Revista Contexto & Saúde
Editora Unijuí
Programa de Pós-Graduação em Atenção Integral à Saúde
ISSN 2176-7114 – v. 25, n. 50, 2025
http://dx.doi.org/10.21527/2176-7114.2025.50.14892
HOW TO CITE:
de Almeida CL, da Silva DA; Peres CRFB, Marçal AA, Pavelqueires S, Menolli GA. et al. Validação de conteúdo de instrumentos para simulação realística no atendimento inicial a vítima de trauma. Rev. Contexto & Saúde, 2025;25(50):e14892.

ORIGINAL ARTICLE

CONTENT VALIDATION OF INSTRUMENTS FOR REALISTIC SIMULATION IN INITIAL TRAUMA CARE

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Highlight:
(1) The instruments for realistic simulation in initial trauma care were successfully validated.
(2) The validation process showed high agreement among experts, reinforcing the instruments' reliability.
(3) The validated tools can be applied in the education and training of nurses in trauma care.

ABSTRACT

Objective: To validate the content of a prior knowledge questionnaire, simulated scenario, and checklist used in realistic simulation for initial trauma care. *Method*: This methodological study was conducted in two stages: instrument development and content validation by expert judges. Data analysis was performed using the percentage of agreement among assessors regarding the retention or exclusion of instrument items. A minimum acceptance criterion of 80% agreement was established. *Results*: For the assessment of the prior knowledge questionnaire, simulated scenario, and checklist, an overall score of 8.8 was obtained, based on assessments from 12 and 8 judges, respectively. The instruments were assessed based on the percentage of agreement among judges. In the overall assessment, the instruments achieved an agreement index of 8.2, with a standard deviation of 0.7 and an average agreement score of 9.2 among the judges. *Conclusion*: The instruments demonstrated satisfactory validity evidence and may be used as educational tools for teaching this topic.

Keywords: nursing education; simulation exercise; wounds and injuries; validation studies; nursing; nursing care.

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INTRODUCTION

Trauma is defined as an injury of varying extent, intensity, and severity, which can be caused by various physical, chemical, or electrical agents, either accidentally or intentionally, and is capable of producing local or systemic disturbances[1].

In 2022, Brazil recorded 33,894 trauma-related deaths, an increase of 81 deaths compared to 2021. Regarding the sex of the victims, males continue to account for the majority of trauma-related fatalities, representing 83% of deaths, with the highest mortality rate observed in the 20 to 24-year-old age group[2].

Among the professionals involved in the initial care of trauma victims, nurses play a key role. This care includes effective communication, immobilization, maintenance of respiration, hemodynamic stability, and level of consciousness[3]. However, it is not limited to clinical aspects alone. Leadership, specialized skills for managing critically ill patients and/or complex clinical events, and the coordination of safe care are essential responsibilities of nurses in trauma care[4].

Nevertheless, nursing education programs do not always adequately cover trauma care, resulting in a gap in training for handling various trauma-related situations. Given the importance of initial trauma care, the use of learning methodologies that support knowledge acquisition among nursing students enhances decision-making based on fundamental principles and evidence-based practices[5].

Thus, there is a need to develop instruments that effectively measure learning progress. Questionnaires, checklists, and simulated scenarios are three key mechanisms for obtaining information, as they are easy to implement and cost-effective. However, these instruments must demonstrate validity and reproducibility to ensure the reliability of the assessed indicators[6,7].

In this context, ensuring high-quality, risk-free nursing care for trauma victims leads to the following research question: What are the content validity criteria for the instruments developed for realistic nursing simulation, according to expert assessment?

An increasing number of questionnaires and scales have been developed across various health fields to measure and assess phenomena under investigation. Researchers emphasize the importance of ensuring the reliability and validity of these instruments to minimize the risk of subjective judgments[8].

Given these criteria, it is evident that the quality of the instruments is a fundamental aspect of the legitimacy and credibility of research findings[9], reinforcing the significance of the validation process, which is the focus of this study.

Thus, the objective of this study was to validate the content of the prior knowledge assessment instrument, simulated scenario, and checklist used in realistic simulation for initial trauma care.

METHODS

This is a methodological study focused on the content validation of a knowledge questionnaire on initial trauma care. The instruments – knowledge questionnaire, constituted by the simulated scenario script, and initial trauma care checklist - were assessed by expert judges, including both practicing professionals and faculty members with prior experience in instrument validation.

The experts were selected using non-probability snowball sampling, initially divided into two groups. In the first group, invitations were sent via email to 386 researchers identified on the Lattes Platform of the National Council for Scientific and Technological Development (CNPq). In the second group, 12 expert nurses, faculty members at two higher education institutions where the researchers

worked and were also actively engaged in realistic simulation, were invited. These professionals were identified as potential users of the instruments.

The inclusion criteria for expert selection included: undergraduate and postgraduate degrees in health sciences; proven clinical experience in emergency and trauma care; at least one year of teaching experience; at least one year of experience in realistic simulation, or prior research/publications on the topic. The exclusion criterion was failure to participate in all stages of the validation process.

The professionals were contacted via email or phone in May 2020. They received an invitation letter detailing the study's objectives and a Free and Informed Consent Form. Of the 398 selected experts, 20 agreed to participate, 12 completed the instrument analysis within the 45-day deadline, and 8 completed the assessment of all three instruments within the required timeframe.

The knowledge questionnaire consisted of 10 multiple-choice questions, each with four answer options. The checklist comprised 9 main categories and 80 sub-items, organized as follows: 1. Organization and communication (sub-items Q1-Q10); 2. Severe external hemorrhages (sub-items Q11-Q14); 3. Airway management with cervical spine control (sub-items Q15-Q26); 4. Ventilation: breathing and oxygenation (sub-items Q27-Q36); 5. Circulation and hemorrhage control (sub-items Q37-Q54); 6. Neurological dysfunction: abbreviated neurological examination (sub-items Q55-Q63); 7. Exposure and environmental control: hypothermia prevention (sub-items Q64-Q69); 8. Spinal management (sub-items Q70-Q74); 9. Ancillary measures: complementary interventions (sub-items Q75-Q80). Additionally, the simulated scenario included a script detailing the case event, cues, descriptions of required materials and equipment, and guidelines for the standardized patient (actor).

After developing the instruments, they underwent content validation by field experts, marking the second stage of the study.

The data collection instrument was created using Google Forms and included variables related to the experts' personal and professional characteristics, such as sex, age, institution, professional qualifications, years of experience in clinical care, trauma, emergency care, and teaching.

Following, the experts assessed: the knowledge questionnaire with 10 questions on the topic; the checklist, which contained items assessing the skills students needed to perform in the simulation; the simulated scenario, which included a structured guide for designing and implementing the realistic trauma care simulation.

Each item in the instruments was assessed individually based on nine criteria[11]: relevance/appropriateness; consistency; clarity; objectivity; simplicity; feasibility; timeliness; vocabulary; precision. The judges classified each item as "adequate," "adequate with modifications," or "inadequate." In the latter two cases, they could provide justifications and suggest improvements for refining or modifying the items.

Following the expert assessment, data analysis was performed based on the percentage of agreement regarding whether the items should be retained. Responses categorized as "inadequate" and "adequate with modifications" were grouped into a single category for analysis. A minimum acceptance threshold of 90% agreement was established.

Confidence intervals were also calculated to assess item adequacy percentages, using a 95% confidence level. Data were organized in an electronic spreadsheet and exported to JMP® Pro software (version 13, SAS Institute Inc., Cary, NC, USA, 1989 – 2019). After coding and tabulation, the data were analyzed using descriptive statistics.

Five tables were used to present the findings. Table 4 differed from the others in terms of the Likert scale used. While the other tables presented means, standard deviations, and confidence intervals, Table 4 used a three-point scale: "Strongly agree"; "Partially agree"; "Disagree". This choice was made to facilitate the assessment of checklist items by the judges.

This study is part of a doctoral dissertation that aimed to assess realistic simulation as a teaching-learning strategy for developing knowledge of initial trauma care among nursing students.

The study complied with ethical guidelines established by Resolution No. 466/2012 of the Brazilian National Health Council. The project was reviewed and approved by the Research Ethics Committee of the State University of Londrina – Department of Nursing, under Approval No. 3.989.981 (CAAE: 28941520.3.1001.5231).

RESULTS

For the assessment of the knowledge questionnaire, simulated scenario, and checklist, a total of eight judges assessed the questionnaire and simulated scenario, while twelve judges assessed the checklist. The majority of the judges were female nurses (77.8%), with a master's degree as their highest qualification (22.2%). Regarding prior experience in instrument validation, most judges (66.7%) had previously participated in similar studies. The mean age of the judges was 42.7 years, ranging from 34 to 55 years, while their professional experience averaged 19.6 years, ranging from 13 to 35 years.

Table 1 presents the means, standard deviations, and confidence intervals (CI) for the quality scores of the questionnaire. The update criterion was met, with all assessors assigning the highest score, resulting in a mean score of 10 points. All mean scores exceeded 8.8 points, and the lower confidence interval limits remained above 7.4 points, indicating a high level of agreement among the judges.

Table 1 – Agreement Among Judges on the *Questionnaire Items.* Londrina, PR, Brazil, 2023

Items	Mean	Standard Deviation	Confidence Interval
Relevance/Appropriateness – The content is relevant and aligns with the intended objective.	9.0	1.7	(7.6; 10.4)
Consistency – The content provides sufficient depth for understanding the topic.	9.4	1.4	(8.2; 10.6)
Clarity – Presented in a clear, simple, and unambiguous manner.	8.8	1.6	(7.4; 10.1)
Objectivity – Allows for precise responses.	8.9	1.6	(7.5; 10.2)
Simplicity – Each item expresses a single idea.	9.5	0.9	(8.7; 10.3)
Feasibility – The item is applicable in practice.	9.5	0.8	(8.9; 10.1)
Timeliness – The content follows the most current evidence-based practices.	10.0	0.0	—
Vocabulary – Words are appropriately chosen, avoiding ambiguity.	9.1	1.4	(8.0; 10.3)
Precision – Each assessment item is distinct and does not overlap with others.	9.0	1.2	(8.0; 10.0)
Instructional Sequence of Topics – The sequence of content is coherent and follows the correct order for execution and learning.	9.3	1.4	(8.1; 10.4)

Source: Prepared by the authors

The adequacy of the items related to the simulated scenario instrument is presented in Table 2. Items 4, 6, 7, 8, and 13 were rated as "inadequate" by one judge. Meanwhile, items 4, 9, and 10 achieved 100% adequacy, according to the judges.

Table 2 – Distribution of Judges' Responses for the Simulated Scenario Items. Londrina, PR, Brazil, 2023

Item	Adequate n (%) (Confidence Interval)	Adequate with Modifications n (%) (Confidence Interval)	Inadequate n (%) (Confidence Interval)
Definition of Themes	6 (75.0%) (40.9%; 92.9%)	2 (25,0%) (7.1%; 59.1%)	0 (0.0%) (0.0%; 32.4%)
Objectives	7 (87.5%) (52.9%; 97.8%)	1 (12.5%) (2.2%; 47.1%)	0 (0.0%) (0.0%; 32.4%)
Accident Scene	7 (87.5%) (52.9%; 97.8%)	1 (12.5%) (2.2%; 47.1%)	0 (0.0%) (0.0%; 32.4%)
Receiving the Patient in the Emergency Room	7 (87.5%) (52.9%; 97.8%)	0 (0.0%) (0.0%; 32.4%)	1 (12.5%) (2.2%; 47.1%)
Providing Care in the Emergency Room	8 (100.0%) (67.6%; 100.0%)	0 (0.0%) (0.0%; 32.4%)	0 (0.0%) (0.0%; 32.4%)
Part 1	6 (75.0%) (40.9%; 92.9%)	1 (12.5%) (2.2%; 47.1%)	1 (12.5%) (2.2%; 47.1%)
Part 2	6 (75.0%) (40.9%; 92.9%)	1 (12.5%) (2.2%; 47.1%)	1 (12.5%) (2.2%; 47.1%)
Part 3	6 (75.0%) (40.9%; 92.9%)	1 (12.5%) (2.2%; 47.1%)	1 (12.5%) (2.2%; 47.1%)
Actor Profile and Scene	7 (87.5%) (52.9%; 97.8%)	1 (12.5%) (2.2%; 47.1%)	0 (0.0%) (0.0%; 32.4%)
Situation 1 – Speech and Performance Guidance for the Actor	8 (100.0%) (67.6%; 100.0%)	0 (0.0%) (0.0%; 32.4%)	0 (0.0%) (0.0%; 32.4%)
Situation 2 – Speech and Performance Guidance for the Actor	8 (100.0%) (67.6%; 100.0%)	0 (0.0%) (0.0%; 32.4%)	0 (0.0%) (0.0%; 32.4%)
Situations 3, 4, and 5 – Speech and Performance Guidance for the Actor	7 (87.5%) (52.9%; 97.8%)	1 (12.5%) (2.2%; 47.1%)	0 (0.0%) (0.0%; 32.4%)
Critical Points	6 (75.0%) (40.9%; 92.9%)	1 (12.5%) (2.2%; 47.1%)	1 (12.5%) (2.2%; 47.1%)
Scenario Duration and Debriefing Guidance	7 (87.5%) (52.9%; 97.8%)	1 (12.5%) (2.2%; 47.1%)	0 (0.0%) (0.0%; 32.4%)

Source: Prepared by the authors

Table 3 presents the means, standard deviations, and confidence intervals for the quality assessment scores of the simulated scenario. All mean scores were high, exceeding 9.25 points. The lower confidence interval limits remained above 8.2 points, indicating a high level of agreement among the judges.

Table 3 – Agreement Among Judges on the *Simulated Scenario Items*. Londrina, PR, Brazil, 2023

Items	Mean	Standard Deviation	Confidence Interval
Relevance/Appropriateness – The content is relevant and aligns with the intended objective.	9.5	0,8	(8.9; 10.1)
Consistency – The content provides sufficient depth for understanding the topic.	9.5	0,9	(8.7; 10.3)
Clarity – Presented in a clear, simple, and unambiguous manner.	9.4	1.2	(8.4; 10.4)
Objectivity – Allows for precise responses.	9.3	1.2	(8.3; 10.2)
Simplicity – Each item expresses a single idea.	9.3	1.2	(8.3; 10.2)
Feasibility – The item is applicable in practice.	9.3	1.2	(8.3; 10.2)
Timeliness – The content follows the most current evidence-based practices.	9.6	0.7	(9.0;10.2)
Vocabulary – Words are appropriately chosen, avoiding ambiguity.	9.6	0.7	(9.0;10.2)
Precision – Each assessment item is distinct and does not overlap with others.	9.3	1.2	(8.3; 10.2)
Instructional Sequence of Topics – The sequence of content is coherent and follows the correct order for execution and learning.	9.3	1.2	(8.3; 10.2)

Source: Prepared by the authors

Finally, the adequacy percentages of the general items in relation to the checklist instrument are presented in Table 4. The checklist instrument contains 80 items, outlining the step-by-step process for initial trauma care. Some items were rated as “Inadequate” by one assessor: Q11 (Identify exsanguinating hemorrhage); Q23 (Recommend definitive airway if Glasgow score is ≤8); Q27 (Expose the thorax for assessment); Q38 (Assess skin coloration); Q44 (Palpate the abdomen); Q55 (Perform an indwelling urinary catheterization for fluid control). Additionally, one item (Q5 – Assess the scene) was rated as “Inadequate” by two assessors. Overall, adequacy rates were relatively high, with a minimum adequacy percentage of 72%. All other items achieved 100% adequacy, according to the assessors.

Table 4 – Distribution of Judges’ Responses for the Checklist Items. Londrina, PR, Brazil, 2023

Indicator	Strongly Agree n (%) (Confidence Interval)	Partially Agree n (%) (Confidence Interval)	Disagree n (%) (Confidence Interval)
Indicator 1 – “Communication”	8 (88.9%) (56.5%; 98.0%)	1 (11.1%) (2.0%; 43.5%)	0 (0.0%) (0.0%; 29.9%)
Assessment of the set of items comprising Indicator 1 – “Communication”	8 (88.9%) (56.5%; 98.0%)	1 (11.1%) (2.0%; 43.5%)	0 (0.0%) (0.0%; 29.9%)
Indicator 2 – “Immediate Assessment and Treatment”	7 (77.8%) (45.3%; 93.7%)	2 (22.2%) (6.3%; 54.7%)	0 (0.0%) (0.0%; 29.9%)
Assessment of the set of items and sub-items comprising Indicator 2 – “Immediate Assessment and Treatment”	8 (88.9%) (56.5%; 98.0%)	1 (11.1%) (2.0%; 43.5%)	0 (0.0%) (0.0%; 29.9%)
Overall Assessment of the Instrument	6 (66.7%) (35.4%; 87.9%)	3 (33.3%) (12.1%; 64.6%)	0 (0.0%) (0.0%; 29.9%)

Source: Prepared by the authors

Regarding the quality ratings of the checklist instrument, the results are presented in Table 5. All mean scores exceeded 9.2 points. The lower limits of the confidence intervals remained above 8.2 points, indicating a high level of assessment by the judges.

Table 5 – Percentage of Checklist Quality Assessment by Judges, Considering Means, Standard Deviation, and Confidence Interval. Londrina, PR, Brazil, 2023

Items	Mean	Standard Deviation	Confidence Interval
Relevance/Appropriateness – The content is relevant and aligns with the intended objective.	9.8	0,6	(9.2; 10.3)
Consistency – The content provides sufficient depth for understanding the topic.	9.9	0,3	(9.7; 10.2)
Clarity – Presented in a clear, simple, and unambiguous manner.	9.2	1.1	(8.2; 10.1)
Objectivity – Allows for precise responses.	9.6	1.0	(8.8; 10.4)
Simplicity – Each item expresses a single idea.	9.4	1.0	(8.6; 10.2)
Feasibility – The item is applicable in practice.	9.8	0.6	(9.2; 10.3)
Timeliness – The content follows the most current evidence-based practices.	9.8	0.6	(9.2; 10.3)
Vocabulary – Words are appropriately chosen, avoiding ambiguity.	9.8	0.6	(9.2; 10.3)
Precision – Each assessment item is distinct and does not overlap with others.	9.8	0.4	(9.5; 10.2)
Instructional Sequence of Topics – The sequence of content is coherent and follows the correct order for execution and learning.	-	-	-

Source: Prepared by the authors

In the overall assessment, the knowledge assessment questionnaire, simulated scenario, and checklist for initial trauma care obtained confidence intervals of 7.4, 8.2, and 8.2, respectively. The mean scores were 8.8 for the questionnaire, 9.25 for the simulated scenario, and 9.2 for the checklist, indicating an optimal level of agreement among the judges. A significance level of 0.05 was applied.

DISCUSSION

This study validated three instruments: a knowledge questionnaire, a simulated scenario, and a checklist for initial trauma care, used in the realistic simulation learning method.

Simulation-based training should be designed as a structured project, meaning that more time should be allocated to its development than to its execution[12,13]. The simulation process, including design, testing, implementation, and assessment, must be supported by structured and systematized tools[14,15] to ensure that the learning objectives and expected outcomes are clearly defined.

To assist facilitators, educators, and researchers in developing this methodology, several simulation framework models are described in the literature[14,15,16,17,18].

Considering the priority competencies for nurses established by Cofen Resolution No. 551/2017, nurses providing urgent and emergency care must develop skills in teamwork, communication and leadership, self-regulation, technical knowledge, task delegation, and health education within their teams.

Thus, the development and validation of instruments that assess these competencies in nursing students are essential. Technical proficiency and agility can significantly impact patient outcomes, potentially determining the patient's vital condition[19].

For instrument validation, the selected judges must have proven expertise in the field. The socio-academic profile data of the selected sample confirm this requirement for expert assessment.

This specialized knowledge in instrument validation, combined with experience in the field, enhances the applicability of these instruments in nursing research and trauma care both in hospital and pre-hospital settings.

The content validation process yielded high approval scores across all three instruments, based on percentage agreement analysis.

Regarding the knowledge questionnaire, only items 1 and 2 received a lower approval percentage (62.2%), specifically: questions on trauma kinematics and in relation to primary concerns for trauma victims

Understanding the circumstances leading to an emergency is essential for critical decision--making in trauma care. The primary goal of emergency care is to preserve life, prevent deterioration before definitive treatment can be administered, and restore the patient to optimal function[10].

Therefore, the determination of care priorities is based on any threat that compromises vital physiological functions[5].

Considering the means, standard deviations, and confidence intervals for the quality assessment scores of the questionnaire, all mean scores were high, exceeding 8.8 points, with confidence intervals above 7.4 points, indicating a high level of agreement.

The simulated scenario was developed based on the National League for Nursing/Jeffries Simulation Framework[14] and was deemed appropriate during its construction process, corroborating previous findings[20,21]. These structured and systematized frameworks serve as the foundation for the development of this methodology, assisting facilitators, educators, and researchers in conducting simulations.

The simulated scenario instrument includes a table aligned with the guidelines of the theoretical framework used, detailing five components: objectives; fidelity; problem-solving; cues; debriefing. These components were structured in a table, which led one judge to rate all five related items as “inadequate”. However, given that the National League for Nursing/Jeffries Simulation Framework is widely used in simulation research, the final simulated scenario model in this study maintained the original framework components, and the items misunderstood by one single judge were not modified[14,16].

There is no standardized protocol in the literature for developing initial trauma care simulations. The creation of trauma-related simulated scenarios is essential for training undergraduate students, enabling them to develop and refine their skills in these specialized situations[11].

The scene assessment aids in identifying injuries caused by force and movement during the impact of an accident, therefore, must be taken into consideration. Properly trained professionals are able to identify or anticipate severe injuries through scene assessment and initiate early treatment[22,23].

Thus, this professional competency should be reinforced during undergraduate education using active learning methodologies, which significantly contribute to the teaching-learning process in health education by fostering critical thinking and clinical reasoning[24].

Regarding the identification of exsanguinating hemorrhages, the well-known “ABCDE” trauma mnemonic was expanded in the 9th edition of PHTLS[5] with the addition of “X” for severe external hemorrhage. This approach should precede airway management, as, epidemiologically, while airway obstruction is a leading cause of rapid fatality, severe external hemorrhages can anticipate potential death.

The emergency nurse must be able to assess neurological dysfunction and communicate any deterioration, as all patients with a Glasgow Coma Scale (GCS) score of ≤8 require a definitive airway and mechanical ventilation until they recover sufficient neurological function for spontaneous breathing[5,10,25].

During trauma care, it is essential to assess chest movement, tracheal deviation, respiratory rate, cyanosis, use of accessory muscles, wounds, hematomas, and bruising. For this, exposing and inspecting the thorax is necessary[5,10,26,27] .

Checklist items related to circulation and hemorrhage control, rated as "inadequate" by the same judge, emphasized the importance of assessing skin color, cyanosis, and diaphoresis, as well as the need to palpate the abdomen.

It is essential to determine whether the hemorrhage source is external or internal. External hemorrhages should be identified and controlled during the primary assessment, while internal hemorrhages are detected initially through a physical examination[10]. To assess circulation and identify possible internal hemorrhages, healthcare providers must check skin color, cyanosis, diaphoresis, pulse rate, capillary refill, abdominal inspection and palpation, as these indicators may suggest compromised perfusion[28].

Finally, another checklist item rated as "inadequate" by the same judge was related to determining the Glasgow Coma Scale (GCS) score. According to ATLS, the GCS is a rapid and simple method for assessing consciousness level and predicting patient prognosis[10].

STUDY LIMITATIONS

The main limitation of this study was the difficulty in obtaining a larger sample of expert judges. Due to the number of assessed instruments (three in total) and their specific assessment criteria (both item-level and global assessment), expert participation decreased over time, with only 8 judges completing the final assessment from an initial sample of 398. Another limitation was the absence of a pilot test involving the target audience (nursing students). This step remains a recommendation for future studies.

CONTRIBUTIONS TO THE FIELD OF NURSING

Trauma care, a common and frequently performed practice in nursing care within critical care units, is classified as an emergency situation. Therefore, it requires highly trained professionals with technical and scientific knowledge to provide high-quality care, minimizing risks and complications. As trauma care is a specialized field with a shortage of trained professionals and educational resources, developing training programs and educational strategies, which must be continuously assessed, remains a significant challenge.

The instruments developed and validated in this study can support educational institutions and healthcare services in developing, updating, and monitoring the knowledge of nursing students and professionals regarding initial trauma care. These instruments can guide training programs and update courses, as well as support the implementation of corrective measures to enhance the quality of trauma care services.

CONCLUSIONS

The vast majority of items in the validated instruments achieved a judge agreement level above 90%. Overall, the instruments demonstrated satisfactory validity evidence.

The validated instruments are expected to be disseminated and utilized by educational institutions and healthcare services to support training programs and continuing education initiatives in trauma care, whether in skills laboratories or clinical practice settings.

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Submitted: July 22, 2023
Accepted: August 29, 2024
Published: April 11, 2025

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All authors approved the final version of the text.

Conflict of interest: There is no conflict of interest.

There is no financing.

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Editor: Adrielle Zagmignan. PhD

Editor-in-chief: Adriane Cristina Bernat Kolankiewicz. PhD