

Factors Affecting Weaning of Mechanically Ventilated Patients

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Abstract

Background: Mechanical ventilation (MV) is life-saving technology. Mechanical ventilator has serious complications, so the ultimate goal of MV is ventilator discontinuation, weaning a patient from MV is challenge for critical care nurses who play a vital role in assessing patient readiness for weaning. **The aim:** Study aimed to assess the factors affecting weaning of mechanically ventilated patients. **Design:** Descriptive exploratory research design was used in carrying out this study. **Setting:** The study was conducted in the medical intensive care units at Ain Shams Hospitals. **Sample:** A convenience sample of all available nurses (n=50) and a convenience sample of 50 patients with MV. **Tools of data collection:** Patients' physical assessment tool, Hospital anxiety and depression scale, Nurses' self-administered questionnaire, Equipment's and Environmental- related factors tool. **Results:** 70% of the studied nurses had satisfactory level of knowledge regarding the total knowledge about patient weaning from mechanical ventilator. Also, 72% of the studied nurses had satisfactory level in practicing their role during the process of weaning of patient from MV device. In addition to 81% of the human resources and structure was available. Moreover 67% of the equipment was available. **Conclusion:** More than two thirds of the studied nurses had a satisfactory level in practicing their role during the process of weaning of patient from MV. Also the most of the human resources and structure was available. In addition to more than two thirds of the equipment was available. **Recommendations:** An orientation programme for staff newly appointed to the ICU should be conducted including education with regard weaning from mechanical ventilator. Extensive and ongoing in-service training programmes for ICU nurses to improve their knowledge and practice regarding weaning of patients from mechanical ventilator.

Keywords: Factors Affecting Weaning, Ventilated Patient

Introduction:

Mechanical ventilation (MV) may be indicated for many reasons. These reasons may include controlling the patient's respirations during surgical procedures or during treatment of severe traumatic brain injury, to oxygenate the blood when the patient's ventilatory efforts are inadequate, and to rest the respiratory muscles. (Khalil, et al., 2018), Also Irajpour (2018) had mentioned that, mechanical ventilation is indicated

when a patient's lungs are incapable of delivering an adequate amount of oxygen to the tissues and/or removing a sufficient amount of carbon dioxide. This condition can be the result of many diseases or injury process as drug overdose, chronic obstructive pulmonary diseases, asthma, pneumonia, neuromuscular diseases, shock and multisystem failure.

Weaning from ventilator refers to independent breathing restoration in an individual dependent on mechanically assisted ventilation, which includes gradually exposing the patient to longer time of partially supported or independent breathing (Elliott & Morrell-Scott, 2017). Weaning patients from the ventilator is complex as the nurse needs to discontinue ventilation while give continuous care, patient-focused, individualized weaning care plans and highlighting the expanding role of the ICU nurse (Lavelle and Dowling, 2018).

Weaning patients from mechanical ventilation is a complex and challenging process. The complex nature of weaning is reflected in the lack of consensus for the definition of weaning in the literature. The search for definition consensus of weaning is hampered as the use of the term weaning is under debate by some researchers, with some using the term 'ventilator discontinuation'. Some consider this to be a more encompassing term because 'weaning' implies a gradual reduction in ventilator support and for most patients, this gradual reduction does not happen (Irajpour, 2018).

Nurses must be having knowledge about the ventilator modes function and limitations, respiratory distress causes and dysynchrony with the ventilator, and suitable management in order to give high-quality patient-centered care. Basic knowledge for ICU nurses is knowledge beyond that required to register as a nurse; it is this knowledge that nurses use to give safe care to critically ill adults and children. Knowledge itself does not ensure safe practice but safe practice is not

possible without knowledge (Shehab et al., 2018).

Significance of the study:

Patients on mechanical ventilation represent 40 % of total patients entering ICU. Cost for a patient in ICU are approximately 4 times greater than costs for a patient who is not and much of the added costs are related to mechanical ventilation (Hadfield et al.,2020).Reintubation and mortality rate may be reduced by proper weaning. Accordingly, weaning from mechanical ventilation is expeditious, safe and highly desirable (Sandoval-Moreno, & Diaz-Henao, 2018)

About 90% of all ICU critically ill patients requiring MV support as a life saving measure. Approximately 30% of patients who require MV are not simply weaned. Positive patient outcomes depends on an understanding of the principles of MV and the patient care needs as well as, weaning plans, and patients tolerance of changes in ventilator setting. Care of the patient on MV is an everyday assignment in the critical care unit. Therefore, it is essential to assess the nurses' performance about safety weaning from MV of critically ill patients at intensive care units (Todorova et al., 2017).

Aim of the study:

- The aim of this study was to assess the factors affecting weaning of mechanically ventilated patients through the following:
- Identify the factors affecting weaning of mechanically ventilated patients.

- Assess nurses' performance regarding weaning factors.

Research questions

The current study answered the following questions:

- What are the factors affecting weaning of mechanically ventilated patients?
- What is the nurses' performance during weaning of the critically ill patient from mechanical ventilation?

Subjects and Methods:

I: Technical design

Research Design:

A descriptive exploratory research design was adopted to fulfill the aim of the study and answer the research questions. It helps the investigator to describe and document aspects of a situation as it naturally occurs. As well, this design helps to establish a database for future research.

Research Settings:

The current study was carried out at medical intensive care unit of Ain Shams University Hospital.

Subjects:

- A convenience sample of 50 nurses were included in the study, representing all those who work in the selected medical intensive care unit (MICU) of Ain Shams University Hospital, and were willing to participate in the current study.

- A convenience sample of all available patients who started weaning from MV at Ain Shams Hospital and were willing (or their families) to participate in the current study. Based on sample size equation 50 patients participated in the study.

Tools of the study:

Tool I: A Structured assessment questionnaire: This tool used to assess patient physical and psychological condition. It was developed by the investigator based on relevant literature. It was written in English language. (McLean & Auttajaroon, 2016).

It consists of three parts as follows:-

Part I: it included demographic data of the patient (age, gender, marital status, place of residence, occupation, education level, smoking habits, patient anthropometric measurements).

Part II: It covered a detailed physical assessment for the patient including eight sections covering the different body systems.

Part III: It concerned with assessment of **psychological needs** for patients on MV to assess level of anxiety and depression.

❖ Scoring system:

The hospital anxiety and depression scale consisted of 14 statements. Each statement was rated on a four point:

Not at all = 0, Sometimes =1, Very often = 2, Most of the time = 3.

The total score of hospital anxiety and depression scale range from 0 to 21.

The patients' scores were collected and ranged as follows:

- 0-7: No depression / Anxiety.
- 8-10: Mild depression / Anxiety.
- 11-14: Moderate depression / Anxiety.
- 15-21: Severe depression / Anxiety.

Tool II: Nurses' self-administered questionnaire: This tool was used to assess nurse's level of knowledge regarding care of mechanically ventilated patients in critical care units; it was developed by the investigator in a simple Arabic language based on recent and relevant literature (**Lavelle & Dowling, 2018**). It consists of two parts as follow:

Part I: It included demographic characteristics of the studied nurses including age, gender, marital status, educational level and years of experience, training courses (6 closed ended questions).

Part II: Nurses' knowledge assessment questionnaire: Nurses' knowledge assessment questionnaire: Tool aimed to assess nurses knowledge related to weaning of patients from MV e.g. definition, causes, complications, indicators of weaning, blood gases interpretation, weaning process, weaning failure and nurse' role. This questionnaire developed by the investigator and written in simple Arabic language based on scientific literatures review and filled by the subjects.

❖ **Scoring system:**

The total score of questions is 47 questions. The right answers were given one mark and wrong answers were given zero mark.

- $\geq 85\%$ = Satisfactory level of the knowledge = ≥ 45 correct answers.
- $< 85\%$ =unsatisfactory level of the knowledge = < 45 correct answers.

Tool III: Nurses' practice observational checklist: This observational checklist was developed by the investigator after reviewing the recent related literatures to assess level of nurses's practice regarding weaning of patients from MV It was adopted for the study from (**Conroy et al., 2013 and Nassar, 2019**). It consists of 50 questions and included the following parts: (Pre-weaning practice (6 items), Monitoring of the patient during weaning from mechanical ventilator (6 items), Obtaining an arterial blood sample from arterial line (5 items), Performs suctioning (17 items), Extubation technique (11 items) and Post extubation care (5 items).

❖ **Scoring system:**

The right answers were given one mark and wrong answers were given zero mark.

- $\geq 85\%$ = Satisfactory level of the practice = ≥ 43 correct actions.
- $< 85\%$ =unsatisfactory level of the practice = < 43 correct actions.

Tool IV: Equipment's and Environment related factors: It included the facilities, equipment's and infection control measures regarding weaning of mechanical ventilated patient it was adopted for the study from **Wang, (2019)**. It was used to assess the structure, application of infection control measures and training programs in intensive care unit and was filled out once. It consists of two parts as follows:

Part (1): The equipment related factors; it included 8 questions about ventilators (types, modes, parameters, tubes and humidifiers).

Part (2): The environmental related factors; it included 21 questions about (human resources and structure, training program, infection control system, sterilization and care of equipment, documentation).

❖ **Scoring system:**

The items that done by the nurses were given one score, while, the items which were not done were given zero score, the total scores for every procedures was calculated and classified into:

- $\geq 85\%$ = Safe environment.
- $< 85\%$ = Unsafe environment.

Content, Face Validity and Reliability:

Validity of the developed tools revised by a panel of five experts from Faculty of Nursing, Ain Shams University (3 lecturers and 2 assistant professors of medical surgical nursing). Exerts reviewed the tools for clarity, relevance, comprehensiveness, simplicity and applicability. Then the tools were examined statistically for their reliability. Alpha Cronbach's test was used to measure the internal consistency. The reliability score was 0.745 for knowledge assessment questionnaire, 0,790 for practice and was 0.837 for equipment and environment.

**II: operational Design:
Preparatory Phase:**

In this phase, the researcher reviewed current and past, local and international related literature to gain in-depth knowledge of the difference

aspects of the study subjects. This was achieved by using textbooks, articles, journals and internet search. This was helpful in the selection and preparation of the data collection tool and in writing up the scientific background of the study.

Ethical Considerations

An approval was obtained through an issued letter from the Dean of Faculty of Nursing, Ain Shams University to the director of the previous mentioned setting. The investigator then met the hospital director and explained the purpose and the methods of the data collection

Pilot Study:

A pilot study was conducted to test feasibility and applicability of the study tools used in this study. It was carried out on 10 % of total subjects (5 nurses). To test the applicability and clarity of the tool and as well as to estimate the time needed to fill the tool. Minor modification was done for the used tool so that the nurses who included in the pilot study were included to the main study group.

Fieldwork:

To carry out the study, an approval was obtained from the hospital and nursing directors of critical care units at Ain Shams University hospitals. The purpose of the study was explained to the studied nurses who agreed to participate in the study prior to data collection.

Data of the current study was collected over a period of four months, from beginning of October 2019 to the end of January 2020. The investigator visited the study setting three days/week (Saturday, Tuesday

and Thursday). The investigator filled the observational checklist in the morning, afternoon and night shifts during actual nurses' work, each nurse was observed using the observational checklist during caring of mechanically ventilated patients when initiating weaning process.

The patients' physical assessment tool was filled by the investigator for each mechanically ventilated patient when initiating weaning process while visiting the study setting it took about 20-30 minutes for each tool. The observational checklist was used prior to administration of the questionnaire to ensure the maximal realistic observations of the nurses' performance and minimize the possibility of bias.

The nurses' practice was assessed by the investigator while they caring of mechanically ventilated patients when initiating weaning process it took about 20-30 minutes for each period. The self-administered questionnaire sheet was filled by the nurses providing the care for mechanically ventilated patients when initiating weaning process; it took 30-45 minutes. The answer recorded by the nurses themselves.

Equipment's and Environment tool was filled by the investigator while visiting the study settings it took about 30-45 minutes for each tool. Each nurse interviewed individually to gather the data of the first and second tool.

Assessing (50) nurses who was caring of mechanically ventilated patients was done at rate 2 to 3 nurses per day, they were assured that, the data collected will be treated

confidentially, and would be used only for the purpose of the research.

Administrative Design:

An approval was obtained through an issued letter from the Dean of Faculty of Nursing, Ain Shams University to the director of the previous mentioned setting. The investigator then met the hospital director and explained the purpose and the methods of the data collection

III: statistical Design:

The data were collected and coded. Then the collected data were organized, analyzed using appropriate statistical significance tests using the Computer Statistical Package for Social Science (SPSS), version 24. Data were presented using descriptive statistics in the form of frequencies and percentages. Chi square test was used to compare the frequencies and the correlation between study variables. Degrees of significance of results were considered as follow: Non-significant (NS) difference at $P > 0.05$. Significant (S) difference at $P < 0.05$. Highly significant (HS) at $p < 0.001$.

Results:

Table (1): shows that: 58% of the studied patients were females as well as the mean age of the studied group was 41.7 ± 5.68 . As regards to marital status 60% were married and 54% had employee occupations. Concerning to educational level: 52 of the studied group had university degree. However, 22% had master or doctorate.

Table (2): reveals that 48% of the studied patients had moderate depression and anxiety while 24% of

them had severe depression and anxiety.

Table (3): reveals that the mean blood pressure of studied patients was 110.51 ± 17.6 as well as the mean Spo2 was 795.2 ± 12.9 . As regards to body mass index 34% was normal and 42 was under weight, In addition to medical diagnosis 90 % of the studied patients had hypertension, 80% DM, 60% ischemic heart disease.as well as 22% had Severe chronic respiratory insufficiency as risk factor for prolonged weaning. Furthermore, 50 % of the studied patients had no previous connection with mechanical ventilation.

Table (4): reveals that, slightly more than half of the studied nurses were within the age group between 20 to less than 30 years; more than half of them were male this may due to more masculine to deal with comatose patients and critical situations to tolerate the nature of the work. This finding is not supported by **Silva & Cruz (2020)** who revealed that, most

Figure (1): clarifies that 70% of the studied nurses had satisfactory level of knowledge regarding the nurse role during weaning from mechanical ventilation.

Figure (2): illustrates that, 72% of the studied nurses had a

satisfactory level of knowledge regarding nurse practice for weaning of patients from mechanical ventilation while 28% of the studied nurses had unsatisfactory level of practice.

Table (5): shows that more than 81% of the environment-related factors were available as well as more than 67% of the equipment-related factors were available.

Table (6): shows that, there were highly statically significant correlation between weaning form mechanical ventilator and patient gender, medical diagnosis, body mass index with (P-value= 0.015, P-value <0.001, P-value=0.003, respectively).

Table (7): shows that, there were highly statically significant correlation between weaning form mechanical ventilator and nurses age, years of experience, total score of knowledge and total score of practice with (P-value= 0.035, P-value <0.001, P-value <0.001, P-value <0.001, respectively).

Table (8): shows that, there was highly statically significant correlations between score of total knowledge and score of total practice of the studied nurses through weaning with (P-value <0.001).

Table (1): Percentage distribution of demographic characteristics of the studied mechanical ventilated patients (N=50).

Items	N	%
Gender:		
Male	21	42
Female	29	58
Age:		
20-<30	4	8
30-<40	9	18
40-<50	21	42
≥50	16	32
$\bar{x} \pm SD$		41.7±5.68
Marital status:		
Single	20	40
Married	30	60
Level of education:		
Read & write	9	18
Secondary level	4	8
University	26	52
Master / Doctorate	11	22
Type of Occupation:		
Employee	27	54
Farmer/ Worker	8	16
House wife	11	22
Retired	4	8
Smoking Habits		
Yes	19	38
No	31	62

Table (2): Frequency and percentage distribution of the studied patients regarding their total hospital anxiety and depression scale under weaning from mechanical ventilator (n=33).

Items	N	%
Hospital Anxiety and Depression Scale		
No depression /Anxiety	4	12
Mild depression /Anxiety	5	16
Moderate depression /Anxiety	16	48
Severe depression /Anxiety	8	24

Table (3): Frequency and percentage distribution of studied patients' clinical data (n=50).

Items	N	%
Patient Anthropometric Measurements		
Vital signs		
T	38.4±5.67	
P	80.3±4.5	
R	16.27 ±3.12	
BP	110.51 ±17.6	
Spo2	95.2 ±12.9	
Body mass Index		
Under Weight (<18.5)	21	42
With Normal (18.5- 24.9)	17	34
Over Weight (25- 29.9)	5	10
Obese (> 30)	7	14
Medical Diagnosis		
Diabetes Mellitus	40	80
Hypertension	45	90
Ischemic Heart Disease	30	60
Hepatic Impairment	15	30
Chronic Obstructive Pulmonary Disease	12	24
Risk factors for prolonged/ failed weaning		
Severe chronic heart failure	10	20
Severe chronic respiratory insufficiency	11	22
Prolonged respiratory muscle weakness	9	18
Depression	7	14
Poor sleep quality	5	10
Severe constipation	2	4

Table (4): Demographic characteristics of the studied nurses (N=50).

Nurses' demographic data sheet	N	%
Gender		
Male	29	58
Female	21	42
Age		
20-<30	28	56
30-<40	18	36
40-<50	3	6
50 or more	1	2
Education Level		
Nursing Diploma	17	34
technical Institute	22	44
Bachelor of Nursing	8	16
Postgraduate	3	6
years of experience by working in ICU		
<1	18	36
<3	14	28
3-5 years	13	26
More than 5	5	10
Have you attended any courses about weaning of the patient from mechanical ventilator?		
Yes	42	84
No	8	16
Did you have a benefit from these training courses?		
Yes	41	82
No	9	18
Do you have a real role in weaning of a patient from mechanical ventilator?		
Yes	40	80
No	10	20

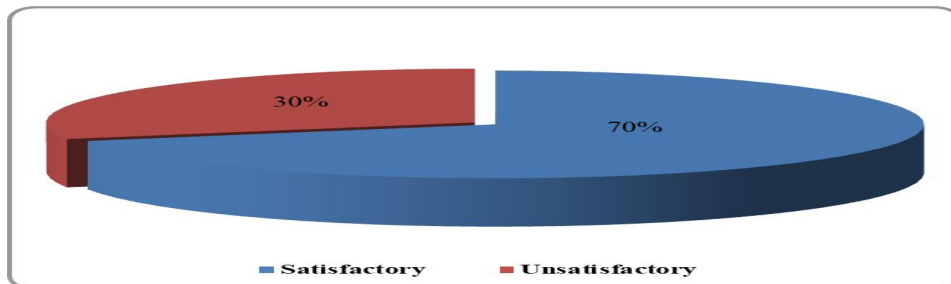


Figure (1): Frequency and percentage distribution of the total nurses' knowledge regarding weaning from mechanical ventilation (n=50).

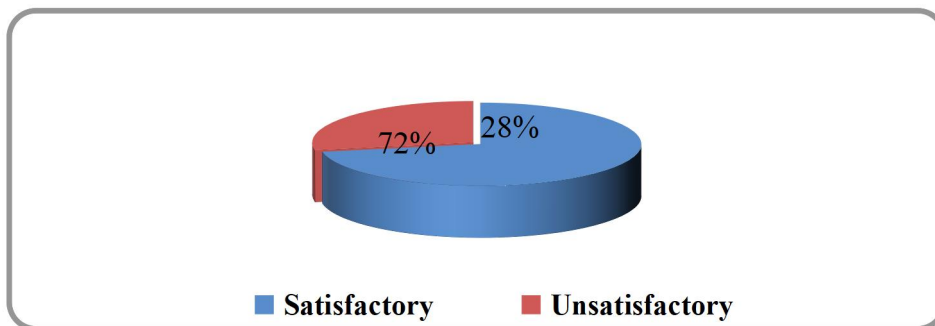


Figure (2): Frequency and Percentage distribution of the total nurses' practice for weaning of patients from mechanical ventilation (n=50)

Table (5): Frequency and percentage distribution of the total environmental and equipment-related factors regarding weaning from mechanical ventilation.

Items	Present		Not present	
	N	%	N	%
Total environmental-related factors	17	81	4	19
Total equipment-related factors	10	67	5	33

Table (6): Correlation between weaning from mechanical ventilation and patient- related factors.

Variable	Weaning from mechanical ventilator	
	r	P-value
Gender	0.169	0.015**
Medical diagnosis	0.394	<0.001**
Body mass index	0.234	0.003**

Table (7):Correlation between weaning from mechanical ventilation and nurse- related factors.

Variable	Weaning from mechanical ventilator	
	r	P-value
Age (years)	0.198	0.035*
Years of experience	0.384	<0.001**
Total score of knowledge	0.517	<0.001**
Total score of practice	0.587	<0.001**

Table (8): Correlation between total nurses’ knowledge and total nurses’ practices regarding studied mechanical ventilated patients through weaning (n=50).

	Total knowledge	
	r	P-value
Total practice	0.755	<0.001*

Discussion:

The weaning of mechanical ventilation is a complex process and depends on many factors. Its failure may cause a negative impact to the patient, the family and the hospital for prolonging the duration of mechanical ventilation that could lead to increase the risk of ventilator associated pneumonia, morbidity, mortality, expand hospital cost and lessen the quality of hospital services. Factors investigated in this study included patient related factors, nurses related factors, psychological related factors, metabolic and endocrine related factors, equipment and environment related factors (Saiphoklang & Auttajaroon, 2018).

Part I. Demographic characteristics of the studied patients and their medical data:

The present study revealed that, the mean age of the patients included in the current study were (41.7±5.68) it found that slightly less than half of the studied patients were within the age group between 40 to less than 50 years; more than half of them were female .This result is related to their characteristics and not

affected by any other cause. These results agree with a study done by Wang, (2019) who studied “Factors affecting performance of critical care nurses regarding weaning patients from MV”. Who revealed that more than half of the study sample (55%) was female and (45%) of the sample aged between 40 to less than 50 years old; while these results contradicted with a study done by Saiphoklang, & Auttajaroon (2018) who studied “Determination of the critical care nurses knowledge toward weaning patients from MV” in AL-Hilla teaching hospitals. who discovered that the majority of studied patients were male and their age range from 35-65 years old. Regarding the place of residence, present study revealed that more than half of the studied patients were from urban area .This result comes inconsistent with Emaliyawati et al (2019). who studied "Socio-demographic characteristics of the patients undergoing mechanical ventilation- and reported that more than half of the studied sample lives in rural area. Also, this result disagrees with Hadfield et al., (2020) who stated that slightly less than two third of the studied sample live in rural area.

Part II. Physical and psychological assessment of the studied patients:

Regarding distribution of the studied patients to their respiratory system assessment, the finding of this study revealed that, more than two thirds of the studied patients had invasive ventilation with endotracheal tube and trachea in mid line this result may be due to patients' medical condition and disease process as respiratory problems are the leading causes for compromising the normal ventilation process of the human body and hence they are the most common diagnoses among the mechanically ventilated patients. This finding is in agreement with **Rello et al., (2018)** who conducted a study on "Earlier and enhanced rehabilitation of mechanically ventilated patients in critical care" and revealed that 75% of the studied had invasive ventilation with endotracheal tube and trachea in mid line.

Regarding the distribution of the studied patients regarding their psychological status, the finding of this study revealed that, near to half of the studied patients had moderate depression and anxiety while more than one third of them had severe depression and anxiety. This may be due to stress and major life changes which prevent the patients from doing many of the things they used to do. The current finding was contradicted with **Venkatram, et al., (2020)** who reported the majority of the studied patients had moderate depression or anxiety. From the investigators' point of view psychological factors may have an influence on their attitude which causes illness. As their beliefs about MV have a decisive role in their health behavior. Cognitions and beliefs of patients have a significant impact on their progression of the

disease experience, including understanding the signs, looking for causes, and changes in individual behavior. Beliefs of the patient play a crucial role in effective treatment, psychological adjustment and adherence to treatment recommendations.

Part III. Nurses' demographic characteristics:

Regarding the demographic characteristics of the nurses in the present study revealed that, slightly more than half of the studied nurses were within the age group between 20 to less than 30 years; more than half of them were male this may due to more masculine to deal with comatose patients and critical situations to tolerate the nature of the work. This finding is not supported by **Silva & Cruz (2020)** who revealed that, most participants were female, aged between 28 and 35years.

Part IV. Nurses' related factors:

The results of the present study showed that, slightly less than three quarters of the studied nurses had satisfactory total knowledge regarding to their patient total knowledge regarding weaning from ventilation. These results are not in agreement with **Patroniti et al. (2017)** who reported that, one quarter of the studied sample was poor, thirty percent was fair, and slightly less than half was good knowledge of participants regarding MV. Also, **Worrall et al. (2020)** mentioned that, the overall analysis is that professional nurses lack knowledge regarding a general overview of weaning from MV, as more than three quarters of the studied sample scores were below fifty percent.

Regarding the results related to nurses' practices before starting weaning process, it was found that more than half of the studied nurses observe patient closely before weaning or monitor pulse, respiratory characteristics. This result agree with **Hadfield et al., (2020)** who reported that, concerning ventilator weaning, slightly less than half of the studied sample reported that they always check the patient's hemodynamic status in this process. From the investigator's point of view this finding may be due to that they consider this phase a critical one and assessment is necessary.

From **the investigator** point of view, the ICU nurse prefers to give priority to caring for a patient in an acute, critical state who requires immediate, advanced actions and extensive medical technical equipment. This deemed to require a competent and experienced nurse. Caring for patients weaned from the ventilator can appear less interesting and stimulating, as their critical state has stabilized.

Part V. Environmental-related factors:

Regarding the distribution of environmental tool in the current study it showed that, all items of the human resources and structure was present in spite of nurse to patient didn't 1:1. The result of present study disagrees with **Patroniti et al. (2017)** who stated that all items of the human resources and structure was present. From the investigators' point of view the implementation of proper intervention to reach to quality of care needed at the unit structure and safe environment. The work environment should be safe to allow health providers to perform tasks according to the standard.

Part VI. Equipment-related factors:

Regarding the distribution of equipment tool the present study revealed that all items of the equipment were available except humidifier this may be due to absence of standard about how to use or care of humidifier and this impact negatively on weaning process. This finding agrees with **Hadfield et al., (2020)** who stated that, all items of the equipment were available and that help the patient to be weaned from the MV.

Part VII. Relations and correlation:

The results of the current study stated that there were a statistically significant correlation between weaning from MV and these patients' related variables (gender, medical diagnosis and BMI). This result is in accordance with **Saiphoklang, & Auttajaroon (2018)** who found that, there is a relation between weaning from MV and the patients' gender or BMI.

The results of the current study stated that there were a statistically significant correlation between weaning from MV and these nurses' related variables (age, years of experience, total score of knowledge and total score of practice). That is enforcing the truth that high educated staff nurses improving the overall patients' outcomes. This result is in accordance with **Saiphoklang, & Auttajaroon (2018)** who mentioned that was there a statistically significant relationship between total nurses' knowledge and practice and weaning from MV.

The results of the present study showed that, there is a positive correlation between total knowledge of the studied nurses and their total practices where the nurses who have

satisfactory total knowledge had satisfactory level in their total practice while the nurses who have unsatisfactory total knowledge are had unsatisfactory level in their total practice. This means that the level of nurses' practice affected by the nurses' knowledge. This result is in congruence with **Silva & Cruz (2020)** who mentioned that, there was a positive correlation between knowledge and practice of the study nurses. Surgical nurses feel empowered at their work when they have higher education and have completed the continuing education courses.

Conclusion:

Based on the findings of the current study, the current study concluded that, there are many factors affecting weaning of patients from MV portrayed under Patient related factors including patients' age, level of education, type of occupation, medical diagnosis, BMI, smoking habits and patient's physical and psychological status. Also, the factors including nurses- related factors as age, nurse level of education, years of experience, attendance of training courses, their level of total knowledge and practice. As well also there are environment and equipment – related factors, more than two third of the studied nurses had satisfactory level of knowledge during the process of weaning of patient from MV. Also more than two third of the studied nurses had satisfactory level of practice regarding weaning of patient from MV.

Recommendations:

Based on the findings of the present study, the following recommendations are suggested:

Recommendations related to patients

- a) Establish simplified and illustrated educational booklet for the conscious patient connected with mv about basic information regarding weaning from MV

Recommendations related to nurses

- b) An orientation programme for newly staff appointed to the ICU should be conducted including education with regard weaning from mechanical ventilator.
- c) Extensive and ongoing in-service training programmes for ICU nurses to improve their knowledge and practice regarding weaning of patients from mechanical ventilator.
- d) Provide the guidelines suggested in this study, for nurses caring for patients on mechanical ventilator and updating it periodically to promote quality of care.
- e) Replication of the study on larger probability sample and different geographical areas to generalize the results.
- f) Further study is recommended to assess the other factors associated with successful weaning from MV.

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