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RESEARCH

CONSTRUCTION AND VALIDATION OF THE SCALE FOR VERIFYING ADHERENCE TO THE RECOMMENDATIONS OF THE BRAZILIAN GUIDELINES FOR MECHANICAL VENTILATION

CONSTRUÇÃO E VALIDAÇÃO DA ESCALA DE VERIFICAÇÃO DA ADESÃO ÀS RECOMENDAÇÕES DAS DIRETRIZES BRASILEIRAS DE VENTILAÇÃO MECÂNICA

CONSTRUCCIÓN Y VALIDACIÓN DE LA ESCALA PARA VERIFICAR LA ADHERENCIA A LAS RECOMENDACIONES DE LAS DIRECTRICES BRASILEÑAS SOBRE VENTILACIÓN MECÁNICA

Larissa Fernanda do Nascimento Celeste[1]
Sheila Aparecida da Silva[2]
Maria Beatriz Guimarães Raponi[3]
Maria Helena Barbosa[2]
Fabiana Cristina Pires Bernardinelli[2]
Suzel Regina Ribeiro Chavaglia[2]

[1]Universidade Federal do Triângulo Mineiro - UFTM, Hospital de Clínicas da Universidade Federal do Triângulo Mineiro, Serviço de Fisioterapia. Uberaba, MG - Brazil.

[2]Universidade Federal do Triângulo Mineiro - UFTM, Programa de Pós-Graduação em Atenção à Saúde. Uberaba, MG - Brazil.

[3]Universidade Federal de Uberlândia - UFU, Faculdade de Medicina, Curso de Graduação em Enfermagem. Uberlândia, MG - Brazil.

Corresponding Author: Suzel Regina Ribeiro Chavaglia
E-mail: suzel.ribeiro@yahoo.com.br

Authors' Contributions:
Conceptualization: Larissa F. N. Celeste; Suzel R. R. Chavaglia; ***Data Colection:*** Larissa F. N. Celeste; ***Investigation:*** Larissa F. N. Celeste; ***Methodology:*** Larissa F. N. Celeste; ***Project Management:*** Suzel R. R. Chavaglia; ***Software:*** Larissa F. N. Celeste; ***Statistical Analysis:*** Larissa F. N. Celeste; Suzel R. R. Chavaglia; ***Validation:*** Larissa F. N. Celeste; ***Visualization:*** Suzel R. R. Chavaglia; Maria H. Barbosa; Maria B. G. Raponi; Fabiana C. P. Bernardinelli; ***Writing - Original Draft Preparation:*** Maria B. G. Raponi; Maria H. Barbosa; Fabiana C. P. Bernardinelli; ***Writing - Review and Editing:*** Maria B. G. Raponi; Fabiana C. P. Bernardinelli.

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José Wicto Pereira Borges
Tânia Couto Machado Chianca

ABSTRACT

Objective: to construct and validate a scale for verifying adherence to the recommendations of the Brazilian Guidelines for Mechanical Ventilation by healthcare professionals. **Method:** methodological study, conducted between September and December 2019 in a public hospital with 87 patients. For content validation, the Content Validation Index was adopted; for criterion validity, *Pearson's* Correlation Coefficient; for internal consistency, *Cronbach's* alpha; and, for interobserver reliability, the *Kappa* Coefficient, and the Intraclass Correlation Coefficient. **Results:** the scale identified acceptable content validity and internal consistency. *Pearson's* correlation indicated a correlation between adherence score and saturation ($r = 0.31$; $p \leq 0.005$), the average score for observer A and B resulted, respectively, in 88.89(±5.23) and 88.86(±5.34), and the confidence interval was 0.96. **Conclusion:** the scale showed validity and reliability to verify adherence to the Brazilian Guidelines for Mechanical Ventilation by professionals.

Keywords: Respiration, Artificial; Guideline Adherence; Validation Studies; Nurses; Physical Therapists.

RESUMO

Objetivo: *construir e validar uma escala de verificação da adesão às recomendações das Diretrizes Brasileiras de Ventilação Mecânica por profissionais da saúde.* ***Método:*** *estudo metodológico, conduzido no período entre setembro e dezembro de 2019 em um hospital público com 87 pacientes. Para a validação de conteúdo, adotou-se o Índice de Validação de Conteúdo; para a validade de critério, o Coeficiente de Correlação de Pearson; para a consistência interna, o alfa de Cronbach; e, para a confiabilidade interobservador, o Coeficiente Kappa e o Coeficiente de Correlação Intraclasse.* ***Resultados:*** *a escala identificou uma validade de conteúdo e consistência interna aceitável. A correlação de Pearson indicou uma correlação do escore de adesão com a saturação ($r = 0,31$; $p \leq 0,005$), o escore médio para o observador A e B resultou, respectivamente, em 88,89(±5,23) e 88,86(±5,34), e o intervalo de confiança foi de 0,96.* ***Conclusão:*** *a escala apresentou validade e confiabilidade para verificar a adesão às Diretrizes Brasileiras de Ventilação Mecânica dos profissionais.*

Palavras-chave: *Respiração Artificial; Fidelidade a Diretrizes; Estudos de Validação; Enfermeiras e Enfermeiros; Fisioterapeutas.*

RESUMEN

Objetivo: *construir y validar una escala para verificar la adherencia a las recomendaciones de las directrices brasileñas sobre ventilación mecánica por parte de los profesionales de la salud.* ***Método:*** *estudio metodológico, realizado entre septiembre y diciembre de 2019 en un hospital público con 87 pacientes. Se adoptó el Índice de Validación de Contenido para la validación de contenido, para la validez de criterio, el Coeficiente de Correlación de Pearson, para la consistencia interna, el alfa de Cronbach y, para la fiabilidad interobservador, el Coeficiente Kappa y el Coeficiente de Correlación Intraclase.* ***Resultados:*** *la escala presentó una validez de contenido y una consistencia interna aceptables. La correlación de Pearson indicó una correlación de la puntuación de adherencia con la saturación ($r = 0,31$; $p \leq 0,005$), la puntuación media para el observador A y B resultó de 88,89(±5,23) y 88,86(±5,34), respectivamente, y el intervalo de confianza fue de 0,96.* ***Conclusión:*** *la escala presentó validez y confiabilidad para verificar la adherencia a las Directrices Brasileñas de Ventilación Mecánica de los profesionales.*

Palabras clave: *Respiración Artificial; Adhesión a Directriz; Estudios de Validación; Enfermeras y Enfermeros; Fisioterapeutas.*

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INTRODUCTION

The mortality rates of patients admitted to Intensive Care Units (ICUs) who required ventilatory support in 2019 ranged from 40 to 60%, regardless of the underlying condition.[1] Age, comorbidities, Acute Respiratory Distress Syndrome (ARDS), severity of the underlying disease and variables related to ICU support (positive fluid balance and failure of non-invasive ventilation) are considered factors associated with hospital mortality.[2,3]

Such factors, when related to Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection, have a high lethality. same viral agent.[4] In addition, this is a disease with very heterogeneous characteristics among individuals, as it presents different phenotypes caused by the same viral agent.[4] According to data from the United States, these characteristics inevitably end up impacting the worsening of the clinical condition, culminating in ICU admission and mortality rates greater than 50% when ventilatory support is required.[5] In Brazil, mortality is even higher, ranging from 60% to 80% in patients admitted to ICUs and in those using Invasive Mechanical Ventilation (IMV), respectively.[6]

In times of the COVID-19 pandemic, providing means of adherence to the guidelines, such as the degree of following a specific guideline, is essential considering that the patient can be intubated on IMV for a period that can vary from two weeks to months , requiring intensive care.[7] The appropriate use of IMV and adherence to guidelines can reduce the chances of death, the probability of developing complications, the period of use of IMV, the length of stay in health institutions and hospital costs.[7,8]

A safe way to promote excellent health care is the use of guidelines, characterized as a set of recommendations systematically prepared by a group of specialists based on evidence available in the literature.[9] The guidelines aim to support health professionals in reasoning clinical practice, as well as helping patients adhere to practices and behaviors.[9] In view of this, more than 50 experts gathered and compiled the *Diretrizes Brasileiras de Ventilação Mecânica* [Brazilian Guidelines for Mechanical Ventilation] - DBVM, which address safe practices for intubation, artificial ventilation and extubation.[8]

DBVM includes 29 recommendations for invasive and non-invasive ventilatory support, mechanical ventilation parameters, sedation, and analgesia and post-extubation, aiming to improve understanding on the subject and optimize care for patients with respiratory failure.[8]

Despite the importance of the use of DBVM, there is still a lack of scientific evidence about its adherence by health professionals, as well as the lack of instruments (in particular, validated scales) to favor safe and effective assistance. of quality in the IMV process.[8] This led to the development of this research, which has the following guiding question: is the instrument, defined as "Scale for Verification of Adherence to DBVM recommendations" valid and reliable to verify the adherence of health professionals? Thus, the present study aimed to construct and validate a scale for verifying adherence to the recommendations of the Brazilian Guidelines for Mechanical Ventilation by health professionals.

METHOD

This is a methodological study[10] that describes the construction and validation of a scale to verify adherence to DBVM recommendations. It was developed in the period between June 2017 and March 2019 and organized in three stages, namely: (1) construction of the scale, characterized as a stage of reasoning and construction of the scale; (2) content validation, aimed at assessing whether the scale has enough content to clearly measure what it proposes for the target population; finally, (3) assessment of psychometric properties through criterion validity and reliability analysis, determined to verify whether the scale is accurate and capable of measuring without errors, and also whether it has an association with an external criterion.

Step 1: building the scale

In the first step, the construction of the scale was supported by the recommendations of the DBVM[8] and by scientific evidence available in the literature, identified through a search in the following databases: US National Library of Medicine National Institutes Database Search of Health (Medline/PubMed®); Cochrane Library; Cumulative Index to Nursing and Allied Health Literature (CINAHL); Web of Science; and Latin American and Caribbean Literature on Health Sciences (LILACS). For this, the descriptors "Artificial Breathing", "Fidelity to the Guidelines" and "Validation Studies" were used in the Portuguese, English, and Spanish versions. The findings identified through the search were read in full, with the intention of extracting the maximum amount of relevant information for the construction of the scale.

The scale was constructed by the authors of the present study with the aim of becoming a tool for implementing guidelines for clinical practice. The

domains that composed it included: the clinical and sociodemographic profile, consisting of 17 items; the IMV parameters, composed of 13 items; care associated with IMV, divided into 13 items; the combination of sedation and analgesia, divided into 4 items; finally, the adherence score.

Step 2: Content validation

In the second step, this scale was submitted to content validation by experts found on the Lattes Platform of the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* [National Council for Scientific and Technological Development] - CNPq and selected according to the following inclusion criteria: nurses, doctors or physiotherapists, masters and/or PhDs with at least five years of experience in VMI and/or ICU. Those who did not reach a minimum value of six points according to *Fehring's* criteria were excluded.[11]

A *priori*, 30 experts were selected, to whom an invitation letter was sent via e-mail, whose address was obtained from articles and at the participant's institution. Only seven experts contacted the researcher, who received, by e-mail, the access link to an online form, composed, sequentially, by the Free and Informed Consent Form (ICF), by the expert characterization questionnaire, the tutorial for completing and the scale with the evaluation form composed of a *Likert*-type scale. This scale consists of four options, considering clarity/precision and relevance/representativeness, whose values indicated: 1 = not equivalent; 2 = needs major review; 3 = equivalent; and 4 = completely equivalent item. The experts had a space for suggestions in each item. It should be noted that a period of 30 days was granted for the experts to return the completed materials.

The Content Validity Index (CVI) was adopted for analysis of the scale's content, which was calculated from the expression: amount of answers 3 or 4/total of answers. A validity index of ≥ 80% of consensus among experts was established for each evaluated item.

Step 3: assessment of psychometric properties

Then, with the intention of fulfilling the third step, the research was developed in a medium-sized public university hospital in the interior of *Minas Gerais*. Between September and December 2019, this hospital served approximately 30 municipalities in the state and municipalities in other states in Adult and Coronary Intensive Care Units (ICU), consisting of 302 beds, of which 20 were in the Children's ICU, 10 in the ICU Adult and 10 from the Coronary ICU. In addition, the hospital had an Adult Emergency Unit with 32 beds.

The target population consisted of patients under IMV, including patients under IMV within the period of 24 and 48 hours, aged 18 years or older. Those who died within the first 48 hours of hospitalization and patients on IMV for more than 48 hours were excluded.

To carry out the criterion validity and interobserver reliability analysis, the sample calculation established an Intraclass Correlation Coefficient (ICC) between the expected adherence scores of 0.7, assuming that it was not less than 0.5 for one power of 90%, stipulating the significance level at $\alpha=0.05$. By adhering to the Power Analysis and Sample Size (PASS) software version 13 with these a *priori* values, a sample size of 87 patients was generated.

It is worth noting that, for the application of the scale, the data collection team received prior training with theoretical and practical explanations to carry out the pre-test with 10 individuals, identified based on the inclusion and exclusion criteria. Such individuals were not included in the final sample of the study, in order to verify the understanding, content and clarity of the scale, as well as its applicability to reality.

At this stage, the reliability analysis and criterion validity were evaluated, in which, initially, patients were identified, with inclusion and exclusion criteria being adopted. Then, consent was requested from participants who had physical and mental conditions to consent and sign the ICF; those who were unable to consent and sign the ICF, authorization was requested from those responsible. Data collection took place at the bedside through the application of the elaborated and validated scale, with direct observation of the mechanical ventilator, the patient, and the medical record. 107 patients were approached; however, 10 did not consent to participate in the research, 4 died within the first 48 hours and 6 did not fit within the period of 24 to 48 hours of hospitalization. Therefore, the total number of patients able to participate in the study was 87.

In the evaluation of the reliability analysis, at first, the internal consistency was verified to verify if the scale items had a correlation with each other. Then, the inter-observer reliability was identified, in which two observers, members of the data collection team, trained and with experience in IMV, completed the scale independently in a close period of time, in order to avoid bias in the application of the scale, since the VMI parameters can be changed at any time. Regarding criterion validity, a correlation was observed between the adherence score

and the patient's Peripheral Oxygen Saturation (SpO_2) at the time of application of the scale.

Thirty items were considered relevant to the assessment of patients on IMV (domains B, C and D), followed by a checklist to assess whether or not the parameters and care provided were in accordance with the guidelines, resulting in an adherence score. The score is calculated by adding the number of items classified as adequate, divided by the number of items in the instrument, minus the number of "not applicable" items, multiplied by 100.

Next, an electronic spreadsheet was prepared, using Microsoft® Excel®, and a dictionary with the presentation of each variable. The collected data were processed by two people, in double entry, to later verify the existence of inconsistencies in the databaseThen, for processing and analysis, the database was imported into the Statistical Package for the Social Sciences (SPSS) application. Initially, a univariate analysis was performed, which included absolute and relative frequency distributions for categorical variables, as well as measures of central tendency (mean, median) and measures of variability (amplitudes of variation and standard deviation) for quantitative variables.

Criterion validity was investigated using *Pearson's* correlation coefficient to correlate the external factor to the instrument. The reliability analysis, referring to internal consistency, was evaluated using *Cronbach's* alpha coefficient, in which an acceptable alpha value above 0.60 was considered.[12] For the analysis of interobserver reliability, the *Kappa* coefficient was considered for the analysis of each item of the scale individually, and the Intraclass Correlation Coefficient (ICC) for measuring the reliability of the total scores of the two observers. It is noteworthy that domain A was not part of these analyses, as it consists of variables related to the patient's characterization.

It should be noted that the research project was approved by the Ethics and Research Committee of the *Universidade Federal do Triângulo Mineiro* (UFTM) and approved under opinion report no. 2,112,037 and adjusts to the determinations of CONEP Resolution 466/12.

RESULTS

The construction of the scale resulted in an initial version consisting of 54 items. They were divided into 19 items in domain A (Clinical and Sociodemographic Profile), 11 items in domain B (IMV Parameters), 20 items in domain C (Care Associated with IMV) and 4 items in domain D (Sedation and Analgesia), ending with the adherence score.

Of the seven experts who made up the committee, three (42.8%) were nurses, three (42.8%) were physiotherapists and one (14.4%) was a physician. As for the degree, three (42.8) had a master's degree and four (57.2%) had a PhD degree. All declared clinical practice in IMV and/or ICU for more than five years.

The presentation of content validation results and inter-rater agreement is presented in Table 1.

It is noteworthy that domain D, characterized by sedation and analgesia, showed 100% conformity between the 4 items, both for clarity and precision, and domain CVI equal to 1.0.

Table 1 - Presentation of the consensus among the experts (7), for domains A, B and C regarding relevance and clarity. *Uberaba*, MG, Brazil, 2019

Domain A			
Items	Proportion of conformity of the judges		
	Clarity n (%)	Relevance n (%)	CVI
1. Patient	7 (100%)	7 (100%)	
2. Assessment date	7 (100%)	7 (100%)	
3. Overall registration	7 (100%)	6 (85.7%)	
4. Gender	7 (100%)	7 (100%)	
5. Date of birth	7 (100%)	7 (100%)	
6. Occupation	7 (100%)	5 (71.4%)	
7. Admission date	7 (100%)	7 (100%)	
8. Diagnosis	6 (85.7%)	7 (100%)	
9. Height	7 (100%)	7 (100%)	
10. Predicted weight	6 (85.7%)	7 (100%)	0.95
11. Ideal tidal volumen	6 (85.7%)	7 (100%)	

Continue...

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Table 1 - Presentation of the consensus among the experts (7), for domains A, B and C regarding relevance and clarity. *Uberaba*, MG, Brazil, 2019

Domain A			
Items	Proportion of conformity of the judges		
	Clarity n (%)	Relevance n (%)	CVI
12. Previous comorbidities	7 (100%)	7 (100%)	
13. Life habits	7 (100%)	6 (85.7%)	
14. Date of OTI	7 (100%)	7 (100%)	
15. Reason for OTI	7 (100%)	7 (100%)	
16. Arterial blood pressure	6 (85.7%)	6 (85.7%)	
17. Heart Rate	6 (85.7%)	6 (85.7%)	
18. Peripheral Oxygen Saturation (SpO_2)	7 (100%)	7 (100%)	
19. APACHE II	6 (85.7%)	6 (85.7%)	
Domain B			
Items	Proportion of conformity of the judges		
	Clarity n (%)	Relevance n (%)	CVI
1. Ventilation Mode	7 (100%)	7 (100%)	
2. Pinsp or scheduled VC	7 (100%)	7 (100%)	
3. VC performed	7 (100%)	7 (100%)	
4. PEEP	7 (100%)	7 (100%)	
5. Inspiratory Time	7 (100%)	7 (100%)	
6. RR schedule	7 (100%)	7 (100%)	0.97
7. RR performed	7 (100%)	7 (100%)	
8. FiO_2	7 (100%)	7 (100%)	
9. Sensitivity	7 (100%)	6 (85.7%)	
10. Peak pressure	7 (100%)	7 (100%)	
11. Auto-PEEP	7 (100%)	6 (85.7%)	
Domain C			
Items	Proportion of conformity of the judges		
	Clarity n (%)	Relevance n (%)	CVI
1. OTT or TQT number and fixation in the rhyme	7 (100%)	6 (85.7%)	
2. Secretion-free OTT	7 (100%)	6 (85.7%)	
3. Properly fixed OTT	7 (100%)	7 (100%)	
4. Secure OTT fixation	6 (85.7%)	7 (100%)	
5. OTT free of bubbles in the oral cavity or air leak	7 (100%)	6 (85.7%)	
6. Pcuff entre 25 e 30 cm H_2O	7 (100%)	7 (100%)	
7. TQT without visible secretions	7 (100%)	5 (71.4%)	
8. TQT with insertion without displacement	7 (100%)	6 (85.7%)	
9. Mechanical ventilator circuit integrity	7 (100%)	6 (85.7%)	
10. Circuit free of secretions and condensates	7 (100%)	7 (100%)	0.94
11. Heated water moisture	7 (100%)	7 (100%)	
12. Proper water level in moisture	7 (100%)	6 (85.7%)	

continue...

...continuation

Table 1 - Presentation of the consensus among the experts (7), for domains A, B and C regarding relevance and clarity. *Uberaba*, MG, Brazil, 2019

Domain C			
Items	Proportion of conformity of the judges		
	Clarity n (%)	Relevance n (%)	CVI
13. Clean and identified HME filter	7 (100%)	7 (100%)	
14. Aspirator up and running	7 (100%)	7 (100%)	
15. Secretion aspirator assembled and working	7 (100%)	6 (85.7%)	
16. Integrity and identified closed aspiration system	7 (100%)	7 (100%)	
17. Headboard between 30° e 45°	7 (100%)	7 (100%)	
18. Constant monitoring	7 (100%)	7 (100%)	
19. Physiotherapeutic Service	7 (100%)	7 (100%)	
20. Oral hygiene	7 (100%)	7 (100%)	

OTI: Orotracheal Intubation; SpO_2: Peripheral Oxygen Saturation; APACHE: Acute Physiology and Chronic Health Evaluation; Pinsp: Inspiratory pressure; VC: Controlled Ventilation; PEEP: Positive End Expiratory Pressure; RR: Respiratory Rate; FiO_2: Fraction of inspired oxygen; OTT: Orotracheal Tube; TQT: Tracheostomy; Pcuff: Intra-cuff pressure; cm H_2O: Centimeters of water; HME: Heat and Moisture Exchanger.

The experts made suggestions for domains A, B and C, generating exclusion, inclusion, and changes in the wording of items, so that existing items were incorporated. The experts' suggestions were accepted for they were relevant. Thus, the final version of the instrument emerged, named "Scale for Verification of Adherence to DBVM recommendations" (SVA-DBVM), which obtained a total CVI equal to 0.95 and started to present 48 items, namely: 17 items in the domain A (Clinical and Sociodemographic Profile), 13 items in domain B (IMV Parameters), 13 items in domain C (Care Associated with IMV), 4 items in domain D (Sedation and Analgesia) and the adherence score, as presented in ANNEX. It should be noted that domain A is not part of the calculation of adherence to the guidelines.

The 30 items relevant to the assessment of patients on IMV (domains B, C and D) are followed by a checklist to assess whether or not the parameters and care provided are in accordance with the guidelines, resulting in an adherence score. The score is calculated by adding the number of items classified as adequate, divided by the number of items in the instrument, minus the number of "not applicable" items and multiplied by 100. Thus, the greater the number of adequate items, the greater will be the percentage of adherence to the guidelines.

After changes were made, the pre-final version of the scale was submitted to a pre-test in 10 patients on IMV, without the need for further changes. Thus, the scale was considered validated in terms of content validity.

Then, the psychometric properties of the final version of the scale were analyzed, in which, of the 87 participants, 49 (56.3%) were male, with a mean age of 60 years (±19.8). Among the reasons for orotracheal intubation, 36 (41.4%) patients had a lowered level of consciousness; 28 (32.2%) had respiratory failure; 12 (13.8%) had cardiorespiratory arrest; and 11 (12.6%) were related to surgery.

To verify the criterion validity through *Pearson's* correlation, there was a correlation between the adherence score and saturation ($r=0.31$; $p\leq0.005$), indicating that the higher the SVA-DBVM score, the greater the saturation levels of the patient. During the assessment of the internal consistency of the 30 items related to MV that make up the scale, *Cronbach's* alpha was calculated, which presented an acceptable value of 0.70.

The inter-observer reliability analysis was performed based on the calculation of the *Kappa* coefficient for each item in domains B, C and D. When comparing the IVA-DBVM scores, independently analyzed by two observers (members of the data collection team), the mean score for observer A was 88.89 (±5.23) and for observer B it was 88.86 (±5.34). Both presented identical evaluations for the minimum and maximum scores, respectively 71 and 100, as shown in Table 2.

The total for each domain was analyzed using the CCI. Considering the 95% confidence interval, the ICC evaluated was 0.96 ($p<0.001$), showing excellent reliability. Measures of central tendency and dispersion and the ICC with the significance level are presented for the scaled scores for domains B, C and D, as shown in Table 3.

Table 2 - Distribution of agreement between observers, *Kappa* coefficient and significance level (p) for the SVA-DBVM items (n=87). *Uberaba*, MG, Brazil, 2019

Domain B			
Items	Concordance Ratio n (%)	*Kappa*	*p*
Ventilatory Mode	1 (100%)	-*	-
Adjusted inspiratory pressure or tidal volume	1 (100%)	1.0	<0.001
Realized tidal volume	0.95 (95%)	0.91	<0.001
Peep	1 (100%)	1.0	<0.001
Inspiratory time	1 (100%)	1.0	<0.001
Adjusted Respiratory Rate	1 (100%)	1.0	<0.001
Performed Respiratory Rate	1 (100%)	1.0	<0.001
FiO_2	1 (100%)	1.0	<0.001
Sensitivity	1 (100%)	-*	-
Peak inspiratory pressure	1 (100%)	-*	-
Auto-Peep	1 (100%)	1.0	<0.001
Plateau Pressure	1 (100%)	1.0	<0.001
Synchrony	0.99 (99%)	0.95	<0.001
Domain C			
Items	Concordance Ratio n (%)	*Kappa*	*p*
OTT or TQT number and fixation in the rhyme	1 (100%)	-*	-
OTT or TQT correctly fixed	0.98 (98%)	0.93	<0.001
Cuff pressure between 25 and 30 cm H_2O and OTT free of bubbles in the oral cavity	1 (100%)	1.0	<0.001
Circuit intact and free of secretions and condensates	0.98 (98%)	0.94	<0.001
Heated moisture	0.99 (99%)	0.66	<0.001
Proper water level in moisture	0.97 (97%)	0.92	<0.001
Clean and identified HME filter	1 (100%)	-*	-
Aspirator up and running	0.99 (99%)	0.79	<0.001
Integrity and identified closed aspiration system	1 (100%)	-*	-
Headboard between 30° and 45°	0.99 (99%)	0.95	<0.001
Constant monitoring	1 (100%)	-*	-
Physiotherapeutic service	1 (100%)	-*	-
Oral hygiene	1 (100%)	1.0	<0.001
Domain D			
Items	Concordance Ratio n (%)	*Kappa*	*p*
Sedation	1 (100%)	-*	-
Analgesia	1 (100%)	1.0	<0.001
RASS	0.99 (99%)	0.66	<0.001
Neuromuscular blocker	1 (100%)	-*	-

*The *Kappa* value is only calculated in 2x2 tables; *Kappa*: The *Kappa* value is only calculated in 2x2 tables; (*p*): significance level; SVA-DBVM: Scale for Verification of Adherence to the recommendations of the Brazilian Guidelines for Mechanical Ventilation; Peep: Positive End Expiratory Pressure; FiO_2: Fraction of inspired oxygen; OTT: Orotracheal tube; TQT: Tracheostomy tube; HME: Heat and moisture exchanger device; RASS: Richmond Agitation and Sedation Scale.

Table 3 - ICC distribution for scaled scores for domains B, C and D of the scale. (N=87). *Uberaba*, MG, Brazil, 2019

Domain Scores						
	Domain B		Domain C		Domain D	
	ObsA	ObsB	ObsA	ObsB	ObsA	ObsB
Minimum	69.00	69.00	56.00	55.00	75.00	75.00
Maximum	100.00	100.00	100.00	100.00	100.00	100.00
Mean	92.03	91.87	81.91	82.01	99.43	99.14
SD	7.49	7.45	9.72	9.96	3.77	4.59
ICC	0.98		0.97		0.89	
p	<0.001		<0.001		<0.001	

Note: ObsA: Observer A; ObsB: Observer B; ICC: Intraclass Correlation Coefficient; SD: standard deviation; *p*: p-value.

DISCUSSION

Adherence to guidelines by health professionals implies better conduct to guide clinical practice, in addition to contributing to the quality of health care by reducing inappropriate decisions. Furthermore, the use of guidelines provides a faster incorporation of advances in knowledge and technology in clinical practice, enabling safe and quality health care.[9]

Given the benefits provided by adherence to guidelines by healthcare professionals, the present study advances health science by building and validating a scale to verify adherence to DBVM recommendations. With this, it provides the improvement of the care provided, with a view to patient safety in the management of resources and the quality of care.

In its final version, the SVA-DBVM showed acceptable consistency and excellent reliability, proving to be valid. Furthermore, it was able to indicate that the higher the total score, the higher the patient's saturation levels; that is, the levels of Peripheral Oxygen Saturation (SpO_2) significantly influenced the adherence score to the recommendations of the Brazilian guidelines in the care of patients on IMV. This characteristic is important, as SpO_2 and Oxygen Partial Pressure (PaO_2) are closely related. In addition, both are used to monitor the state of oxygenation, and PaO_2 reflects the homeostasis between supply and consumption of oxygen, being the factor that interferes in the assessment of the presence and severity of ARDS, in which low or high values have been associated to bad prognoses.[13]

The literature adds that the non-invasive measurement of SpO_2 by pulse oximetry is a derivative of Arterial Oxygen Saturation (SaO_2) and is used as a quick and easy way to assess oxygenation.[14,15] Recently, studies have concluded that maintaining an SpO_2 of 95% (or as close as possible to this level) prevents the occurrence of hypoxemia or hyperoxemia in patients with acute illness who receive supplemental oxygen.[16,17] Thus, ensuring adequate saturation seems to be a parameter protection for the patient on IMV.

In the present research, the reliability of the construct was evaluated both by the Kappa coefficient and by the ICC analysis, indicating adequate reliability of the scale between the independent evaluations of two observers.[10] In view of these results, the SAV-DBVM proved to be adequate for verifying adherence to the DBVM, presenting itself as valid and reliable.[10] The implementation of this scale in health services enables qualified patient care and can help achieve levels of service excellence. However, a study carried out at an international level points out that, in order to have a greater adherence of health professionals to the application of instruments, training and guidance are necessary to optimize their application in daily life, reducing the time to fill them out and, consequently, encouraging their use. adhesion.[9,18]

Validation studies that go beyond the establishment of deductive ventilatory parameters are essential for evidence-based clinical practice since the correct use of ventilatory support minimizes lung injuries and enables early mobilization. That is, the patient can start practicing minimally active exercises, which minimizes the loss of bone and muscle mass, thus reducing the possibility of sequelae.[9,10,19]

This scale has 48 items, which include the patient's clinical and sociodemographic profile, parameters and care related to IMV, and aspects of sedation and analgesia. The literature corroborates the items of this scale with protective ventilation strategies (also related to the patient's profile),[1] the parameters and care associated with IMV,[20] and sedation and analgesia[21] in patients with ARDS.[22]

As for the profile of the patient undergoing IMV, there was a predominance of male patients aged over 60 years, with chronic non-communicable diseases and

underlying diseases, among which the most prevalent are diabetes and systemic arterial hypertension, followed by autoimmune diseases. Also, among the clinical supports used by patients during their stay in the ICU on IMV, the use of an orotracheal tube as an interface between the patient and the mechanical ventilator stands out. In view of this, support with the help of vasoactive drugs was evidenced in the vast majority of patients, considering that such drugs are essential for the maintenance of vital organs, such as noradrenaline, dobutamine and dopamine.[23]

In addition, it should be noted that it is necessary to perform high-cost tests, such as arterial blood gas analysis, ultrasound, and chest tomography. It also points out, in addition to the need for trained professionals, considering the mortality rate of patients with variation between 40 and 60%.[2,6,24]

Thus, providing protective ventilation parameters such as tidal volume levels, peak inspiratory pressure and PEEP are associated with lower mortality. Faced with such a situation, neglecting such parameters causes a worsening of the pulmonary condition (pneumonia, lower compliance of the respiratory system and lower PaO_2/FiO_2 ratio) or an increase in ventilatory demand.[20]

Thus, in order to adequately establish IMV parameters, it is essential to consider the patient's clinical condition and the correct implementation of DBVM.[8] In patients with ARDS undergoing IMV, it is necessary to be aware of the following considerations: a) limitations of tidal volume, pressure plateau, distension pressure, use of higher positive end-expiratory pressure (PEEP) and the prone position, which also reduce mortality;[2,20] b) the maximum airway pressure (MDP), the PaO_2/FiO_2 ratio , compliance of the respiratory system, the presence of acidosis and lower predicted weight should be carefully observed, with the aim of ensuring adequate ventilation for the patient, preventing harmful parameters from being used.[19] Therefore, professionals must carefully consider the patient's clinical characteristics, physiological state and response to ventilatory support to determine how to optimally ventilate the patient, providing adequate gas exchange and promoting minimal stress and strain on the injured lung.[20]

Regarding sedation and analgesia, it is important to establish adequate levels to guarantee them, and this goal is characterized as a challenge. A longitudinal study carried out with 1,338 patients in four hospitals in Peru found that deep sedation was present in 98% of the participants. This fact is associated with higher mortality and agitation; thus, the most commonly used sedatives were opioids and benzodiazepines, the latter being associated with a 41% higher mortality in participants with higher doses.[21] It is already established in the literature that daily interruption of sedation and minimal sedation are considered the gold standard for removing the patient from the ventilatory prosthesis.[8,21,22]

At first, the sample size stands out as a limitation of the present study, since it allowed limited power in detecting small variations. In addition, the predominance of the clinical outcome death was an obstacle to the use of IMV time and hospitalization time for correlation with the scale items, since only 27 patients were discharged from the hospital, which confirms the need for this study be carried out with a larger sample. Also, the fact that the study was carried out exclusively with patients between 24 and 48 hours of hospitalization minimized the detection potential of some scale items, such as sedation, but this criterion was important to control the study and the time of collection. Furthermore, the scarcity of studies that address instruments related to the theme, mainly mechanical ventilation, and adherence, hindered the discussion stage of the results.

Regarding the scale, it is considered as a limitation the fact that it does not present a cutoff point and its classifications. Despite this, the present study contributes to the advancement of care, teaching and research in health and Nursing, as it offers a standardized scale to measure adherence to DBVM. With this, it enables comparisons between different national services, facilitates the identification of risks to patient safety and meets the need for continuing education and/or clinical research related to ventilatory parameters.

CONCLUSION

The constructed SVA-DBVM had 47 items and proved to be valid and reliable to verify adherence to the DBVM. It can be used by nurses, physiotherapists, and physicians as a scale for evaluating the care provided in different health services to guide the clinical practice of health professionals who assist patients in IMV.

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Presentation of the final version of the SVA-DBVM			
A. CLINICAL AND SOCIODEMOGRAPHIC PROFILE			
1. Patient:		2. Assessment Date: / /	
3. Medical Record:	4. Gender: ( ) M ( ) F	5. Date of Birth: / / ( ) years	
6. Hospitalization Date: / /			
7. Diagnosis:			
8. Height: cm	9. Predicted weight: kg	10. Ideal Tidal Volume: ml	
11. Previous Comorbities: ( ) COPD ( ) CI ( ) Obesity ( ) SAH ( ) DM ( ) Stroke ( ) Neuromuscular disease ( ) HIV ( ) Others Total no. of previous comorbidities:			
12. Life Habits: ( ) Smoking ( ) Alcoholism ( ) Use of illicit drugs			
13. Date of OTI: / / ( ) days		14. Reason for OTI: ( ) IRespA ( ) DLOC ( ) CRA ( ) Procedure/Surgery ( ) Others	
15. BP: mmHg	16. HR: bpm	17. SpO_2: %	

B. PARAMETERS OF INVASIVE MECHANICAL VENTILATION			
	APPROPRIATE		
	YES	NO	NA
1. Ventilatory Mode ( ) PCV ( ) VCV ( ) PSV ( ) SIMV ( ) PRVC ( )APRV ( ) PAV ( ) ATC ( ) NAVA ( ) ASV ( ) Other:	( )	( )	( )
2. Pinsp. (cmH_2O): or Adjusted Tidal Volume (ml):	( )	( )	( )
3. Performed Tidal Volume (ml):	( )	( )	( )
4. PEEP (cmH_2O):	( )	( )	( )
5. Inspiratory time (s):	( )	( )	( )
6. Respiratory Rate adjusted (bpm):	( )	( )	( )
7. Respiratory Rate performed (bpm):	( )	( )	( )
8. FiO_2 (%):	( )	( )	( )
9. Sensitivity (L/min or cmH_2O):	( )	( )	( )
10. Peak inspiratory pressure (cmH_2O):	( )	( )	( )
11. Auto-PEEP (cmH_2O):	( )	( )	( )
12. Plateau Pressure (cmH_2O):	( )	( )	( )
13. Synchrony	( )	( )	( )
C. CARE ASSOCIATED WITH INVASIVE MECHANICAL VENTILATION			
1. Endotracheal or tracheostomy tube no.: Rhyme: cm	( )	( )	( )
2. Endotracheal or tracheostomy tube properly secured	( )	( )	( )
3. Cuff pressure between 25 and 30 cmH_2O and Orotracheal Tube free of bubbles in the oral cavity	( )	( )	( )
4. Circuit intact and free of secretions and condensates	( )	( )	( )
5. Heated water moisture	( )	( )	( )
6. Proper water level in moisture	( )	( )	( )
7. Clean and identified HME filter	( )	( )	( )
8. Aspirator set up and running	( )	( )	( )
9. Integrity and identified closed aspiration system	( )	( )	( )
10. Headboard between 30° e 45°	( )	( )	( )
11. Constant monitoring	( )	( )	( )
12. Physiotherapeutic service	( )	( )	( )
13. Oral hygiene	( )	( )	( )

Continue...

...continuation

Presentation of the final version of the SVA-DBVM			
D. SEDATION AND ANALGESIA			
1. Sedation: ( ) Continuous ( ) Daily awakening ( ) Abscent	( )	( )	( )
2. Analgesia: ( ) Continuous ( ) Intermittent ( ) Abscent	( )	( )	( )
3. Richmond Agitation and Sedadion Scale (RASS):	( )	( )	( )
4. Neuromuscular blocker: ( ) Present ( ) Abscent	( )	( )	( )

ADHESION SCORE: $\frac{no.\ of\ APPROPRIATE\ items}{30 - no.\ of\ non-applicable\ items\ (NA)} \times 100 =$

M: Male; F: Female; cm: centimeters; kg: kilogram; mL: milliliters; COPD: Chronic Obstructive Pulmonary Disease; CI: Heart Failure; SAH: Systemic Arterial Hypertension; DM: Diabetes *Mellitus*; Stroke: Cerebral Vascular Accident; HIV: Human Immunodeficiency Virus; no.: Number; OTI: Orotracheal Intubation; IrespA: Acute Respiratory Failure; DLOC: Downgrading of the Level of Consciousness; CRA: Cardiorespiratory Arrest; SHOVEL; Blood pressure; HR: Heart Rate; SpO_2: Peripheral Oxygen Saturation; NA: Not applicable; PCV: Pressure Controlled Ventilation; VCV: Volume Controlled Ventilation; PSV: Pressure Support Ventilation; SIMV: Synchronized Intermittent Mandatory Ventilation; PRVC: Volume Controlled with Regulated Pressure; APRV: Airway Pressure Release Ventilation; PAV: Proportional Assisted Ventilation; ATC: Automatic Tube Compensation; NAVA: Neurally Tuned Assisted Ventilation; ASV: Adaptive Support Ventilation; Pinsp: Inspiratory pressure; PEEP: Positive End Expiratory Pressure; bpm: breath per minute; FiO_2: Fraction of inspired oxygen; L/min: Liters per minute; HME: Heat and Moisture Exchanger.