

Knowledge of intensive care nurses about mechanical ventilation: a cross-sectional analysis in a Brazilian public hospital

Conhecimento de enfermeiras(os) intensivistas sobre ventilação mecânica: análise transversal em hospital público brasileiro

Camilla de Souza Menezes¹ 
Helder Brito Duarte² 
Waleska Náyra da Silva Reis³ 

Rafael Lima Rodrigues de Carvalho⁴ 
Paloma de Castro Brandão⁵ 
Alyne Henri Motta Coifman⁶ 
Mariana de Almeida Moraes⁷ 

¹Corresponding contact. Hospital Universitário Professor Edgard Santos (Salvador). Bahia, Brazil. millaa_menezes@hotmail.com

^{2,4-7}Universidade Federal da Bahia (Salvador). Bahia, Brazil.

³Hospital Universitário Professor Edgard Santos (Salvador). Bahia, Brazil.

ABSTRACT | OBJECTIVE: To assess the knowledge of intensive care nurses regarding mechanical ventilation (MV). **METHOD:** This was a cross-sectional study involving bedside nurses working in intensive care units of a public hospital in Bahia, Brazil. A validated questionnaire with eleven questions about MV was used, addressing autonomy in MV management, ventilatory monitoring, equipment setup, care related to ventilator-associated pneumonia, and basic ventilatory modes. **RESULTS:** Eighty nurses participated in the study, most of whom were female (75%), with a median age of 39 years (interquartile range [IQR] 32–44) and a median of 9 (5–11) years since graduation. Among them, 43 (53.8%) reported having an average level of knowledge on the topic. Regarding MV knowledge, most participants (20%; $n = 16$) answered only two questions correctly. The question with the highest number of correct answers concerned basic ventilatory modes (65%; $n = 52$), while the one with the fewest correct answers addressed the MV triggering mechanism (12.5%; $n = 10$). Notably, 70% of participants answered incorrectly regarding MV autonomy, stating it to be the exclusive responsibility of physicians or physiotherapists. **CONCLUSION:** There are significant gaps in the knowledge of intensive care nurses about MV, regardless of ICU experience, time since graduation, self-reported knowledge, or frequency of training.

KEYWORDS: Artificial Respiration. Surveys and Questionnaires. Nursing Education. Continuing Education. Health Knowledge. Attitudes. Practice.

RESUMO | OBJETIVO: Avaliar o conhecimento de enfermeiras(os) intensivistas sobre ventilação mecânica (VM). **MÉTODO:** Estudo transversal, com enfermeiras(os) assistenciais de unidades de terapia intensiva de um hospital público da Bahia. Para a avaliação, foi utilizado um questionário validado, com onze questões sobre VM, abordando a autonomia em VM, monitorização ventilatória, montagem, cuidados com pneumonia associada à VM e modos ventilatórios básicos. **RESULTADOS:** Oitenta enfermeiras(os) participaram da pesquisa, na sua maioria (75%) do sexo feminino, idade mediana de 39 (intervalo interquartil [IIQ] 32-44) anos, mediana de 9 (5-11) anos de formação, sendo que 43 (53,8%) afirmaram possuir conhecimento regular sobre o tema. Em relação ao conhecimento sobre VM, a maioria dos participantes (20%; $n = 16$) acertou apenas duas questões. A questão com maior proporção de acertos abordou os modos ventilatórios básicos (65%; $n = 52$), enquanto a que apresentou maior número de erros foi relacionada ao mecanismo de disparo da VM (87,5%; $n = 70$). Chama a atenção que 70% erraram a questão sobre a autonomia da VM, referindo-a como de propriedade médica ou fisioterapêutica. **CONCLUSÃO:** Há fragilidade no conhecimento de enfermeiras(os) intensivistas acerca da VM, independentemente do tempo de atuação em UTI, do tempo de graduação, do autorrelato de conhecimento e da frequência de treinamento.

PALAVRAS-CHAVE: Respiração Artificial. Inquéritos e Questionários. Educação em Enfermagem. Educação Continuada. Conhecimentos. Atitudes e Prática em Saúde.

1. Introduction

Among the equipment used in the intensive care unit (ICU), mechanical ventilation (MV) is considered one of the most important for life support. Thus, for the critical patient, this tool allows for the reestablishment of gas exchange, reduction of ventilatory work, and assistance in protecting the airways^{1,2}.

Due to these basic organic maintenance functions, MV is required daily in ICUs, where, according to the Society of Critical Care Medicine, 20 to 40% of admissions in the United States use this support, with respiratory failure as the main cause of hospitalization³.

Despite its clinical relevance, the prolonged use of MV can result in complications arising from positive pressure — a non-physiological mechanism of breathing — favoring ventilation-induced lung injury, hemodynamic changes, and infections, such as ventilator-associated pneumonia (VAP). These risks reinforce the importance of adequate management and continuous vigilance by the involved professionals, whose performance directly impacts the safety and autonomy of the ventilated patient¹⁻⁵.

Furthermore, the application of MV transcends the intensive care environment, being also present in various care contexts, such as emergency units, urgent care centers, and home care, where the nurse frequently assumes a leading role in the management and handling of ventilatory support⁶.

In many Brazilian contexts, such as in small hospitals without a 24-hour physiotherapist available or in urgent care units, the nurse is the primary responsible for the initial management and maintenance of ventilatory support, which reinforces the need for technical mastery and safe decision-making⁷.

Therefore, the conduct of MV must be based on updated evidence and carried out in a multidisciplinary manner, especially by the nurse, who, according to Brazilian resolution number 639/2020 of the Conselho Federal de Enfermagem — COFEN (Federal Nursing Council)⁸, has the competence to assist

patients under MV, from the assembly, testing, and installation of this equipment, monitoring, alarm checking, initial adjustments, and management of ventilatory parameters⁶.

However, the current situation observed in ICUs is one where nurses are minimally involved in the actions described, leading to distance and disownership of this therapy⁸. This may be associated with work accumulation and overload, the precariousness of professional staffing within the nursing team, and the managerial functions of the service, which may translate into the nurse's removal from direct patient care and weaknesses in theoretical knowledge^{8,9}.

In this case, due to the complexity involved in assisting the mechanically ventilated patient, it is essential to evaluate the level of knowledge of nurses using scientifically validated instruments. This assessment can help identify formative gaps and plan more effective and targeted educational interventions.

Therefore, based on the hypothesis that the understanding of MV among intensive care nurses varies across different care contexts, the objective of this research is to assess the knowledge of intensive care nurses regarding mechanical ventilation, contributing to the improvement of professional practices and the safety of these patients.

2. Methods

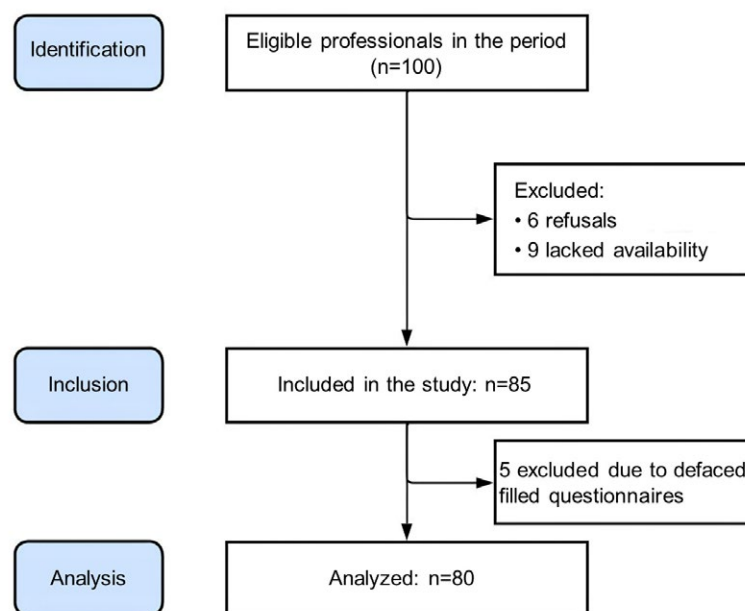
This was a descriptive, cross-sectional study with a quantitative approach, conducted at the Hospital Geral Roberto Santos, located in Salvador, Brazil. The sample was recruited between October and November 2022, when all nurses in the ICU were invited to participate. The development of the present study followed the premises of STROBE (Strengthening the Reporting of Observational studies in Epidemiology)¹⁰. The entire research was conducted in compliance with the principles established in the Universal Declaration of Human Rights and was initiated after approval by the Research Ethics Committee of Hospital Roberto Santos, under CAEE number 61022822.9.0000.5028.

The following inclusion criteria for sample selection were being a clinical nurse allocated to one of the respective hospital's ICUs, being on the staff roster during data collection, and agreeing to participate in the study by signing the informed consent form. The exclusion criteria were refusal to participate, having been reassigned to another unit considered non-intensive, performing an administrative or coordination function during the data collection period, medical leave or license, and incorrectly or inadequately filling out the questionnaire (marking multiple statements).

The decision was made not to perform a sample size calculation at first, as the study included the entire population of 100 nurses working at the study locus. Considering possible refusals and losses, an acceptability rate of up to 20% was previously estimated, resulting in the final participation of 80 professionals. Additionally, a statistical power calculation was subsequently performed for the sex variable, which identified a low power of 48.6%, with the ideal being above 80%.

All 100 eligible nurses were invited to participate. Of these, 15 refused to participate, claiming lack of availability, and five were excluded from the analysis for marking or filling out the questionnaire improperly, making the analysis of the results unfeasible. Thus, the final sample consisted of 80 nurses. The sample selection data are available in figure 1.

Figure 1. Sample selection flowchart. Demonstrates the sample selection, based on the total population of 100 nurses, in which 15 questionnaires were excluded according to the criteria and, subsequently, 5 were removed due to erasures in the completion, resulting in a total of 80 questionnaires analyzed



Source: authors (2022).

As a knowledge assessment instrument, a questionnaire validated by expert judges was used, and later published in full by Menezes et al.¹¹. This instrument includes questions for sample characterization (type of ICU where they work, sex, age, time since graduation, time working in the ICU, type of specialization, self-reported knowledge on the topic, and frequency of training) and 11 multiple-choice questions with a single correct answer that address daily themes in the direct care of critically ill patients under MV, such as autonomy over parameter usage, assembly of the artificial ventilator, alarm monitoring, care to prevent VAP, basic ventilatory modes, and protective ventilation.

This questionnaire was chosen because it was validated according to the method of content validation by specialist judges, being considered suitable for assessing the knowledge of nurses working in intensive care regarding MV, and because it has an average completion time of 10 to 15 minutes, which makes its application feasible in the professionals' workplace without significantly interrupting their routines¹¹.

The present questionnaire was administered in print, during the work shift, preferably in a place without interruptions and in the presence of a member of the research team. There was no interference from the research team during the participant's completion of the questionnaire. This measure was important to avoid the risk of embarrassment or coaching.

Regarding statistical analysis, the distribution of continuous variables was validated using the Shapiro-Wilk test and the evaluation of the

histogram plot¹², which identified a non-parametric pattern. Therefore, the median (ME) was used as the measure of central tendency and the interquartile range (IQR, 25th-75th) as the measure of dispersion. Qualitative, nominal, and ordinal variables were presented as absolute frequency (*n*) and relative frequency (%). Comparative analyses were performed using the Mann-Whitney tests (for two medians) or Kruskal-Wallis tests (for three or more medians). For the correlation analysis, Spearman's non-parametric test was used.

All data were stored in Microsoft Excel software and processed using the Statistical Package for the Social Sciences (SPSS) software, version 26. In addition, the post-hoc statistical power analysis was performed in R Studio software (version 2025.05.1) using the "*pwr*" package. A *p*-value < 0.05 was considered statistically significant.

3. Results

The 80 participants had a median age of 39 (32–44) years, with 60 (75%) being female, a median of 9 (5–11) years since graduation, and 3.5 (2–7) years of experience working in the ICU. Furthermore, 55 (68.8%) had completed a lato sensu specialization in ICU and 43 (53.8%) reported having regular knowledge about the topic, although the majority reported that the institution never (40%, 32) or rarely (35%, 28) provided training on the subject. Regarding the characteristics of the work setting, 29 (36.2%) worked in a General ICU, followed by 25 (31.2%) who worked in a Cardiology ICU (Table 1).

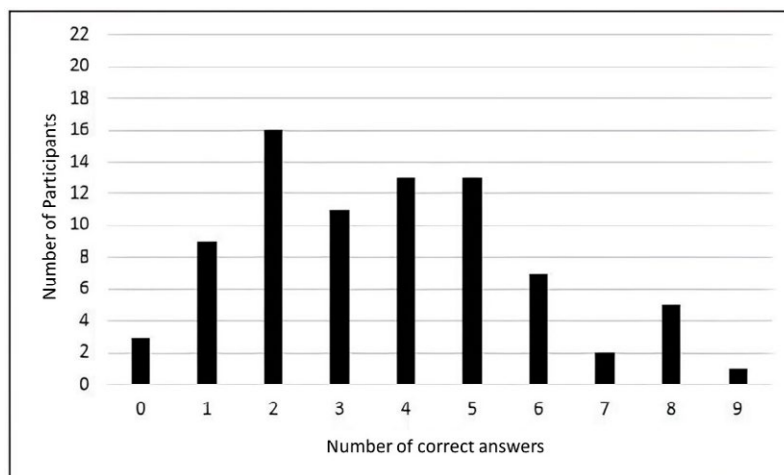
Table 1. Sample characterization of intensive care nurses participating in the study. Salvador, Bahia, Brazil, *N* = 80, 2022

Sample Characterization	<i>n</i> = 80
Age, ME (IQR)	39 (32-44)
Female, <i>n</i> (%)	60 (75)
Years since graduation, ME (IQR)	9 (5-11)
Years of experience working in the ICU, ME (IQR)	3.5 (2-7)
ICU Type, <i>n</i> (%)	
General	29 (36.2)
Cardiology	25 (31.2)
Neurology	13 (16.3)
Surgery	13 (16.3)
Level of instruction, <i>n</i> (%)	
Undergraduate Degree	9 (11.3)
Residency	6 (7.5)
Post-graduation in ICU	55 (68.8)
Post-graduation in Emergency	4 (5)
Post-graduation in another field	6 (7.5)
Self-reported Knowledge about MV, <i>n</i> (%)	
Insufficient	11 (13.8)
Regular	43 (53.8)
Good	25 (31.3)
Excellent	1 (1.3)
Frequency of Training, <i>n</i> (%)	
Never	32 (40)
Rarely	28 (35)
Sometimes	14 (17.5)
Many times	1 (1.3)
Aways	5 (6.3)

Source: authors (2022).

Subtitle: *n*: absolute frequency; %: relative frequency; ME: Median; IQR: Interquartile Range; ICU: Intensive Care Unit; MV: Mechanical Ventilation.

Regarding the knowledge of the nurses concerning MV, it was observed that 20% (16) answered only two questions correctly, and 16.2% (13) answered four and five questions correctly. Another important fact to note is that there were 3 professionals with zero correct answers and only 1 with 9 correct answers (Figure 2).

Figure 2. Bar graph showing the number of correct answers per research participant

Source: authors (2022).

Regarding the specific topics addressed in the questions, table 2 demonstrates that the highest number of correct answers was for question 11, which is related to VAP, with a total of 54 (67.5%) participants; followed by question 3, which deals with the adjustable parameters in ventilatory modes, with 52 (65%) correct answers. For all other questions, more than 60% errors were observed; the question with the lowest number of correct answers was question 9, which referred to the type of cycling in the pressure-controlled ventilation mode, which only 10 (12.5%) participants answered correctly.

Table 2. Number and percentage of correct answers by intensive care nurses on mechanical ventilation questions. Salvador, Bahia, Brazil. *N* = 80, 2022

Question	Topic	Number of Correct Answers	Percentage
Question 1	MV Assembly	24	30.0%
Question 2	Autonomy over MV parameters	24	30.0%
Question 3	Adjustments of basic ventilatory modes	52	65.0%
Question 4	High airway pressure alarms	28	35.0%
Question 5	Low airway pressure alarms	24	30.0%
Question 6	Low expiratory minute volume alarms	28	35.0%
Question 7	Apnea alarms	16	20.0%
Question 8	Triggering in PSV mode	21	26.3%
Question 9	Triggering in PCV mode	10	12.5%
Question 10	Protective Mechanical Ventilation	15	18.7%
Question 11	VAP	54	67.5%

Source: authors (2022).

Subtitle: MV: Mechanical Ventilator; %: relative frequency; PSV: Pressure Support Ventilation; PCV: Pressure Control Ventilation; VAP: Ventilator-Associated Pneumonia.

A correlation was performed between the number of correct answers and sociodemographic variables such as age ($r = -0.161$, $p = 0.15$), years since nursing graduation ($r = -0.034$, $p = 0.76$), years of experience working in the ICU ($r = 0.031$, $p = 0.78$), self-reported knowledge ($r = 0.031$, $p = 0.78$), and the frequency of training ($r = -0.054$, $p = 0.63$) offered by the institution where the participant works. However, none of these variables showed a statistically significant correlation with the number of correct answers.

In addition to these analyses, a comparison of the number of correct answers was performed among the variables sex, age grouped with a cutoff point at 40 years, type of ICU, and presence/type of post-graduation. However, only the variable sex showed a statistically significant difference ($p = 0.03$), indicating a higher number of correct answers for male participants (median of 5.0 [2.2–6.0]) compared to female participants (median of 3.0), as shown in table 3.

Table 3. Comparison of the median number of correct answers by intensive care nurses on mechanical ventilation, according to sociodemographic and work-setting variables. Salvador, Bahia, Brazil, *N* = 80, 2022

Variable	Sample	ME (IQR)	<i>p</i> -value
Sex			
Male	20	5.0 (2.2–6.0)	0.03*
Female	60	3.0 (2.0–5.0)	
Age			
Under 40 years	47	4.0 (2.0–5.0)	0.32*
40 years and older	33	3.0 (2.0–5.0)	
Type of ICU			
General	29	4.0 (2.0–6.0)	0.56†
Cardiology	25	3.0 (2.0–5.0)	
Neurology	13	4.0 (2.0–7.0)	
Surgery	13	3.0 (1.5–4.5)	
Post-graduation			
None	9	4.0 (3.0–5.5)	0.49†
Residency	6	4.5 (3.5–5.2)	
Post-graduation in ICU	55	3.0 (2.0–5.0)	
Post-graduation in Emergency	4	3.5 (1.2–5.0)	
Post-graduation in other fields	6	4.0 (3.5–6.2)	
Self-reported knowledge about MV			
Insufficient	12	3.0 (2.0–4.0)	0.24‡
Regular	60	4.0 (2.0–5.0)	
Good	35	3.0 (2.0–5.0)	

Source: authors (2022).

Subtitle: ME: Median; IQR: Interquartile Range; ICU: Intensive Care Unit; MV: Mechanical Ventilation;

*: Mann-Whitney Test; †: Kruskal-Wallis Test; ‡: Self-reported knowledge "Excellent" was not computed due to only one participant choosing it.

4. Discussion

Based on the results of this study, it can be stated that there are weaknesses in the knowledge of MV among nurses, as the majority answered only two out of the eleven questions of the validated instrument correctly. During the comparative analysis, the only variable that showed a statistically significant difference was sex, where men obtained a higher number of correct answers than women.

Regarding the low knowledge of nurses about MV, several other national^[8,9,13] and international studies, conducted in countries such as Turkey^[14], the United States^[15], and Sri Lanka^[16], including those with different realities in the scope of nursing care, obtained similar results, indicating a problem not only local but international.

However, even though this is a global issue, one of the national failures may be linked to the lack of dedicated coursework, specifically a dedicated ICU discipline, during undergraduate studies. In this regard, according to data raised by the study by Gomes and Galindo Neto^[17], this discipline was present in 62.7% of the 1090 curricula matrices available for analysis. Thus, it is possible to assume that institutions that do not include the ICU discipline may fractionate learning about critical patient care, and often, artificial respiration may be secondary or nonexistent in these undergraduate programs.

Due to the gaps presented by undergraduate education concerning the ICU discipline, the professional tends to seek further education through lato sensu post-graduation programs. However, according to Gerônimo et al.^[18], of the 501 post-graduation programs in ICU analyzed, only 13.7% include MV as part of their curriculum.

Educational curricula need to be rethought and the topic of MV included. Once the nurse has adequate training, they will have greater confidence in positioning themselves during strategy definition and in participating in care, especially in urgent care units, home care, and ICUs where physiotherapists are present only 18 hours a day^{6,7}.

Another important data point to consider is the frequency of institutional training. In the present study, 75% of the participants reported that they never or rarely received training. Furthermore, according to Viana et al.¹⁹, more than one-third of intensive care nurses feel the lack of a permanent education program in the institution where they work.

This type of importance attributed to MV by educational institutions and by the service itself mitigates the perception and knowledge of the nurses. According to this study, the majority considered their knowledge "regular," corroborating data from the study by Santos et al.⁹. Therefore, educational measures at the foundational level and/or during practice are necessary to improve their competence. In this case, the most effective solution to the problems presented is, in fact, the creation of a permanent education program based on solid institutional protocols. This type of action equalizes both theoretical and technical knowledge and improves safety in direct care for the critically ill patient²⁰.

Another finding that drew attention in this study was the statistically higher number of correct answers among male participants. However, the low statistical power obtained in the post-hoc analysis (49%) and the unbalanced number of female participants (75%) suggest that this finding should be interpreted with caution, as it may be subject to selection bias and limitations in generalizability.

Another important factor identified by the present study was that 24 (30%) participants incorrectly answered question 2, which deals with autonomy in defining MV parameters, stating that these should be performed by physiotherapists and/or physicians. This type of response was also observed in the studies by Bucci et al.⁸ and Rodrigues et al.¹³, which point to a need for reflection on the nurse's investment of working hours in bureaucratic and

managerial activities, which may lead to detachment and difficulty in building clinical knowledge.

The lack of correlation between the knowledge of the evaluated nurses (using the validated instrument) and variables such as self-reported knowledge, years since nursing graduation, and years of experience working in the ICU, demonstrates that permanent in-service education is necessary, regardless of the time since graduation and the experience of these professionals. Thus, given the analysis of the low percentage of correct answers and the report by 75% of the participants that they never or rarely received training, the implementation of permanent, in-person, and periodic educational activities for nurses is also suggested, with the results found serving as a focus for discussion and further study.

The present study has some limitations: (1) the configuration of the cross-sectional method, which does not allow for the monitoring of the team's knowledge, providing only a single temporal snapshot; (2) the participants' concentration and reasoning may have been impaired since the questionnaire was administered at their workplace, where the demands of care sometimes took precedence, especially due to the nurses' exclusive dependence on resolving important, and even trivial, issues.

5. Conclusion

The results of this study demonstrate a fragility in the knowledge of intensive care nurses regarding MV, regardless of age, time working in the ICU, time since graduation, self-reported knowledge, and training frequency. Specifically, the topics that most highlighted this issue were those concerning basic ventilatory modes and protective MV.

Furthermore, the number of errors (70%) on question 2, which addresses autonomy in MV, sheds light on the lack of perception by most nurses regarding their importance in this management. Therefore, it is essential to reflect on the curricula of specialized training and the importance of permanent education actions focused on nursing care, especially for patients on artificial respiration.

In addition, the findings reinforce the need for innovative and continuous pedagogical strategies that integrate theory and practice, promoting greater safety, critical decision-making, and quality in intensive care. Future studies may explore educational interventions aimed at specific training in mechanical ventilation, evaluating their effects on clinical outcomes and patient safety.

Acknowledgments

The authors thank all the professionals who participated in this research, contributing significantly to the improvement of practices and knowledge about mechanical ventilation in nursing. Gratitude is also extended to the special people who inspire and support every step of this journey: Silvia, Lucca, and Luisa Menezes.

Authors' contributions

The authors declared substantial contributions to the work in terms of the conception or design of the research; the acquisition, analysis, or interpretation of data for the work; and the drafting or critical revision of relevant intellectual content. All authors approved the final version to be published and agreed to assume public responsibility for all aspects of the study.

Competing of interests

No financial, legal, or political conflicts of interest involving third parties (government, private companies, and foundations, etc.) were declared for any aspect of the submitted work (including, but not limited to, grants and funding, advisory board participation, study design, manuscript preparation, statistical analysis, etc.).

Indexers

The Journal of Contemporary Nursing is indexed by [DOAJ](#) and [EBSCO](#).



References

1. Hickey SM, Sankari A, Giwa AO. Mechanical Ventilation. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024. Cited: PMID: [30969564](#)

2. Ferreira JC, Vianna AOA, Pinheiro BV, Maia IS, Baldisserotto SV, Isola AM, et al. Joint statement on evidence-based practices in mechanical ventilation: suggestions from two Brazilian medical societies. *Critical Care Science*. 2025;37:e20250242en. <https://doi.org/10.62675/2965-2774.20250242-en>

3. Society of Critical Care Medicine. *Critical Care Statistics*. [Internet]. 2024. Available from: <https://sccm.org/communications/critical-care-statistics>

4. Su L, Pan P, Liu D, Long Y. Mean airway pressure has the potential to become the core pressure indicator of mechanical ventilation: Raising to the front from behind the clinical scenes. *J Intensive Med*. 2021;1(2):96–8. <https://doi.org/10.1016/j.jointm.2021.04.002>

5. Kohbodi G, Rajasurya V, Noor A. Ventilator-Associated Pneumonia. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024. Cited: PMID: [29939533](#)

6. Resolução COFEN nº 639, de 06 de maio de 2020 (Brazil). Dispõe sobre as competências do Enfermeiro no cuidado aos pacientes em ventilação mecânica no ambiente extra e intra-hospitalar. [Internet]. Diário Oficial da União. 2020. Available from: <https://www.cofen.gov.br/resolucao-cofen-no-639-2020/>

7. Resolução RDC nº 7, de 24 de fevereiro de 2010 (Brazil). Dispõe sobre os requisitos mínimos para funcionamento de Unidades de Terapia Intensiva e dá outras providências. [Internet]. Diário Oficial da União. 2010. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2010/res0007_24_02_2010.html

8. Bucci AF, Misko MD, Duran ECM, Boaventura AP. Conhecimento do enfermeiro de unidade de terapia intensiva sobre ventilação mecânica: estudo exploratório-descritivo. *Revista Recien*. 2021;11(35):287–96. <https://doi.org/10.24276/rrecien2021.11.35.287-296>

9. Santos TR, Carvalho JFO, Pereira MWM, Queiroz SS, Marques FS, Deus JC. Atuação do enfermeiro frente ao paciente submetido à ventilação mecânica na emergência. *Nursing* [Internet]. 2022:7340–51. Available from: <https://www.revistanursing.com.br/index.php/revistanursing/article/view/2320>

10. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for reporting observational studies. *J Clin Epidemiol*. 2007;61(4):867–72. <https://doi.org/10.1016/j.jclinepi.2007.11.008>

11. Menezes CS, Duarte HB, Nascimento MVA, Santana Júnior FA, Borges DVP, Brandão PC, et al. Validação de conteúdo por juízes sobre o conhecimento de enfermeiras(os) sobre ventilação mecânica. *Rev Enf Contemp*. 2024;13:e5710. <https://doi.org/10.17267/2317-3378rec.2024.e5710>

12. Demir S. Comparison of Normality Tests in Terms of Sample Sizes under Different Skewness and Kurtosis Coefficients. *IJATE*. 2022;9(2):397–409. <https://doi.org/10.21449/ijate.1101295>
13. Rodrigues YCSJ, Studart RMB, Andrade ÍRC, Citó MCO, Melo EM, Barbosa IV. Mechanic ventilation: evidence for nursing care. *Esc. Anna Nery*. 2012;16(4):789–95. <https://doi.org/10.1590/S1414-81452012000400021>
14. Saritas S, Kaya A, Dolanbay N. Knowledge and practices of intensive care nurses on mechanical ventilation. *IJCS* [Internet]. 2019;12(1):30–9. Available from: <https://www.proquest.com/openview/29d26545b206fae4fea5d13fe869106d/1?pq-origsite=gscholar&cbl=1606338>
15. Ramirez-Damilig J. Knowledge, Perceptions, and Attitudes of Critical Care Nurses Towards the Comprehensive Unit-Based Safety Program for Mechanically Ventilated Patients in Preventing Ventilator-Associated Events [dissertation] [Internet]. Arizona: The University of Arizona; 2017. Available from: https://repository.arizona.edu/bitstream/handle/10150/626315/azu_etd_15911_sip1_m.pdf?sequence=1&isAllowed=y
16. Colombage TD, Goonewardena CS. Knowledge and practices of nurses caring for patients with endotracheal tube admitted to intensive care units in National Hospital of Sri Lanka. *Sri Lankan J Anaesthesiol*. 2020;28(2):94–100. <https://doi.org/10.4038/slja.v28i2.8541>
17. Gomes MFS, Galindo Neto NM. Componente curricular de terapia intensiva nas matrizes curriculares das graduações de enfermagem no Brasil [undergraduate dissertation] [Internet]. Pesqueira (PE): Instituto Federal de Pernambuco; 2022. Available from: <https://repositorio.ifpe.edu.br/xmlui/handle/123456789/809>
18. Gerônimo CAO, Gomes MFS, Muniz MLC, Rocha LS, Santos MSTG, Galindo Neto NM. Especialização *latu sensu* de enfermagem em terapia intensiva no Brasil. *Saúde Coletiva*. 2021;11(68):7279–88. <https://doi.org/10.36489/saudecoletiva.2021v11i68p7279-7288>
19. Viana RAPP, Vargas MAO, Carmagnani MIS, Tanaka LH, Luz KR, Schmitt PH. Perfil do enfermeiro de terapia intensiva em diferentes regiões do Brasil. *Texto Contexto Enferm*. 2014;23(1):151–9. <https://doi.org/10.1590/S0104-07072014000100018>
20. Sade PMC, Peres AM, Zago DPL, Matsuda LM, Wolff LDG, Bernardino E. Avaliação dos efeitos da educação permanente para enfermagem em uma organização hospitalar. *Acta Paul Enferm*. 2020;33. <http://dx.doi.org/10.37689/acta-ape/2020AO0023>