

ORIGINAL ARTICLE

RESOURCES FOR PREVENTING PRESSURE INJURIES: METHODOLOGICAL STUDY TO DEVELOP AND VALIDATE A SCALE*

HIGHLIGHTS

1. Evaluation of resources to prevent pressure injuries (PI).
2. Validation of the scale's content by nurses specializing in dermatology.
3. It enables a situational diagnosis of resources in the clinical and surgical wards.
4. It contributes to practice from the perspective of PI prevention.

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ABSTRACT

Objective: To develop and validate a scale for evaluating human and material resources from the perspective of preventing pressure injuries in medical and surgical wards. **Method:** Methodological study was conducted in three stages: integrative review, elaboration, and validation using the Delphi technique, with eight nurses specializing in dermatology from different states in Brazil from November 2018 to January 2019. They assessed 32 items relating to human and material resources in intermediate care and high-dependency patients. A minimum content validity index of 0.80 was used for validation. **Results:** In the intermediate care scenario, all items reached 0.77 in the first phase and 0.93 in the second phase. In high dependency, they reached 0.74 in the first phase and 0.84 in the second phase. **Conclusion:** The scale will allow the assessment of the situational diagnosis of the wards from the perspective of pressure injury prevention.

KEYWORDS: Nursing; Pressure Injury; Health Personnel; Health Resources; Validation study.

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INTRODUCTION

Pressure injuries (PI) are a serious public health problem and the main cause of adverse events, causing physical, social, and psychological damage, especially to hospitalized people¹.

One study quantified the prevalence, incidence, and overall rate of PI in hospitalized adults, obtaining 39 publications eligible for meta-analysis, with a sample of 2,579,049 patients. The pooled prevalence of 1,366,848 patients was 12.8%; the pooled incidence rate of 681,885 patients was 5.4 per 10,000 patient days, and the pooled PI rate of 1,893,593 was 8.4%, showing that PI affects more than one in ten of those admitted². Among the stages reported in 16 studies, I (43.5%) and II (28.0%) were more frequent, and the most affected regions were the sacrum, calcaneus, and hip².

The consequences of these injuries include the high cost of treatment. A study of 60 Brazilians analyzed the costs of dressings, with the average per patient per six months being R\$1,886.00 and the total cost being R\$113,186.00³.

Using validated scales to assess the risk of developing PI is the first step toward prevention. When identifying people at risk, nurses need human resources (HR) and materials (MR) to implement continuity care, such as hygiene, daily skin inspection, moisturizing, changing decubitus/repositioning, and constant diaper changes, among others⁴⁻⁵.

However, in everyday practice, the scenarios in public and private institutions where patients are at risk are not always favorable regarding HR and MR. Studies have shown that the number of nursing professionals in hospitalization units is undersized, which impacts the quality of care⁶⁻⁷. Faced with this reality, it is common for nurses and staff to complain about the lack of an adequate structure to carry out preventive actions effectively and individually⁶.

Objective: to develop and validate a scale for evaluating human and material resources from the perspective of preventing pressure injuries in medical and surgical wards.

METHOD

Methodological study carried out in three stages:

First stage

Integrative literature review⁵, guided by the research question: what are the recommendations in the literature on HR and MR aimed at preventing PI?

The material was selected in November 2018 from the databases/libraries: Latin American and Caribbean Literature in Health Sciences, Medical Literature Analysis and Retrieval System Online, Nursing Database, and SCOPUS. The research also considered gray literature (dissertations, theses, technical notes, guidelines resolutions, and manuals), guided by Health Sciences descriptors and Medical Subject Headings: *Health resources*, *Nursing staff*, *pressure ulcer*, and *nursing* using the Boolean operators "and" and "or". The inclusion criteria were publications on the subject, available in full online, in Portuguese, English, and Spanish, and within the last five years. In one hundred ninety-three publications, 63 were identified, and 63 were selected to be read in full, leaving only two articles. Concerning gray literature, the following were selected: COFEN Resolution No. 547/2017⁸, o Quick reference Guide prepared by the European Pressure Ulcer Advisory Panel (EPUAP),

National Pressure Injury Advisory Panel (NPIAP), Pan Pacific Pressure Injury Alliance (PPIA)⁹ and the Ministry of Health Technical Note No. 3/2017¹⁰.

Second stage: drawing up the scale

Regarding the sizing of HR, Resolution 547/2017 of the Federal Nursing Council (COFEN)⁸ was used as a basis, which updates and establishes parameters for the Nursing Professional Staff based on the profile of patients in each care setting.

Considering that the Scale aims to assess the availability of HR and MR in medical and surgical wards, the parameters established for the scenarios of intermediate-care patients (ICP) and high-dependency care patients (HCP) were considered. These scenarios were chosen because they characterize the patients' profile on the wards.

Thus, the scale was drawn up with six columns, the first two specifying the HR (percentage of nurses, nursing technicians, and the ratio of professionals/patients per work shift) and the list of materials in each scenario (ICP and HCP). The other four are classified as deficient, reasonable, good, and ideal, according to the percentages of the total number of nursing professionals, the client/professional ratio established in Resolution⁸, and the classification concerning the number of items/materials considered basic for prevention⁹⁻¹¹.

About HR in the ICP scenario, the scale was presented to the experts with the number of professionals: number of nurses considered deficient up to 11%; reasonable from 12 to 22%; good from 23 to 33%, and ideal above 34%. For technicians, deficient up to 23%, reasonable from 24 to 45%, good from 46 to 66%, and ideal above 67%. As for the professional/patient ratio is poor 1/10, reasonable 1/8, good 1/6, and ideal 1/4.

In the HCP scenario, the number of nurses is considered deficient up to 12%; reasonable from 13 to 24%, good from 25 to 36%, and ideal above 36%. For technicians, poor is up to 22%, reasonable from 23 to 43%, good from 44 to 64%, and ideal above 64%; as for the professional/patient ratio, poor is 1/8, reasonable 1/6, good 1/4, and ideal 1/2.

As for MR, the following were listed: pyramidal mattress, pneumatic mattress, pressure relievers, cushions, essential fatty acids, 10% urea cream, non-sterile polyurethane film, extra-thin hydrocolloid, foot savers and barrier cream⁹⁻¹⁰. All in both scenarios, with up to two items considered deficient in the ICP: three to four, reasonable; five to six, good, and above seven, ideal. In the HCP, more items were considered deficient: up to five, reasonable; from six to seven, good; from eight to nine; and ideal, ten.

Third stage

Validation of the scale using the Delphi¹¹ technique, with experts being nurses who are specialists in dermatology by the Brazilian Association of Dermatology Nursing (SOBENDE). The Lattes curriculum vitae was analyzed as a selection criterion based on the model proposed by Fehring adapted¹². The choice to work with specialists qualified by SOBENDE was due to the Association's concern with prioritizing skin health and the maintenance of its integrity, as well as treating people with skin wounds/afflictions.

To not exceed the maximum number of experts established by the Delphi Technique, the researchers randomly selected 15 university graduates. They sent an invitation letter by e-mail explaining the research objectives and the Informed Consent Form (ICF). Of these, eight experts agreed to take part and signed the ICF.

They were sent a form to collect sociodemographic and professional data and an instrument to evaluate the content of the scale, prepared using Google Forms. It has 32 items, 24 referring to HR and eight to MR.

The suggestions were analyzed for each item by assigning increasing scores from one to four according to the modified Likert scale: 1. Irrelevant or unrepresentative; 2. Needs major revision; 3. Needs minor revision; and 4. Relevant.

Quantitative measures were used in the analytical procedure: Content Validity Index (CVI), obtained through the relative frequency of the score attributed to the judgment of the experts, adopting an index of 0.80 as the minimum consensus to be obtained¹³. The Coefficient of Variation and the Error of Estimate for the average CVI were considered to assess the divergence between the experts' responses in each phase.

The study was approved by the Research Ethics Committee of the Universidade Federal Fluminense Faculty of Medicine under Opinion No. 2.766.767.

RESULTS

The eight experts come from the following states: Rio de Janeiro, São Paulo, Porto Alegre, and Piauí. Five have a master's degree, and three have a doctorate. In terms of scientific activity, all of them have published articles and book chapters on skin health.

Intermediate Care Patient Scenario

Concerning HR in phase 1, the good and ideal indices were validated for the percentage of nurses, technicians, and the professional/patient ratio. Only one expert suggested increasing the percentage of nurses in the classification considered ideal to above 40% and reducing the percentage of nursing technicians to up to 60%.

Based on the experts' evaluations of this scenario, phase 1, the changes were made: 1. Percentage of nurses: poor (up to 20%); reasonable (21 to 30%); good (31 to 40%); ideal (41% or more). 2. Percentage of technicians: poor (80% or more); reasonable (79% to 70%); good (69% to 60%); ideal (up to 59%); 3. Ratio of professionals/patients: poor (1/10); reasonable (1/8); good (1/6); and ideal (1/4).

Concerning the MRs, as shown in Table 1, although in the first phase, the number of items in the good and ideal classifications was (IVC=0.88) and (IVC=1.0), respectively, the experts (E2), (E5), (E6) and (E8) suggested increasing the number of items in the "reasonable", "good" and "ideal" classifications. In addition, it was suggested that the following materials be included: non-alkaline PH soap for body hygiene, barrier spray, and the existing barrier cream and multilayer foam. Another suggestion was to replace the pyramidal mattress with viscoelastic and the 10% urea cream and essential fatty acids with 10% urea lotion.

After modifications, the content of the scale was sent to the second evaluation phase, as shown in Tables 1 and 2. Table 1 shows the score given by the experts (E) and the CVI about HR and MR in the ICP scenario in phases 1 and 2.

Also, in Table 1, phase 1, of the 16 items referring to HR and MR, eight were accepted, while in Phase 2, all received an acceptance grade due to the previous qualitative analysis. Overall, all the aspects evaluated reached an estimated Average Content Validity Index (IMVC) of 0.77 in the first phase and 0.93 in the second; a coefficient of variation of 0.24 and 0.08; and estimation errors of 20.51 and 6.56%, respectively, showing the need for two evaluations. It should be noted that seven experts remained in phase 2, as one did not meet the deadline for filling in the form.

Table 1 - Experts' scores (E) about human and material resources in the Intermediate Care Patient setting. Rio de Janeiro, RJ, Brazil, 2019.

DISCRIMINATION	ICP (n=8)								IVC
	E1	E2	E3	E4	E5	E6	E7	E8	
PHASE 1									
RH									
Nurses									
Q1: Disabled up to 11%	4	2	2	4	2	2	4	3	0.50
Q2: Fair 12% to 22%	4	2	2	4	2	4	4	4	0.63
Q3: Good 23% to 33%	4	3	3	4	3	4	4	4	1.00
Q4: Ideal above 33	4	3	4	4	4	4	4	4	1.00
Estimated Average CVI									0.78
Coefficient of Variation (CV)									0.28
Estimation error for average CVI (%)									24.76
Nursing Technicians									
Q5: Disabled up to 23%	4	2	2	4	2	4	4	3	0.63
Q6: Fair 24% to 45%	4	2	2	4	2	4	4	4	0.63
Q7: Good 46% to 67%	4	3	3	4	3	4	4	4	1.00
Q8: Ideal above 67%	4	3	4	4	2	4	4	4	0.88
Estimated Average CVI									0.79
CV									0.20
Estimation error for average CVI (%)									17.84
Professional/patient ratio									
Q9: Disabled 1/10	4	2	2	4	4	1	4	3	0.63
Q10: Fair 1/8	3	2	2	4	2	1	4	4	0.50
Q11: Good 1/6	4	3	2	4	3	4	4	4	0.88
Q12: Ideal 1/4	4	3	4	4	4	4	4	1	0.88
Estimated Average CVI									0.72
CV									0.23
Estimation error for average CVI (%)									19.79
MR									
Q13: Disabled up to 2 items	4	2	4	4	4	1	4	2	0.63
Q14: Fair 3 to 4	4	2	3	4	2	1	4	3	0.63
Q15: Good 5 to 6	4	3	4	4	2	3	4	4	0.88
Q16: Ideal over 7 items	4	3	4	4	3	4	3	4	1.00
Estimated Average CVI									0.79
CV									0.20
Estimation error for average CVI (%)									17.84
PHASE 1									
Estimated Average CVI									0.77
CV									0.24
Estimation error for average CVI (%)									20.51
PHASE 2									
RH									
Nurses									

Q1: Disabled up to 20%	3	4	4	4	4	2	4	-	0.86
Q2: Fair 21% to 30%	3	2	4	4	3	3	4	-	0.86
Q3: Good 31% to 40%	4	4	4	4	4	4	4	-	1.00
Q4: Ideal 41% or more	4	4	4	4	4	4	4	-	1.00
Estimated Average CVI									0,93
CV									0.08
Estimation error for average CVI (%)									6.56
Nursing Technicians									
Q5: Disabled 80% or more	3	4	4	4	4	2	4	-	0.86
Q6: Fair 79% to 70%	3	2	4	4	3	3	4	-	0.86
Q7: Good 69% to 60%	4	4	4	4	4	4	4	-	1.00
Q8: Ideal up to 59%	4	4	4	4	4	4	4	-	1.00
Estimated Average CVI									0.93
CV									0.08
Estimation error for average CVI (%)									6.56
Professional/patient ratio									
Q9: Disabled 1/10	3	4	4	4	4	2	4	-	0.86
Q10: Fair 1/8	3	2	4	4	3	3	4	-	0.86
Q11: Good 1/6	4	4	4	4	4	4	4	-	1.00
Q12: Ideal 1/4	4	4	4	4	4	4	4	-	1.00
Estimated Average CVI									0.93
CV									0.08
Estimation error for average CVI (%)									6.56
MR									
Q13: Disabled up to 4 items	3	4	4	4	4	2	3	-	0.86
Q14: Fair 5 to 6	4	2	4	4	3	3	3	-	0.86
Q15: Good 7 to 8	4	3	4	4	4	4	3	-	1.00
Q16: Ideal 9 items or more	4	3	4	4	4	4	3	-	1.00
Estimated Average CVI									0.93
CV									0.08
Estimation error for average CVI (%)									6.56
PHASE 2									
Estimated Average CVI									0.93
CV									0.08
Estimation error for average CVI (%)									6.56

Source: The authors (2019).

High Dependency Care Patient Scenario

Table 2 shows the score the experts (E) and the CVI gave about HR and MR in the HCP scenario in the two phases.

Table 2 - Experts' scores (E) about human and material resources in the setting of high-dependency patients. Rio de Janeiro, RJ, Brazil, 2019.

CPAD (n=8)									
DISCRIMINATION	E1	E2	E3	E4	E5	E6	E7	E8	IVC
PHASE 1									
RH									
Nurses									
Q1: Disabled up to 12%	2	2	2	4	4	2	4	4	0.50
Q2: Fair 13% to 24%	2	2	2	4	2	3	4	4	0.50
Q3: Good 25% to 36%	4	3	2	4	2	4	4	4	0.75
Q4: Ideal above 36%	4	3	2	4	3	4	4	4	0.88
Estimated Average CVI									0.66
Coefficient of Variation (CV)									0.25
Estimation error for average CVI (%)									21.75
Nursing Technicians									
Q5: Disabled up to 22%	2	2	2	4	4	2	4	4	0.50
Q6: Fair 23% to 43%	4	2	2	4	2	3	4	4	0.63
Q7: Good 44% to 64%	4	3	3	4	3	4	4	4	1.00
Q8: Ideal above 64%	3	3	4	4	3	4	4	4	1.00
Estimated Average CVI									0.78
CV									0.28
Estimation error for average CVI (%)									24.76
Professional/patient ratio									
Q9: Disabled 1/8	2	2	4	4	4	2	4	3	0.50
Q10: Fair 1/6	2	2	2	4	2	3	4	2	0.38
Q11: Good 1/4	3	3	2	4	3	4	4	4	0.88
Q12: Ideal 1/2	4	3	4	4	4	4	4	4	1.00
Estimated Average CVI									0.69
CV									0.37
Estimation error for average CVI (%)									32.48
MR									
Q13: Disabled up to 5 items	2	2	4	4	4	2	4	2	0.50
Q14: Fair 6 to 7	4	2	3	4	2	3	4	4	0.75
Q15: Good 8 to 9	4	3	4	4	3	4	4	4	1.00
Q16: Ideal over 9 items	4	3	4	4	4	4	3	4	1.00
Estimated Average CVI									0.81
CV									0.26
Estimation error for average CVI (%)									22.24
PHASE 1									
Estimated Average CVI									0.74
CV									0.31
Estimation error for average CVI (%)									26.61
PHASE 2									
RH									

Nurses									
Q1: Disabled up to 25%	3	4	4	4	4	2	4	-	0.86
Q2: Fair 26% to 35%	3	2	4	4	3	3	4	-	0.86
Q3: Good 36% to 45%	3	3	4	4	4	4	4	-	1.00
Q4: Ideal 46% or more	3	3	4	4	4	4	4	-	1.00
Estimated Average CVI									0.93
CV									0.08
Estimation error for average CVI (%)									6.56
Nursing Technicians									
Q5: Disabled 75% or more	3	4	4	4	4	2	4	-	0.86
Q6: Fair 74% to 65%	3	2	4	4	3	3	4	-	0.86
Q7: Good 64% to 55%	3	3	4	4	4	4	4	-	1.00
Q8: Ideal up to 54%	3	3	4	4	4	4	4	-	1.00
Estimated Average CVI									0.93
CV									0.08
Estimation error for average CVI (%)									6.56
Professional/patient ratio									
Q9: Disabled 1/10	3	4	4	4	4	2	4	-	0.86
Q10: Fair 1/8	3	2	4	4	3	3	4	-	0.86
Q11: Good 1/6	3	3	4	4	4	4	4	-	1.00
Q12: Ideal 1/4	3	3	4	4	4	4	4	-	1.00
Estimated Average CVI									0.93
CV									0.08
Estimation error for average CVI (%)									6.56
MR									
Q13: Disabled up to 6 items	3	4	4	4	4	3	3	-	1.00
Q14: Fair 7 to 8	3	2	4	4	4	4	3	-	0.86
Q15: Good 9 to 10	4	4	4	4	3	4	3	-	1.00
Q16: Ideal all items	4	4	4	4	4	4	3	-	1.00
Estimated Average CVI									0.97
CV									0.06
Estimation error for average CVI (%)									5.48
PHASE 2									
Estimated Average CVI									0.84
CV									0.23
Estimation error for average CVI (%)									21.90

Source: The authors (2019).

In Table 2, phase 1, the HCP scenario, although four experts disagreed with the percentages of nurses and technicians in the "deficient" and "reasonable" classifications, one suggested that the minimum percentage of nurses considered "reasonable" should be above 30% and "ideal" above 50%. Regarding technicians, the same expert considered that the percentage above 64% reduced the percentage of nurses in the team and suggested

reducing these professionals to 50%.

Regarding the ratio of professionals to patients, despite the dissatisfaction of the experts with the poor and reasonable classifications, only one said that the ratio of one professional to four patients could be considered good only during the night.

Based on the experts' contributions, the following changes were made to the content of the scale: 1. Percentage of nurses: poor (up to 25%); reasonable (26 to 35%); good (36 to 45%); ideal (46% or more). 2. Percentage of technicians: poor (75% or more); reasonable (74% to 65%); good (64% to 55%); ideal (up to 54%); 3. Ratio of professionals/patients: poor (1/8); reasonable (1/6); good (1/4); and ideal (1/2).

About MR, in phase 1, four experts marked option 2 in the quantity considered deficient and two in the quantity considered reasonable, suggesting an increase in the quantity of items considered reasonable, good, and ideal, in addition to the additions of materials suggested in the ICP. So, in both scenarios, the suggested materials were added.

Still, concerning the HCP scenario, Table 2 shows that in Phase 1, seven of the 16 questions were accepted, while in Phase 2, all were accepted due to the changes suggested by the experts in Phase 1. The aspects assessed globally in phase 2 reached an IMVC of 0.84 with a coefficient of variation of 0.23 and an estimation error of 21.90%, revealing the need for two assessments.

Table 3 shows Cronbach's alpha and internal consistency for the two evaluation phases.

Table 3 - Cronbach's Alpha and respective Internal Consistency, phases 1 and 2. Rio de Janeiro, RJ, Brazil, 2019.

Specification	Phase 1 (n=8)		Phase 2 (n=7)	
	Cronbach's alpha	Internal consistency	Cronbach's alpha	Internal consistency
ICP				
Nurses	0.84	Almost perfect	0.26	Fair
Nursing Technicians	0.93	Almost perfect	0.26	Fair
Professional/patient ratio	0.48	Moderate	0.26	Fair
Material Resources	0.71	Substantial	0.63	Substantial
HCP				
Nurses	0.83	Almost perfect	0.71	Substantial
Nursing Technicians	0.71	Substantial	0.26	Fair
Professional/patient ratio	0.60	Moderate	0.75	Substantial
Material Resources	0.40	Fair	0.46	Moderate

Source: The authors (2019).

DISCUSSION

As this is an unprecedented instrument in the literature, its development faced some challenges, especially about MR; it should be noted that COFEN Resolution No. 543/2017 establishes parameters for sizing nursing professionals from a general perspective and not specifically related to PI prevention⁸. It is worth noting that in the study in question, there

was disagreement between the experts and what is recommended in this resolution, given that for prevention to be successful, they considered the multiple preventive actions to be carried out continuously over the twenty-four hours, and according to the risk presented by the client.

According to Resolution⁸ for the ICP scenario, compliance is 33% nurses, the remaining 67% nursing assistants and technicians, and the ratio of one professional to four patients. In the HCP scenario, 36% of nurses and 64% of nursing technicians are recommended, with a ratio of one professional to two patients. In this study, the percentage deemed necessary by the experts in the ICP scenario was 41% or more nurses and up to 59% technicians, with a ratio of one professional to four patients. In the HCP, the percentage of nurses suggested was 46% or more, up to 54% of technicians, and the ratio of one professional to two patients.

It can be seen that staff shortages lead to the prioritization of activities considered essential, such as body hygiene, administering medication, and measuring vital signs, to the detriment of preventive measures aimed at PI. A survey of 2,917 nurses in general hospital wards in England stands out. The nurses highlighted the insufficient number of nurses and, consequently, the failure to carry out essential care, such as comforting/guiding patients and developing or updating care plans, adversely affecting the quality of care⁶.

From the perspective of PI prevention, the importance of the nurse in the patient's assessment is emphasized, which should include a careful inspection of the skin and the classification of risk for PI, with a view to prescribing preventive care. In addition to these actions, there is a need to continue with the daily skin assessment and implement the prescribed care with the other team members. Thus, when nurses undersupply, private activities provided for by law according to professional practice and resolutions are no longer carried out.

On the international scene, studies carried out in Intensive Care Units show that the high workload of nurses is directly related to compromised quality of care, increasing the risk of adverse events such as PI¹⁴⁻¹⁶.

A national study evaluated care/management indicators after the increase in nursing HR, finding a 75.0% reduction in the prevalence of PI, 10.5% in falls, and 50.0% in bladder tube infections. This shows that the adequacy of the number of professionals has directly impacted the quality and safety of client care¹⁷.

Regarding the inclusion of the multilayer silicone foam cover in the Validated Scale, a study in a tertiary hospital in Germany from June 2015 to July 2018 evaluated the positivity of using this cover. Two groups were randomized: a control group (n=210) and an experimental group (n=212). In addition to the usual preventive strategies, the experimental group was given silicone foam, and there was an 8% reduction in the incidence of PI¹⁸.

A study comparing viscoelastic mattresses with standard mattresses found significant evidence of pressure reduction, especially in bony prominences¹⁹. Concern about support surfaces is also highlighted in the latest EPUAP, NPIAP, and PPPIA20 Guideline.

As a limitation, it should be pointed out that, as it required two phases of evaluation by the experts, there was a lack of response from one of the experts and delayed feedback from some in the second evaluation phase.

CONCLUSION

This study developed and validated the content of a scale for evaluating HR and MR from the perspective of PI prevention in intermediate care and high-dependency units. It will be able to guide nurses/managers in the sizing of professionals and foresee and

provide materials for implementing personalized preventive measures.

Validation made it possible to improve the scale based on modifications suggested by experts. The final version was considered valid regarding its content, thus achieving the proposed objective.

To continue, a new study could be carried out with a view to its clinical validation. After this stage, it can be widely used in clinical and surgical wards in public and private institutions, contributing to care, teaching, and research.

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Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work - **Tonole R, Brandão ES**. Drafting the work or revising it critically for important intellectual content - **Tonole R, Brandão ES, Lanzillotti RS, Cavalcanti ACD**. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved - **Tonole R, Brandão ES, Lanzillotti RS, Cavalcanti ACD**. All authors approved the final version of the text.

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