

Navigating Through Human Factor Elements in Airway Management: A Qualitative Study of Current Trends in Intubation Practices

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ABSTRACT

Background: Difficult airway management requires appropriate assessment, planning, technical skills, teamwork, and effective use of cognitive aids. Human factors may influence decision-making during challenging airway situations. This study explored the experiences of airway practitioners and identified facilitators and barriers in routine airway instrumentation using the SEIPS framework.

Methods: A qualitative study using thematic analysis based on Braun and Clarke's approach was conducted at a tertiary care center in Kottayam, Kerala. Fifteen anaesthesiologists or emergency physicians with at least five years of airway-management experience were purposively selected. Data were collected through in-depth face-to-face interviews conducted between October 2024 and October 2025. Interviews were transcribed and analyzed using an inductive approach, with themes and subthemes developed and reviewed by the investigators.

Results: Three initial codes, five major themes, and 15 subthemes emerged from the interviews. The major themes were clinical and problem-solving skills, training and teamwork, overcoming challenges, the role of tools in clinical decision-making, and sources of error in clinical decisions. Participants emphasized appropriate airway assessment, timely decision-making, teamwork, supervision, access to advanced airway devices, updated knowledge, and effective communication. Uncertainty from previous experiences, overconfidence, cognitive overload, poor communication, and system-related constraints were identified as barriers.

Conclusion: Standardization, updated knowledge, teamwork, leadership, effective communication, and appropriate cognitive aids may help address challenges in airway management and bridge gaps between policy and clinical practice.

Keywords: Anaesthesia, Human factor, Endotracheal intubation, Safe practice, Clinical decision making

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INTRODUCTION

Real - life medical practice always emphasizes outcome-driven, physician-centred work system conforming to the global standards. [1] Difficult airway management refers to strategies [1] maintaining ventilation in situations where conventional methods fail, such as difficulties with facemask ventilation or tracheal intubation. [2] This needs airway assessment, planning and intubation by the team involved; [1,2] while safely overcoming the anatomical or physiological challenges perceived.

Successful airway management necessitates a research framework and supervisory guidelines for professional development in this field. Cognitive biases from cognitive Overload can impact clinical reasoning [3] in high-stress critical airway situations. This explains healthcare as a Complex Adaptive System with interconnected individual, team, and organizational dynamics. [4] There are only few studies on qualitative insights with real world examples on routine intubation practices in relation to SEIPS model framework. Narrating specific human factors involvement as per the SEIPS model framework qualitatively, including the current guidelines as cognitive aids are the aim of this study. Using Human factors and ergonomics (HFE) approach in SEIPS model (the Systems Engineering Initiative for Patient Safety) framework [5] in health care, one can analyze interaction of each domain in airway management, such as person, task in the work system, tools, organization and environment. This often identifies barriers and facilitators through a feedback loop, and this can redesign the work system for more efficiency.

The aim of this study was to evaluate experiences of airway practitioners in intubating the patients and thus investigating the facilitators and barriers during their routine practices of airway instrumentation.

MATERIALS AND METHODS

Study design: In this qualitative study, thematic analysis was performed as described by Braun and Clarke. [6-8]

Theoretical framework: The Systems Engineering Initiative for Patient Safety (SEIPS) model provides a theoretical framework for examining the interactions of work system elements through the Human Factor and Ergonomics Approach. This can lead to people involved as the center, their capabilities and limitations deciding the outcome [5,9] thus attaining a rigorous study design.

Sample and settings: Purposive sampling method was followed. Participants were enlisted from the Government Medical College, Kottayam, Kerala, India. The inclusion criteria were (a) Anaesthesiologists or emergency physicians working in a tertiary care center, having at least five years of experience (b) Specialisation in Anesthesiology or in Emergency Medicine. (c) Willing to participate after explaining the objectives of the research. Exclusion criteria were (a) not willing to participate in the study (b) having less than five years of experience

in airway management.

Thirty individuals in the airway management team, who met the inclusion criteria, were screened for eligibility; wherein 15 were selected, based on age, specialization and years of experience in airway management.

Data collection: Data for the study were collected through in- depth face to face interview techniques using an interview guide. From October 2024 to October 2025, all interviews were conducted by the principal investigator, who had training in qualitative research in health care. Prior to the interviews, the researchers tried to build rapport with the participants, to ensure trustworthy data. Before collecting the data, the principal investigator conducted two short pilot interviews to test the interview questions. Accordingly, some of the open-ended questions were changed to help the researcher to be more analytical (Table 1).

The interview questions focused on six factors, including acceptable intubation practices, technical skills and teamwork for improving performance, ease of using tools like algorithms for clinical convenience, access to advanced airway gadgets and new information for reducing risk and stress involved along with perceived reasons for biased clinical decisions. This was also a cause of self-awareness among the research team. During each interview, a short interview schedule (Table 1) was completed with field notes. Each interview was 20-25 minutes duration. Twelve interviews were conducted till data saturation occurred. Then three additional interviews were performed to detect any variations. [10] To get persistent support from the participants, they were frequently informed of the progress of the study. The staff cooperated and supported. Identification numbers were assigned for each participant.

Furthermore, a short survey on the demographic and general characteristics of the participants based on age, sex, years of experience, specialization was done. The authors discussed the dataset among them, as they were medical education teachers with airway expertise. Below are the sample interview questions.

Table 1: Interview schedule

Central question

1. What is the intubation practices you follow intraoperatively and in the critical care room?

Sub questions

2. Can you discuss how you can improve on this?
3. How do you face a failed intubation, when it is unanticipated? Can you explain with an example, if you have faced one? How can you avoid it?
4. How can you improve the first attempt success rate at intubation?
5. How can you improve upon the various issues in airway management, such as the stress response?
6. Do you think anything more is important in this context?

Ethical considerations: The current study was approved by the Institutional Review Board (IRB No: 15/2024, Dat-

ed 27-02-2024). Clearly written information on objectives of the research was provided and consent obtained from participants. They were explained about withdrawing at any time without any consequences and were given a guarantee of confidentiality.

Analysis of texts: Demographic characteristics were detailed using frequencies and percentages. Responses, suggestions and interpretations got using the interview questions were read thoroughly and made into interview transcripts. Then codes were developed on paper. This was done by the first author and key insights checked by the other author. Thematic analysis was conducted on interview transcripts using Braun and Clarke's six-step approach [6-8,11] and the Consolidated Criteria for Reporting Qualitative Studies (COREQ) was applied as a quality assessment tool [12-14].

In the next phase, some major themes and subthemes emerged spontaneously from the data segments. In the fourth phase, themes were checked for their application close to the meaning of the text. Then accordingly, revised and rephrased. The final phase involved writing the text in accordance with the study's aim, literature review, and highlighted quotes.

Rigor: To ensure the rigor of the qualitative study, semi-structured questionnaire was used. The detailed context for enhancing "transferability" in all 15 interviews was assured. [10] Peer feedback helped in gaining insight into the findings, thus ensuring reflexivity and "credibility". [14,15] Next criteria of "dependability" was achieved by systematically analyzing the data and developing major themes and subthemes close to the meaning of the text. The quotes in the interview texts were included to exemplify the themes for conformability.

RESULTS

As described in Table 2, fifteen doctors took part. Their average age was 47 years. Eighty percent of the respondents in the present study were aged less than 55 years and had experience of more than 10 years. Nearly 80 % of respondents were females. All of them were anesthesia consultants and one of them had training in Emergency Medicine. All were working as faculties in the tertiary care center in an urban area. The response rate was 100%.

Table 2: Baseline characteristics of participants

Demographic data	Participants (%)
Gender	
Female	12 (80)
Male	3 (20)
Age	
35-44 years	6 (40)
44-54 years	6 (40)
55- 64 years	3 (20)
Experience as airway experts	
>10 years	12 (80)
>20 years	3 (20)

Themes and sub-themes

During the interview, study participants discussed their experiences of current intubation practices, the role of various educational tools they use for clinical convenience and methods of improving a dynamic strategy in communication among the airway management team.

Some positive comments such as "role- play", " excellent topic" " for omission of errors" indicated that they were comfortable and thoughtful of risk reduction. Studying the dataset resulted in emergence of three codes, 5 major themes and 15 subthemes through an inductive approach.

Theme 1. Importance of clinical and problem - solving skills of the practitioner

Participants' views and overall experiences are detailed in the coming sections.

Subtheme 1.1 Preferences. During the intubation procedure, some advanced airway devices like the video laryngoscope and fiber optic bronchoscope, intubation aids like stylets and Bougies are preferred, especially in difficult airway encounters. For example, a participant with more than 20 years of experience stated that;

'Video laryngoscopes (VLS) provide enhanced visualization and reduce airway injury during challenging intubations. They require less neck manipulation and can serve as a rescue tool; however, direct laryngoscopes may still be beneficial in cases where Video Laryngoscope is ineffective.' (Participant 2)

According to them, which device is to be used is often context sensitive, rather than one's own perspective, as expressed in, " as rescue device", " to improve first pass success rate".

Subtheme 1.2 Approaches. Most of the participants positively described their feelings on approaches to airway management at each step of preoperative, intraoperative, postoperative period as " omission of errors", " timely decisions", " optimal". A positive reflection was noted as;

"Meeting the patient in preanesthetic clinic is important. Ability to protrude the tongue is crucial to check, as it affects laryngoscopy and visualization of the glottis..."

Including Cormack-Lehane grade in anesthesia notes after direct laryngoscopy would be beneficial." (Participant 12)

Similarly, another contextual issue was stated is that;

"In case, we are facing a failed intubation or a can't intubate can't oxygenate situation, this can be optimized by a planned approach. Emergency surgical airway procedures, particularly in pediatric patients, are performed only by well-trained individuals under supervision after enough practice. It is better to work as a team." (Participant 12)

Subtheme 1.3. Overall experiences of intubating personnel based on level of expertise.

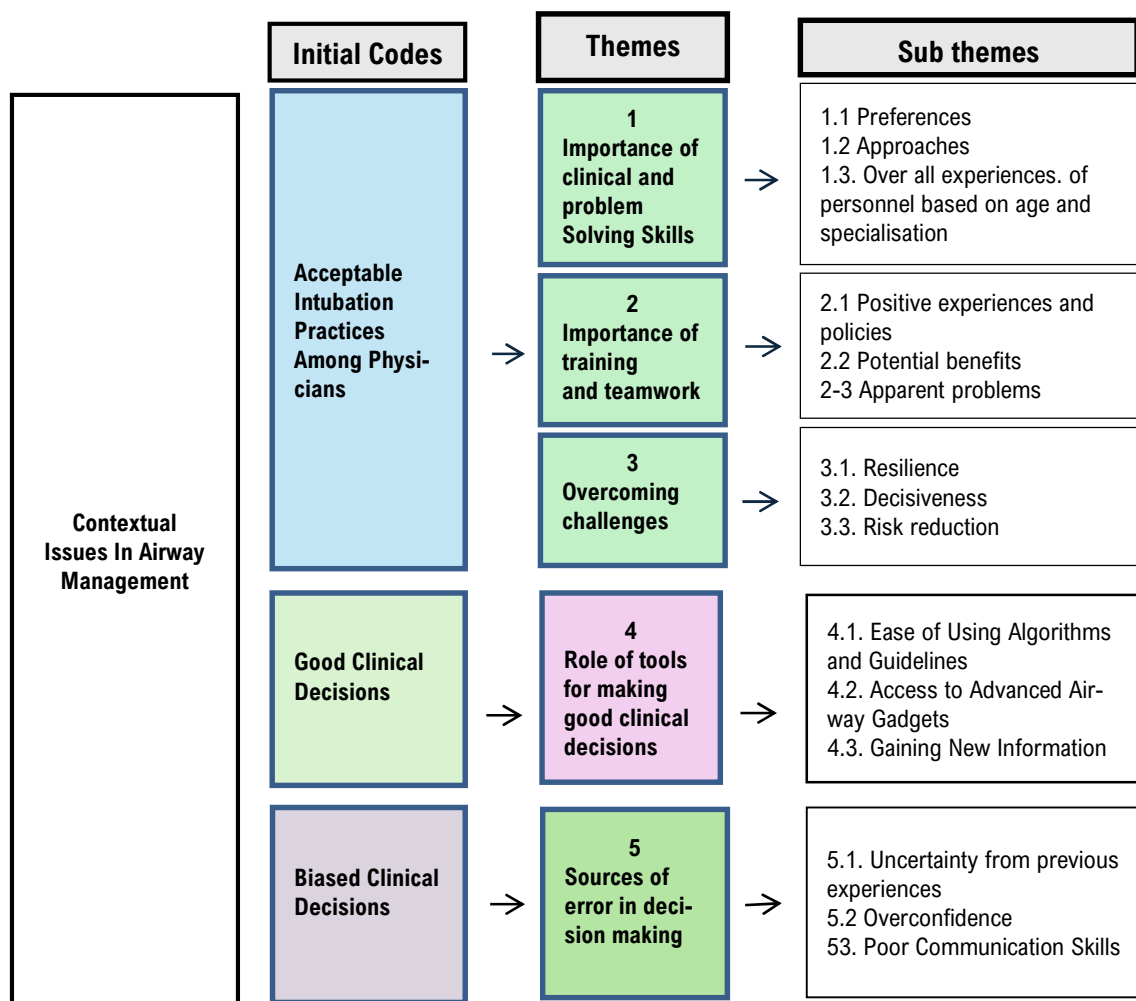


Figure 1: Code-theme subtheme pathway

Younger doctors expressed their fear and anxiety in many ways.

One young doctor stated that " ...when a paediatric patient went to severe laryngospasm after putting a laryngeal mask airway and was unable to intubate, I was anxious...". (Participant 6).

In contrast, an elderly doctor advised.

"Direct laryngoscopy is often the most useful airway device. Doing what is most effective and safe for the patient is important. Fiber-optic bronchoscopy should be avoided in an unanticipated difficult airway scenario as multiple attempts at direct laryngoscopy might have already done and it affects the vision."

Additionally, specialization in emergency medicine and critical care is often helpful in managing difficult airway as expressed in;

" In an emergency, video laryngoscope is often used as a rescue device. It is superior to others in avoiding a failed intubation".

Theme Two. Importance of training and teamwork.

Participants' descriptions of their teamwork are detailed below.

Subtheme 2.1. Potential benefits.

A positive reflection noted was that;

" I-gel is preferred for ease of insertion ... getting help from senior hands gives better results. Feeling of planning and working together is welcome."

Subtheme 2.2. Apparent problems. Analyzing the challenges faced by them showed that;

"...long hours of work make us frustrated ...delineation of our roles in varying scenarios can reinforce our performance. Sharing stress with other team members is often useful." (Participant 4)

One young doctor stated that,

'...Giving us roles and explaining the risk factors would make us do things properly... What are the alternate plans also is discussed.' (Participant 11).

Some sentences like "Shall we start now " can help to ease the stress.

Subtheme 2.3. Positive experiences and policies.

According to the participants, decision making in airway management needs proper planning, based on the experiences and tools.

This was stated as "Priorities should be set with clarity and worked up to, rather than struggling and losing confidence... Always call for help at times of difficulty, as this is optimal." (Participant 7).

They all suggested that the presence of more than one airway expert can help in better outcome in a difficult airway case. Participants expressed that self-reflection on daily actions can make them work more comfortably in a similar situation in future. Decision on surgical airway is final, and training is often needed in this procedure. Critical care training can be helpful.

'Surgical airway is the final step to deliver oxygen in the difficult airway algorithm. Knowledge in this gives confidence to anaesthesiologists in facing difficult airway situations.' (Participant 3)

Theme 3: Overcoming challenges.

Participants believe that challenges like an unanticipated difficult airway can result in a failed intubation. Involvement of human factors like expertise and experience were explained by the participants as a 'clinician-centered approach'.

Subtheme 3.1. Decisiveness. Participants' view clearly showed that the work done should be more solution-oriented. For example, this was stated as;

'Effective decisions should be taken on time...Thinking, I literally can't do it; is not good. In times of trouble, what I could do instead is a matter of thought.' (Participant 13).

They opined that urgency of the situation should always be considered.

Subtheme 3.2. Resilient. Participants explained their own work as a role-play to prevent mishaps like failed intubation.

'After a first attempt failure, which device to choose next is sometimes not clear. But still, I think, we must act without much mental pressure, or else, there is a high risk of patients going into other preventable complications.' (Participant 8)

Subtheme 3.3. Risk reduction

In the participants words, "complete evaluation of the airway", "timely interventions" and "avoiding procedural delay" can minimize the risk and improve patient safety.

'I feel that we should not keep a negative attitude. Team leader can help us in our active participation and to reflect upon our performance...Patient might desaturate if we keep on thinking on next plan or make multiple attempts at intubation. This is to be avoided.' (Participant 4).

"Technique of apneic oxygenation always ensures adequate gas exchange especially in critically ill patients and in children."

Theme 4. Role of tools for making good clinical decisions

All the participants expressed that strict adherence to airway management principles is often helpful for patient safety.

Subtheme 4.1. Ease of using algorithms and guidelines

According to the participants, only the problem specific algorithms or patient-specific guidelines are helpful and they enlisted a few algorithms and guidelines. They supported the fact that noncompliance in using them can happen due to multiple algorithms, unwillingness or lack of knowledge.

They described it in their own words such as "communication aid", "educational tool", "for clinical convenience", "as a basic law". They stated it as,

"Clinical guidelines in airway management helps us develop plans and backup plans, right from the preoperative evaluation itself... Difficult airway Society Guidelines are frequently followed...All India Difficult Airway (AIDAA) guidelines are also good...Difficult airway registry is needed in India.... For teamwork, the standard operation procedures and evidence-based guidelines can help." (Participant 1).

Subtheme 4.2. Access to advanced airway gadgets

According to the participants, techniques with high success rate like fiber optic intubation can be adopted. Majority of them were satisfied with the hospital services, as they could access these rescue devices and improve first pass success rate. This can be stated as;

"I often use video laryngoscopes as a rescue device. It is easier to learn and easily available. Fiberoptic bronchoscope is used only occasionally, when that much indicated...."

Sub-theme 4.3. Gaining new information

To prevent occurrence of airway mishaps, latest work-related information should be known to physicians involved. This was detailed as;

"Latest advances should be known. For this, attending difficult airway conferences frequently can be useful...I am gaining new information from everyday work... learning through discussions are always needed. Self-reflection on our daily actions is a much-needed practice to be attained." (participant 9).

Theme 5. Sources of error in clinical decisions.

Participants' experiences on importance of quick decision making in uncertain airway situations were discussed in detail. They described it as "very much needed, but often confusing".

Subtheme 5.1. Uncertainty from previous experiences

Participants spoke regarding the uncertainty they feel at times regarding which airway device to use or what to do next.

Subtheme 5.2. Overconfidence. Some of the participants were giving some advice.

"Exploring new and advanced airway interventions can prevent us from being overconfident...Always think twice and reassess the patient." (Participant 9).

Subtheme 5.3. Poor communication skills

Communication skills are a very good clinical tool, and this was discussed as;

"Questions about any airway concerns and type of airway device to be used for intubation are often discussed. Algorithms and guidelines are useful communication tools. This adds to effective communication."

DISCUSSION

In this qualitative study, viewpoints and approaches of airway experts, based on their routine intubation practices were analyzed. Facilitators and barriers to implementation of sound clinical practice were identified.

Importance of clinical and problem - solving skills of the practitioner: According to the participants, airway expertise and teamworking skills are essential for successful airway management. New airway devices are video laryngoscope, fiber-optic scopes, i-gel, intubation aids like bougies. Of these, only video laryngoscopes are mentioned in the recent guidelines [16,17]. Video laryngoscopy allows a shared glottic view and a better learning curve [18]. Similar opinion was given by senior anesthesiologists in this study regarding the limited use of fiber optic bronchoscope as a rescue device. Additionally, apneic oxygenation in the peri- intubation period improves patient outcomes in the emergency settings, which aligns with the findings in this study. [19,20]

It was suggested that for best clinical practice, a focused and documented airway examination is needed, keeping the Cormack Lehane grade as the gold standard. Previous studies have reported that this planned approach could be useful in managing a failed intubation or a CICO situation optimally [2,20]. These lessons show a multilevel approach covering the preoperative, intraoperative and postoperative period.

The combined results shows the importance of health

care being considered as a 'Complex Adaptive System' with interconnected work design that goes well with SEIPS (Systems Engineering Initiative for Patient Safety) model.[21] This includes the 'micro system' level, where the cognitive capabilities and technical skills of individuals come to play in a patient safety culture and the 'me-so system' level, [21] where the anaesthesia care team works collectively or interdisciplinary teamwork happens, such as in a surgical airway procedure. [21,22]

Importance of training and teamwork: Access to supervising personnel along with self-reflection on their daily practices were among the acceptable intubation strategies in this study. Learning from one's own experiences helps to know acceptable intubation practices, as emphasized in a recent study by Edelman DA et al. [23]

Systems engineering principles work as the basic framework [9] highlighting the critical requirement of team briefing, debriefing and peer feedback, which should be the priority of team leaders, as discussed in this study. Well – focused discussions on any questions regarding the airway management of the patient is team briefing [24] and practical ideas should be given to juniors even informally in the daily practice. [25] Some studies show that motivating each other and knowledge sharing among the team members will foster communication and minimize errors [26]. This concept was well appreciated in this study.

Overcoming challenges: According to the participants, setting clear priorities before decision making, timely interventions, avoiding procedural delay and proper communication are essential to prevent mishaps. Difficult intubation, failed intubation, a 'cannot intubate, cannot oxygenate' (CICO) situation, absence of supervision and support, poor access to newer devices and information, strained relationships with colleagues and long hours of duties are discussed as among the top tiers of challenges. Practitioners should be able to accept responsibility for the outcome. This learning- Oriented culture was well acknowledged in the recent study by Gomez- Rios MA et al. [25] Risk factor evaluation, following strategies or plans and learning from the outcome keeps us going in the much-needed role play.[26]

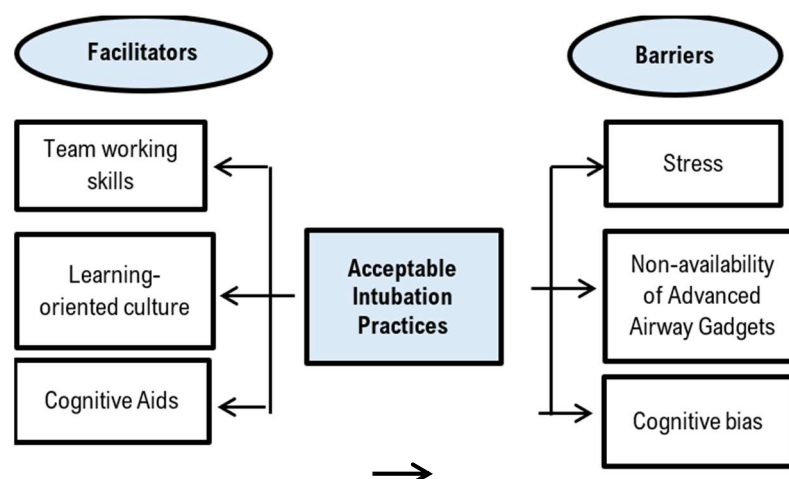


Figure 2: Facilitators and barriers in current best practices in airway management

Role of tools for making good clinical decisions: Participants supported the use of Difficult Airway Society (DAS) 2025 guidelines (n= 11) and the AIDAA guidelines (n= 4). These findings align with the process of compliance for ensuring standard practices and thereby enhancing uniformity in decision making minimising airway mishaps.[27] Structured frameworks like Difficult Airway Society (DAS) 2025 guidelines, [16] AIDAA guidelines are also helpful practically [28], optimizing the workflow for the whole team. Access to advanced airway gadgets like fiberoptic bronchoscopy for awake intubation is also important.[29] Acquiring knowledge through discussions, webinars and conferences were emphasized in this study and expressed that proper documentation is critical for transparency.

Standardization in clinical practice brings uniformity in decisions. Evidence based algorithms and guidelines can be considered as a communication tool, educational tool or as a tool used for clinical convenience, as cognitive aids minimizing adverse events, especially in anticipated difficult airway cases. Cognitive tools can help in making teamwork more coordinated. [27,30]

Sources of error in decision making: Outdated knowledge, poor communication skills, cognitive overload and system constraints are found as the barriers to effective airway management. Distortions in judgement is cognitive bias. [3,30] Uncertainty from previous experiences and Overconfidence bias can affect decision making, especially in unanticipated difficult airway. Poor peer relationships, planning and time pressure can cause stress.

LIMITATIONS

One limitation of the study is the lack of participant responses regarding the adoption of innovative techniques like simulation, genomics, artificial intelligence, and robotics, primarily due to limited access to these approaches. Additionally, the study may not reflect the diverse opinions, goals, and needs of individuals who were not included in the participant pool.

CONCLUSION

Detailed analysis of issues in intubation practices in terms of SEIPS model framework in health care, was done through this study. Standardizations, updated knowledge, teamworking skills, leadership and effective communication can overcome the inherent challenges in it, bridging the gap between policy and practice.

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Availability of data: The data that support the findings of this study are available from the corresponding author on reasonable request.

Declaration of Non-use of generative AI Tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

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