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The infusion after the bolus: a quality improvement programme to support emergency department airway governance in Ireland

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ABSTRACT

Background Emergency department (ED) intubations are high-risk procedures with wide variability in training and governance. Although emergency physicians (EPs) in Ireland are trained to intubate, structured airway governance within EDs is not well described. This quality improvement project aimed to develop and evaluate a sustainable airway governance framework in a large Irish ED.

Methods Using the model for improvement, sequential interventions were implemented between May 2024 and October 2025. Interventions evolved across cycles and included appointment of an emergency medicine (EM) airway lead, Emergency Medicine Airway Registry Ireland (EMARI)-linked QR code data capture, standardised checklists and airway equipment, video laryngoscopy with recording, daily intubation drills, competency-based sign-off and structured multidisciplinary teaching with feedback (*Airways, Biscuits, Caffeine*). Primary outcome measures were first-pass success (FPS) and complication rates.

Results Across 156 intubations in 154 patients, EPs were primary intubators in 82.7%. Overall mean FPS was 91.7% and complication rate was 12.3%. Performance metrics were maintained within predefined safety targets (>90% FPS, <15% complications) across all four Plan-Do-Study-Act (PDSA) cycles, despite staff turnover and progressive introduction of interventions. Following implementation of daily drills, senior airway supervision and competency sign-off (PDSA cycle 2), FPS remained consistently above target and complication rates remained low through subsequent cycles. EMARI data capture reached 99.4%, and video capture increased over time to 72%.

Conclusions A structured airway governance programme combining leadership, checklist standardisation, simulation and continuous feedback was associated with maintenance of FPS>90% with low complication rates over successive PDSA cycles. This pragmatic, replicable framework supports establishment of national EM airway governance standards to maintain procedural competency and patient safety and is replicable in international EDs with similar pre-existing airway management practices.

INTRODUCTION

Problem description

Endotracheal intubation (ETI) is an emergency procedure that occurs in every resuscitation room of every emergency department (ED) in the world.¹⁻³

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Emergency department (ED) intubations are high-risk procedures that require ongoing training and governance to ensure safety and skills maintenance. In Ireland, despite emergency physicians being trained to intubate, there is no nationally described or published ED-based airway governance programme.

WHAT THIS STUDY ADDS

⇒ This structured governance programme demonstrates that emergency physicians can maintain high first-pass success and low complication rates through a combination of dedicated leadership, training, governance and data-driven feedback.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study provides a replicable model for airway governance in EDs in Ireland and internationally. It offers a pragmatic approach to maintaining competency in low-frequency intubation environments and may guide airway training standards and policy across EDs.

However, there is significant variability in the literature around the practice of ETI, in particular as it relates to the operator specialty, equipment choice and programmatic airway training.⁴⁻⁶ Models of practice vary from emergency medicine (EM)-led intubation in North America and Australia to critical care or anaesthesiology-led intubation in parts of Europe and Asia, with many hybrids in between.^{3,7} Despite this diversity, high-performing systems share common elements of governance frameworks, registry-based data collection, simulation training and use of checklists to improve patient safety and first-pass success (FPS).

Core specialty training in EM in Ireland has incorporated a 6-month foundational anaesthesiology rotation prior to progressing to advanced specialty training, and it is established practice in Ireland that intubation is a core skill for emergency physicians (EPs).⁸ Previous studies have shown that Irish EPs intubate frequently in the resuscitation room, particularly in larger training hospitals.^{2,8} However, despite this, and the foundational training acquired, higher specialist



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trainees then continue on as registrars (and subsequently consultants) with minimal airway training on a regular basis, which underscores the challenge of maintaining procedural competency among infrequent intubators in the ED. This is not unique to Ireland, with similar concerns recognised internationally across EM and critical care literature, where maintaining airway competence is an ongoing focus of patient safety and educational research.^{9–11}

To date, the Emergency Medicine Airway Registry Ireland (EMARI) represents the only existing airway database for Irish EDs.⁸ EMARI, established in 2020, is a national quality assurance and audit initiative, modelled on international airway registries such as National Emergency Airway Registry and the Australian and New Zealand Emergency Department Airway Registry.^{12–13} Previous literature highlights that there was variability in equipment, use of checklists and airway training nationally, and therefore, the key aims of EMARI were to standardise airway management in Ireland.^{2–5} The 2025 report from EMARI demonstrates an FPS of 84.4%, with EM as the primary intubator in 68.3% of cases. These figures mirror those reported internationally, highlighting that while outcomes are comparable, structured governance and training are necessary to sustain performance over time.

Departments without structured airway governance and training may inadvertently lead to conditions that potentially increase the cognitive load of intubators and the risk of unrecognised complications, and they limit our ability to learn from cases. Existing international reports and registries emphasise that achieving and sustaining high FPS ($\geq 90\%$) with low complications depends on structured governance, standardised preparation and team training with feedback.^{3–14} Our programme aim was to close these safety gaps locally using those principles.

This quality improvement (QI) programme was therefore designed to close those safety and governance gaps using internationally recognised principles of airway safety and learning. While there are several descriptions of EM airway training and governance programmes globally, there has been no published example of an EM-led airway governance programme from Ireland or the UK. The goal was to establish a sustainable, accountable and replicable airway governance model that supports competency, safety and continuous improvement—principles transferable to any ED internationally.

PROBLEM EXPLORATION

A baseline review of airway management in our ED was undertaken, and over a 6-month period prior to May 2024, there was no consistent documentation of ETIs, with data available for only a small subset of cases captured informally through clinical handover or governance meetings. As such, the department lacked accurate measures of FPS, complication rates or operator experience. Clear patient safety risks existed regarding documentation, use of a standardised checklist and standardised equipment. Although no serious adverse events were reported in the preceding years, this lack of oversight represented a latent patient safety risk.

This absence of structured data limited the ability to identify training needs, recognise adverse events or benchmark local performance against national or international standards. Anecdotally, staff reported variation in checklist use and inconsistent equipment layout. From this review, key metrics were identified as primary outcomes to inform the specific, measurable, achievable, relevant, timely (SMART) aims of the project.

Specific aims

As figure 1 demonstrates, the SMART aims for the quality improvement project (QIP) were to:

1. Achieve a $>90\%$ FPS rate by July 2025, at least 1 year after project commencement.
2. Achieve an overall documented complication rate $<15\%$.
3. Achieve 100% airway data capture on EMARI.

While 100% data capture was an aspirational aim, the implementation team felt that it was a key component of proving a sustained concept of airway governance.

METHODS

The setting

University Hospital Galway (UHG) ED is a model 4 hospital in the West of Ireland with a 2024 census of 80 000 attendances. A model 4 ED in Ireland refers to an ED in a hospital that provides 24/7 acute surgery, acute medicine, critical care and tertiary-level services.¹⁵ This ED receives both adult and paediatric cases, and prior to the intervention, airway processes varied with no data capture of any ETIs, limiting surveillance of FPS or complication rate. There are 8.5 whole-time equivalent consultants in EM, and at the time of QIP implementation, there were 16 registrars in EM on the roster.

The QIP implementation team consisted of two consultants in EM and nursing clinical facilitators, with additional support from the clinical lead of the intensive care unit (ICU) at UHG. All consultants in EM supported the project.

Stakeholder engagement

To extrapolate the problem, stakeholder engagement was undertaken prior to project implementation, as shown in figure 2. This group included EM consultants, EM registrars and nursing staff, in addition to the ICU clinical lead. Input was gathered from a combination of structured meetings, governance discussions and informal feedback on the shop floor. Key themes identified were the need for a standardised checklist, a consensus agreement on equipment choice and layout, and real-time feedback mechanisms. Feedback from registrars revealed that practices vary around the country, with some EDs having ICU doctors perform all ED intubations, which can also make it difficult to maintain competencies. Nursing clinical facilitators highlighted that training was also an issue for nurses, with a high volume of staff and high turnover making it difficult to achieve a consistent standard of airway nursing, which is a key component of all ED ETIs. These insights directly informed the design of the intervention package, reflecting the opinions of the end users in the resuscitation room.

Design

Our airway governance programme was not one that was established in one formative intervention, but rather an evolution of a series of interventions.

Measurement

Patient safety was the ultimate aim, and we felt that the FPS and complication rates were both patient focused and realistic. Our primary outcome measure was FPS, and while not a complete assessment of technical skill, FPS is currently the best measure in the literature for measure of technical competency of ETI and used as a measure of airway governance programme performance.^{1–3} This was defined as successful tracheal intubation on the first attempt by the first intubator. Complications were primarily focused on

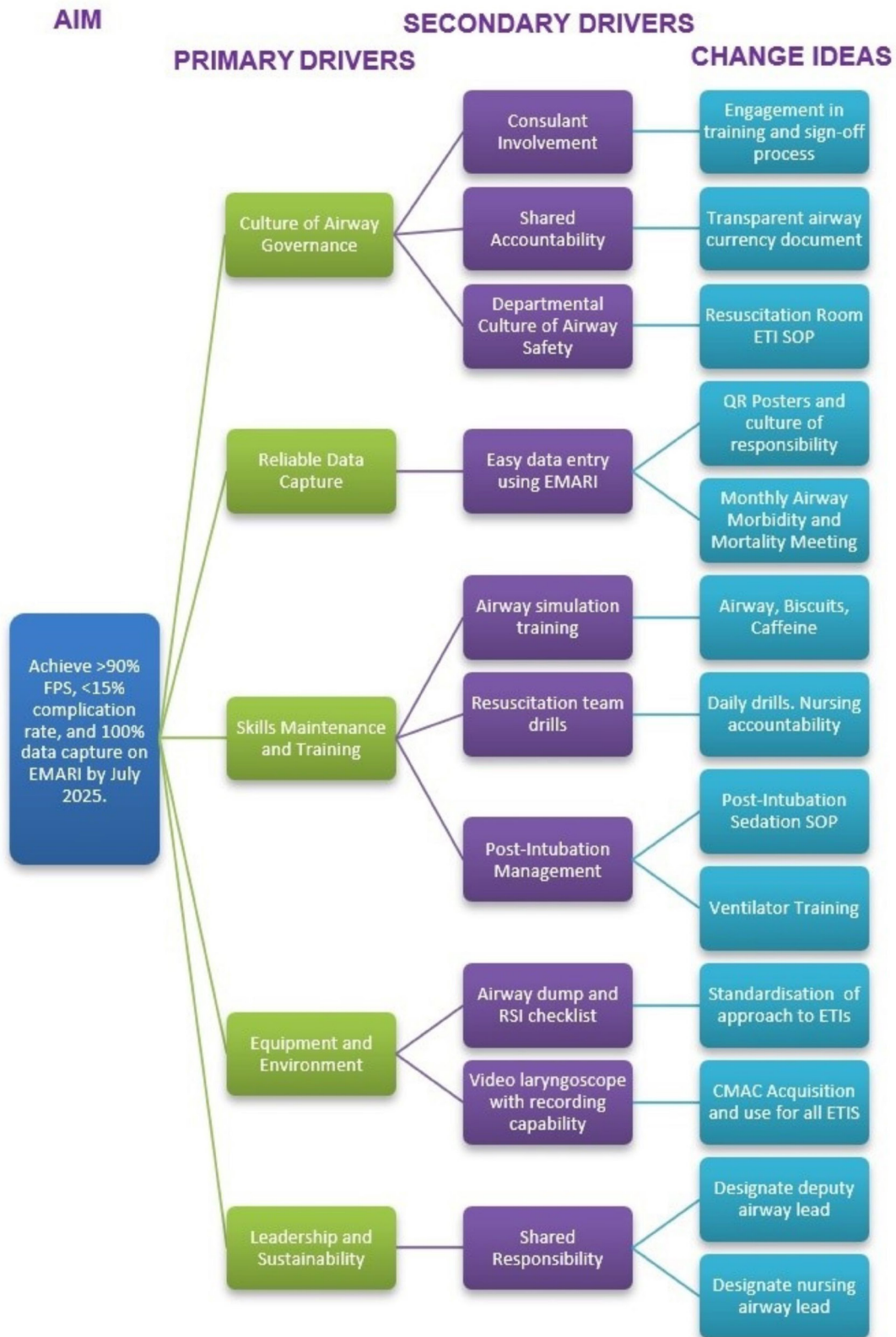


Figure 1 QIP driver diagram. EMARI, Emergency Medicine Airway Registry Ireland; ETI, endotracheal intubation; FPS, first-pass success; QIP, quality improvement project; RSI, rapid sequence induction; SOP, standard operating procedure.

oesophageal intubation, hypoxia and hypotension—the three most common and concerning issues when intubating.

Outcome measures:

1. FPS (%).

2. Complication rates.

Process measures:

1. Data capture (%) on EMARI.

2. Video capture (%) of intubations.

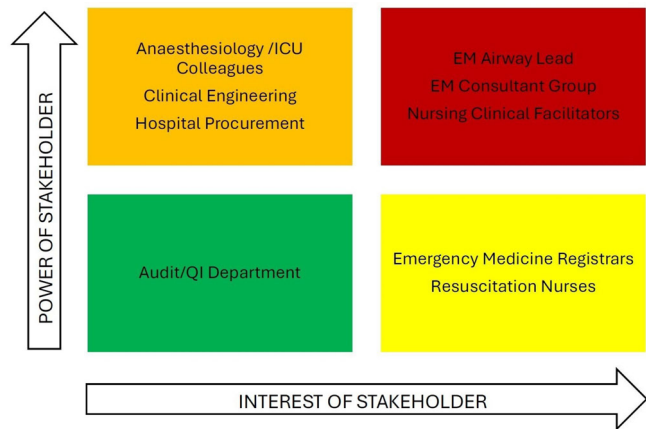


Figure 2 QIP stakeholder matrix. EM, emergency medicine; ICU, intensive care unit; QI, quality improvement; QIP, quality improvement project.

To evaluate both the impact and sustainability of the intervention, data were analysed as a continuous time series with monthly granularity. This approach enabled assessment of whether improvements were maintained over successive months, reflecting real-world embedding of practice change rather than a simple pre and post comparison. Outcome measures are described in graph form with process measures described in the Plan-Do-Study-Act (PDSA) cycle descriptions. Regarding complications, the rate per month describes the total number of complications overall, recognising that patients can have more than one complication, per ETI.

QI approach

The airway governance programme followed the core principles of the model for improvement, guided by the departmental driver diagram (figure 1).¹⁶ Interventions were introduced sequentially, guided by staff feedback, data monitoring and observed limitations.

Balancing measures

During the implementation phase, potential unintended consequences of the intervention were also considered. Specifically, limiting intubation to registrars with foundational anaesthesiology training led to some perceived reduction in procedural opportunities among other EM registrars. This was recognised as a potential negative effect on training experience and team morale. To mitigate this, supervised learning opportunities were expanded through dedicated simulation sessions, observed intubations and structured airway training during consultant-led resuscitations. Monitoring of registrar feedback formed part of the ongoing governance process but was not captured formally. Patient safety was at the core of this decision, and it was ensured that registrars knew that the EM programme is not established to replace the core training that is provided during an anaesthesiology rotation.

RESULTS

There were 156 intubations recorded for 154 patients from May 2024 to October 2025. EM was the first intubator in 82.7% (n=129) of cases, with the primary intubator and number of monthly intubation totals displayed in figure 3.

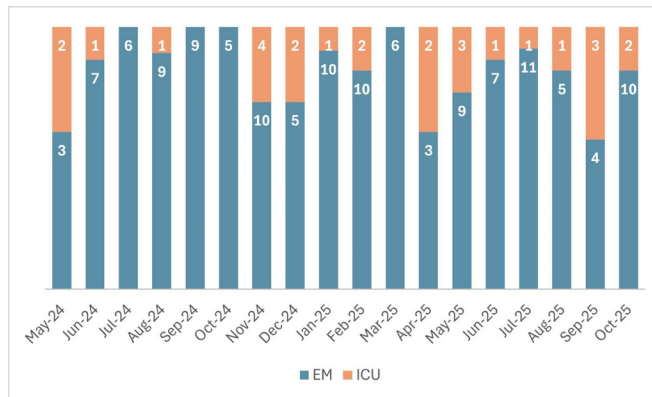


Figure 3 Intubations, emergency medicine (EM) and intensive care unit (ICU); May 2024–October 2025.

Outcome measures

The overall FPS and complication rates were 91.7% and 12.3%, respectively. When analysed as a monthly time series (figure 4), FPS and complication rates demonstrated variation around the mean, but performance remained consistently within predefined safety targets (>90% FPS and <15% complications) across all four PDSA cycles. Following the second PDSA cycle (January 2025), which introduced daily rapid sequence induction (RSI) drills, a formal airway sign-off process and senior airway supervision, FPS was maintained above the target threshold in subsequent months, with complication rates (table 1) also remaining within target limits.

Process measures

Data were recorded on 99.2% of intubations with video capture achieved for 53.8%.

Timelines and sequential interventions

May 2024: project commencement

Interventions

Establishment of an EM airway lead

A lead EM consultant was appointed to oversee airway governance, training and implementation. This role, endorsed by the Difficult Airway Society (DAS) and EMARI frameworks, ensured senior oversight and consultant buy-in to sustain the initiative during and beyond the pilot period.

Preintubation checklist and airway drop

A standardised preintubation checklist, adapted from DAS guidance, was introduced to support consistency and safety. Non-relevant items (eg, ‘Can we wake the patient?’) were removed for ED applicability. In parallel, a fully stocked airway drop was introduced in each resuscitation bay, ensuring immediate access to essential equipment and reducing cognitive load during emergencies.

EMARI data capture

EMARI was launched to capture all ED intubations. A QR code link was displayed in each resuscitation bay, with education at registrar teaching. Early adoption was excellent with 100% data capture within the first 2 months. The system provided real-time reporting and supported immediate review and learning, strengthening local governance and contributing to a national database. The importance of EMARI cannot be understated. While not a traditional intervention in QI, this was regarded

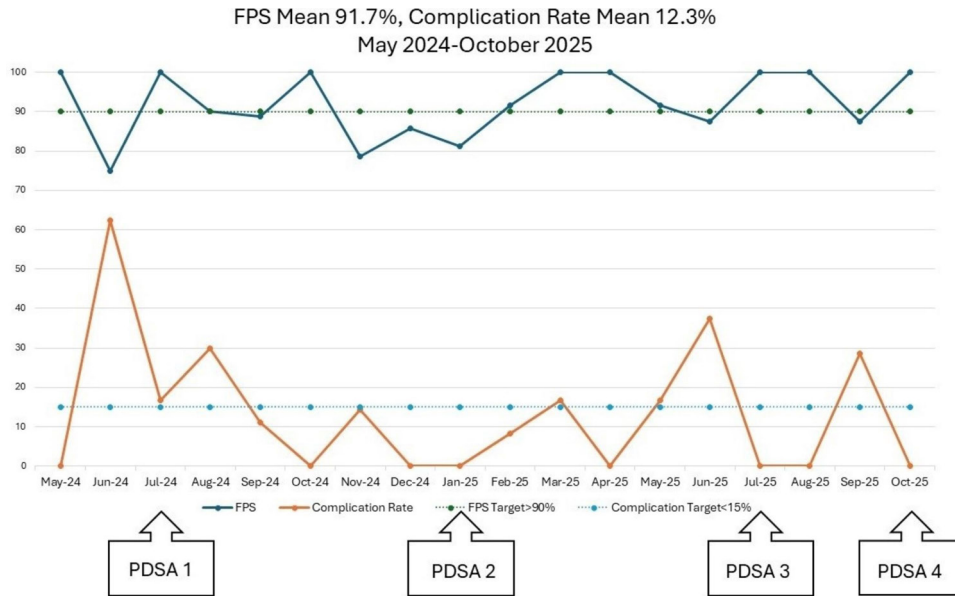


Figure 4 FPS and complication rates; May 2024–October 2025. FPS, first-pass success; PDSA, Plan-Do-Study-Act.

as part of the resuscitation management of patients undergoing ETI and aimed to reinforce our governance process throughout complete data reporting, in real time.

July 2024: PDSA 1

During May–June 2024, thirteen ETIs were performed (10 EM, 3 ICU), with 92.3% FPS and a 38.5% complication rate. Staff reported improved confidence with the checklist and airway drop. Engagement of nursing facilitators ensured continuity of practice.

Interventions

CMAC acquisition

To enhance feedback and learning, a CMAC video laryngoscope (Karl Storz, Germany) was introduced, replacing the non-recording McGrath device. This allowed correlation of EMARI data with video footage to provide targeted feedback for each ETI.

Training programme (Airways, Biscuits, Caffeine sessions)

A structured teaching programme, ‘Airways, Biscuits, Caffeine’ (ABC), was introduced, incorporating ETI video review, airway literature updates and practical microskill sessions. Sessions ran fortnightly, fostering a non-judgemental learning environment. Initial focus was placed on bougie/styler technique and familiarisation with the CMAC system. Ventilator training was part of the initial plan for training, but not prioritised at this time due to lack of familiarity of staff with the CMAC.

January 2025: PDSA 2

Between July 2024 and January 2025, fifty-one ETIs were performed (44 EM, 7 ICU), with 88.2% FPS and 11.8% complications. EMARI capture was 98%, but video capture was 53%. The checklist was further refined to include ‘Is the CMAC recording button pressed?’ to increase the number of video captures. A contributing factor here was that EMARI was not always completed by ICU staff, and the CMAC was not always used for an ICU-led intubation due to familiarity with the McGrath. In these scenarios, the EM registrar was encouraged to upload the ETI to EMARI to maintain data completeness.

Resuscitation room intubation standard operating procedure

A formal standard operating procedure (SOP) was introduced consolidating airway governance processes and standardising expectations for clinicians performing ETI.

Interventions

Airway drills

10-minute daily RSI drills were introduced, focusing on core scenarios (cardiac arrest, neuroprotective intubation, contaminated airway). These promoted team coordination, checklist familiarity and early troubleshooting. Debriefs at morning handover reinforced shared learning and maintained consistency across shifts, particularly for nocturnal ETIs when staff and resources are not as available as during daytime hours.

Airway sign-off process and senior airway doctor role

A formal sign-off process ensured only trained clinicians performed independent ETIs. Supervised simulation confirmed competence, overseen by the airway lead. A senior airway doctor role (experienced EM consultant or registrar) was designated per shift to supervise intubations and ensure real-time governance. Where unavailable, the ICU registrar assumed this supervisory role.

Maintaining airway currency

A live online register tracked both simulated and real intubation activity for signed-off clinicians. Those falling behind

Table 1 Complications, May 2024–October 2025

Complications	n (%)
Hypotension	15 (9.6)
Hypoxia	9 (5.8)
Oesophageal intubation	2 (1.3)

in practice received reminders or targeted remediation to maintain skills currency and patient safety, including EM consultants.

Airway morbidity and mortality meetings

Quarterly airway morbidity and mortality (M&M) meetings, paired with ABC sessions, provided a forum for reviewing EMARI data and CMAC videos. Each session incorporated key learning points and technical updates relevant to recent cases.

July 2025: PDSA 3

From January to June 2025, fifty-four ETIs were performed (45 EM, 9 ICU) with 90.7% FPS and 13.0% complications. EMARI capture remained 100%, video 56%. Registrar change-over required retraining and reimplementation of sign-off and senior doctor processes, as fewer new trainees had prior airway experience. ICU collaboration ensured consistent coverage and escalation when less experienced staff were on duty.

Interventions

Introduction of new bougie and stylet

Review of CMAC footage identified posterior bougie insertion as a recurring factor in failed first-pass attempts. To address this, the Frova bougie (Cook Medical, UK) was introduced for its superior rigidity and shape retention, alongside a new stylet for improved control when using hyper-angulated blades. Early feedback indicated improved ease of intubation and better glottic targeting.

October 2025: PDSA 4

Between July and October 2025, thirty-eight ETIs (33 EM, 5 ICU) were recorded, achieving 96.2% FPS and 7.7% complications. EMARI capture was 100%, and video recording increased to 72%. Despite a less experienced registrar cohort, outcomes exceeded programme targets, with a cumulative 2025 FPS of 94.7% for EM intubations. The sustained performance reflected strong consultant engagement, consistent governance through EMARI and video review, and ongoing adaptation through each PDSA cycle.

Summary of iterative impact

Over four PDSA cycles, the structured introduction of airway governance measures led to maintenance within predefined safety targets. Key enablers included:

- ▶ **Leadership:** dedicated EM airway lead driving engagement and sustainability.
- ▶ **Standardisation:** introduction of checklist, airway drop and SOP embedding consistent practice.
- ▶ **Feedback:** combined EMARI data and CMAC recordings enabling real-time review.
- ▶ **Training:** regular ABC sessions, daily drills and competency-based sign-off maintaining staff proficiency.
- ▶ **Governance:** continuous data collection, debriefing and formal M&M review reinforcing safety culture.

By October 2025, the ED maintained FPS above predefined targets and <10% complication rates, with near-complete EMARI and video data capture, representing a mature, learning airway governance system.

DISCUSSION

Our iterative QI programme was designed to deliver clinical excellence through a structured governance framework

incorporating prospective data capture, regular multidisciplinary review and targeted training. Over the first year of data collection, EPs were the primary intubator in the majority of cases. FPS exceeded 90% across the study period, and the overall complication rate remained below 15%. These findings demonstrate that, within a governance-led airway programme, EPs can achieve high procedural success and maintain low complication rates, comparable with established international benchmarks.¹⁻³ Collectively, our results support the effectiveness of structured airway governance and training in sustaining safe, high-quality emergency airway management.

While the FPS and complication rates are more than satisfactory for each cycle, interpretation requires careful consideration given the natural variation around the mean throughout the study period. However, following PDSA 2 in January 2025, which represented a shift from primarily equipment interventions to human factors and governance-focused strategies, including daily RSI drills, a formal competency sign-off process and designated senior airway supervision, FPS remained above target for the majority of the subsequent months. This pattern suggests maturation of airway practices over time rather than a transient postintervention effect. In this context, PDSA 2 could be viewed as a key intervention point when standardisation efforts became routine practice.

Although the overall complication rate averaged 12.7%, a modest increase was observed after the introduction of structured, real-time data collection and video review. FPS remained consistently above 90% on average during this period, suggesting that airway performance was maintained. The initial observed rise in complications likely reflects improved reporting accuracy rather than a true increase in adverse events. Prior to this initiative, minor events such as transient desaturation or hypotension were less consistently documented. Enhanced detection and recording therefore represent a positive indicator of governance maturity and transparency, rather than deterioration in clinical performance.

Sustained improvement over several months is an important indicator of effective system and cultural change. The persistence of high compliance with airway reporting and performance metrics suggests that the implementation of a real-time reporting system, supported by consultant governance and team engagement, resulted in lasting behavioural change rather than a temporary improvement following project launch. This is evident when examining the FPS and complication rate beyond July, with sustained improvements evident. Comparable sustained effects have been documented internationally where airway governance frameworks combine data and training.

Early engagement of multidisciplinary stakeholders was critical to the success and sustainability of the airway governance programme. Involving nursing, medical and critical care colleagues from the outset ensured shared ownership, practical design and smoother adoption of new processes. Specifically, our nursing clinical facilitators were key stakeholders in the coordinated training of our daily RSI drills, ensuring a focus on nursing airway training, matching the focus on physician training. Airway teams have been able to improve outcomes for patients in emergency airway situations, and during this QIP, it was obvious that a departmental focus on training, rather than just the intubating physicians, was one of the main drivers for success as the project developed.^{17 18}

Registrar engagement was equally important. Historically, the opportunity for intubation was inconsistent, leading to variable experience among trainees, a challenge with many EM procedures including intubation. The introduction of a defined sign-off

process, structured feedback and daily drills helped maintain skills for both frequent and infrequent intubators. Creating a culture of constant feedback and training with an emphasis on the maintenance of airway currencies led to a culture where even EM consultants were intubating when EM registrars were present, should they need the opportunity to maintain skills. EM consultants were held to the same training standard, which is important for the registrars to see and value, as the message was that they could only continue as trainers if they maintained our own clinical practice as well. Balancing training exposure with patient safety governance remains a challenging educational issue recognised internationally.

Although formal RSI drills were limited to daytime shifts, the same structured airway approach was maintained overnight through checklist use, clear role designation and consultant or ICU registrar supervision. This ensured that airway safety standards and communication practices were upheld during night-time intubations and that learning from nocturnal cases fed back into subsequent drills or simulations, reinforcing a continuous safety culture across all shifts.

CONCLUSION

A structured airway governance programme combining leadership, checklist standardisation, simulation and continuous feedback was associated with maintenance of FPS > 90% and low complication rates over time. Both the FPS and the complication rate over 1 year are within international recommendations, highlighting that this is safe, consistent and implementable. This pragmatic, replicable framework supports the establishment of national EM airway governance standards to maintain procedural competency and patient safety and is replicable in international EDs with similar pre-existing airway management practices.

Contributors JL: airway lead, airway programme conceptualisation, manuscript writing, overall guarantor for the project. LON, EM: nursing education and training, manuscript review. PM: lead intensive care physician, manuscript review. MD: CMAC introduction and maintenance. JF: airway programme conceptualisation, manuscript writing.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This project was conducted as a quality improvement initiative within the Emergency Department at University Hospital Galway. Formal ethical approval was not required according to local institutional policy, and there is no formal or centralised facility for prospective registration of QI projects. It was prospectively planned and approved through the emergency department and intensive care clinical governance as well as audit structures prior to commencement

in line with local quality improvement oversight processes. The study involved a retrospective review of prospectively collected audit and training data. All data were anonymised prior to analysis.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available.

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