Assessment of Nurses Performance Obstacles during Weaning patients from Mechanical Ventilation

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Abstract
Background: The intensive care unit is a highly stressful environment, where nurses face multiple challenges during the weaning process from mechanical ventilation. Identifying these performance obstacles is essential to improve nursing care quality and ensure patient safety during weaning. **Aim:** Assessment of nurses performance obstacles on weaning during patients from mechanical ventilation. Research design: Descriptive research design was utilized. **Setting:** This study was conducted in intensive care units in main hospital at Assiut University hospitals. **Subjects:** sixty of critical care nurses in intensive care units. **Tools;** Tool (I): Nurses Assessment tool. Tool (II): obstacles face critical care nurse during weaning patient from mechanical ventilation . **Results:** The study revealed that 76.7% of nurses demonstrated satisfactory clinical practice during weaning from mechanical ventilation. However, gaps were observed in areas such as nutritional assessment (61.7%) and laboratory data evaluation (70%). Most nurses (88.3%) had basic knowledge of mechanical ventilation, yet only 35% recognized pH disorders as a contraindication to weaning. Additionally, 33.3% of nurses reported shortages in essential equipment. The most common obstacles reported were high workload, fatigue (91.7%), and lack of training. **Conclusion:** This study concluded that nurses face significant obstacles during weaning from mechanical ventilation, including limited knowledge, inconsistent practices, equipment shortages, and high workload. These factors negatively affect patient outcomes and delay recovery. **Recommendation:** Overcome these obstacles are essential in hospitals through application of new strategies to provide appropriate patients care during weaning .

Keywords: Mechanical ventilation, Nurses performance, Obstacles & Weaning

Introduction

Mechanical ventilation (MV) is one of the most common interventions performed in intensive care units (ICUs) around the world, with a predicted increase in incidence over the next decade, and is one of the main reasons why patients need an ICU bed **(Borah, et al., 2023).** Mechanical ventilation is a life-saving treatment, decreasing the work of breathing for patients and reversing acute life-threatening respiratory acidosis and hypoxemia **(Gayen, et al., 2023)**.

Weaning from mechanical ventilation is an essential and universal element in the care of critically ill intubated patients receiving mechanical ventilation. Weaning covers the entire process of liberating the patient from mechanical support and from the endotracheal tube, including relevant aspects of terminal care. There is uncertainty about the best methods for conducting this process, which will generally require the cooperation of the patient during the phase of recovery from critical illness. This makes weaning an important clinical issue for patients and clinicians. **(Shalash, et al., 2023)**.

Cederwall, et al., (2021) defines weaning more accurately as the gradual withdrawal of respiratory support until the point has been reached .when either the patient no longer of requires assistance or has reached their maximum potential and further reduction of respiratory support is neither feasible or realistic .

Even with medical advancements, weaning too soon or too late is still a problem. One typical reason for late weaning is the delay in determining readiness to wean. Patients with prolonged ventilation may consequently suffer from pneumonia caused by the ventilator, airway injury, post-extubation disorientation, drug dependence, other types of increased morbidity, and even greater death rates. **(Bureau, et al., 2023)**

Nurses encounter several obstacles during the weaning process from mechanical ventilation, which may negatively impact patient outcomes. These challenges include limited training in evidence-based weaning protocols, time constraints, high workload. Many nurses report feeling unprepared to manage complex weaning cases due to inadequate support and limited participation in clinical decision-making .Additionally, emotional stress, fear of complications, and lack of updated guidelines contribute to inconsistent practices during the weaning phase.

Addressing these barriers through continuous education and team collaboration is essential to enhance the quality and safety of care provided in intensive care units. (**Ali & Hassan, 2023**).

Discontinuation of mechanical ventilatory support represents a milestone in the progression to patient recovery in the Intensive Care Unit (ICU) .Despite advances in mechanical ventilation and respiratory support, the science of determining if the patient is ready for extubation is still very imprecise. As a result, reported reintubation rates vary from 2% to as high as 25%, depending on the ICU population studied**. (Wu, et al., 2023)**.

Research evidence regarding the ICU nurses' role and autonomy focuses on their participation in the development or implementation of weaning protocols. (**Duyndam, et al., 2020**). Nurses play important role in monitoring the patient's respiratory status,

Significance of the study

Over 1 million patients receive mechanical ventilation (MV) annually in an intensive care unit (ICU) world wide. Patients receiving MV occupy 24–41% of ICU beds in the United States and Canada at any time. This consumes significant ICU recourses with estimated daily costs around $2300 in the US. (**Dhala, et al., 2023**). According to current records in intensive care units at Assiut university hospitals in main hospital(2023) revealed that the number of patients admitted to intensive care units was approximately 2890 patients 80% of them were on mechanical ventilation. (**hospital records of Assiut university 2023**)

In the critical and intricate process of weaning patients from mechanical ventilation, nurses serve as indispensable providers of both clinical judgment and compassionate care. Their contributions begin with continuous assessment of weaning readiness, blending objective indicators such as spontaneous breathing trials, respiratory parameters. Nurses initiate and monitor spontaneous breathing trials, adjusting interventions like sedation or ventilatory support, and use weaning protocols and checklists (e.g., Burns Wean Assessment Program or ventilator care bundles) to facilitate timely and evidence-based progress toward extubation. They also play a critical role in preventing ventilator-associated complications such as pneumonia or unplanned extubation through vigilant care measures. Moreover, nurses act as the glue of interprofessional teamwork advocating for patients, coordinating care among physicians. (**Duncan, 2025**)

The investigator observed that during weaning from mechanical ventilation the nurses face many of obstacles that may lead to failure the process of weaning such as lack nurses knowledge, clinical

including assessing lung sounds, oxygen saturation levels, and end-tidal carbon dioxide (EtCO2) monitoring. Monitoring and managing sedation levels and pain control for patient comfort and to promote synchrony with the ventilator (**Maillie, et al., 2023**). Recent decades, the role of intensive care nurses in the weaning process has been highlighted. (**Taylor, et al., 2020**).

The success of weaning may be optimized through continuity of care, knowledge of patient and the development of patient-centered, individualized weaning plans, which suggests the importance of nurse involvement in the process and acknowledges its complexity. The nurse should be able to recognize which patient is ready for weaning as soon as possible. Studies in nurses involvement in weaning illustrate the importance of nurses decision-making and autonomy in this area . (**Mitchell, et al., 2019**) practice and equipment .or may be patient criteria to weaning lead to that

Aim of the study:

This study aimed to assess the obstacles face critical care nurses' performance during weaning from mechanical ventilation**.**

Research question:

What is nurses performance obstacles during weaning from mechanical ventilation in the intensive care units?

Research design:

Quantitative Descriptive research design was used to fulfil the aim of study. This Descriptive research might used a variety of data collection methods with the most common being questionnaires and interviews.

Setting:

This study was conducted in intensive care units (anesthesia ICU, Trauma ICU ,General ICU ,critical ICU) in main hospital at Assiut University hospitals

Sample:

Convenience sample of critical care nurses (who were 60 nurses) from both sex , Who were admitted to in previous mentioned setting .

Tools of data collection:

Tool (I): Nurses Assessment tool, this tool was developed by the researcher include: Socio-demographic data of nurses as: age, gender, marital status ,educational level, years of experience, working area and attending training program regarding care of critical ill patient during weaning.

TOOL (II): Nurses performance weaning obstacles assessment tool: This tool developed by the researcher after reading the related literature review (**Vyas, et al., 2022**), (**Awang, et al., 2021**) To assess nurses performance weaning obstacles which faced critical care nurse during weaning patient from mechanical ventilation. It comprised of the following:-

Part (1): Obstacles face critical care nurse regarding clinical practices. It consists of (19) items such as assess vitals signs, provide chest physiotherapy, Tracheal suction, etc. Through Each item was scored as follows: A score of 1 was given for a correct response. A score of 0 was given for an incorrect response, The total score for each nurse was calculated and converted into a percentage. Scores were then classified into two categories: Satisfactory: ≥ 75% of the total possible score (≥ 14 out of 19) and Unsatisfactory: < 75% of the total possible score (< 14 out of 19). **(Tian, et al 2023).**

Part (2): Obstacles face critical care nurse regarding nurses' knowledge It consists of (14) items such as Do you know what is process of mechanical ventilation, Do you know what is process of mechanical ventilation? Do you know what is preparation of weaning? etc. Through Scoring system: The scoring grades attributed to each domain and overall, were adopted from the Original Bloom's Cut off points, score of 80- 100% correct response as good, 60-79% as average and score <60% as poor knowledge **(Stamatopoulos, et al., (2024).**

Part (3): Obstacles face critical care nurse regarding equipment available in ICU It consists of (9) items such as available equipment and supplies to wean the patient, suction device, suction equipment, venturi mask, are there organized supplies and equipment area, etc.

Part (4): Obstacles face critical care nurse regarding patient criteria to weaning as mechanical ventilation data and hemodynamic parameter .

Procedures:
To accomplish the aim of the study, it passed through the following phases**:**

Preparatory phase:
Tools development:
▪ Official permission was obtained to carry out the proposed study, enabling the researcher to initiate data collection**.**
▪ Tools for collecting data were developed based on reviewing the current, past, local, and international related literature.

Pilot study
The pilot study included 10% of the studied sample (6 nurses and 6 patients) they were used to determine the tools' applicability and clarity as well to estimate time needed to fill in the data collection tools.

Content validity and Reliability
Face validity: was done by two consultants who evaluated the tools for clarity, relevance, comprehensiveness, and understanding, including three professors and from the critical care nursing team and two professor from the critical care Medicine. Minor modifications were made and the tools were then designed in their final version and

reliability tests were conducted
Reliability of the tools was measured by Cronbach's alpha coefficient (r- 0.722).

Ethical considerations
Research proposal was approved from Ethical Committee in the Faculty of Nursing, Assiut University on (2024/8/26), with ID approval (1120240865). There was no risk for study subject during application of the study. Explanation of the aim and nature of the study was done to nurses and the right to refuse participation in the study was emphasized to the nurses . Verbal consent was obtained from nurses .

Implementation phase:
▪ The data collection period extended from September 2024 to may 2025.
▪ Data was obtained from each patient underwent weaning from mechanical ventilation .
▪ The investigator attended to main hospital ICUs from 9 am to 12 pm \ five days per week, 20-25 min with every nurse to collect relevant data .
▪ The researcher introduced herself, described the study's goals, take nurses' verbal consent.
▪ Data collection related to the demographic characteristics of the studied nurses were conducted using Tool I.
▪ Data collection related to obstacles face critical care nurse during weaning patient from mechanical ventilation was carried out using Tool II .
▪ The investigator monitored the patient during, after weaning patient from mechanical ventilation .

Statistical analysis:
The researcher submitted the data through a personal computer. All data underwent analysis using the Statistical Package for the Social Sciences (SPSS) version 26.0 software, and Excel was employed to generate the figures. The researcher examined, classified, and coded the content of each tool. Categorical variables were presented as numbers and percentages, while continuous variables were described using the mean and standard deviation (Mean, SD). The comparison between categorical variables utilized the Chi-square test, and for continuous variables, the t-test was employed. A P-value <0.05 was considered statistically significant (**Riina, et al 2023).**

Results
Table (1): Frequency and percentage distribution of studied nurse's according to their demographic characteristics (n=60)

	No	%
Age		
Less than 25 year	22	36.7
From 25-30 year	30	50.0
More than 30 year	8	13.3
Mean±SD(range)	**27.13±3.71(22-40)**	
Gender		
Male	18	30.0
Female	42	70.0
Marital status		
Single	33	55.0
Married	27	45.0
Level of education		
Bachelor of nursing	23	38.3
Technical Institute of nursing	37	61.7
Years of experiences		
More than 1 years	39	65.0
More than 5 years	16	26.7
More than 10 years	5	8.3
Working area		
Anathesia icu	24	40.0
GeneraICU	10	16.7
Tropical icu	8	13.3
Truma ICU	18	30.0
Do you attendance training program about weaning process		
No	31	51.7
Yes	29	48.3
Did you apply what you learned in training program?		
Yes	29	48.3
No	31	51.7

Table (2): Frequency and percentage distribution of Obstacles which face critical care nurses during weaning regarding clinical practice (n=60)

|	Not Done		Done	
	No	%	No	%
Vital signs	0	0.0	60	100.0
Assessment of level of consciousness	5	8.3	55	91.7
Assessment of laboratory data	18	30.0	42	70.0
Ability to cough and expectorant secretion	13	21.7	47	78.3
Enteral nutritional tolerance	23	38.3	37	61.7
Discuss the assessment of findings and weaning Parameters with physician	10	16.7	50	83.3
Plan to initiate early weaning process in the day	6	10.0	54	90.0
Explain procedure to the patient.	13	21.7	47	78.3
Initiate weaning according to the physician orders	9	15.0	51	85.0
Provide psychological support to the patient and encourage the patient to breathe normally	14	23.3	46	76.7
Provide chest physiotherapy	18	30.0	42	70.0
Tracheal suction	3	5.0	57	95.0
Oral suction	1	1.7	59	98.3
Cuff care before weaning (emptying air /12hr and reassess pressure daily.	13	21.7	47	78.3
Oral care	11	18.3	49	81.7
External fixation care.	13	21.7	47	78.3
Assist with extubation	8	13.3	52	86.7
Obtaining an ABGs	4	6.7	56	93.3
Do you have workload fatigue and stress ?	5	8.3	55	91.7
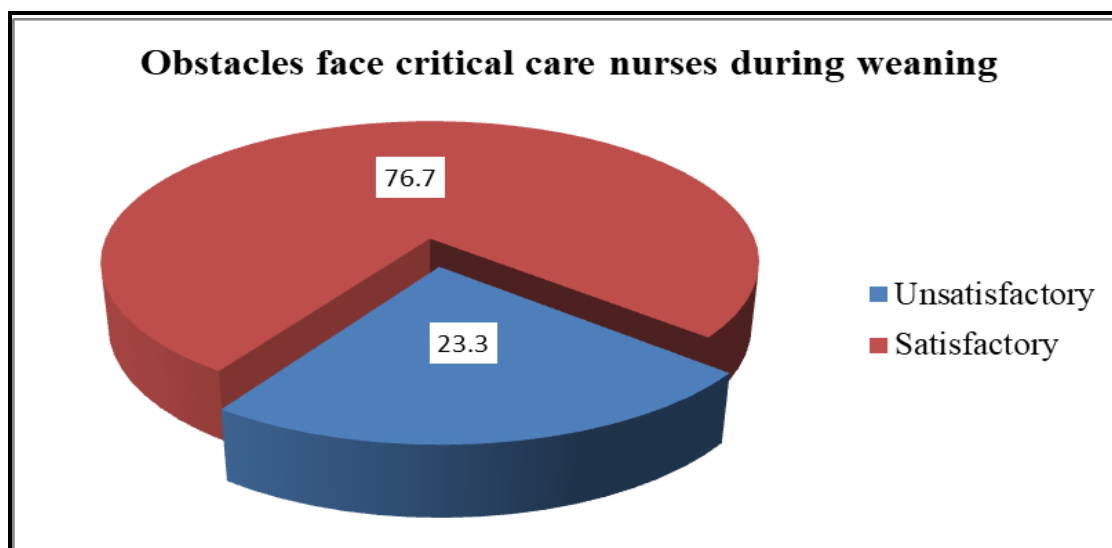
Figure (1): Distribution of studied Obstacles face critical care nurses during weaning regarding clinical practice (n=60)

Table (3): Relationship Between Obstacles face critical care nurses during weaning during regarding clinical Practice With Their demographic data(n=60)

	Obstacles face critical care nurses during weaning					
	Unsatisfactory (n=14)		Satisfactory (n=46)		X2	P. value
	No	%	No	%		
Age						
Less than 25 year	4	28.6	18	39.1		
From 25-30 year	8	57.1	22	47.8	0.53	0.769
More than 30 year	2	14.3	6	13.0		
Gender						
Male	6	42.9	12	26.1		
Female	8	57.1	34	73.9	1.44	0.231
Marital status						
Single	9	64.3	24	52.2		
Married	5	35.7	22	47.8	0.64	0.425
Level of education						
Bachelor of nursing	5	35.7	18	39.1		
Technical Institute of nursing	9	64.3	28	60.9	0.05	0.818
Years of experiences						
More than 1 years	9	64.3	30	65.2		
More than 5 years	4	28.6	12	26.1	0.06	0.972
More than 10 years	1	7.1	4	8.7		
Working area						
Anathesia icu	4	28.6	20	43.5		
AeneraICU	4	28.6	6	13.0		
Tropical icu	2	14.3	6	13.0	2.17	0.537
Truma ICU	4	28.6	14	30.4		
Do you attendance training program about weaning process						
No	6	42.9	23	50.0		
Yes	8	57.1	23	50.0	0.22	0.640
Did you apply what you learned in training program?						
Yes	7	50.0	22	47.8		
No	7	50.0	24	52.2	0.02	0.887

Chi square test for qualitative data between the two groups   *Significant level at P value < 0.05*

Table (4): Frequency and percentage distribution of studied Obstacles face nurses regarding their knowledge (n=60)

|	No	%
Do you know what is process of mechanical ventilation?		
No	7	11.7
Yes	53	88.3
Do you know what is indication of mechanical ventilation?		
No	2	3.3
Yes	58	96.7
what is indication of mechanical ventilation ?		
GCS<7	39	65.0
RR >40	43	71.7
Shocked	51	85.0
Hypoxia	47	78.3
Distress	28	46.7
Do you know what is complication of mechanical ventilation ?		
No	5	8.3
Yes	55	91.7
What is complication of mechanical ventilation ?		
Barotrauma	36	60.0
Pneumonia	46	76.7
Lung injury	42	70.0
What is preparation of weaning ?		
Drawing ABG from patient	58	96.7
Prepare Oxygen mask and nebulizer mask	54	90.0
Make Suction to patient	55	91.7
Make chest physiotherapy to patient	48	80.0
Head elevation	41	68.3
Decrease meal before weaning .	31	51.7
Do you know indication of weaning ?		
No	7	11.7
Yes	53	88.3
What is indication of weaning ?		
Improvement of the condition that led to the need for mechanical ventilation	51	85.0
Hemodynamic stable	42	70.0
GCS improved	42	70.0
Do you know blood gas interpretation ?		
No	11	18.3
Yes	49	81.7
Do you what is signs and symptoms of weaning failure ?		
No	2	3.3
Yes	58	96.7
What is signs and symptoms of weaning failure ?		
Hypoxemia	53	88.3
Tachypnea	50	83.3
Loss of conscious	44	73.3
Tachycardia	37	61.7
Do you know contraindications of weaning ?		
No	10	16.7
Yes	50	83.3
What is contraindications of weaning?		
Hemodynamically unstable	45	75.0
Fever	53	88.3
Tachypnea	29	48.3
Not fully awake	24	40.0
Abnormal laboratory date	27	45.0
Ph disorders	21	35.0
Ventilator setting	13	21.7
Do you know blood gas interpretation ?		
No	11	18.3
Yes	49	81.7
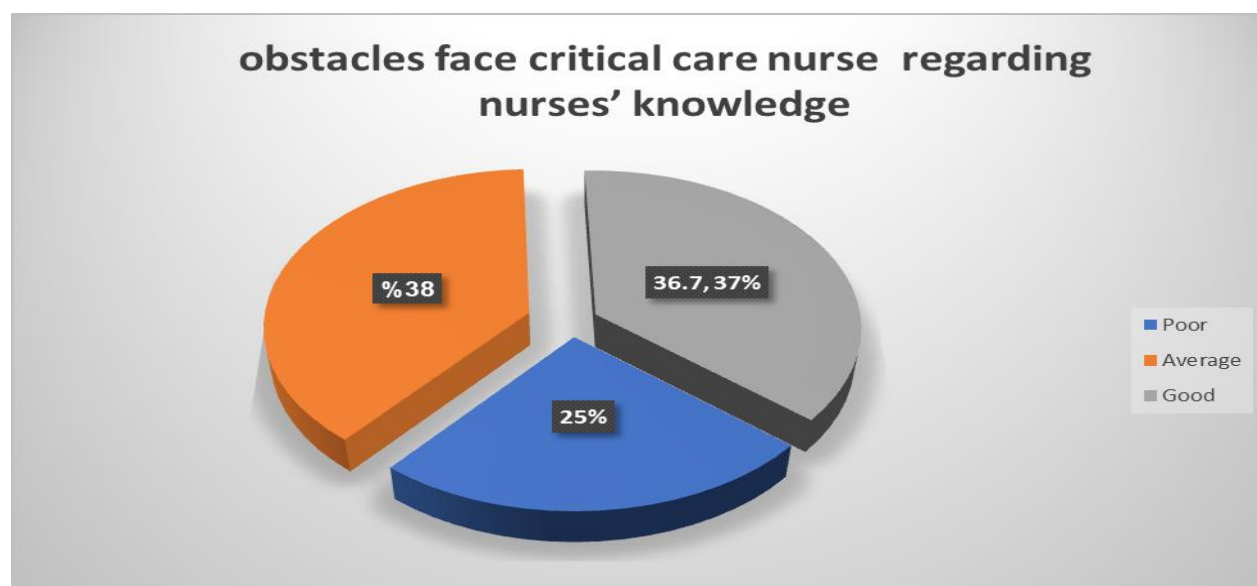
Figure (2): Distribution of studied Obstacles which face nurses regarding their level of knowledge (n=60)

Table (5): Relationship Between Obstacles which face nurses regarding their level of knowledge With Their demographic data (n=60)

	Obstacles face critical care nurse regarding nurses' knowledge							
	Poor (n=10)		Average (n=28)		Good (n=22)		X2	P. value
	No	%	No	%	No	%		
Age								
Less than 25 year	6	60.0	11	39.3	5	22.7		
From 25-30 year	3	30.0	12	42.9	15	68.2	6.05	0.195
More than 30 year	1	10.0	5	17.9	2	9.1		
Gender								
Male	5	50.0	8	28.6	5	22.7	2.49	0.289
Female	5	50.0	20	71.4	17	77.3		
Marital status								
Single	8	80.0	13	46.4	12	54.5	3.36	0.187
Married	2	20.0	15	53.6	10	45.5		
Level of education								
Bachelor of nursing	2	20.0	4	14.3	17	77.3	22.38	<0.001**
Technical Institute of nursing	8	80.0	24	85.7	5	22.7		
Years of experiences								
More than 1 years	8	80.0	17	60.7	14	63.6		
More than 5 years	2	20.0	7	25.0	7	31.8	3.25	0.517
More than 10 years	0	0.0	4	14.3	1	4.5		
Working area								
Anathesia icu	4	40.0	13	46.4	7	31.8		
GeneraICU	2	20.0	4	14.3	4	18.2		
Tropical icu	2	20.0	3	10.7	3	13.6	1.98	0.922
Truma ICU	2	20.0	8	28.6	8	36.4		
Do you attendance training program about weaning process								
No	4	40.0	14	50.0	11	50.0	0.33	0.846
Yes	6	60.0	14	50.0	11	50.0		
Did you apply what you learned in training program?								
Yes	5	50.0	13	46.4	11	50.0	0.08	0.963
No	5	50.0	15	53.6	11	50.0		

Chi square test for qualitative data between the two groups
Significant level at P value < 0.05,   *Significant level at P value < 0.01*

Table (6): Comparison Between Obstacles face critical care nurses during weaning regarding nurses practice and obstacles face critical care nurse regarding nurses' knowledge With Their demographic data (n=60)

	N	Obstacles face critical care nurses during weaning regarding nurses practice		obstacles face critical care nurse regarding nurses' knowledge	
		Mean±SD	Range	Mean±SD	Range
Age					
Less than 25 year	22	16.23±2.16	11-19	25±5.48	13-32
From 25-30 year	30	15.67±2.01	12-19	29.03±4.45	17-37
More than 30 year	8	15.75±2.49	11-19	26.88±5.59	15-34
Test Used		**F= 0.46 P.V=0.634**		**F= 4.16 P.V=0.021***	
Gender					
Male	18	15.22±2.34	11-19	25.72±5.99	15-37
Female	42	16.17±1.96	12-19	27.93±4.84	13-36
Test Used		**T= 2.60 P.V=0.112**		**T=2.27 P.V=0.138**	
Marital status					
Single	33	15.88±2.29	11-19	27.03±5.94	13-37
Married	27	15.89±1.91	11-19	27.56±4.38	15-34
Test Used		**T=0.00 P.V=0.985**		**T=0.15 P.V=0.704**	
Level of education					
Bachelor of nursing	23	16.13±1.94	12-19	29.96±4.34	18-36
Technical Institute of Nursing	37	15.72±2.22	11-19	25.59±5.14	13-37
Test Used		**T=0.21 P.V=0.647**		**T=5.05 P.V=0.001****	
Years of experiences					
More than 1 years	39	16±2.08	11-19	26.92±5.35	13-36
More than 5 years	16	15.5±2.25	11-19	27.94±5.56	15-37
More than 10 years	5	16.2±2.17	14-19	27.8±4.09	23-34
Test Used		**F= 0.37 P.V=0.691**		**F= 0.23 P.V=0.793**	
Working area					
Anathesia icu	24	16±1.93	12-19	27.25±5.13	17-37
GeneraICU	10	15.3±2.95	11-19	26.3±6.18	15-34
Tropical icu	8	15.88±1.64	14-18	26.13±6.17	13-32
Truma ICU	18	16.06±2.1	12-19	28.33±4.7	16-34
Test Used		**F= 0.31 P.V=0.819**		**F= 0.47 P.V=0.703**	
Do you attendance training program about weaning process					
No	29	16.07±2.15	11-19	27.83±5.57	15-37
Yes	31	15.71±2.08	11-19	26.74±4.98	13-34
Test Used		**T=0.43 P.V=0.514**		**T=0.63 P.V=0.429**	
Did you apply what you learned in training program?					
Yes	29	15.86±2.17	11-19	27.45±4.63	18-37
No	31	15.9±2.09	11-19	27.1±5.86	13-36
Test Used		**T=0.01 P.V=0.941**		**T=0.07 P.V=0.798**	

- Independent T-test quantitative data between the two groups

- One-way Anova T-test quantitative data between the Three groups or more

*Significant level at P value < 0.05,

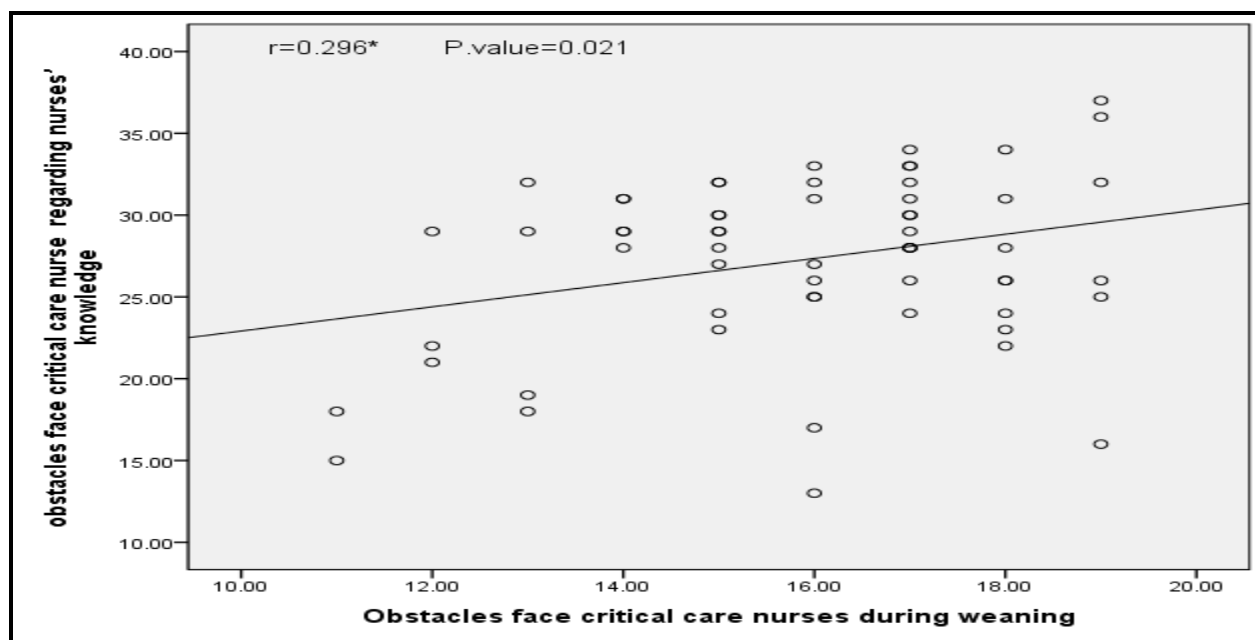***Significant level at P value < 0.01*

Figure (3): Scatterplot illustrating Statistically Significant Positive correlation hypothetical data for the relationship between Obstacles face critical care nurses during weaning and obstacles face critical care nurse regarding nurses' knowledge (r=0.296*) (P value=0.021)

Table (7): Frequency and percentage distribution of studied Obstacles face critical care nurses during weaning regarding nurses equipment (n=60)

	No	%
Are there available equipment and supplies to wean the patient		
No	20	33.3
Yes	40	66.7
What is available equipment and supplies?		
Nasal cannula	53	88.3
Simple mask	50	83.3
Venturi mask	57	95.0
High flow oxygen system	48	80.0
Suction device	50	83.3
Suction equipment	48	80.0
Are there organized supplies and equipment area ?		
No	23	38.3
Yes	37	61.7
Do you have Poor physical work equipment?		
No	24	40.0
Yes	36	60.0

Table (1): Clears up that the participants age ranged from (25-30) years that Mean± SD(range) 27.13±3.71(22-40). More than half of participants(70.0%) were females. (55.0%) were single ,Regarding education level more than half (61.7%) had Technical Institute of nursing, (65.0 %) had Years of experiences more than 1 years and less than half (40.0%) their working area were Anesthesia Icu, (51.7%) of nurses don't attend any training program about weaning process and (48.3%) of them applied learned program .

Table (2): This table show that the majority of nurses were done vital signs(100%),assess laboratory data (91%), oral suction (98.3 %), Tracheal suction (95.0 %), the nurses practice not done such as providing chest physiotherapy (30.0%) , assessment of laboratory data (30.0 %) assessment of Enteral nutritional tolerance (38.3 %) .

Figure (1): The pie chart demonstrates the distribution of clinical practice-related obstacles faced by critical care nurses during the weaning process. It shows that 76.7% of nurses achieved a satisfactory level of clinical practice, while 23.3% reported unsatisfactory performance. This indicates

that although the majority of nurses are performing key clinical tasks during weaning. A notable proportion still experience difficulties that may hinder the quality of patient care. The presence of unsatisfactory performance suggests the need for enhanced clinical training, ongoing supervision, and reinforcement of standardized weaning protocols to ensure safe and effective ventilator discontinuation practices.

Table (3): Presents the relationship between the level of obstacles faced by critical care nurses during the weaning process and their demographic data, using the Chi-square test. The findings show that none of the demographic variables had a statistically significant association with the level of obstacles encountered (P > 0.05 in all cases). Variables such as age, gender, marital status, educational level, years of experience, working area, attendance in training programs, and application of training content did not significantly affect whether nurses reported satisfactory or unsatisfactory experiences with weaning obstacles. For example, although 64.3% of nurses with unsatisfactory experiences were technical institute graduates, compared to 60.9% in the satisfactory group, this difference was not significant (P = 0.818). Similarly, attendance at training programs showed no meaningful influence on reported obstacle levels (P = 0.640).

Table (4): Demonstrates the frequency and percentage distribution of obstacles related to nurses' knowledge regarding mechanical ventilation and the weaning process. The findings indicate that the majority of nurses possess adequate knowledge in most areas: 88.3% of nurses reported knowing the process of mechanical ventilation, and 96.7% were aware of its indications. Awareness of complications was high, with 91.7% able to identify complications such as pneumonia (76.7%) and lung injury (70.0%).

A large proportion correctly identified necessary weaning preparations, including drawing ABGs (96.7%) and performing suction (91.7%). 88.3% of nurses knew the indications for weaning, and 96.7% recognized signs of weaning failure, such as hypoxemia (88.3%) and tachypnea (83.3%).

Knowledge of blood gas interpretation was slightly lower, at 81.7%, and awareness of contraindications to weaning was 83.3%, with fever (88.3%) and hemodynamic instability (75.0%) being the most recognized.

Figure (2): The pie chart visually represents the distribution of knowledge levels among critical care nurses regarding the weaning process. It shows that: 25% of nurses had poor knowledge, 38.3% had average knowledge, 36.7% demonstrated good knowledge. This distribution indicates that more than 60% of nurses (those in the poor and average

categories) may lack the comprehensive understanding needed for safe and effective ventilator weaning. The relatively low proportion of nurses with good knowledge highlights a significant educational gap, which could negatively impact patient outcomes. These results emphasize the importance of continuous training programs to improve nurses' theoretical and clinical competencies in mechanical ventilation and weaning procedures.

Table (5): Examines the relationship between obstacles faced by critical care nurses regarding their knowledge during weaning and their demographic characteristics using the Chi-square test. The results show that most demographic factors, including age, gender, marital status, years of experience, working area, attendance of training programs, and application of training, had no statistically significant association with nurses' knowledge levels (all P > 0.05). However, the level of education was significantly associated with knowledge obstacles (X^2 = 22.38, P < 0.001). Specifically, nurses with a Bachelor of Nursing degree were much more likely to have good knowledge (77.3%) compared to those from Technical Institutes (22.7%).

Table (6): Compares obstacles faced by critical care nurses during weaning regarding their practice and knowledge across different demographic groups. Nurses' knowledge scores showed a statistically significant difference by age (F=4.16, P=0.021), with nurses aged 25-30 years having the highest mean knowledge score (29.03±4.45). Level of education was significantly associated with nurses' knowledge scores (T=5.05, P=0.001), where nurses holding a Bachelor of Nursing degree had higher knowledge scores (29.96±4.34) than those from Technical Institutes (25.59±5.14). No significant differences were found in nurses' practice obstacle scores related to any demographic variables, including age, gender, marital status, years of experience, working area, attendance of training programs, or application of training (all P > 0.05). Similarly, nurses' knowledge scores were not significantly different by gender, marital status, years of experience, working area, attendance, or application of training (all P > 0.05).

Figure (3): Scatterplot illustrating Statistically Significant Positive correlation hypothetical data for the relationship between Obstacles face critical care nurses during weaning and obstacles face critical care nurse regarding nurses' knowledge (r=0.296*) (P value=0.021)

Table (7): Presents the distribution of obstacles faced by critical care nurses during the weaning process related to equipment availability and organization. The findings show that 66.7% of nurses reported availability of necessary equipment and

supplies, while 33.3% indicated a lack of availability. Among available equipment, the most frequently reported were: Venturi mask (95.0%) ,Nasal cannula (88.3%), Simple mask (83.3%), Suction devices and equipment (each 80.0–83.3%), High-flow oxygen systems (80.0%) However, 38.3% of nurses noted that the supply and equipment areas were not well-organized, and 60.0% reported poor physical work equipment.

Discussion:
Weaning from mechanical ventilation is a complex and critical phase in the care of ICU patients, requiring coordinated clinical judgment, adequate knowledge, and appropriate resources. This study aimed to explore the challenges faced by critical care nurses during the weaning process and how these challenges impact patient outcomes. The findings revealed variations in nurses' knowledge and clinical practice, as well as the presence of systemic barriers such as equipment shortages and high workload. These results are consistent with existing literature and underscore the multifaceted nature of the weaning process **(Mokhtar & Elgazzar, 2021)**

Frequency and percentage distribution of studied nurse's according to their demographic The result of the present study showed that half of nurses were at the age group between 25 and 30years, more than half female, single , years of experience of more than half of them more than 1 years, holds nursing technical institute of nursing is the highest proportion . Regarding that half of the nurses were in the age group between 24 and 30years , This is maybe due to that middle age are more experienced, active and get more involved in high complexity health care field as intensive care units. These results were in agreement with **Doe, & Smith, (2022),** who reported that the majority of nurses were female while the male was less than one third, nurses with the age group of 25-29 years had the highest percentage. On the other hand, disagree with Current study result in that the majority of nurses who are working in ICU generally had a bachelor's degree in nursing.

This study revealed that nearly two-thirds of the nurses had more than one year of ICU experience, while less than one-tenth had over ten years, suggesting a shortage of highly experienced nurses in critical care settings. According to **Ali & Mahmoud (2022)**, limited cumulative experience among ICU nurses may reduce the quality of respiratory care and increase the likelihood of clinical errors during weaning procedures. Furthermore, more than half of the nurses had not attended any training programs related to the weaning process, and the same proportion failed to apply the knowledge they gained from such training. This highlights a critical gap between knowledge acquisition and its translation into clinical practice. Similarly, **Nguyen et al., (2021)** found that inadequate application of training content compromises both patient safety and the overall effectiveness of professional development programs.

Regarding The data illustrates the frequency and percentage distribution of obstacles faced by critical care nurses during the weaning process related to clinical practice. The data highlights that while some practices are consistently implemented, others show notable variability, reflecting potential barriers to optimal weaning care. The most universally performed practices were monitoring vital signs (all nurses), oral suction (almost all nurses), tracheal suction (the vast majority of nurses), and obtaining arterial blood gases (more than nine out of ten nurses).These findings suggest strong adherence to fundamental respiratory care protocols. This is consistent with **El-Sayed et al., (2022)**, who reported high compliance with routine monitoring and suctioning during the weaning phase due to their direct impact on patient safety and extubation readiness. However, other essential interventions were less consistently performed.

Inadequate attention to these factors could compromise clinical decision-making. According to **Mokhtar & Elgazzar (2021)**, proper evaluation of lab data and nutritional status is critical for predicting weaning success, as electrolyte imbalances and malnutrition are known contributors to weaning failure. The majority of nurses (nearly four out of five) assessed the patient's ability to cough and clear secretions, while about three-quarters provided psychological support. These gaps may reflect time constraints or a lack of training. A study by **Younes et al., (2023)** emphasized that psychological reassurance and secretion management are essential nursing actions that reduce patient anxiety and support spontaneous breathing. Moreover, just over four-fifths of nurses discussed weaning parameters with physicians, and nine out of ten initiated weaning early in the day, which suggests that interprofessional communication and planning remain areas for improvement. **Ahmed et al., (2021)** highlighted that early interdisciplinary collaboration is key to efficient weaning and shorter ICU stays.

Alarmingly, only seven out of ten nurses provided chest physiotherapy, and nearly four-fifths performed cuff care—despite their importance in maintaining airway clearance and optimizing ventilation. In agreement, **Hassan & Shebl (2022)** reported that insufficient training in advanced respiratory procedures among nurses contributes to inconsistent implementation.

Regarding nurse-reported challenges, more than nine out of ten indicated they faced workload, fatigue, and stress—factors likely contributing to inconsistent practice. This aligns with **Ali et al., (2020)**, who found that high workload and emotional strain in ICUs significantly hinder nurses' ability to consistently apply weaning protocols. These findings underscore the need for continuous professional education, structured clinical protocols, and adequate staffing to support nurses in overcoming clinical practice obstacles during the weaning process.

Regarding the pie chart illustrates the distribution of obstacles encountered by critical care nurses during the weaning process from mechanical ventilation in relation to clinical practice. It shows that approximately three-quarters of the nurses were classified as having a satisfactory level, while nearly one-quarter fell into the unsatisfactory category. These results suggest that the majority of nurses were able to meet essential clinical requirements during weaning, which may be due to their routine involvement in ICU tasks such as vital signs monitoring, suctioning, and physician collaboration. This finding is consistent with **El-Sayed et al. (2022),** who reported high adherence to basic respiratory care practices among ICU nurses.

Nevertheless, the presence of almost one in four nurses with unsatisfactory performance points to existing gaps that may jeopardize patient safety. These issues may arise from factors such as high workload, outdated training, inconsistent implementation of weaning protocols, or weak interdisciplinary coordination. According to **Ali et al. (2020),** stress and fatigue in ICU environments can significantly impede nurses' ability to perform safe and timely weaning. Therefore, the data highlight the necessity of targeted training programs, regular clinical audits, and reinforcement of evidence-based weaning protocols to ensure that all nurses are well-prepared to address the clinical challenges of ventilator weaning effectively.

Relationship Between Obstacles face critical Practice care nurses during weaning With Their demographic data The study found no significant association between the level of obstacles faced by ICU nurses during ventilator weaning and their demographic characteristics such as age, gender, marital status, education, experience, work unit, or training. For example, although about two-thirds of nurses with a technical degree reported unsatisfactory practice levels versus just over one-third with a bachelor's degree, this was not statistically significant.

These results suggest that the challenges are system-wide, likely due to organizational limitations like heavy workload, lack of protocols, or insufficient resources, rather than individual nurse factors. This is consistent with **Hassan & Shebl (2022),** who emphasized that barriers in ICU practice often arise from structural issues within healthcare institutions. Therefore, to improve practice, institutional reforms such as improved training, clear protocols, and better staffing are needed.

Regarding The results offer a detailed insight into the knowledge-related challenges faced by critical care nurses concerning mechanical ventilation and weaning. While the vast majority of nurses were familiar with general concepts such as the process (almost nine out of ten) and indications (nearly all) of mechanical ventilation there were noticeable gaps in specific areas. For instance, less than half recognized respiratory distress as an indication, and roughly two-thirds were aware of the significance of a GCS below 7. These gaps may result from limited theoretical training, as supported by **Al-(Kalaldeh, et al., 2023)**. Although more than nine out of ten nurses were aware of complications like pneumonia, lung injury, and barotrauma findings that align with **Mansour & Tawfik (2022)** there was still incomplete awareness of the full range of potential complications, pointing to a need for continued education.

In terms of preparation for weaning, nurses showed strong knowledge in key practices like drawing ABGs and suctioning, but only about half recognized the importance of reducing meal intake beforehand a step vital to prevent aspiration, as emphasized by **El-Gazzar & Salem (2020).** When it came to understanding weaning criteria, nearly nine out of ten nurses were familiar with the concept, and most identified clinical improvement and hemodynamic stability as essential indicators. However, only about one-third were aware of pH disorders as a contraindication, echoing findings from **Yousef & Abdelrahman (2021).**

Notably, less than one-fifth of nurses showed limited ability to interpret ABGs, a skill deemed critical by **Hassan et al. (2023)** for safe ventilator withdrawal. Moreover, although almost all nurses recognized general signs of weaning failure, recognition of specific symptoms such as tachycardia (about three-fifths) and loss of consciousness (nearly three-quarters) was lower than expected.

Overall, while a large portion of nurses demonstrated basic knowledge, there were inconsistencies in identifying subtle clinical cues. The knowledge distribution shows that slightly more than one-third of nurses had a good level of knowledge, over one-third were average, and one-quarter were poor, with a mean score of 27.27 out of 37. This underlines the importance of reinforcing theoretical knowledge through ongoing training, simulation-based learning,

and clinical competency evaluations.

Distribution of studied Obstacles face regarding nurses knowledge These results suggest that while a portion of ICU nurses are well-informed, **a significant proportion still lack adequate knowledge**, which may negatively affect the quality and safety of weaning practices. The presence of 25% of nurses in the poor category raises concern, as inadequate knowledge about ventilator settings, weaning indicators, and complications can lead to delayed or inappropriate decision-making, increasing the risk of extubation failure and patient harm. This aligns with the findings of **Al-Kalaldeh et al. (2023)** and **Yousef & Abdelrahman (2021)**, who highlighted that knowledge deficits among ICU nurses remain a major barrier to optimal ventilator weaning and emphasized the need for targeted educational interventions. Furthermore, **Hassan et al. (2023)** pointed out that weak interpretation of blood gases and incomplete recognition of weaning failure signs can result in prolonged ventilation or premature extubation. The variation in scores may reflect inconsistencies in training, lack of continuous professional development, or insufficient bedside exposure. These findings underscore the need for regular in-service education, competency-based training, and clinical mentoring to bridge knowledge gaps.

Relationship Between Obstacles face regarding nurses knowledge With Their demographic data. This section investigates the connection between critical care nurses' knowledge-related obstacles during weaning from mechanical ventilation and their demographic characteristics. The analysis reveals that educational level is the only factor significantly associated with knowledge levels, while other variables such as age, gender, marital status, years of experience, work area, and training participation showed no significant association.

The data indicates that nearly four out of five nurses holding a Bachelor of Nursing degree had good knowledge, compared to fewer than one in four nurses from a technical nursing background. This supports previous findings by **Al-Kalaldeh et al. (2023) & Yousef; Abdelrahman (2021),** who emphasized that higher academic qualifications better prepare nurses to manage complex clinical tasks, such as weaning from mechanical ventilation.

The lack of correlation between knowledge and factors like experience or training participation implies that formal academic education may be more influential than clinical exposure alone in building theoretical competence. This may also highlight potential shortcomings in current training programs, which might be inconsistent or lack sufficient depth, as noted by **El-Gazzar & Salem (2020)**. In conclusion, the findings point to the vital importance of advancing nursing education in ICU settings, reinforcing the idea that investing in formal academic development can bridge knowledge gaps and improve patient outcomes during ventilator weaning.

Regarding the data analysis compares the obstacles faced by critical care nurses during mechanical ventilation weaning in terms of both clinical practice and knowledge, relative to their demographic characteristics. The results demonstrate that demographic factors influence knowledge more than practice**. Knowledge-Related Obstacles**: A statistically significant difference in knowledge scores was observed based on age, with nurses aged between twenty-five and thirty years scoring the highest. This may reflect their recent education and active involvement in professional development. Additionally, educational level showed a highly significant impact, as nurses holding a Bachelor's degree scored notably. This supports findings by **Yousef & Abdelrahman (2021)**, who emphasized that academic qualifications strongly influence nurses' preparedness for managing weaning processes.

Practice-Related Obstacles: In contrast, no statistically significant differences were found in practice scores across any demographic variables including age, gender, marital status, years of experience, educational background, or training participation. This indicates that practice-related barriers are likely institutional or systemic such as inadequate staffing, resource constraints, or lack of clear protocols rather than being tied to individual characteristics. These findings align with **Hassan & Shebl (2022),** who reported that organizational challenges often affect nurses' clinical performance during weaning. Training Participation and Application: Notably, neither attending training programs nor applying their content had a statistically significant effect on nurses' knowledge or practice levels. This suggests that existing training initiatives may be ineffective, possibly due to poor design, lack of follow-up, or failure to integrate training into clinical routines.

Regarding The scatter plot analysis demonstrates a statistically significant positive correlation between the obstacles faced by critical care nurses during the weaning process related to clinical practice and those related to nurses' knowledge. This suggests that nurses who encounter more challenges in practical aspects of weaning also tend to face more knowledge-related barriers.

Although the correlation is relatively weak, it is meaningful, indicating that clinical difficulties may be linked to limited understanding or inadequate training regarding weaning protocols, assessment of

readiness, or evidence-based strategies. These results emphasize the interdependence of knowledge and practice in critical care settings, where a gap in one domain may reinforce deficiencies in the other. This finding supports the results of earlier studies (e.g., **Taylor et al., 2020; Hassan & Shebl, 2022),** which identified that nurses' knowledge and decision-making autonomy are essential for successful weaning, and deficiencies in training often manifest as poor clinical outcomes. The implication is that enhancing knowledge alone may improve practice, and vice versa, suggesting the need for integrated educational and clinical competency programs.

Regarding Obstacles face critical care nurses during weaning regarding nurses equipment illustrates the availability and adequacy of equipment and supplies required for ventilator weaning as perceived by critical care nurses. Equipment availability is a fundamental prerequisite for safe and effective weaning, and any shortcomings can directly compromise patient outcomes. In this study, more than half of nurses reported the availability of the necessary equipment and supplies to wean patients, indicating that one-third of ICUs may experience equipment shortages. This finding is concerning and aligns with the results of Khamis et al. (2022), who reported that limited resource availability was a significant barrier to optimal weaning practices in low-resource settings . However, only sixty-one point seven percent of nurses confirmed the presence of organized supply areas, while thirty-eight point three percent reported a lack of systematized equipment storage. Disorganization may lead to delays in care and increased stress on nurses during critical interventions. **Abd El-Moneim et al. (2023)** highlighted that organized and accessible workspaces are associated with improved task efficiency and reduced nurse fatigue during mechanical ventilation management.

Moreover, sixty percent of the nurses experienced poor physical work equipment, such as worn-out monitors, beds, or suction devices. Such issues not only pose a safety risk but may also affect the timeliness and success of extubation procedures. This finding aligns with a study by **Mohamed & Tawfik (2021),** which emphasized that outdated or malfunctioning ICU equipment contributes to increased workload, higher nurse stress levels, and poorer weaning outcomes. In resource-constrained ICUs, nurses often compensate for equipment limitations by relying more heavily on clinical judgment and manual tasks, which increases the potential for human error. Thus, the findings underscore the urgent need for investment in ICU infrastructure, maintenance of biomedical equipment, and structured inventory systems.

Conclusion:

This study highlighted the significant obstacles faced by critical care nurses during the weaning process from mechanical ventilation. Despite their pivotal role in patient assessment and support, nurses encounter barriers such as insufficient knowledge, limited clinical training, inadequate equipment, and the absence of standardized protocols.

Recommendation:
- **Enhance Nurse Training:** Conduct regular, up-to-date training programs on mechanical ventilation and weaning protocols, focusing on both knowledge and hands-on clinical skills.
- **Address Workload and Stress:** Implement strategies to reduce nurse fatigue and stress, such as optimal nurse-to-patient ratios and psychological support systems**.**
- **Improve Equipment Availability:** Ensure the continuous availability and proper organization of essential weaning equipment and supplies in all ICU units.
- **Standardize Weaning Protocols:** Develop and enforce evidence-based weaning protocols to support clinical decision-making and improve consistency in care and Application of the current study with more participants in other locations around Egypt to generalize the findings

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