BRAZILIAN JOURNAL BJHBS OF HEALTH AND BIOMEDICAL SCIENCES

Original article

# Translation and cross-cultural adaptation of the air medical prehospital triage score for helicopter transport of trauma patients to brazilian portuguese

**Roges Alvim-Oliveira,[1,2]* Camila L. Bernardes-Oliveira,[2,3] Aline S. Reis,[1,2] Joshua B. Brown,[4] Danúbia C. Sá-Caputo,[2,3,5] Mario Bernardo-Filho[2]**

## Abstract

Introduction: The transport of patients by airplanes or helicopters reduces treatment time, while improving the chances of survival and the quality of life. Due to its costly maintenance and operation service, the air transport of victims depends on appropriate triage criteria for patients eligible for this type of transport. The Air Medical Prehospital Triage (AMPT) Score for Helicopter Transport of Trauma Patients quickly classifies the likelihood of trauma victims benefiting or not from helicopter transport. Objectives: The aim of this study was to translate the AMPT Score and cross-culturally adapt it to Brazilian Portuguese. Methods: This study followed international guidelines for standardized translation processes and was developed from: translation, synthesis, back translation, assessment of equivalences by the expert committee, proposal of the previous version of AMPT Score, application of pre-test/post-test and proposition of the final version of the translated scale. Results: The Wilcoxon Test comparing the experts' assessment with the positive expected resulted in a *p*-value = 0.0625 (General) CI 95%. The Content Validity Index (CVI) of the experts committee was calculated as 0.9479. The pre-test data resulted in a Cronbach's Alpha of 0.920 ± 7.26. The free-marginal Kappa coefficient of pre-test data was 0.89 (95% CI for 0.86, 0.93). The post-test data resulted in a Cronbach's Alpha of 0.925 ± 5.36. The Wilcoxon Test comparing pre-test with post-test resulted in a p-value of 0.0942. Conclusions: The process resulted in a translation of the AMPT Score with the appropriate equivalences proposed by the literature that is statistically reliable and will be of great value to professionals who work with transporting trauma victims in helicopters.

**Keywords**: Prehospital care; Air ambulances; Helicopter; Triage; Translation.

1. Mestrado Profissional em Saúde, Medicina Laboratorial e Tecnologia Forense, Universidade do Estado do Rio de Janeiro. Rio de Janeiro, RJ, Brazil.
2. Laboratório de Vibrações Mecânicas e Práticas Integrativas, Instituto de Biologia Roberto Alcântara Gomes e Policlínica Piquet Carneiro, Universidade do Estado do Rio de Janeiro. Rio de Janeiro, RJ, Brazil.
3. Programa de Pós-Graduação em Ciências Médicas, Faculdade de Ciências Médicas, Universidade do Estado do Rio de Janeiro. Rio de Janeiro, RJ, Brazil.
4. Division of General Surgery and Trauma, Department of Surgery, University of Pittsburgh Medical Center. Pittsburgh, Pennsylvania, USA.
5. Faculdade Bezerra de Araújo. Rio de Janeiro, RJ, Brazil.

***Correspondence address:**
Rua Uberaba, 60/402
Rio de Janeiro, RJ, Brazil.
CEP 20561-240.
E-mail: roges.enf@gmail.com.
ORCID: https://orcid.org/0000-0003-3908-198X

BJHBS, Rio de Janeiro, 2022;21(1):11-20
DOI: 10.12957/bjhbs.2022.68176
Received on 30/06/21. Approved on 07/12/2021.

## Introduction

The need to transport trauma victims, whether due to a lack of resources in a hospital unit or pre-hospital emergency care, means that movement by air is an important strategy. Helicopter Emergency Medical Services (HEMS) aim to take a highly specialized crew to an accident scene for triage, treatment and to provide a fast and efficient form of transport directly to a trauma center for definitive treatment.[1,2] When the location is difficult to access, HEMS can be the only viable means of transport for both rescuers and patients.[2,3] Currently, helicopter rescues cover the entire field of emergency medicine and are an important transport device for polytrauma victims and, in conjunction with ambulances, provide fast (even transregional) transport to specialized trauma centers. Transport by air using fixed-wing (airplanes) or rotary-wing (helicopters) aircraft provides a reduction in treatment time,[4] as well as benefits in terms of survivability[5] and quality of life.[6] Since it is a costly service to maintain and operate, the air transport of patients requires research to determine appropriate triage criteria for patients that stand to benefit from this type of transport.[7] Studies indicate that financial resources spent unnecessarily on air transport could be saved with appropriate triage.[7,8] On the other hand, if air transport is available and appropriate for a specific situation, the sooner the decision to call it in is

made during the evaluation process, the more likely it is for the victims to benefit from it.[9] On-board professionals working in pre-hospital rescue are expected to be able to confront problems and challenges in this area by seeking more knowledge, while developing skills for decision-making as supported by scientific evidence in any adverse situation.[10]

The Air Medical Prehospital Triage (AMPT) Score is a scale developed in the United States of America, validated nationally and internationally', that identifies trauma victims at the injury site who stand to benefit from helicopter transport.[11,12]

The AMPT Score has not been translated and cross-culturally adapted to the Portuguese language of Brazil according to the norms established for this purpose.[13,14] Using it through free translations can generate misinterpretations, which justified the need for the translation and cross-cultural adaptation of the AMPT Score. Its relevance is based on the need for a tool to assist health professionals who work with air transportation of trauma victims.

This study aimed to create a translation and cross-cultural adaptation of the AMPT Score for helicopter transportation of trauma victims, proposed by Brown and colleagues (2016),[11] into Brazilian Portuguese. This work is configured as a first step towards a future validation of this scale and its benefits are related to the improvement of the quality of the service provided by those who work with this type of transport. When using the AMPT Score, health professionals will have in their hand a tool to assist in determining whether air transport is justified or not, in addition to possible cost reductions, since unnecessary flights can be more easily triaged.

## Methods

In Brazil, reports have arisen on the use of free translations of scales without carrying out cross-cultural adaptation, an essential step before conducting a study and applying its results.[15] The type of translation most used nowadays is based on the work of two independent translators, in which the back translation method is applied.[13,14,16,17] It was a cross-sectional methodological study with a quantitative and qualitative approach that deals with the process of translation and cross-cultural adaptation to Brazilian Portuguese of the AMPT Score. Equivalence will be assessed according to the stages proposed by Beaton and colleagues (1993 and 2000).[13,14]

All participants in this study provided their written informed consent. The study protocol was approved by the Research Ethics Committee of the *Hospital Universitário Pedro Ernesto* of the *Universidade do Estado do Rio de Janeiro* (UERJ) under the number CAAE 91960418.0.0000.5259, opinion number 2.751.679.

Dr. Joshua Brown, creator of the AMPT Score, authorized this study.

### Translation and cross-cultural adaptation

- Stage 1: Translation – the translation of the AMPT Score from English to Portuguese was performed by two individuals proficient in the English language. One individual was informed about the purpose of the study, while the other did not receive any information. As a result, two translations were obtained (T1 and T2).

- Stage 2: Synthesis – T1 and T2 were evaluated for the general meaning of each item by consensus of translators and researchers, paying attention to the Brazilian cultural context. This meaning transcends the literalness of words, encompassing more subtle aspects, such as the impact of a term on the cultural context of the target population. This evaluation was necessary because the literal correspondence of a certain term does not imply similar interpretations in different cultures.[13] From this assessment and evaluation of T1 and T2, a joint Translation 12 (T-12) was generated.

- Stage 3: Back-translation – from the resulting document (T-12), a back-translation was performed by two other native speakers of the English language (BT1 and BT2). Again, only one individual was informed of the purpose of the work, while the other individual did not receive any information. BT1 and BT2 were analyzed and, by consensus among researchers and back-translators, gave rise to Back-translation 12 (BT12). BT12 was compared to the original document, and the creator of the Scale (Dr. Joshua Brown), was asked to assess the equivalence between them.

- Stage 4: Committee of Experts – following the guidelines of Beaton and colleagues, (2000),[14] the entire process of translation and back-translation, along with their respective reports, was analyzed by a committee formed by: a methodological health professional with English language proficiency, a bilingual health professional, a translator, a researcher with English language proficiency, a teacher with English language proficiency and a student with English language proficiency. These professionals, in addition to assessing the entire process through reports, evaluated the equivalences of each item by comparing the original

scale with the translated document (T12). They assigned scores for each item according to the semantic, idiomatic, cultural and conceptual equivalences.[14] The Wilcoxon Test and the Content Validity Index were used to assess the responses of these professionals and, by consensus of these assessments, an initial version translated into Brazilian Portuguese of the AMPT Score was proposed.

- Stage 5: Pre-test – from this initial version, a pre-test was applied to 44 health professionals who work with the air transport of patients in helicopters. The aim was to assess the level of understanding of the scale by these professionals. This pre-test was reapplied to the same professionals after an average interval of two weeks, being answered again by 32 professionals, and then submitted to the Wilcoxon Test, Kappa and Cronbach's Alpha in order to assess internal consistency and agreement, so as to determine operational equivalence and reliability.

The analysis was performed using Excel for Windows® software (Microsoft Office Professional Plus, 2016, Microsoft Corporation), Prism 6 for Windows® software (version 6.01, 2012, GraphPad Software Inc.) and Online Kappa Calculator software (Randolph Justus, 2008).

In stage 4 (experts committee) the Wilcoxon test and the Content Validation Index (CVI) were used. The Wilcoxon Test is a non-parametric hypothesis test used when comparing two related samples [18] and it was applied in stage 4 to compare the evaluation by the experts committee. The CVI, a proportion agreement procedure, allows two or more raters to independently review and evaluate the relevance of a sample of items to the domain of content represented in an instrument. It then determines the proportion of cases in which the raters agree and calculates the stability of their agreement.[19]

In stage 5 (pre-test and post-test), statistical tools were used to determine the internal consistency, agreement and equivalence (Cronbach's α, Kappa's Agreement Coefficient and Wilcoxon Test) as a way to assess the reliability of the construct.[20] In the pre-test, Cronbach's α and Kappa were used. Cronbach's α was used to assess the internal consistency of a construct.[21] The Kappa Agreement Coefficient is a measure used for interobserver evaluation, that is, a measure of agreement among evaluators. Values range from 0.00 to 1.00. The higher the Kappa value, the greater the agreement among observers.[22] Cronbach's α was utilized in the post-test. The Wilcoxon Test was used to compare the equivalence of the pre- and post-tests. The results are presented in absolute values and in terms of mean or standard deviation (confidence interval, CI).

## Results

In first and second stage, two independent Brazilian translators, with proficiency in the English language, produced two documents in the stage of translating the original document into Brazilian Portuguese (T1 and T2). Translators and researchers evaluated T1 and T2 to perceive subtle aspects that, if free translation were used, might be non-equivalent. This assessment resulted in the T12 scale.

Table 1 shows sentences that illustrate the comparisons between the original sentence, variations in translation and the first version (synthesis) of the AMPT Score translation (T12).

In the third stage, two back-translators, North Americans fluent in Portuguese, performed the back-translation of this initial version of the Scale into English.

**Table 1. Comparisons between the original sentence, translation variation and synthesis (T12) of the AMPT Score**

| AMPT Score | Translation variation | Synthesis (T12) |
|---|---|---|
| Respiratory rate | Ritmo Respiratório | Frequência Respiratória |
| Multisystem trauma | Traumas múltiplos | Trauma multissistêmico |
| Signs of tension physiology | Sinais de tensão fisiológica | Sinais de tensão/compressão (dispneia, distensão de jugular desvio de traqueia contralateral) |
| Mangled | Laceramento | Mutilada |

**Source:** The authors (2021).

The BT12 scale was generated by consensus. BT12 was compared with the original scale and submitted to the assessment of the author of the AMPT, who rated it as very good in general ("Overall is a very good translation to the original") with only 2 caveats that were analyzed and accepted by the expert committee.

The Expert Committee (Stage 4) judged each item of the translated scale (T12) and compared them with the original scale. Each item received 4 marks between 1 and 4 (one for each equivalence judged: semantic, idiomatic, conceptual, cultural), being: 1 = unchanged; 2 = little changed; 3 = very changed; 4 = completely changed.

The evaluation data were submitted to the Wilcoxon Test comparing the expert assessments with the positive expected (completely equivalent) and the results of the equivalences are shown in Figure 1.

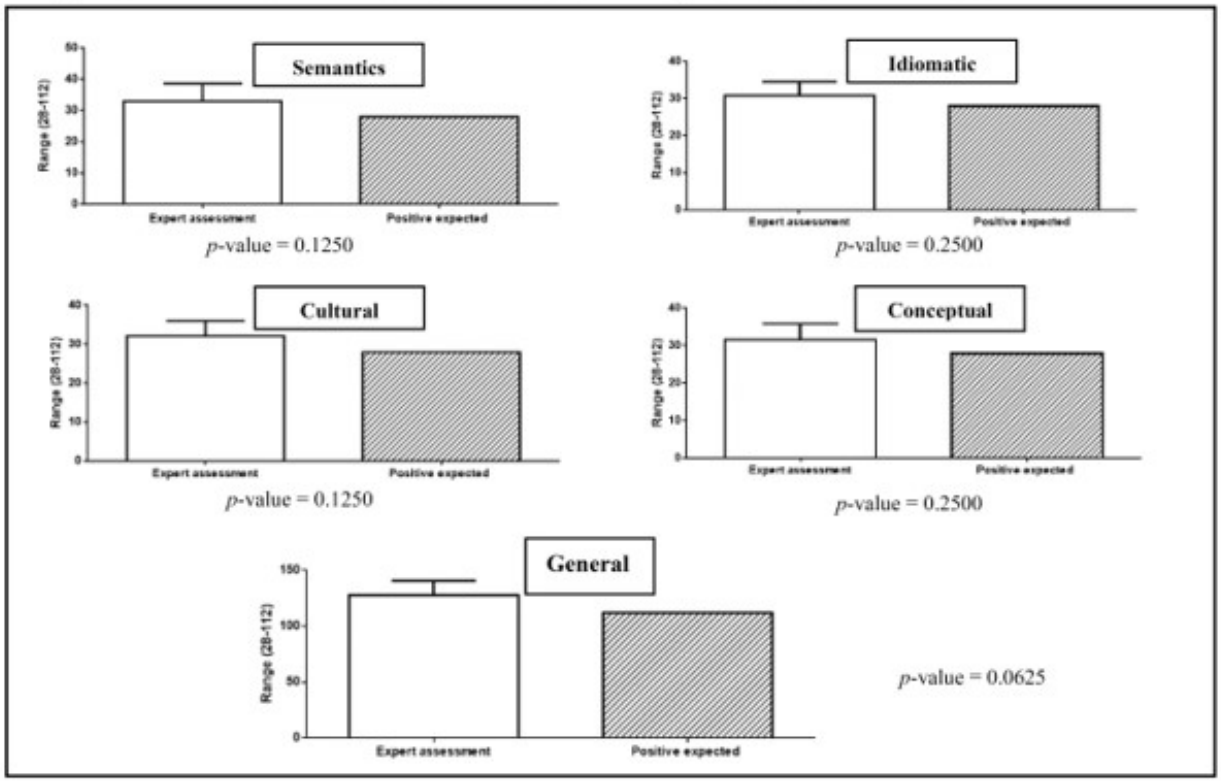



**Figure 1. The Wilcoxon Test of Experts Committee**
**Source:** The authors (2021).

The evaluations of the expert committee were also submitted to the CVI, by adding responses 1 and 2 of the participants and dividing the result of this sum by the total number of responses, with the calculated CVI being 0.9479.

In this fourth stage, after the placements and changes suggested by the expert committee discussed below, the final version of the translation of the AMPT Score into Brazilian Portuguese was then proposed.

Stage 5 consisted of an assessment by 44 health professionals with a higher education degree who work with the air transport of patients on their level of understanding of the items on the scale. The profile of these professionals is presented in Table 2.

These professionals were asked to assign values from 1 to 5 (1 – I did not understand anything at all; 2 – I understood very little; 3 – I do not know if I understood or did not understand; 4 – I understood, but with some

**Table 2. Profile of professionals who responded to the pre-test**

| Characterization of the individuals | | |
|---|---|---|
| Age (year old) | 41.8 ‡ 5.75 | |
| Gender | Male 32 (72.7%) Female 12 (27.3%) | |
| Work City | Rio de Janeiro RJ - 18 (40.8%)<br>Curitiba PR - 4 (9.1%)<br>Cascavel PR - 2 (4.5%)<br>Blumenau SC - 1 (2.3%)<br>Itaboraí RJ - 1 (2.3%)<br>Maricá RJ - 1 (2.3%)<br>São Paulo SP - 1 (2.3%) | Brasília DF - 6 (13.6%)<br>Florianópolis SC - 4 (9.1%)<br>Paranaguá PR - 2 (4.5%)<br>Chapecó SC - 1 (2.3%)<br>Itajaí SC - 1 (2.3%)<br>Ponta Grossa PR - 1 (2.3%)<br>Toledo PR - 1 (2.3%) |
| Scholarity | Doctorate degree - I (2.3%)<br>Postgraduate - 31 (70.5%) | Master's degree - I (2.3%)<br>Graduate - 6 (13.6%) |
| University Graduate | Nursing - 26 (59.2%) | Medicine - 18 (40.8%) |
| Post-graduation in Acrospace Medicine or Aerospace Nursing? | Yes - 17 (38.6%) | No - 27 (61.4%) |
| Use of a trauma patient triage scale for transport by helicopter? | Yes - 6 (13.7%) | No - 38 (86.3%) |
| Which scale do you use? | Glasgow - 2 (4.5%)<br>Glasgow and RASS - 1 (2.3%)<br>RTS - 1 (2.3%) | Glasgow and Aldrete - 1 (2.3%)<br>SOP - 1 (2.3%)<br>None - 38 (86.3%) |

**Source:** The authors (2021).

doubts; 5 – I understood perfectly and have no doubts) for each item, according to the clarity and level of understanding of the information. As a way to facilitate understanding, four items analyzed separately by the Committee of Experts were grouped, totaling 24 items for this pre-test. The results were submitted to Cronbach's Alpha for assessment of internal consistency. Cronbach's Alpha was 0.920 ± 7.26.

The Kappa coefficient was applied to determine the level of agreement among the 44 professionals who answered the pre-test. For this calculation, the values of 4 and 5 (4 – I understood, but with some doubts; 5 – I understood perfectly and have no doubts) were considered a high level of understanding, whereas values 1, 2 and 3 (1 – I did not understand at all; 2 – I understood very little; 3 – I do not know if I understood or if I did not understand) were considered a low level of understanding. It results in free-marginal Kappa 0.89 [95% CI for free-marginal Kappa (0.86, 0.93)], percent overall agreement 94.65%.

Within 15±3 days after the pre-test, 32 of the 44 professionals answered a post-test, containing the same questions as the pre-test. Although this post-test is not provided for the guideline used (19), it was applied to determine whether the level of understanding of the professionals changed over time. The professionals were instructed not to consult their previous responses. Cronbach's Alpha was 0.925 ± 5.36 for these data.

The pre-test and post-test data were compared to determine pre-test – post-test reliability, and the Wilcoxon Test was calculated, resulting in a p-value of 0.0942 (Figure 2).

## Discussion

The AMPT score represents the first attempt to develop a triage tool for the helicopter transport of trauma patients [11] and, in addition to internal validation, the AMPT has also been validated externally.[12]

Measurement instruments are used in clinical practice and research in different areas of knowledge in order to provide valid and reliable measures, requiring the evaluation of their quality during the selection of an instrument.[20] Therefore, reliability and validity are

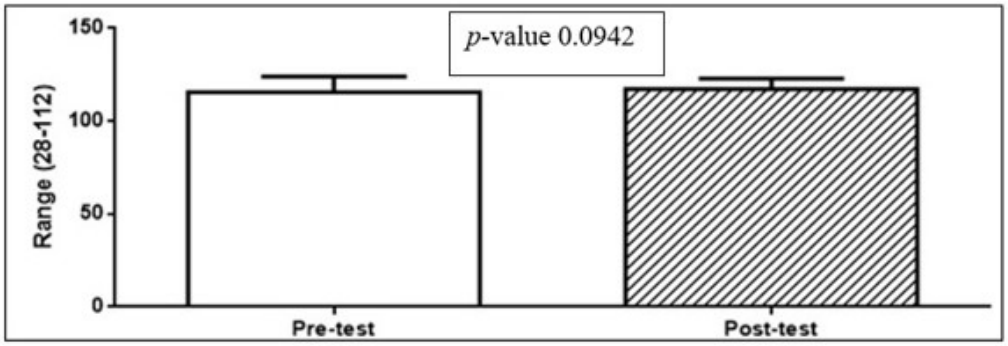



**Figure 2. The Wilcoxon test of pre-test and post-test**
**Source:** The authors (2021).

configured as the main measurement properties of such instruments.[23]

For necessary adaptation, even if an instrument is designed in English, using it in another country also in English requires adaptation to the local culture, which need is further increased when transported to a language other than the original.[13]

According to the recommendations,[14] additional comments were made to highlight challenging phrases or uncertainties and our reasoning for choices is also summarized in the written report.[14] Table 1 demonstrated the challenge of adapting literal translations to appropriate sentences.

The term "respiratory rate" would not be incorrect if translated as "*ritmo respiratório*", but the cross-cultural adaptation to Brazilian Portuguese shows a better perception if translated as "*frequência respiratória*". The expression "*ritmo respiratório*", refers to the sequence, form and amplitude of respiratory incursions[24] (for example: dyspnea, platypnea, orthopnea, trepopnea, Cheyne-stokes, among others). Therefore, it does not denote the number of respiratory incursions per minute, which is clearly the object evaluated in the AMPT Score and is more correctly translated as "*frequência respiratória*".

The term "multisystem trauma" could be understood as "*traumas múltiplos*" in a free translation, however the term "*trauma multissistêmico*" occurs frequently in the Brazilian scientific literature[25] and also in translated reference documents,[9] reflecting practicality and understanding for health professionals who use this triage object.

The term "signs of tension physiology", when translated as "*sinais de tensão fisiológica*", is a typical case of error due to free translation, because, in the context, it is clear that the term refers to physiological signs of compression. In order to confer greater simplicity and objectivity, it was decided to adapt the translation to "*sinais de tensão/compressão*" in addition to including examples of these signs: "*dispneia, distensão de jugular ou desvio de traqueia contralateral*",[9] in order to facilitate the evaluation by the persons who will use the scale.

During the translation of "mangled", the word "*laceramento*" came up, a word that does not exist in Brazilian Portuguese language because the correct one would be "*laceração*". However, it was observed that "mangled" is more widely used in the English language to denote "mutilation", which is why it has been translated as "*mutilada*". "Mangled" is defined as "to destroy something by twisting it with force or tearing it into pieces so that its original form is completely changed",[26] which is compatible with the meaning of "mutilated" in the Portuguese language: "Cut (any part of the body), eliminate part or parts of, unravel, distort, destroy part of."[24]

Based on the synthesis (T12), a back translation was performed by two other native speakers of the English language, who, by consensus, originated the back translation 12 (BT12).

The author of the AMPT received the reports on stages 1, 2 and 3 (translation, synthesis and back-translation) and considered the work up to that point to be very good. Two comments were made: in the expression "All penetrating injuries to head, neck, torso, and extremities proximal to elbow or knee" the RT12 back translation was "All injuries penetrating head, neck, torso, or extremities near elbow or knee", with

the author observing that the word "above" would be more precise than "near" compared to the original "proximal"; in the original expression "Amputation proximal to wrist or ankle" the RT12 was "Amputation near wrist or ankle", with the author again observing that the word "above" would be more precisely equivalent than "near".

In both cases, it was observed that the word "proximal" is used in the medical field to anatomically define a point closer to the center of the body (proximal - distal).[26] Thus, in order to avoid confusion between the words "proximal" and "near", the word "above/*acima*" was chosen.[27]

The expert committee recommended changing a preposition[27] that might cause confusion. They also recommended to change the term "*pressão sanguínea sistólica*" to "*pressão arterial sistólica*", a term used in the 7th Brazilian Guideline for Hypertension[28] and also widely used by academic and health professionals.

In relation to the term "wrist", the committee recommended replacing the translated term "*pulso*" by "*punho*", which is a better anatomical designation.[29]

The Wilcoxon test was applied to compare two related samples (34): the evaluation (by the expert committee) of the initial translated version of the AMPT under the best possible scenario, which would be the full equivalence (Figure 1), resulting in a p-value = 0.0625 (general); p-value = 0.1250 (semantics); p-value = 0.2500 (idiomatic); p-value = 0.1250 (conceptual); p-value = 0.2500 (cultural) demonstrating that the two results are not significantly different.

The CVI[30] was calculated at 0.9479, and a relevant CVI agreement between the members of the expert committee must be at least 0.80 and, preferably, greater than 0.90,[31] showing high agreement on the aspects of the instrument and its items.

After the deliberations and amendments suggested by the Committee of Experts, the final version of the translation into Brazilian Portuguese of the Air Medical Prehospital Triage (AMPT) Score for Helicopter Transport of Trauma Patients was written.

Health professionals with higher education degrees who work with the air transport of patients answered a questionnaire assessing the clarity of the scale items and their level of understanding. In the Table 2 it is possible to verify that there is a predominance of professionals from the Southeast (21/47.7%) over the South (17/38.6%) and Midwest (6/13.7%) regions of Brazil. The professional profile reveals 26/59.2% nurses and 18/40.8% physicians; the vast majority (31/70.5%) have undergraduate degrees', however, only 17 (38.6%) have a specialization in Aerospace Medicine or Nursing; the highest prevalence of time since graduation was 11 to 15 years (13/29.5%) and experience with air transportation of patients from 1 to 3 years (15/34.1%). Furthermore, only six professionals (13.7%) reported using any scale to triage trauma victims, mentioning the following (Table 2): Aldrete, Glasgow, RTS, RASS and SOP.

In an attempt to systematize the criteria of evolution in the post-anesthesia period, the Aldrete Scale was devised by Aldrete and Kroulik in 1970[32] to assess muscle activity, respiration, systemic circulation, conscience and oxygen saturation.

The Glasgow Coma Scale is a reliable and practical method of assessing the level of consciousness in patients suffering from head trauma through the sum of scores attributed to three independent measures: eye opening, motor response and verbal response.[33]

The Revised Trauma Score (RTS) is a tool for trauma triage and estimating initial severity that does not require sophisticated examination devices and is extremely useful in prehospital emergency care. This scoring system consists of the sum of values attributed to: Glasgow Coma Scale, systolic blood pressure and respiratory rate.[34]

The Richmond Agitation and Sedation Scale (RASS) is used for routine neurological assessments in intensive care units, especially in patients without traumatic brain injury.[35] It was initially developed to assist in the management of sedation and analgesia in ICUs and has been shown to be highly reliable and consistent in estimating the patient's level of consciousness. It can be assessed in less than a minute with a simple three-step sequence (observation, response to verbal stimulation and response to physical stimulation).[36]

Standard operating procedures (SOPs) are components of clinical use that were introduced to improve diagnosis and therapeutic management in medicine. They are based on current studies and recommendations for experts and professional organizations.[37] However, in certain situations, they are created internally based on the experiences and opinions of professionals.

It can be seen that the instruments mentioned by health professionals may have a predictive value for the severity of injury to the patient, but do not demonstrate any benefit relationship linked to helicopter transport.

In stage 5 (pre-test and post-test), statistical tools were used to determine the internal consistency, equivalence

and agreement (Cronbach's Alpha, Kappa's Agreement Coefficient and Wilcoxon Test), as a means to assess the reliability of the construct.[20]

Cronbach's Alpha demonstrated positive consistency rates, both when evaluating the pre-test and in post-test evaluation. The pre-test obtained a Cronbach's Alpha value of 0.920 with a standard deviation of 7.26. The post-test obtained a Cronbach's Alpha value of 0.925 ± 5.36. Values between 0.81 and 1.00 are considered to show "almost perfect" consistency.[38]

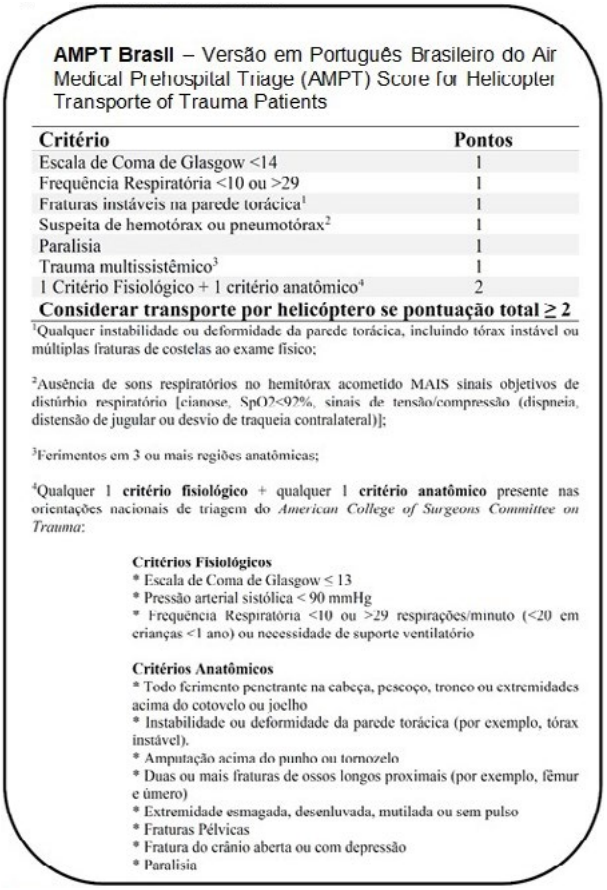
The Kappa Agreement Coefficient is a measure used for interobserver evaluation, that is, a measure of agreement among evaluators. Values range from 0.00 to 1.00. The higher the Kappa value, the greater the agreement among observers.[22] Applied to the pre-test, the calculated Kappa was 0.89 with an overall agreement percentage of 94.65%, which reflects an "almost perfect" agreement (from 0.81 to 1.00).

Test-retest reliability is assessed by applying the same instrument to the same professionals after an average interval of two weeks.[39,40] The average time between pre-test and post-test applications was 15±3 days. Several tests can be used as a statistical measure,[39] and we performed the Wilcoxon Test (Figure 3), which showed no statistically significant difference between the samples (*p*-value = 0.0942).

The limitations of the study are related to: i) lack of comparison of the performance of the scale with another (gold standard), because the AMPT Score represents the first attempt to develop a triage tool for the helicopter transport of trauma victims;[11] ii) psychometric variables of construct validity, item response theory were not evaluated, since they will be the subject of further work to validate the scale, even though the document has been properly translated and adapted to Brazilian Portuguese, psychometric properties must be checked in order to validate the reliability of the data when applied in Brazilian territory; iii) the evaluation did not cover professionals from all regions of Brazil, only the South, Southeast and Midwest regions, and this need should be taken into account in a future validation study.

The Brazilian Portuguese version of the AMPT Score presented in this study is a short and specific questionnaire that assesses, through objective criteria, which trauma patients stand to benefit from air transport by helicopter.

It was observed that few professionals who work with air transport report using any patient triage scale to evaluate the use of a helicopter. Additionally, they reported that, in most cases, the scales used reflect the severity of the victim's injuries, but have no direct relationship to possible benefits of air transport. Thus, the AMPT Score qualifies as an important tool in guiding and assisting healthcare professionals in triage trauma patients who stand to benefit from helicopter transport. In view of the completion of all stages of the translation and cross-cultural adaptation process and positive statistical results, we consider the Air Medical Prehospital Triage Score for Helicopter Transport of Trauma Patients to have been translated and culturally adapted to Brazilian Portuguese (Figure 3), thus qualifying this material for future validation studies.



**AMPT Brasil** – Versão em Português Brasileiro do Air Medical Prehospital Triage (AMPT) Score for Helicopter Transporte of Trauma Patients

| Critério | Pontos |
|---|---|
| Escala de Coma de Glasgow <14 | 1 |
| Frequência Respiratória <10 ou >29 | 1 |
| Fraturas instáveis na parede torácica[1] | 1 |
| Suspeita de hemotórax ou pneumotórax[2] | 1 |
| Paralisia | 1 |
| Trauma multissistêmico[3] | 1 |
| 1 Critério Fisiológico + 1 critério anatômico[4] | 2 |

**Considerar transporte por helicóptero se pontuação total ≥ 2**

[1]Qualquer instabilidade ou deformidade da parede torácica, incluindo tórax instável ou múltiplas fraturas de costelas ao exame físico;

[2]Ausência de sons respiratórios no hemitórax acometido MAIS sinais objetivos de distúrbio respiratório [cianose, SpO2<92%, sinais de tensão/compressão (dispneia, distensão de jugular ou desvio de traqueia contralateral)];

[3]Ferimentos em 3 ou mais regiões anatômicas;

[4]Qualquer 1 **critério fisiológico** + qualquer 1 **critério anatômico** presente nas orientações nacionais de triagem do *American College of Surgeons Committee on Trauma*:

**Critérios Fisiológicos**
* Escala de Coma de Glasgow ≤ 13
* Pressão arterial sistólica < 90 mmHg
* Frequência Respiratória <10 ou >29 respirações/minuto (<20 em crianças <1 ano) ou necessidade de suporte ventilatório

**Critérios Anatômicos**
* Todo ferimento penetrante na cabeça, pescoço, tronco ou extremidades acima do cotovelo ou joelho
* Instabilidade ou deformidade da parede torácica (por exemplo, tórax instável).
* Amputação acima do punho ou tornozelo
* Duas ou mais fraturas de ossos longos proximais (por exemplo, fêmur e úmero)
* Extremidade esmagada, desenluvada, mutilada ou sem pulso
* Fraturas Pélvicas
* Fratura do crânio aberta ou com depressão
* Paralisia

**Figure 3. The Wilcoxon test of pre-test and post-test**
**Source:** The authors (2021).

## Acknowledgments

The corresponding author of AMPT Dr. Joshua Brown.

## Declaration of interest statement

The authors declare no conflict of interest.

## References


1. Butler DP, Anwar I, Willett K. Is it the H or the EMS in HEMS that has an impact on trauma patient mortality? A systematic review of the evidence. Emerg Med J. 2010;27(9):692–701. doi: 10.1136/emj.2009.087486
2. Assa A, Landau DA, Barenboim E, et al. Role of air-medical evacuation in mass-casualty incidents-A train collision experience. Prehosp Disaster Med. 2009;24(3):271–6. doi: 10.1017/S1049023X00006920
3. Lyon RM, Sanders J. The Swiss bus accident on 13 March 2012: Lessons for pre-hospital care. Crit Care. 2012;16(4):2010–1. doi: 10.1186/cc11370
4. Phillips M, Arthur AO, Chandwaney R, et al. Helicopter transport effectiveness of patients for primary percutaneous coronary intervention. Air Med J. 2013;32(3):144–52. doi: 10.1016/j.amj.2012.08.007
5. Gearhart PA, Wuerz R, Localio AR. Cost-effectiveness analysis of helicopter ems for trauma patients. J Trauma Nurs. 1998;5(1):18–9. doi: 10.1097/00043860-199801000-00006
6. Silbergleit R, Scott PA, Lowell MJ, et al. Cost-effectiveness of helicopter transport of stroke patients for thrombolysis. Acad Emerg Med. 2003;10(9):966–72. doi: 10.1197/S1069-6563(03)00316-6
7. Englum BR, Rialon KL, Kim J, et al. Current use and outcomes of helicopter transport in pediatric trauma: a review of 18,291 transports. J Pediatr Surg. 2017;52(1):140–4. doi: 10.1016/j.jpedsurg.2016.10.030
8. Grantham W, To P, Watson J, et al. Retrospective Review of Air Transportation Use for Upper Extremity Amputations at a Level-1 Trauma Center. J Hand Microsurg. 2016;08(02):086–90. doi: 10.1055/s-0036-1583299
9. Wai AKC. Prehospital Trauma Life Support. Eur J Emerg Med. 8a ed. 2012 Dec;19(6):412. doi: 10.1097/MEJ.0b013e32835538b8
10. Morais ÊM de, Agostini FCAD, Oliveira NA de. Role of aerospace care nursing in Brazil: Integrative review. Brazilian J Heal Biomed Sci. 2021;20(1):63–72. doi: 10.12957/bjhbs.2021.59747
11. Brown JJB, Gestring ML, Guyette FX, et al. Development and validation of the air medical prehospital triage score. Ann Surg. 2016;264(2):378–85. doi: 10.1097/SLA.0000000000001496
12. Brown JB, Gestring ML, Guyette FX, et al. External validation of the Air Medical Prehospital Triage score for identifying trauma patients likely to benefit from scene helicopter transport. J Trauma Acute Care Surg. 2017;82(2):270–9. doi: 10.1097/TA.0000000000001326
13. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. J Clin Épidemiology. 1993;46(12):1417–32. doi: 10.1016/0895-4356(93)90142-N
14. Beaton DE, Bombardier C, Guillemin F, et al. Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures. Spine (Phila Pa 1976). 2000;25(24):3186–91. doi: 0362-2436
15. Lino VTS, Pereira SRM, Camacho LAB, et al. Adaptação transcultural da Escala de Independência em Atividades da Vida Diária (Escala de Katz). Cad Saude Publica. 2008;24(1):103–12. doi: 10.1590/s0102-311x2008000100010
16. Hilton A, Skrutowski M. Translating instruments into other lnguages: development and testing processes. Cancer Nurs. 2002;25(1):1–7. doi: 10.1097/00002820-200202000-00001
17. Reichenheim ME, Moraes CL, Hasselmannb MH. Equivalencia semantica da versão em português do instrumento Abuse Assessment Screen para rastrear a violência contra a mulher grávida. Rev Saude Publica. 2000;34(6):610–6. doi: 10.1590/S0034-89102000000600008
18. Society IB. Probability Tables for Individual Comparisons by Ranking Methods Author ( s ): Frank Wilcoxon Published by: International Biometric Society Stable [Internet]. [cited 2019 Jan 15]. Available from: http://www.jstor.org/stable/3001946. 2010;3(3):119–22
19. Lynn MR. Determination and quantification of content validity. Nurs Res. 1986;35:382–5. doi: 10.1097/00006199-198611000-00017
20. Souza AC de, Alexandre NMC, Guirardello E de B. Propriedades psicométricas na avaliação de instrumentos: avaliação da confiabilidade e da validade. Epidemiol e Serv saude Rev do Sist Unico Saude do Bras. 2017;26(3):649–59. doi: 10.5123/S1679-49742017000300022
21. Landis JR, Koch GG. The Measurement of Observer Agreement for Categorical Data. Biometrics. 1977;33(1):159-74. doi: 10.2307/2529310. Available from: http://www.jstor.org/stable/2529310
22. Salmond SS. Evaluating the Reliability and Validity of Measurement Instruments. Orthop Nurs. 2008;27(1):28–30. doi: 10.1097/01.NOR.0000310608.00743.54
23. Cook DA, Beckman TJ. Current concepts in validity and reliability for psychometric instruments: Theory and application. Am J Med. 2006;119(2):166.e7-166.e16. doi: 10.1016/j.amjmed.2005.10.036
24. Dicionário Aurélio [Internet]. [cited 2019 Jan 15]. Available from: https://dicionariodoaurelio.com/mutilada
25. Gentile JK de A, Himuro HS, Rojas SSO, et al. Condutas no paciente com trauma crânioencefálico. [Internet]. Rev Bras Clin Med. 2011;9(jan-fev):74–82. [cited 2019 Dez 28]. Available from: https://pesquisa.bvsalud.org/portal/resource/pt/lil-577701
26. Cambridge Dictionary [Internet]. [cited 2019 Jan 15]. Available from: https://dictionary.cambridge.org/pt/dicionario/ingles/mangled
27. Michaelis. Michaelis Dicionário Escolar Língua Portuguesa. São Paulo: Editora Melhoramentos; 2016
28. Malachias M, Plavnik FL, Machado CA, et al. 7th Brazilian Guideline of Arterial Hypertension: Chapter 1 - Concept, Epidemiology and Primary Prevention. Arq Bras Cardiol. 2016;107(3 Suppl 3):1–6. doi: 10.5935/abc.2013s010
29. Netter FH. Atlas de Anatomia Humana. 6a Ed. Rio de Janeiro: Elsevier; 2014
30. Alexandre NMC, Coluci MZO. Validade de conteúdo nos processos de construção e adaptação de instrumentos de medidas. Cienc e Saude Coletiva. 2011;16(7):3061–8. doi: 10.1590/S1413-81232011000800006
31. Polit DF, Beck CT. The content validity index: are you know what's being reported? Critique and recommendations. Res

Nurs Health. 2006;29:489–97. doi: 10.1002/nur.20147
32. Aldrete JA, Kroulik D. A postanesthetic recovery score. Anesth Analg. 1970;49(6):924–34. doi: 10.1213/00000539-197011000-00020
33. Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. Lancet. 1974 Jul 13;2(7872):81-4. doi: 10.1016/s0140-6736(74)91639-0
34. Champion H, Sacco W, Copes W, et al. A revision of the trauma score. J Trauma. 1989;29:623–9. doi: 10.1097/00005373-198905000-00017
35. Trivedi V, Iyer VN. Utility of the Richmond Agitation-Sedation Scale in evaluation of acute neurologic dysfunction in the intensive care unit. J Thorac Dis. 2016;8(5):E292–4. doi: 10.21037/jtd.2016.03.71
36. Sessler CN, Gosnell MS, Grap MJ, et al. The Richmond Agitation-Sedation Scale: Validity and reliability in adult intensive care unit patients. Am J Respir Crit Care Med. 2002;166(10):1338–44. doi: 10.1164/rccm.2107138
37. Zausig YA, Bayer Y, Hacke N, et al. Simulation as an additional tool for investigating the performance of standard operating procedures in anaesthesia. Br J Anaesth. 2007;99(5):673–8. doi: 10.1093/bja/aem240
38. Landis JR, Koch GG. The Measurement of Observer Agreement for Categorical Data. Biometrics. 1977;33(1):159. doi: 10.2307/2529310
39. Arafat S, Chowdhury H, Qusar M, et al. Cross Cultural Adaptation and Psychometric Validation of Research Instruments: a Methodological Review. J Behav Heal. 2016;5(3):129. doi: 10.5455/jbh.20160615121755
40. Arafat S. Validation study can be a separate study design. Int J Med Sci Public Heal. 2016;5(11):2421. doi: 10.5455/ijmsph.2016.19042016471