

Research Article

Perspectives of intensive care professionals on extubation practices, causes of delays, and proposed solutions: A cross-sectional study

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Abstract

Background

Timely extubation is essential to ensure patient safety and efficient intensive care unit (ICU) management. Delays in extubation can lead to adverse outcomes and extended hospital stays. Although several factors affect timely extubation, those contributing to delays, especially in Saudi Arabian ICUs, have not been well described. This study aimed to identify factors contributing to delayed extubation in Saudi Arabian ICUs from the perspective of ICU healthcare professionals (HCPs), including physicians, nurses, and respiratory therapists (RTs).

Methods

A cross-sectional survey was conducted in Saudi Arabia among physicians, respiratory therapists (RTs), and nurses with at least three months of ICU experience. The questionnaire assessed perceived extubation timing, comfort with extubation order placement, perceived barriers to delayed extubation, and suggested solutions. Likert-scale items were interpreted as perceived barrier scores, with higher scores indicating stronger perceived barriers to delay. Open-ended responses were analyzed using Braun and Clarke's thematic analysis framework.

Results

In total, 292 ICU professionals participated in the study (22% physicians, 31% nurses, and 45% RTs). Although most respondents (78%) reported that extubation usually occurred within 3 hours of a successful spontaneous breathing trial (SBT), their perceptions of the appropriateness of this timing differed. The most frequently reported barriers to timely extubation were staffing limitations (18%), communication and teamwork issues (16%), and procedural inefficiencies (14%). Physician comfort levels with placing extubation orders varied significantly by seniority ($p < .001$). Suggested solutions included standardized protocols (20%), adequate staffing (18%), and routine assessments (16%).

Conclusions

ICU healthcare professionals perceived delayed extubation as mainly associated with modifiable organizational and workflow-related barriers. Addressing these barriers through interprofessional collaboration, protocol standardization, and targeted training

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may optimize the extubation process and ultimately may inform future quality improvement initiatives in Saudi ICUs.

INTRODUCTION

Intubation is a life-saving procedure that secures the airway using a flexible tube inserted into the trachea, allowing ventilation and delivery of oxygen and medications.¹ This procedure is essential for patients with respiratory failure or compromised airways who require invasive mechanical ventilation (MV) in the ICU.² Despite its life-saving benefits, MV should be discontinued as soon as possible. Extended MV use is associated with significant risks, including ventilator-associated pneumonia, reduced functional capacity, and greater healthcare use and costs.³⁻⁵

After resolution of the underlying indication for MV, the goal shifts to liberation of the patient from ventilatory support.⁶ Management of successful liberation and extubation is performed using a multidisciplinary team (MDT) approach that includes physicians, nurses, and respiratory therapists (RTs) to optimize patient outcomes.^{7,8} In addition, patient readiness for extubation is routinely assessed by reducing ventilator support and performing daily spontaneous breathing trials (SBTs).⁹

The timing of extubation is critical. Premature extubation can lead to respiratory failure and the need for reintubation,¹⁰ whereas delayed extubation can lead to complications such as respiratory muscle fatigue, ventilator-associated pneumonia, and longer ICU stays.⁵ Consequently, implementing evidence-based decision-making and effective communication among ICU team members is essential to balance these risks.¹¹

Delays in extubation may be associated with multiple factors, including organizational barriers, staffing constraints, communication breakdowns, and procedural inefficiencies.¹² However, these issues vary across health care systems and cultural contexts, highlighting the need for country-specific data to guide future quality improvement initiatives. By investigating these multi-professional perspectives, we aimed to contribute towards the development of evidence-based protocols to enhance clinical alignment and optimize extubation processes. Accordingly, in this study we investigated the factors contributing to extubation delays in Saudi ICUs from the perspective of healthcare professionals (HCPs). Specifically, we aimed to (1) understand ICU physicians', nurses', and RTs' perceptions of SBTs and extubation practices, and (2) identify perceived barriers and facilitators affecting timely extubation.

METHODS

STUDY DESIGN, SETTING, AND PARTICIPANTS

This cross-sectional survey was conducted between February 1 and May 31, 2023. Participants were recruited from ICU healthcare professionals working in hospitals in Madinah and Riyadh, Saudi Arabia. These cities include major healthcare institutions and tertiary referral centers, providing access to multidisciplinary ICU teams involved in

extubation and mechanical ventilation practices. Eligible participants were ICU healthcare professionals, including physicians, nurses, and respiratory therapists (RTs), with at least three months of ICU experience.

SAMPLING AND RECRUITMENT

Eligible intensive care professionals practicing in hospitals located in Madinah and Riyadh, Saudi Arabia, were invited to participate through convenience and snowball sampling methods.¹³ The survey was distributed electronically by trained research assistants via professional WhatsApp groups, X, and email networks targeting ICU healthcare professionals working in these two regions. Because recruitment relied on voluntary participation through professional networks rather than hospital-based sampling, the exact number and identity of participating hospitals could not be determined. The invitation message included a brief explanation of the study purpose, eligibility criteria, confidentiality statement, estimated completion time, and a link to the online questionnaire with informed consent hosted on Google Forms. Participants were also encouraged to share the survey link with eligible colleagues. Completed responses were entered into a secure Microsoft Excel database for analysis.

DATA MANAGEMENT AND ANALYSIS

STUDY TOOL

A self-administered validated survey questionnaire¹² was used to evaluate the HCPs' perceived barriers and facilitators of timely extubation in critically ill adults in the ICU (see **Supplementary material**). The first section of the questionnaire involved information about the study and informed consent, indicating that participation is voluntary and anonymous. No incentives were offered. The data collected would be used for scientific purposes, and the contact details of the principal investigator were provided.

The questionnaire consisted of 26 items organized into four sections: (1) demographic information included sex, age, profession at ICU, ICU type, and years of experience (professional and ICU); (2) knowledge and practice items assessing familiarity with SBTs and their criteria; (3) perceptions of current extubation practices; and (4) perceived barriers to timely extubation.

QUESTIONNAIRE SCORING AND INTERPRETATION

The questionnaire included categorical items, Likert-scale items, and open-ended questions. Perceived barriers to extubation delay were rated on a five-point Likert scale ranging from 1 (not at all) to 5 (very much), with higher scores indicating that respondents perceived the factor as contributing more strongly to delayed extubation. These scores were interpreted as perceived barrier scores rather than objective measures of extubation delay. Items assessing

physicians' comfort with placing extubation orders were analyzed descriptively because they represented a separate construct reflecting perceived confidence in clinical decision-making rather than perceived barriers to delayed extubation. Accordingly, these responses were summarized using their original response categories, whereas the barrier items were analyzed as Likert-scale ratings according to the study objectives. Open-ended responses were analyzed qualitatively using Braun and Clarke's thematic analysis framework.¹⁴ Initially, the primary investigator and a trained research assistant independently familiarized themselves with the responses through repeated reading of the data. Initial codes were generated inductively from participants' responses rather than using predefined categories. The two researchers then compared and discussed the codes, grouping conceptually similar codes into broader categories and candidate themes through consensus. The resulting themes were reviewed and refined to ensure that they accurately reflected the underlying data and were internally coherent while remaining distinct from one another. Any discrepancies in coding or theme allocation were resolved through discussion until consensus was achieved. The finalized themes were then used to summarize the perceived barriers to extubation delay and participants' proposed solutions.

STATISTICAL ANALYSIS

Data were analyzed using Microsoft Excel (Office 365, Microsoft Corporation, Redmond, Washington, USA) for data entry and management and IBM SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA), for statistical analysis. Categorical variables were summarized as absolute and relative frequencies. The Chi-square test was used to examine differences in physicians' comfort levels with placing extubation orders, while the Kruskal–Wallis test was used to compare responses among physicians, nurses, and RTs regarding the factors perceived to contribute to extubation delays. Statistical significance was set at $p < 0.05$.

RESULTS

In total, 332 survey responses were collected. Of these, 29 were not included because of missing or incomplete responses, and 11 were not included because respondents did not meet the eligibility criterion of at least three months of ICU experience. The final sample comprised 292 responses.

The participants included 65 physicians (22%), 134 RTs (46%), and 93 nurses (32%). Nearly two-thirds (66%) had ≤ 5 years of ICU experience ([Table 1](#)).

TIMING FROM SBT SUCCESS TO EXTUBATION

Most participants (78%) reported that extubation occurred within 3 hours of patients passing the SBT. However, opinions differed on this duration: 46% considered 3 hours appropriate, 19% considered it too long, and 13% considered it too short ([Figure 1](#)).

PHYSICIANS' PERCEIVED CONFIDENCE IN PLACING EXTUBATION ORDERS

Among the 63 physicians who provided valid responses, only 41% reported being $> 75\%$ comfortable placing extubation orders. Consultants demonstrated significantly greater confidence than junior physicians ($p < .001$; [Table 2](#)).

REQUIRED PRESENCE AT EXTUBATION

Most respondents believed that RTs should be present during extubation (96% of RTs, 88% of nurses, and 75% of physicians). In contrast, fewer participants perceived the presence of other ICU team members as necessary ([Figure 2](#)).

HCPs PERSPECTIVES REGARDING PERCEIVED BARRIERS CONTRIBUTING TO EXTUBATION DELAYS

Across all HCP groups, the most frequently selected perceived barriers to timely extubation were communication failures and high patient loads. Significant differences were observed among physicians with too many patients ($p = .007$), nurses with too many patients ($p = .002$), and bedside professionals lacking confidence in decision-making ($p = .047$; [Figure 3](#)).

REPORTED BARRIERS FOR DELAYED EXTUBATION AND SUGGESTED SOLUTIONS

Analysis of the two open-ended questions revealed key themes regarding the perceived barriers to extubation delays and proposed solutions. The most reported perceived barriers were staffing limitations (18%), communication and teamwork challenges (16%), and procedural inefficiencies (14%). The proposed solutions included standardized extubation protocols (20%), enhanced staffing and resource availability (18%), and routine assessment with prompt intervention (16%; see [Table 3](#)).

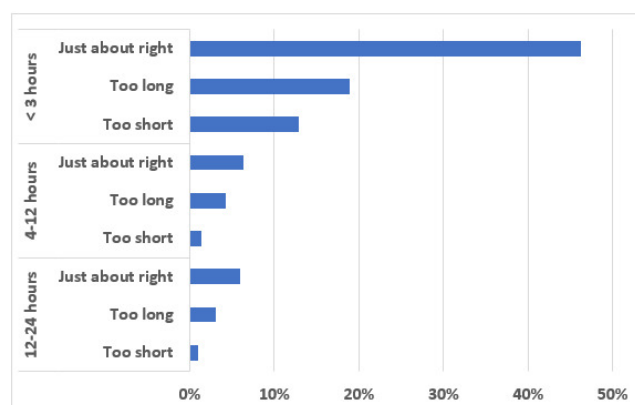
DISCUSSION

This study investigated the perceptions of multi-professional teams regarding key factors affecting extubation delays in Saudi Arabian ICUs. The most frequently reported perceived barriers were staffing limitations, communication, teamwork issues, and procedural inefficiencies. Perceived solutions included standardized protocols and the crucial impact of organizational factors, such as staffing and communication on clinical practice, and quality assurance through regular assessment. The study also revealed that junior physicians were less comfortable than consultants with placing extubation orders and that opinions on which HCPs should be present during extubation were variable, with RTs identified most consistently as necessary.

The observation that registrars were less confident than consultants in placing extubation orders likely reflects their level of experience and seniority. These findings are consistent with those of Baxter et al., who demonstrated that anesthetists with less experience reported lower confidence

Table 1. Healthcare professionals' characteristics and demographics

Table 1. Healthcare professionals' characteristics and demographics		
Category	Subcategory	Count (Percentage)
Sex	Men	146 (50%)
	Women	146 (50%)
Age category	20–29	156 (53%)
	30–39	101 (34%)
	40–49	25 (8%)
	50–59	7 (2%)
	≥ 60	3 (1%)
Profession in the ICU	Physician	65 (22%)
	Nurse	93 (31%)
	Respiratory Therapist	134 (46%)
ICU Type Distribution	Adult ICU	260 (89%)
	Cardiac ICU	64 (22%)
	Surgical ICU	63 (21%)
	Medical ICU	79 (27%)
	Burn Unit	27 (9%)
	Neurological ICU	42 (14%)
Overall Years of Experience	≤ 5 years	169 (58%)
	6–10 years	70 (24%)
	11–15 years	30 (10%)
	> 16 years	21 (7%)
ICU-Specific Experience	≤ 5 years	191 (66%)
	6–10 years	58 (20%)
	11–15 years	29 (10%)
	> 16 years	12 (4.14%)

**Figure 1. HCPs' perception of time elapsed between successful spontaneous breathing trial (SBT) and patient extubation**

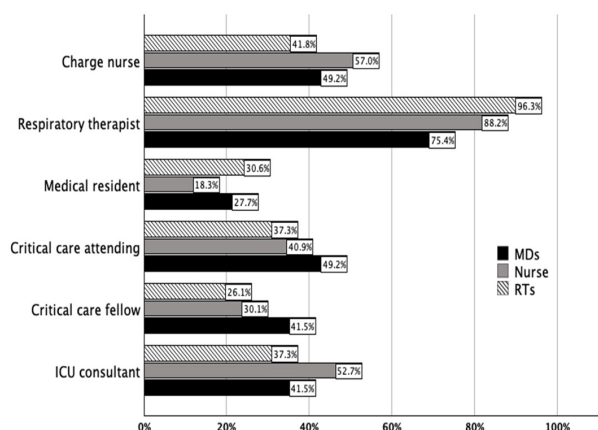
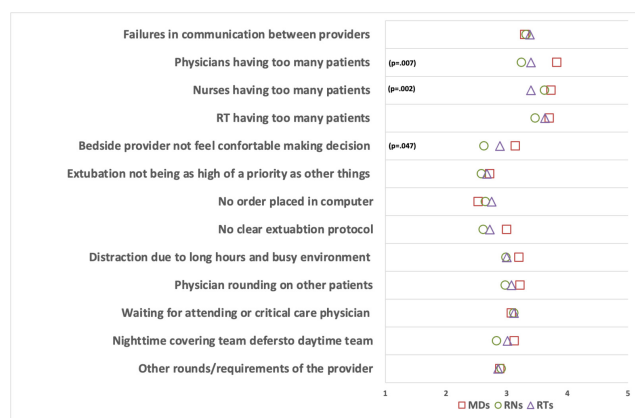
in performing advanced extubation techniques than consultants.¹⁵ Similarly, Balas et al. identified several common contributors to extubation delays, including deferral of decisions from the nighttime team to the daytime team, waiting for the attending or critical care physician, and bedside providers' lack of confidence in making extubation decisions.¹² Together, these findings suggest that bottlenecks

in the extubation process are often organizational and cultural rather than purely clinical. Consistent with previous reports, a substantial proportion of perceived delays in our study were attributed to procedural inefficiencies and waiting for physician attendance, supporting evidence that physician availability and attending preference are frequent causes of delayed extubation after patients have successfully completed an SBT.^{12,16} The majority of participants in our study reported that extubation usually occurred within three hours of a successful SBT, suggesting that delays in our setting may be influenced more by organizational workflow than by physiological assessment of extubation readiness. Esteban et al. demonstrated that reducing the duration of an SBT from 120 to 30 minutes did not adversely affect extubation success, indicating that unnecessarily prolonged respiratory assessment alone is unlikely to improve patient outcomes.⁹ Instead, once extubation readiness has been established, delays related to physician availability, decision-making processes, and institutional workflow may represent more important targets for quality improvement. These findings support the implementation of standardized extubation protocols, multidisciplinary collaboration, and educational initiatives to facilitate timely, evidence-based extubation. The participants' two highest-ranked proposed solutions, empowering all qualified physi-

Table 2. Physician-perceived confidence levels in placing orders for extubation

Physician seniority	Not applicable n (%)	0–25% n (%)	26–50% n (%)	51–75% n (%)	>75% n (%)	Total	p-value
ICU consultant	0 (0)	1 (4)	2 (9)	4 (19)	14 (66)	21	<0.001
Critical care specialist/attending fellow	1 (5)	2 (11)	3 (17)	4 (23)	7 (41)	17	
ICU registrar/resident	13 (52)	1 (4)	3 (12)	3 (12)	5 (20)	25	
Total	14 (22)	4 (6)	8 (12)	11 (17)	26 (41)	63	

Data are presented as absolute and relative frequencies. *p*-value was calculated using the Chi-square test.

**Figure 2. Perspectives of Healthcare professionals on who should be present during extubation****Figure 3. Perceived barriers contributing to extubation delays among HCPs; data presented as mean scores**

cians to make extubation decisions and establishing standardized extubation protocols, are consistent with this interpretation.

Qualitative analysis identified staffing limitations (18%) and communication and teamwork issues (16%) as the two most frequently reported perceived contributors to extubation delay. This finding is consistent with research that identifies institutional factors, such as nursing staffing ra-

tios and communication challenges, as critical obstacles to implementing effective weaning protocols.¹⁷ The high degree of alignment among physicians, nurses, and RTs regarding these barriers underscores that these are systemic issues within the ICU environment, not limited to the perspective of a single profession.¹² The suggested solutions for adequate staffing and effective communication directly address these reported systemic failures, reinforcing the need for administrative support to optimize the clinical environment.¹⁸

There is growing evidence that supports RT-driven protocols for weaning from MV. These protocols are structured, evidence-based algorithms that allow RTs to independently adjust, decrease, and discontinue MV based on objective clinical indicators, which may reduce the duration of MV, even in the face of staffing and communication challenges.^{18,19} However, this study did not evaluate RT-led extubation protocols or compare clinical outcomes across different models of care. Therefore, the findings should not be interpreted as evidence that RT-led protocols reduce extubation delays or improve outcomes. Instead, they suggest that future studies should evaluate whether clearly defined RT roles within multidisciplinary extubation protocols are associated with improved workflow, timeliness, and patient outcomes.

IMPLICATIONS FOR PRACTICE

This study highlights several targets for improvement in Saudi ICUs. Addressing staffing shortages and enhancing interdisciplinary communication may reduce unnecessary delays in extubation, thereby minimizing complications, such as ventilator-associated pneumonia, prolonged ICU stays, and higher healthcare costs. Furthermore, the identification of lower confidence among junior physicians underscores the importance of structured supervision, education, and protocol-driven decision-making during extubation. The consistent emphasis on the presence of RTs during extubation reflects their crucial role in ensuring patient safety and improving team efficiency.

STRENGTHS AND LIMITATIONS

This study had several key strengths that enhanced the validity and relevance of the findings. To our knowledge,

Table 3. Summary of perceived barriers and solutions associated with extubation delays

Themes	n	%
Perceived Barriers		
Staffing limitations	45	18%
Communication and teamwork issues	40	16%
Procedural inefficiencies	35	14%
Patient-specific challenges	30	12%
Lack of protocol adherence	25	10%
Physician and consultant availability	20	8%
Fear and lack of confidence	15	6%
Competing priorities	10	4%
Total	220	
Perceived Solutions for Delayed extubation		
Standardized extubation protocols	50	20%
Adequate staffing and resources	45	18%
Routine assessment and timely action	40	16%
Effective communication and teamwork	35	14%
Education and training	30	12%
Availability of skilled physicians	20	8%
Efficient time management	15	6%
Comprehensive patient preparation	15	6%
Total	250	

this study is the first to comprehensively investigate the perspectives of HCPs regarding the non-physiological factors affecting extubation delays within Saudi Arabian ICUs. A significant strength lies in the large, multi-professional sample (N=292), which provides a robust view by incorporating the perspectives of physicians, nurses, and RTs into the entire MDT involved in patient extubation. Furthermore, the study design, which explored both perceived barriers and suggested solutions, offers a uniquely actionable dataset for quality improvement initiatives.

However, this study also had several limitations. The findings may not be generalizable to intensive care units in other regions of Saudi Arabia or to healthcare systems in other countries because organizational structures, staffing models, and extubation practices may differ across settings. Because participants were recruited through professional networks rather than by hospital-based sampling, the exact number and identity of participating hospitals could not be determined. Consequently, clustering of responses by institution could not be assessed, and institutional-level differences in extubation practices may not be fully represented. In addition,

The use of convenience sampling restricts the generalizability of the findings and may have introduced selection bias because participation depended on existing professional networks and voluntary response. A crucial methodological consideration is that this study focused on the perceived factors contributing to delays. While we acknowledge that we do not have objective data on actual time-to-extubation metrics, the factors perceived as important

are fundamental to the success of any subsequent attempt to change behaviour or clinical practice. In addition, although participants were recruited from multiple hospitals, center-level participant counts were not available in the final dataset. Therefore, we could not describe the number of respondents from each center, which may affect generalizability. Furthermore, the current study was a cross-sectional survey, and no longitudinal follow-up was performed. Therefore, we could not determine whether the perceived barriers reported by HCPs were associated with objective extubation timing, reintubation, duration of mechanical ventilation, ICU length of stay, or other patient outcomes. Future prospective studies with longer follow-up periods are needed to examine whether perceived barriers correspond to objectively measured extubation delays and clinical outcomes.

CONCLUSIONS

This study complements the existing literature by identifying the key contributors to extubation delays in ICUs in Saudi Arabia. Delays were associated with factors such as MDT communication, staffing constraints, and physician comfort levels. The high level of consensus among MDT members highlights the potential for successful implementation of targeted interventions. Standardized multidisciplinary protocols and strategies that address systemic organizational barriers may enhance extubation practices and may improve patient outcomes. These findings provide a

basis for future quality improvement and educational initiatives.

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CONTRIBUTORS

All authors contributed to the conception or design of the work, the acquisition, analysis, or interpretation of the data. All authors were involved in drafting and commenting on the paper and have approved the final version.

ETHICAL CONSIDERATIONS

Ethical approval for this study was obtained from the Ethics Committee of the College of Medical Rehabilitation Sciences at Taibah University (Reference number: CMR-RT-2023-11).

CONSENT TO PARTICIPATE

Informed consent was obtained from all participants before completion of the questionnaire. All responses were anonymized to ensure confidentiality.

AI STATEMENT

The authors confirm that no generative AI or AI-assisted technology was used to generate the scientific content of this manuscript. AI-assisted tools were used only for language editing and improvement of clarity.

CONFLICTS OF INTEREST

All authors have completed the ICMJE uniform disclosure form and declare no conflict of interest.

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DATA AVAILABILITY STATEMENT

The dataset used and analyzed in the current study is available from the corresponding author upon request. The data have not been publicly deposited; however, full access can be granted to journals and reviewers.

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SUPPLEMENTARY MATERIALS

Survey tool

Download: <https://cjrt.ca/article/169500-perspectives-of-intensive-care-professionals-on-extubation-practices-causes-of-delays-and-proposed-solutions-a-cross-sectional-study/attachment/363778.pdf>
