tray consisting of images and uniquely sized slots was created and sought to address technical and non-technical human factors identified in adverse event reports and coronial cases of UOI.

KEYWORDS

SEIPS model, Human factors, Healthcare, Airway Management, Unrecognised Oesophageal Intubation

Introduction

A patient who is critically ill in an intensive care unit (ICU) may require ventilation through an artificial airway, which involves the insertion of an endotracheal tube (ETT) into the trachea. It is possible that the ETT can be unintentionally inserted into the oesophagus, and further, go unrecognised by the intubator. Unrecognised oesophageal intubation (UOI) puts the patient at risk of immediate death or major harm (Baker et al., 2022). Episodes of UOI has been reported in healthcare organisations around the world, however the term 'unrecognised oesophageal intubation' was only recently defined in 2022 as "unintended placement or migration of a tracheal tube into the oesophagus, that is not promptly identified and addressed" (Chrimes et al., 2022).

The incidence of recognised OI was reported in a recent international study as 1 in 18 cases of emergency intubations of critically ill patients in the ICU (Russotto et al., 2021). It has been reported to occur in both routine and challenging airways (Holland et al., 1993), with both experienced and inexperienced clinicians and in all parts of the hospital including the ICU, emergency department (ED) and operating rooms (OR) (Chrimes et al., 2022). Currently, there is no structured method for estimating the true incidence rate of UOI and occurrences are mostly highlighted by coronial or media reports, meaning that it is likely more cases exist than are recorded publicly (Mann et al., 2023).

A literature review was performed to understand how UOI occurs at a macro-level in sociotechnical systems such as the hospital. The findings were framed in the Systems Engineering Initiative for Patient Safety (SEIPS) model to clearly outline work system factors that increase the risk of poor patient safety outcomes. Key findings derived from the SEIPS analysis involving access to

important equipment such as capnography, were highlighted. An analysis of two New Zealand cases from 2024 (HDC, 2024), provided an understanding of how UOI occurs at a micro-level. Issues around capnography were again highlighted in these cases and linked to findings from the SEIPS analysis. These findings address only a portion of the wider body of work related to prevention of UOI but have directed the design of a cognitive aid to address technical and non-technical factors identified in adverse event reports and coronial cases. A project was initiated to design a semantically meaningful tray consisting of images and uniquely sized slots to improve operator performance during equipment preparation. Clinicians who were directly involved with the recent UOI case were involved in the design of the tray, discussed herein.

An evaluation of the new tray with nurses to understand the usability of this tray within the context of the cardiovascular intensive care unit (CVICU) in simulated intubation scenarios. The completeness of equipment preparation, time taken to prepare equipment and ability to identify missing equipment were measured to inform the effectiveness of this aid.

Background

In 2011, the 4th National Audit Project (NAP4), 'Major complications of airway management in the United Kingdom' identified nine cases of UOI, leading to six deaths which accounted for 18% of the total 33 deaths relating to airway management (Cook et al., 2011). This prompted a national campaign: 'No trace = wrong place' to highlight the importance of correct use of capnography (method to measure continuous exhaled CO_2) and human factors relating to this situation (Baker et al., 2022). Unrecognised oesophageal intubation was initially included on the Never Events list in 2018 as it is considered a preventable event through adherence to published guidelines and strong systemic protective barriers at a national level (NHS Improvement, 2018). It has since been suspended from the Never Events list in 2018 pending further clarification. The Royal College of Anaesthetists continue to emphasise that the adherence to proper monitoring of exhaled CO_2 (using waveform capnography) and its correct interpretation as the gold standard practice for confirming ETT placement (Chrimes et al., 2022). In 2022, the Project for Universal Management of Airways (PUMA) guidelines were published and is the first guideline dedicated to preventing UOI. It provides guidance on technical aspects of task performance, equipment choice and decision-making, and addresses the non-technical aspects such as human factors (Chrimes et al., 2022). All major airway societies have endorsed this guideline (Mann et al., 2023).

Literature review

Methodology

A literature review was performed to capture the interacting elements of the sociotechnical system surrounding this aspect of airway management. Articles were sourced from a combination of manual database searching and Elicit AI, an artificial intelligence research tool that uses large language models to search for relevant articles within the Semantic Scholar database (Elicit, 2024). Elicit AI was used to source 30 articles relevant to the research question "What are the human factors related to unrecognised oesophageal intubation?". Elicit AI was used to generate insights from these articles, and this was coupled with manual reading of the same papers to validate insights. To counteract the effect of learning bias, half the papers were analysed by Elicit AI first and the remaining half analysed by manual analysis first. Each insight generated by Elicit AI was checked manually for correctness and those that were deemed inaccurate due to AI related errors were removed (hallucination and referencing errors). Bibliographies from relevant articles were searched for additional research of interest. Searches of MEDLINE, PUBMED and SCOPUS were performed with the initial keywords: Unrecognise*, delay*, oesophag*, esophag*, intubation to capture further relevant articles. A total of 45 articles were included in the review.

Thematic analysis was used to group findings into higher level themes and were then organised into the Systems Engineering Initiative for Patient Safety (SEIPS) framework. The SEIPS model, first published in 2006 by Caryon et al. (2006) and has been widely used in healthcare to frame the design and research of improvement initiatives relating to patient safety. The model describes the interactions between the work system, processes and outcomes. The work system is comprised of five elements: person, task, tools and technology, environment and organisation (Figure 1).

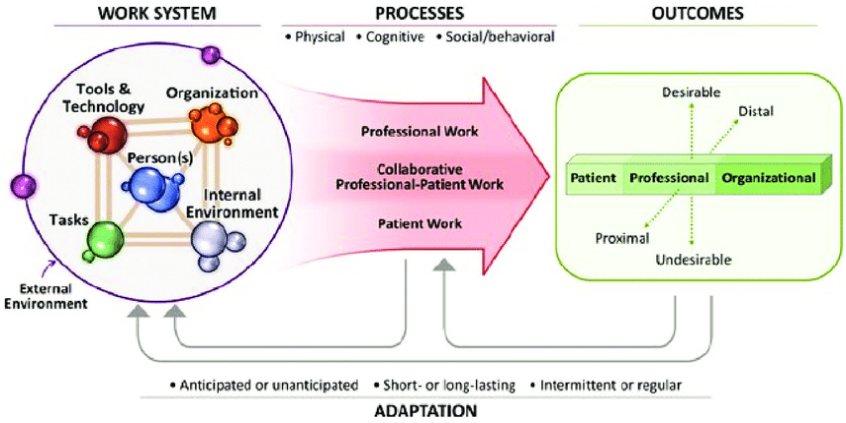

Figure 1: SEIPS model diagram

SEIPS 2.0 (Holden et al., 2013) describes the concept of configuration, which captures the dynamic nature of a system, making it possible to depict the performance of a system based on how the work system is configured. This implies that the same system, configured differently, can result in both desirable and undesirable outcomes. In this context, an *undesirable* outcome is unrecognised oesophageal intubation. Using evidence in literature relating to the cases of UOI, factors relating to how the person, technology, task, environment and organisation contributed to undesirable outcomes were analysed and a snapshot of the work system configuration that likely leads to poor system performance was captured.

Work system factors

Factors of the *person or team* in the context of the SEIPS model describe aspects such as knowledge deficits, anchoring or fixation and cognitive biases. **Knowledge deficits** included misinterpretation of the capnography trace or failure to acknowledge the absence of end tidal carbon dioxide ($ETCO_2$) as a sign for incorrect tube placement, has been reported as one of the leading reasons for UOI (Endlich et al., 2024). **Anchoring or fixation** to an initial diagnosis can lead to tunnel vision and in many cases of UOI, coroners reported that practitioners commonly misattributed the absence of sustained exhaled CO2 to bronchospasm (Sakles et al., 2023) continuing to treat the wrong problem and delaying the identification of OI. Clinical assessments such as listening for breath sounds are prone to subjectivity (Jafferji et al., 2019) as air flowing through the tube into the stomach can be misinterpreted as breath sounds in the lungs (Honardar et al., 2017). Subjective tests are likely to reaffirm their initial diagnosis via confirmation bias.

Technology factors involve the lack of availability of recommended gold standard equipment and delayed access to equipment. The PUMA guidelines highlight the current **'gold standard' equipment** to be used in all airway intubations. Video laryngoscopy is recommended over direct laryngoscopy as it allows the larynx view to be projected onto electronic monitors visible to more team members, not just the intubator (Kelly & Cook, 2022). It is thought to reduce the risk of fixation bias by sharing the view with multiple people in the room. The gold standard for assessing ETT placement is with continuous waveform capnography. The 'no trace = wrong place' and PUMA guidelines both highlight the importance of assessing the capnography trace after intubation

and while monitoring the patient. An analysis of closed claims relating to delayed detection of OI found that $ETCO_2$ monitoring issues was a factor in 73% of cases. In 27% of cases, the capnography device was not used at all due to a **lack of availability** of the device (Honardar et al., 2017). **Lack of immediate access** to important tools such as capnography, video laryngoscopy and other back-up equipment have led to cases of UOI (Chrimes et al., 2022; HDC, 2024). Not having adequate equipment prepared in advance has been reported as a barrier to timely airway management (Mann et al., 2023).

Organisational factors included the presence of team hierarchies hindering communication and teamwork, lack of training and inconsistent procurement of standardised equipment. **Hierarchies** negatively affect teamwork and can result in malignant politeness (Chrimes et al., 2022). This is an important consideration when 'crash teams' are brought together to manage emergency situations (Mann et al., 2023). **Lack of training** or awareness of the 'no trace, wrong place' concept was related to a fatal case of UOI (Flin et al., 2013). Prior to the publication of the PUMA guidelines, there was no universally agreed protocol for preventing UOI and so training and education has not been consistent. Organisational **procurement** decisions have a direct impact on the availability of equipment around the hospital, and with a lack of centralisation, can result in variations in equipment between hospital wards. This is a factor to consider as clinicians are often called to assist in emergencies where they may not have had sufficient orientation to the layout or equipment availability (Mann et al., 2023).

Task factors include **the difficulty and complexity** of inserting an artificial airway, which can be made worse under emergency situations. Determining the cause for an absent $ETCO_2$ trace involves many diagnostic tests with different equipment and can be considered a complicated process (Dob, 2022). The absence of standardised protocols can lead to inconsistencies in work practice (Cook et al., 2019). The **task sequence** can take on a variety of different versions depending on the situation at hand, relying on good situational awareness of the team to navigate the problem effectively. Skipping steps can occur during stressful situations and can be a symptom of cognitive biases causing lapses in situation awareness or premature closure (Nourallah & Levy, 2020).

Internal environmental factors that influence performance included **crowded and distracting working conditions.** A recurrent term used in coroners' reports is 'chaos' reflecting a stressful environment and deterioration in team function during the emergency (Chrimes et al., 2022). Critical moments in the task sequence require higher attention levels and even a moment of distraction can lead to incorrect tube placement (Holland et al., 1993).

New Zealand case studies

In 2024, two separate cases of UOI leading to death were reported in New Zealand (NZ) (HDC, 2024). This initiated the work to develop interventions addressing human factors issues raised in the adverse event analyses. These cases exhibit similar systemic risk factors highlighted in the literature review and called for the design of an intervention grounded in the local context of the NZ hospital system. Issues around the availability and awareness of back-up capnographs, as well as staff experience mix were highlighted in these cases. These themes address only a portion of the wider body of work related to prevention of UOI, with other themes relating to organisational factors such as training and teamwork being addressed in other bodies of work.

The two cases shared similarities which involved staff not knowing the existence of a back-up capnometer (used when the main bedside capnograph is unavailable or believed to be malfunctioning). In both cases, the bedside waveform capnograph recorded no trace when connected to the breathing circuit of the intubated patient. Clinical signs such as 'misting of the tube' were noted in both cases, which led the clinicians to believe that the ETT was correctly in the trachea, and the absence of a capnography trace was attributed to a faulty capnograph cable.

Confirmation bias and delayed use of bronchoscopy to confirm ETT location led to delayed detection of OI and unfortunately death of both patients. In both cases, it was later reported that the initial bedside capnography device was functioning as intended.

Capnography equipment can be fallible, and clinical staff should be made aware of the potential technical issues of older equipment. If there is doubt in the technical performance of this crucial equipment, there needs to be immediate access to a back-up device, such as a single use capnometer or portable capnograph. In both cases, staff members were unaware of the existence of these devices in the airway/resus trolley (i.e. in close proximity to the patient).

In one of these cases, it was reported that the lack of awareness of the back-up capnometer may have related to the poor labelling of the device's case. The capnometer sits in a case labelled EMMA provided by the manufacturer. This name is an abbreviation for EMergency Mainstream Analyser. Without specific orientation it is unlikely that any staff member would know that this a capnometer by purely reading the label. Additionally, the capnometer case was hidden from clear sight as it was at the back of an airway trolley.

In one case, registrars and anaesthetists were called in from different areas of the hospital to attend to the emergency case in the ED, where they had seldom worked. Unfamiliarity with the environment and equipment were associated with delays in recognising OI. In the other case, it was stated that the staff skill mix was below average on the shift when the UOI event took place. Additionally, this ward has had a high staff turnover rate which has resulted in a higher proportion of staff with lower than average airway management training.

Key interactions

The interactions between elements of the work system help to describe important aspects of the system that can have great impact on the overall system outcomes (Holden et al., 2013). The scope of this project addressed only the key findings relating to equipment (failure to confirm $ETCO_2$ trace and timely access to equipment). These themes resonated in the literature as well as the two NZ case studies and led to the formulation of design requirements for a product solution. These themes address only a portion of the wider body of work related to prevention of UOI, with other themes relating to organisational factors such as training and teamwork being addressed in other bodies of work. Table 1 below highlights the interactions that contribute to two issues: failure to confirm $ETCO_2$ trace and timely access to equipment. Each work system factor is uniquely coded.

Table 1: Interactions of work system relating to equipment

Themes	Person/team	Technology	Task	Organisation	Environment
Failure to confirm $ETCO_2$ trace	**P1:** Confirmation bias **P2:** knowledge deficit	**Te1:** Visibility of equipment **Te2:** Labelling of equipment	**Ta1:** Task sequence	**O1:** Interhospital staffing orientation **O2:** Lack of standard protocols	
Timely access to equipment	**P2:** Knowledge deficit	**Te3:** Equipment availability issues	**Ta2:** Equipment preparation **Ta3:** Time pressure	**O2:** Lack of standard protocol **O3:** Staff experience mix **O4:** Low staff training levels	**E1:** Room layout is not standardised

Design of cognitive aid

The scope of this stage of the project involved designing a cognitive aid to support airway equipment preparation to improve completeness and timeliness of this task. The items required for preparation were pre-determined by the project clinical lead and aligned with the globally accepted

consensus guidelines for prevention of UOI (Chrimes et al., 2022). Design requirements of this tray were derived from the work system factors (Table 1) that were identified as being risk factors for poor airway management outcomes. Table 2 indicates which work system factors were addressed with each requirement, and the design specifications and success measures are stated alongside.

Table 2: Design requirements, specifications and success measures for tray development

Design Requirement	**Factors addressed**	**Specification**	**Measure**
1) Cognitive aid designed to assist nurses of all experience levels and familiarity with CVICU equipment	O1, O3, O4, Ta2	Equipment tray designed with shadow board concept to allow users to easily match equipment during equipment preparation	Equipment preparation speed and accuracy across range of staff experience levels.
2) Required equipment to be available in areas of hospital where intubations can occur	Te3, O2	Cognitive aid to be attached to new Glidescope Core, allowing for video laryngoscopy and bronchoscopy on single moveable stack.	Tray to be attached to Glidescope Core
3) Location of single use back up $ETCO_2$ monitor to be more obvious to all staff	P2, Te1, P2	Emergency capnograph located front and centre of tray so all staff have clear line of sight to it during intubation procedure	Staff able to quickly identify during usability testing
4) Back up capnograph can be clearly identified	Te2	Labelling to state capnograph function	Staff able to quickly identify during usability testing

Final design

A cognitive aid was designed by hospital product design engineers alongside a steering group of nurses. A tray identifying all necessary equipment through use of images and uniquely sized slots was fabricated using laser cutting technology (see Figure 2). The tray was fixed to a Glidescope Core which can perform both video laryngoscopy and bronchoscopy (Verathon, 2023). Having the tray affixed to the Glidescope Core ensures all equipment is brought to the bedside for all routine intubations, where previously it was observed to only be brought in when a difficult intubation was anticipated. A new label for the back-up capnograph was designed to clearly indicate its function (Figure 3).

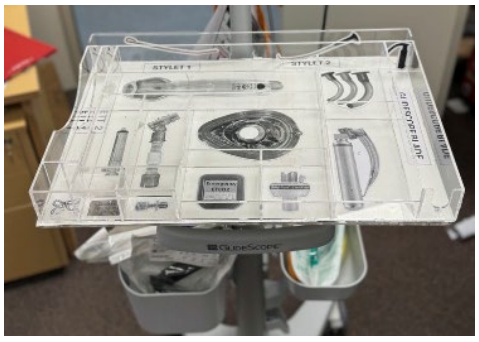

Figure 2: Tray attached to Glidescope Core

Figure 3: New labelling of ETCO2 case

Formative usability testing

A pilot study was performed to gain an initial understanding of the effectiveness of this solution. The tray was tested with 10 participants to compare how this intervention impacts clinical workflow, relative to the existing workflow. Nurses are predominantly tasked with equipment preparation and therefore only nurses were recruited for this testing. A mixed-methodology approach involving a combination of observations, interviews, and questionnaires were used. Thematic analysis was used to review the insights and inform the iterative design process.

Procedure

Participants were tasked to prepare the equipment needed for intubation for a simulated scenario, using the existing airway trolley and the newly designed airway preparation tray which was fixed to the Glidescope Core. A total of 10 nurses of varying experience levels volunteered and were split into two study arms. Both groups consisted of two nurses with high experience (3+ years' experience in the ward) and three nurses with less experience (< 3 years). Group A performed the task using the current system first and then repeated the task on the new tray. Group B did this in reverse, using the new tray first. This was to counterbalance carryover effects within the testing.

At the end of the equipment preparation task, participants were asked to leave the room while three designated items were removed from their working space. The participant was brought back and then asked to identify the missing items. This identification activity was also performed after the participant switched systems where three different items were removed. The purpose of this task was to simulate the likely event of role allocation changes during an emergency response which may result in a nurse having to 'pick up' the equipment preparation task from a teammate. The ability to identify missing equipment is critical to the timely access of equipment when it is needed during the procedure.

Analysis

As this is an observational pilot study with a small sample size, the analysis was descriptive. The completeness of the preparation task was calculated as a percentage of the total number of items needed for intubation. The time taken to complete the preparation task was recorded, as was the time taken to identify the missing items.

Results

In both groups, an increase in percentage of completeness of equipment preparation was observed when using the new tray compared to the current system. On average, group A improved their completeness percentage from 62 % to 99 % (***p<0.01***). Group B improved from 83 % to 95 %. For both groups, the time taken to prepare the equipment using the new tray was higher, with group A taking on average 13 seconds more and group B taking 49 seconds more. For both groups, the time taken to identify missing items was lower when using the new tray than with the current system, with group A taking 7 seconds less and group B taking 25 seconds less (***p<0.01***).

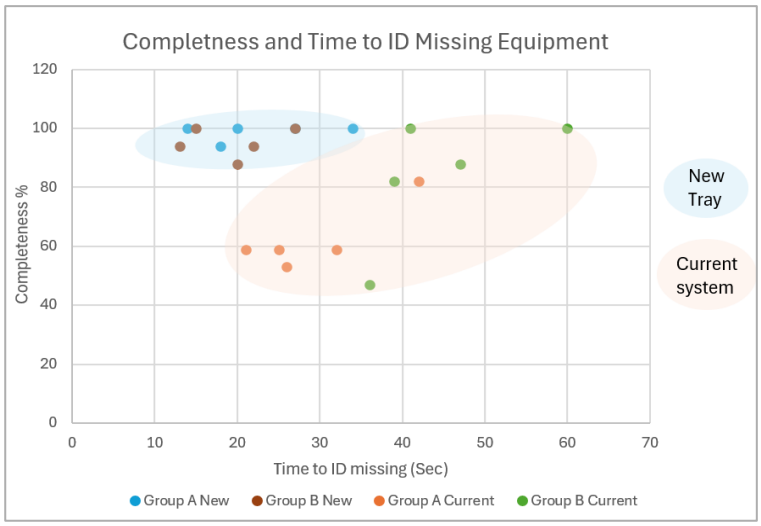

Figure 4: Graph of 'Time to ID missing equipment' vs 'Completeness of equipment preparation'

Table 3: Results of pilot testing

Measure	**Group**	**Current system (average)**	**New Tray (average)**	**Difference**	**T test (P value)**
Equipment prep time	A	110 s	123 s	13 s	0.35
	B	126 s	175 s	49 s	0.09
Completeness % (number of items)	A	62.4 % (11)	98.8 (17)	36.4 % (6)	0.001
	B	83.4 (14)	95.2 (16)	11.8 % (2)	0.10
ID missing equipment	A	29.2 s	22.6 s	-6.6 s	0.19
	B	44.6 se	19.4 s	-25.2 s	0.007

Discussion

In this pilot study, it was found that on average the completeness of equipment preparation as well as time taken to identify missing items was improved when using the new tray. Participants found that they relied much less on their memory and were able to easily prepare equipment by matching patterns. Different recall techniques were discussed by participants with many mentally simulating the intubation procedure to remember which items to prepare. Nurses commented that this technique is often flawed in high stress environments and equipment is easily forgotten. Addressing the issue of equipment availability, with the use of this tray correlating to an increased number of correct equipment prepared, it is more likely that all important equipment (including back-ups) will be available when needed.

All participants stated that it was much easier to identify missing items from the tray than it was with the current system as the technique involved spotting empty boxes, rather than relying on a mental checklist. This was reflected in the shorter time taken to identify the missing items using the new tray, in both groups. In emergency responses, role allocation can sometimes change for a

variety of reasons. Having a clear template indicating what equipment has yet to be prepared is likely to reduce cognitive demand of an incoming clinician tasked with equipment preparation.

On average, the time taken to prepare the equipment using the new tray was higher than with the current system, which was to be expected as there was an increase in the total number of items prepared using the tray. It was also thought to be attributed to the lack of orientation participants had to the new tray with this being the first time all participants had seen the tray.

Nurses with more experience (3+ years) commented that they prefer the current system purely due to familiarity, however, were happy to change systems as they recognised it would be easier for those with less experience to perform the task effectively. This was confirmed by the nurses with less than 3 years' experience in the ward, with the majority stating they would "much prefer" the new tray and "felt more confident" they have prepared the necessary equipment with the tray. These findings indicate that this tray would suit nurses of varying experience levels.

Conclusion

A system level understanding of medical procedures helped to inform the design of a cognitive aid used to improve decision-making and performance of clinical staff in high stress environments. The intubation tray designed in this project places all routine intubation equipment on the same set of wheels as the video laryngoscope and bronchoscope. Given the central importance of a functioning capnograph, the tray also places a backup device front and centre of the airway management team. This tray standardises the equipment preparation process, considers clinician decision-making and may reduce the likelihood of future adverse events.

References

Baker, P. A., O'Sullivan, E. P., & Aziz, M. F. (2022). Unrecognised oesophageal intubation: Time for action. *British Journal of Anaesthesia*, *129*(6), 836–840. https://doi.org/10.1016/j.bja.2022.08.027

Carayon, P., Hundt, A. S., Karsh, B.-T., Gurses, A. P., Alvarado, C. J., Smith, M., & Brennan, P. F. (2006). Work system design for patient safety: The SEIPS model. *Quality & Safety in Health Care*, *15*(Suppl 1), i50. https://doi.org/10.1136/qshc.2005.015842

Chrimes, N., Higgs, A., Hagberg, C. A., Baker, P. A., Cooper, R. M., Greif, R., Kovacs, G., Law, J. A., Marshall, S. D., Myatra, S. N., O'Sullivan, E. P., Rosenblatt, W. H., Ross, C. H., Sakles, J. C., Sorbello, M., & Cook, T. M. (2022). Preventing unrecognised oesophageal intubation: A consensus guideline from the Project for Universal Management of Airways and international airway societies*. *Anaesthesia*, *77*(12), 1395–1415. https://doi.org/10.1111/anae.15817

Cook, T. M., Harrop-Griffiths, A. W., Whitaker, D. K., McNarry, A. F., Patel, A., & McGuire, B. (2019). The 'No Trace=Wrong Place' campaign. *British Journal of Anaesthesia*, *122*(4), e68–e69. https://doi.org/10.1016/j.bja.2019.01.008

Cook, T. M., Woodall, N., & Frerk, C. (2011). Major complications of airway management in the UK: Results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 1: Anaesthesia†. *British Journal of Anaesthesia*, *106*(5), 617–631. https://doi.org/10.1093/bja/aer058

Dob. (2022). *Why does oesophageal intubation still go unrecognised?* https://doi.org/10.1111/anae.15692

Endlich, Y., Fox, T. P., Culwick, M. D., & Acott, C. J. (2024). Oesophageal intubations in anaesthetic practice across Australia and New Zealand: A webAIRS analysis of 109 incidents. *Anaesthesia and Intensive Care*, *52*(5), 302–313. Scopus. https://doi.org/10.1177/0310057X241244809

Flin, R., Fioratou, E., Frerk, C., Trotter, C., & Cook, T. M. (2013). Human factors in the development of complications of airway management: Preliminary evaluation of an interview tool. *Anaesthesia*, *68*(8), 817–825. https://doi.org/10.1111/anae.12253

Health and Disability Commissioner (HDC). (2024). *Te Whatu Ora breaches Code in care of man who died following incorrect intubation 21HDC02785*. Health and Disability Commissioner (HDC). https://www.hdc.org.nz/media/1d0bwyme/21hdc02785mediarelease.pdf

Holden, R. J., Carayon, P., Gurses, A. P., Hoonakker, P., Hundt, A. S., Ozok, A. A., & Rivera-Rodriguez, A. J. (2013). SEIPS 2.0: A human factors framework for studying and improving the work of healthcare professionals and patients. *Ergonomics*, *56*(11), 10.1080/00140139.2013.838643. https://doi.org/10.1080/00140139.2013.838643

Holland, Webb, R. K., & runciman. (1993). *Oesophageal Intubation: An Analysis of 2000 Incident Reports*. https://doi.org/10.1177/0310057X9302100519

Honardar, M. R., Posner, K. L., & Domino, K. B. (2017). Delayed Detection of Esophageal Intubation in Anesthesia Malpractice Claims: Brief Report of a Case Series. *Anesthesia & Analgesia*, *125*(6), 1948–1951. https://doi.org/10.1213/ANE.0000000000001795

Jafferji, D., Morris, R., & Levy, N. (2019). Reducing the risk of confirmation bias in unrecognised oesophageal int ubation. *British Journal of Anaesthesia*, *122*(4), e66–e68. Crossref. https://doi.org/10.1016/j.bja.2019.01.015

Kelly, F. E., & Cook, T. M. (2022). Unrecognised oesophageal intubation: Additional human factors and ergo nomics solutions. *Anaesthesia*, *77*(6), 718–719. Crossref. https://doi.org/10.1111/anae.15686

Mann, A., Higgs, A., & Cook, T. M. (2023). Preventing unrecognised oesophageal intubation. *British Journal of Hospital Medicine*, *84*(3), 1–9. https://doi.org/10.12968/hmed.2023.0007

NHS Improvement. (2021). *Never Events List 2018*. NHS Improvement. https://www.england.nhs.uk/wp-content/uploads/2020/11/2018-Never-Events-List-updated-February-2021.pdf

Nourallah, B., & Levy, N. (2020). Utilisation of 'verbalisation' to reduce the complications of tracheal intubation. *Anaesthesia*, *75*(4), 556–557. https://doi.org/10.1111/anae.15001

Russotto, V., Myatra, S. N., Laffey, J. G., Tassistro, E., Antolini, L., Bauer, P., Lascarrou, J. B., Szułdrzyński, K., Camporota, L., Pelosi, P., Sorbello, M., Higgs, A., Greif, R., Putensen, C., Agvald-Öhman, C., Chalkias, A., Bokums, K., Brewster, D., Rossi, E., … INTUBE Study Investigators. (2021). Intubation Practices and Adverse Peri-intubation Events in Critically Ill Patients From 29 Countries. *JAMA*, *325*(12), 1164–1172. https://doi.org/10.1001/jama.2021.1727

Sakles, J. C., Ross, C., & Kovacs, G. (2023). Preventing unrecognized esophageal intubation in the emergency department. *Journal of the American College of Emergency Physicians Open*, *4*(3), e12951. https://doi.org/10.1002/emp2.12951

Verathon. (2023). *Glidescope Core*. https://www.verathon.com/sites/default/files/2023-09/0900-5235_Rev-04_GS_TAS_BFlex2_SpectrumQC_WEB.pdf