

## Evaluation of Anesthesia Care Team Knowledge Regarding Weaning from Mechanical Ventilation in Intensive Care Unit

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**Abstract Introduction:** One of the most popular therapies for hospitalized patients in critical care units (ICUs) is mechanical ventilation through an endotracheal tube. Delaying weaning is linked to increased difficulty rates, more time in the hospital, and reduced ICU survival rates. **Methodology** This study aims to evaluate the anesthesia care team's knowledge regarding weaning from MV in the ICU. The cross-sectional study of this type was conducted at Imam Khomeini Hospital and Shariati Hospital in Tehran, Iran, from May 2023 until November 2023. During data collection, anesthetic care team members with various educational backgrounds were employed in the ICU at a public hospital. The final sample size was 101 Iranian anesthesia care teams in an Iranian hospital. Inclusion criteria include those who had an educational certificate and agreed to participate in this study during the study period. Anyone with a duration of 1 year or more in the ICU has an associate degree (nursing, anesthesia care team anesthesiology) and above. Exclusion criteria include a pilot study sample and all those not fulfilling the above inclusion criteria and not completing questionnaires. **Results:** The results showed that (77.2%) of the anesthesia care team was female, and (74.3%) were married. (50.5%) worked in the Imam khomainsi hospital; furthermore, the anesthesia care team age was (50.5%) of (31-40) years old, and the mean  $\pm$  SD was (2.14  $\pm$  0.69). (2%)the anesthesia care team possessed plenty of knowledge. (35.6%) The anesthesia care group possessed a middling degree of knowledge, and (62.4%) possessed little knowledge. The relationship between the total knowledge of the anesthesia care team regarding weaning criteria from mechanical ventilation and the educational degree is significant ( $P = 0.005$ ). **The Conclusion:** The knowledge and procedures of the anesthesia care team about weaning patients off of artificial ventilation were deemed inadequate based on the results of the current study. They need better knowledge about weaning criteria from MV in the ICU.

**Key Words** Anesthesia, knowledge, Weaning, Mechanical Ventilation, Intensive Care units (ICU)

### 1. Introduction

One of the most popular therapies for hospitalized patients in critical care units (ICUs) is mechanical ventilation through an endotracheal tube, often known as invasive mechanical ventilation. For patients with severe respiratory problems, mechanical ventilation is a machine that can supplement or completely replace spontaneous breathing for a life-saving medical operation. According to studies, nearly 40% of ICU patients need invasive mechanical breathing [1].

The intrusive mechanical ventilation must be stopped once the acute ailment that requires it has been treated. Often known as this process, weaning is a crucial aspect of intensive care [2], [3]. It has been established that delaying weaning is linked to increased difficulty rates, more time in the hospital, and reduced ICU survival rates [4]. Specialized weaning

facilities, including those in Germany, have been set up in other nations to increase weaning success [5], [6]. Cardiovascular arrest (11%), chronic pulmonary obstructive pulmonary disease (9.7%), Cardiomyopathy-induced lung edema (5.2 percent), post-operative problems (24 percent), neurological conditions (16.9 percent), pneumonia/acute lung injury (33.2%), among other conditions, are listed as the most frequent causes for starting MV [7]. Extubation, also known as weaning, releases a patient from mechanical ventilation and removes their endotracheal tube. The weaning process takes up a large amount of the whole period of mechanical breathing [8]. Identifying whether or not the patient's underlying disease is being efficiently taken care of, as well as hemodynamic stability, a patient's level of awareness, and the present values for ventilator settings, is frequently

included in the assessment of weaning readiness, which is a challenging clinical undertaking. The last step is frequently to carry out several voluntary breathing trials (SBTs) utilizing either minimal pressure-supported ventilation (PSV) or unsupported T-piece breathing for at least 30 minutes [9]. Therefore, early extubations may fail, necessitating re-intubation within 48–72 hours. According to studies, up to 25% of patients have extubation failure from reoccurring respiratory insufficiency and need to be re-intubated [10]. Once an attempt at spontaneous breathing has been made and the precipitating mechanism has been fixed, extubation occurs in seventy to eighty percent of those with respiratory distress who need MV. However, twenty percent to thirty percent of those who require intubation do not tolerate the first efforts to breathe on their own without the assistance of the ventilator [11]. This study evaluates the anesthesia care team's knowledge regarding weaning from MV in the ICU.

## 2. Method and Materials

This cross-sectional study was conducted at Imam Khomeini Hospital and Shariati Hospital in Tehran, Iran, from May 2023 until November 2023.

### *The Study Sample*

During the data collection, anesthetic care team members with various educational backgrounds employed in the ICU at a public hospital in Tehran City were chosen to participate in the study. The study sample they chose was from two hospitals, with 50 and 51 members for each. The final sample size was 101 Iranian anesthesia care teams in an Iranian hospital. Inclusion criteria include those who had an educational certificate and agreed to participate in this study during the study period. Anyone with a duration of working one year or more in the ICU has an associate degree (nursing, anesthesiology) and above. Exclusion criteria include a pilot study sample and all those not fulfilling the above inclusion criteria and needing to complete questionnaires.

### *Data Collection Methods*

The study's variables involved the demographic characteristics of the anesthesia care team's knowledge regarding weaning from MC in the ICU. Demographic information was obtained using a self-administered questionnaire of the ICU anesthesia care team and knowledge of the weaning from MV. The research was conducted in Tehran City intensive care units (ICU) in public hospitals (Al-Imam AL Khomaimi & Shariati Teaching Hospital). All these hospitals contain intensive care units and patients on mechanical ventilation with intubation, so we selected them.

### *Sampling Technique*

To choose the sample size, stratified random sampling was used with data from two significant public hospitals. After receiving official approvals from the previously chosen settings, the researcher used random sample techniques to gather lists of the anesthetic care team currently employed

in research settings. One hundred and one people made up the sample.

### *Procedures*

All members of the anesthetic care team got an Iranian version of the questionnaire, which was written in English and translated into Iranian by two specialists using back-translation and translation techniques. Suppose a few of the survey's questions needed to be clarified. Participants were free to ask questions or request clarification while completing surveys in the researcher's presence. The questionnaire was completed during working hours, and the researcher sealed the forms before removing them daily from each unit. The researcher verified the collected data daily to ensure it was all there.

### *Measures/ Instruments*

The questionnaire is designed as a means of collecting data after a review of the associated literature and prior studies. It was divided into two main sections.

The questionnaire:

A standard questionnaire was used to evaluate the knowledge of the ICU anesthesia care team.

#### Section One

The following are the demographic characteristics of the anesthetic care team: (gender, age, marital situation, education level, and work experience).

#### Section Two

Knowledge of the ICU anesthesia care team regarding weaning criteria from mechanical ventilation, which consists of twenty-five questions This section was made up of the following points:

- I knowledge of the anesthesia care team on hemodynamic and respiratory assessment. The range of the questions is (1 to 4).
- II The anesthesia care team has knowledge of the criteria for mechanical ventilation weaning readiness. The range of the questions is (5 to 9).
- III The anesthesia care team has knowledge of the modes of mechanical ventilation used for weaning interventions. The range of questions is (10-14).
- IV The anesthesia care team has knowledge of the guidelines and parameters for mechanical ventilation during the weaning intervention. The range of questions is (15-18).
- V The anesthesia care team has knowledge regarding the criteria of tolerance for mechanical ventilation weaning. The range of questions is (19-22).
- VI The anesthetic care team's understanding of extubation The range of questions is (23 to 25).

Variable	Category	Frequency (F)	Percentage (%)
Gender	Male	23	22.8
	Female	78	77.2
Age	20-30	18	17.8
	31-40	51	50.5
	>40	32	31.7
Marital Situation	Single	26	25.7
	Married	75	74.3
Education Degree	Diploma	26	25.7
	Bachelor	48	47.5
	Master	27	26.7
Type of ICU	General	50	49.2
	Pediatric	32	31.7
	Surgical	19	18.8
Experience Year in ICU	1-5	22	21.8
	6-10	27	26.7
Hospital	Imam-khomaini	51	50.5
	Sharieti	50	49.5

Table 1: Demographic Characteristic

### 3. Results

The results showed that 77.2% of the anesthesia care team were female, and 74.3% were married. 50.5% worked in the Imam khomaini hospital; furthermore, 47.5% of the anesthesia care team with a bachelor education degree also 49.2% worked in the general ICU; and 51.5% of the anesthesia care team had years of experience > 10 years. The anesthesia care team age was 50.5% of 31- 40 years old, and the mean ± SD was 2.14 ± 0.69 (Table 1).

There is no significant relation between the total final results of the knowledge of the anesthesia care team regarding WC and the training course and with anyone who obtains classes on how to wean from mechanical ventilation, and there is no significant relationship between the total knowledge and who earns a respiratory therapy degree. (P-value >0.05) (Table 2).

The result showed (2%)of the anesthesia care team possessed plenty of knowledge., (35.6%) The anesthesia care group possessed a middling degree of knowledge, and (62.4%) possessed little knowledge (Figure 1).

The relationship between the total results of anesthesia care team knowledge regarding weaning criteria from mechanical ventilation and demographic characteristics is not significant (p-value >0.05), except for the educational degree. There is a significant result of the master degree toward the diploma and bachelor, and the p-value was (0.005) as determined by a one-way ANOVA test. (P-value >0.05) (Table 3).

\* T-Test , \*\*One way ANOVA

There is no statistically significant relationship between the total results of the anesthesia care team knowledge regarding the weaning from mechanical ventilation, the name of the hospital, and the type of ICU. (P-value >0.05) (Table

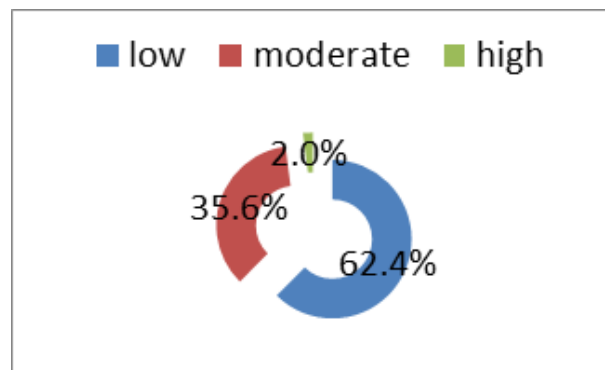


Figure 1: Knowledge levels of anesthesia care team regarding weaning criteria from mechanical ventilation.

4).

### 4. Discussion

The ICU worldwide is one of the most critical places in the hospital because it contains many patients who need mechanical ventilation [12]. Every anesthesia care team member who deals with this machine or takes care of the patient in the ICU must have good skills and experience [13].

In this study, we evaluated the knowledge of the anesthesia care team in six sections. It was crucial to wean patients from mechanical ventilation, and in this study, we found a low level of knowledge about these six parts. This part explains the main result of this study and discusses other similar studies produced by another researcher.

#### **The total of the anesthesia care team’s knowledge regarding additional MV weaning readiness criteria screening**

The total results of the correct knowledge of the anesthesia care team were (24.77%), and the incorrect knowledge was (75. 23%). Moreover, it disagrees with the studies done by Haugdahl (2016). It was the percentage of correct knowledge (54.0%) and the incorrect knowledge of the anesthesia care team (48.0%) [14].

#### **Anesthesia care team knowledge regarding the mode used for weaning patients from mechanical ventilation**

The studies showed that the results of the correct knowledge of the anesthesia care team regarding the mode of ventilation were (26.92%) and the anesthesia care team’s incorrect knowledge was (73.08 %). This knowledge agrees with the study of Thapa et al. [15] where the incorrect knowledge was (54.4%) and the correct knowledge about weaning was (45.6%).

#### **The anesthesia care team’s knowledge regarding the parameters of the proposed weaning intervention for mechanical ventilation**

The total results of the correct knowledge regarding parameters for the proposed weaning were (46.25%). The incorrect knowledge was almost more than half (53.75%), and the

Training	Training course		P-value
	Yes	No	
Did you obtain a degree or ICU-related training?			
Mean ± SD	2.62 ± 0.52	2.33 ± 0.51	0.199*
In your intensive care unit, are weaning procedures written?			
Mean ± SD	2.61 ± 0.53	2.55 ± 0.51	0.614*
Did you obtain classes on how to wean from MV?			
Mean ± SD	2.58 ± 0.55	2.63 ± 0.48	0.687*
Did you earn a respiratory therapy degree?			
Mean ± SD	2.63 ± 0.54	2.55 ± 0.50	0.453*

Table 2: Total final results knowledge regarding weaning from mechanical ventilation by the training course

Demographic characteristics	The total score of knowledge Mean±SD	Number	P-value
Age group			
20-30	2.77± 0.42	18	0.065**
31-40	2.64±0.48	51	
>40	2.43±0.61	32	
Gender			
Male	2.71 ± 0.45	38	0.117*
Female	2.53 ± 0.56	63	
Marital situation			
Single	2.65 ± 0.48	26	0.581*
Married	2.58 ± 0.54	75	
Education degree			
Diploma	2.53 ± 0.50	26	0.005**
Bachelor	2.77 ± 0.42	48	
Master	2.37 ± 0.62	27	
Experience years			
1-5	2.68 ± 0.47	22	0.554**
6-10	2.51 ± 0.50	27	
>10	2.61 ± 0.53	52	

Table 3: The relationship between the knowledge and demographic characteristics

Place of Work	The Total Result of Knowledge			χ <sup>2</sup>	p-value
	Low	Moderate	High		
The name of the hospital N(%)					
Imam-khomaini	37(58.7)	13(36.1)	1(50.0)	4.689 <sup>a</sup>	0.096
sharieati	26(41.3)	23(63.9)	1(50.0)		
ICU type N(%)					
General	33(52.4)	17(47.2)	0(0.0)	9.103 <sup>a</sup>	0.06
Surgical	5(15.9)	7(19.4)	2(100.0)		
Pediatric	20(31.7)	12(33.3)	0(0.0)		

Table 4: The relationship between the knowledge and the work of the place

study supports this result produced by Hassen et al. [16]. The correct knowledge was (47.9%), and the incorrect knowledge regarding parameters for the proposed weaning was (52,1%).

The total results of the anesthesia care team showed that (26.75%) had correct knowledge regarding the mechanical ventilation weaning tolerance criteria screening. In contrast, (73.25%) of the anesthesia care team had incorrect knowledge. The study that agrees with the present study was produced by Hassen et al. [16] (56.8%). It was incorrect knowledge for the weaning sequence and tolerance of the anesthesia care team, and the correct knowledge was (43.2%) [16]. Regarding the anesthesia care team’s knowledge regarding the extubation and withdrawal from mechanical ventilation in the present study, we found the total incorrect knowledge results regarding extubation were (33.0%), and the correct knowledge was (77.0%).

Furthermore, a study by Hassen et al. [16] disagreed with this present study that the correct knowledge of the anesthe-

sia care team about extubation was (57.5%). Moreover, the anesthesia care team’s incorrect knowledge of extubation was (52.5%) [16]. The final total results of the anesthesia care team regarding weaning from the MV in the ICU were incorrect knowledge (31.13%), and the correct knowledge of the anesthesia care team was (68.87 %). There is plenty of study support and agreement with this result. The poor knowledge percentage is less than half of these studies, including the study of Khalaf et al. [17]. This study revealed (67%) of the participants had inadequate knowledge about the weaning criteria from MV [17]. Level the knowledge of the anesthesia care team regarding weaning from MV. In the presence study, we found that the result of the level of anesthesia care team knowledge about weaning from MV was that more than half (62.4%) had an inadequate level of knowledge, (35.6%) had a mild level of knowledge, and (2.0%) had a good level of knowledge. There is a study produced by Fathimath et al. [18] showing that (66%) had poor knowledge about weaning

from MV, (32%) had moderate knowledge, and at last, just (2%) had good knowledge [18].

### The limitations of the Study

It is possible that the center will not cooperate in providing the data. Government and academic letters will be used to solve this problem. In some situations, The members of the anesthetic care team decline to be involved in research. In this case, the researcher describes the benefit of research to the participants.

### 5. Conclusion

Finally, the results of this study showed that the knowledge and procedures of the anesthesia care team about weaning patients off of artificial ventilation were deemed inadequate. They have poor knowledge regarding weaning criteria from mechanical ventilation in ICU.

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### The authors' Contributions

Dr Firoozabadi, Dr Mehrabani, Dr Shamsi: Conceptualization; Dr Firoozabadi, Dr Shamsi: Methodology; Dr Firoozabadi, Naser Abdulrazzaq: Formal analysis; Dr Firoozabadi, Dr Mehrabani, Dr Shamsi: Investigation; Dr Ostadalipour, Naser Abdulrazzaq: Data curation; Dr Firoozabadi, Dr Mehrabani, Naser Abdulrazzaq: Writing-original draft preparation; Dr Firoozabadi, Naser Abdulrazzaq: Writing-review and editing; Dr Firoozabadi, Dr Shamsi: Supervision; Dr Firoozabadi, Dr Mehrabani: Project administration. All authors have read and agreed to the published version of the manuscript.

### Data Reproducibility

The corresponding author can provide, upon reasonable request, the research protocols and the related data set utilized &/or analyzed during this work.

### Ethical approval

Prior to beginning this investigation, Tehran University of Medical Science (Tums) approval was acquired. The ethics committee approved the study's use of human subjects (IR.TUMS.SPH.REC.1401.306).

### Conflict of interest

The authors declare no conflict of interests. All authors read and approved final version of the paper.

### Authors Contribution

All authors contributed equally in this paper.

### References

- [1] Gao, Y., Xu, A., Hu, P. J.-H., & Cheng, T.-H. (2017). Incorporating association rule networks in feature category-weighted naive Bayes model to support weaning decision making. *Decision Support Systems*, 96, 27-38.
- [2] McConville, J. F., & Kress, J. P. (2012). Weaning patients from the ventilator. *New England Journal of Medicine*, 367, 2233-2239.
- [3] Boles, J. M., Bion, J., Connors, A., Herridge, M., Marsh, B., Melot, C., ... & Welte, T. (2007). Weaning from mechanical ventilation. *European Respiratory Journal*, 29, 1033-1056.
- [4] Windisch, W., Dellweg, D., Geiseler, J., Westhoff, M., Pfeifer, M., Suchi, S., & Schönhofer, B. (2020). Prolonged Weaning from Mechanical Ventilation. *Deutsches Ärzteblatt International*, 117(12), 197-204.
- [5] Hannan, L. M., Tan, S., Hopkinson, K., Marchingo, E., Rautela, L., Detering, K., ... & Howard, M. E. (2013). Inpatient and long-term outcomes of individuals admitted for weaning from mechanical ventilation at a specialized ventilation weaning unit. *Respirology*, 18(1), 154-160.
- [6] Scheinhorn, D. J., Hassenpflug, M. S., Votto, J. J., Chao, D. C., Epstein, S. K., Doig, G. S., ... & Ventilation Outcomes Study Group. (2007). Post-ICU mechanical ventilation at 23 long-term care hospitals: a multicenter outcomes study. *Chest*, 131(1), 85-93.
- [7] Garriga Rodríguez, P. B. F., Giraldo Giraldo, J., & Villares Piera, J. (2016). Detection of the Weaning Instant by Means of Recurrence Quantification Analysis (Master's thesis). Universitat Politècnica de Catalunya. Barcelona, Spain.
- [8] Wunsch, H., & Wagner, J. (2013). ICU Occupancy and Mechanical Ventilator Use in the United States. *Critical Care Medicine*, 41(12), 2712-2719.
- [9] Marti, J., Hall, P., Hamilton, P., Lamb, S., McCabe, C., Lall, R., ... & Hulme, C. (2016). One-year resource utilisation, costs and quality of life in patients with acute respiratory distress syndrome (ARDS): secondary analysis of a randomised controlled trial. *Journal of Intensive Care*, 4, 1-11.
- [10] Hughes, C. G., McGrane, S., & Pandharipande, P. P. (2012). Sedation in the intensive care setting. *Clinical Pharmacology: Advances and Applications*, 4, 53-63.
- [11] Ösel, J. (2017). Who Is Safe to Extubate in the Neuroscience Intensive Care Unit? *Seminars in Respiratory and Critical Care Medicine*, 38(6), 830-839.
- [12] Tang, W., Tong, K. L., & Buckley. (2012). Outcome of Adult Critically Ill Patients Mechanically Ventilated on General Medical Wards in Hong Kong. *Hong Kong Medical Journal*, 18(4), 284-290.
- [13] Grossbach, I., Chlan, L., & Tracy, M. F. (2011). Overview of mechanical ventilatory support and management of patient and ventilator-related responses. *Critical Care Nurse*, 31(3), 30-44.
- [14] Haugdahl, H. S., & Selnes, H. (2016). Mechanical ventilation and weaning: Roles and competencies of intensive care nurses and patients' experiences of breathing. *UiT The Arctic University of Norway*, 110(6), 102-115.
- [15] Iyer, R. S., Thapa, M. M., Khanna, P. C., & Chew, F. S. (2012). Pediatric bone imaging: imaging elbow trauma in Children??? A review of acute and chronic injuries. *American Journal of Roentgenology*, 198(5), 1053-1068.
- [16] Hassen, K. A., Namera, M. A., & Aniley, A. W. (2023). Knowledge Regarding Mechanical Ventilation and Practice of Ventilatory Care among Nurses Working in Intensive Care Units in Selected Governmental Hospitals in Addis Ababa, Ethiopia. *Journal of Critical Care Research and Practice*, 13, 4977612.
- [17] Khalaf, J., Riad, A., & Awad, S. (2017). Critical care nurses' knowledge and practices regarding weaning of patients from mechanical ventilation. *Mansoura Nursing Journal*, 4(1), 71-88.
- [18] Fathimath, S., Jancy, G., & Jancy, T. (2013). Assessment of knowledge regarding mechanical ventilation among staff nurses working in selected hospital Mangalore with a view to develop an information pamphlet. *International Journal of Recent Scientific Research*, 4(9), 1410-1413.