Research, Society and Development, v. 11, n. 11, e128111133455, 2022
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v11i11.33455

Translation and cross-cultural adaptation of the Brachial Assessment Tool for Brazilian Population

Tradução e adaptação transcultural do Instrumento de Avaliação Braquial para a População Brasileira

Traducción y adaptación transcultural de la Herramienta de Evaluación Braquial para la Población Brasileña

Received: 07/27/2022 | Reviewed: 08/06/2022 | Accept: 08/08/2022 | Published: 08/17/2022

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Abstract

Objective: Present the translation and cultural adaptation of the BrAT for the Brazilian population. *Methodology*: This translation and cross-cultural adaptation study involved ten steps proposed by the International Society of Pharmacoeconomics and Outcomes Research (ISPOR): preparation, forward translation, reconciliation, back-translation, back-translation review, harmonization, cognitive debriefing – which comprised: a Delphi study involving Brazilian physiotherapists that should answer a 7-item form, divided into 3 central axes: questionnaire content, structure and cross-cultural adaptation; and a Pilot study involving patients with BPI that were questioned regarding their comprehension on each question of Brazilian version of BrAT -, review of cognitive debriefing, proofreading and final report. *Results***:** The translation process generated the first Brazilian Portuguese version of BrAT. On cognitive debriefing, ten physiotherapists from the five Brazilian regions provided answers on Delphi study, and a consensus ≥ 80% was achieved in all items, with no amendments proposed. The pilot study involved twenty-one patients with BPI who showed full understanding of the translated version of BrAT and did not suggest any changes. After proofreading the instrument, the final Brazilian version of BrAT (BrAT-Brasil) was developed. *Conclusion*: BrAT-Brasil version proved to be well adapted to the cultural scenario of the Brazilian population. It exhibited successful results in all

stages recommended by the international guideline on translation and cultural adaptation of patient-reported outcome measures.
Keywords: Brachial plexus; Patient reported outcome measure; Peripheral nerve injuries; Translations.

Resumo

Objetivo: Apresentar a tradução e adaptação cultural do BrAT para a população brasileira. *Metodologia:* Este estudo de tradução e adaptação transcultural envolveu dez etapas propostas pela International Society of Pharmacoeconomics and Outcomes Research (ISPOR): preparação, tradução direta, reconciliação, retrotradução, revisão de retrotradução, harmonização, debriefing cognitivo – que compreendeu: um estudo Delphi envolvendo fisioterapeutas brasileiros que deveriam responder a um formulário de 7 itens, divididos em 3 eixos centrais: conteúdo do questionário, estrutura e adaptação transcultural; e um estudo piloto envolvendo pacientes com BPI que foram questionados quanto à compreensão de cada questão da versão brasileira do BrAT -, revisão do debriefing cognitivo, revisão e relatório final. *Resultados:* O processo de tradução gerou a primeira versão em português do Brasil do BrAT. No debriefing cognitivo, dez fisioterapeutas das cinco regiões brasileiras responderam ao estudo Delphi, e um consenso ≥ 80% foi alcançado em todos os itens, sem propostas de emendas. O estudo piloto envolveu 21 pacientes com BPI que demonstraram total compreensão da versão traduzida do BrAT e não sugeriram alterações. Após a revisão do instrumento, foi desenvolvida a versão brasileira final do BrAT (BrAT-Brasil). *Conclusão*: A versão do BrAT-Brasil mostrou-se bem adaptada ao cenário cultural da população brasileira. Exibiu resultados bem-sucedidos em todas as etapas recomendadas pela diretriz internacional sobre tradução e adaptação cultural de medidas de resultados relatadas pelo paciente.
Palavras-chave: Plexo braquial; Medida de resultado relatada pelo paciente; Lesões de nervos periféricos; Traduções.

Resumen

Objetivo: Presentar la traducción y adaptación cultural del BrAT para la población brasileña. *Metodología:* este estudio de traducción y adaptación transcultural involucró diez pasos propuestos por la Sociedad Internacional de Farmacoeconomía e Investigación de Resultados (ISPOR): preparación, traducción directa, conciliación, traducción inversa, revisión de la traducción inversa, armonización, informe cognitivo. que comprendía: un estudio Delphi con fisioterapeutas brasileños que debían responder un formulario de 7 ítems, divididos en 3 ejes centrales: contenido del cuestionario, estructura y adaptación transcultural; y un estudio piloto con pacientes con BPI que fueron cuestionados sobre su comprensión en cada pregunta de la versión brasileña de BrAT, revisión del debriefing cognitivo, revisión e informe final. *Resultados:* El proceso de traducción generó la primera versión en portugués brasileño de BrAT. En el debriefing cognitivo, diez fisioterapeutas de las cinco regiones brasileñas respondieron sobre el estudio Delphi, y se logró un consenso ≥ 80% en todos los ítems, sin propuestas de enmiendas. El estudio piloto involucró a veintiún pacientes con BPI que mostraron una comprensión completa de la versión traducida de BrAT y no sugirieron ningún cambio. Después de la revisión del instrumento, se desarrolló la versión brasileña final de BrAT (BrAT-Brasil). *Conclusión:* la versión BrAT-Brasil demostró estar bien adaptada al escenario cultural de la población brasileña. Mostró resultados exitosos en todas las etapas recomendadas por la guía internacional sobre traducción y adaptación cultural de las medidas de resultado informadas por los pacientes.
Palabras clave: Plexo braquial; Medida de resultado informada por el paciente; Lesiones de nervios periféricos; Traducciones.

1. Introduction

Among peripheral nervous system lesions, brachial plexus injuries (BPI) accounts for 20% of all injuries, with higher incidences in healthy young males, usually associated with motorbike accidents (Coelho et al., 2015). Given the anatomical complexity of brachial plexus, patients may present with a wide spectrum of disabilities, which range from motor and sensory deficits to pain, functional limitation, poorer quality of life, psychosocial adjustment issues and economical losses due to inability to manage pre-morbid work activities (Coelho et al. 2015; DY et al., 2015).

In spite of its variable and complex clinical presentation, outcome assessment after BPI is usually impairment-based, being restricted to measuring muscle strength, active range of motion and sensation (Dy et al., 2015). Although such evaluation plays a significant role in measuring the success of reinnervation procedures, these outcomes are insufficient to provide a detailed understanding of how the affected upper limb is used in activities of daily living (ADLs) (Hill; et al., 2011).

Upper limb use is a key long-term outcome that may reflect the patient's satisfaction after BPI as well as the interaction with the individual's health condition and the personal and environmental factors in which they live. (Hasson, et. al.

2000; Hill, et.al. 2015). Currently arm use is usually measured with instruments that were not specially developed for people with a BPI, thus they may not truly reflect the patients' abilities to perform ADLs with the affected limb. For example, it has been shown that the most commonly used outcome measure, the Disability of Arm Shoulder and hand (DASH) is more likely to report activities performance using compensatory strategies and adaptations rather than assess actual upper limb use (Mancuso et al., 2016).

In order to address some of these issues, the Brachial Assessment Tool (BrAT), a 31-item patient-reported outcome measure, was the first instrument specifically developed to measure daily use of the affected upper limb after adult traumatic BPI.10 Items based on the International Classification of Functioning, Disability and Health (ICF) definition of activity were generated by a variety of stakeholders, including people with BPI. Activities included were regularly carried out by this population and represent the spectrum of ability (Hill et al., 2018). In Brazil, there is currently no instrument to assess arm use in patients with BPI. Therefore, the present study aims to present the translation and cultural adaptation of the BrAT for the Brazilian population.

2. Methodology

Study design

This is a translation and cross-cultural adaptation study, conducted according to the recommendation of the International Society of Pharmacoeconomics and Outcomes Research (ISPOR) (WILD et al., 2005). The authors obtained permission from the original developers of BrAT to translate and adapt the instrument from English to Portuguese – Brazil.

This study was approved by the Federal University of Pernambuco Ethics Committee (CAAE 19469519.9.0000.5208) and all participants signed the informed consent form.

Procedures

The translation and cross-cultural adaptation process of BrAT involved a 10-step procedure (WILD et al., 2005) described below:

(1) Preparation. In the first stage, permission was obtained from the original instrument developer for translating and cross-culturally adapting the BrAT for a Brazilian population and inviting the BrAT developer to be involved in the study.

(2) Forward translation. Two independent native-speaking Brazilians fluent in English translated the original BrAT into Brazilian Portuguese, resulting in two independent translated versions (T1 and T2). Both translators had prior experience in the translation of patient-reported outcome measures (PROMs).

(3) Reconciliation. A translation panel consisting of the forward translators, the project manager and three physiotherapists with clinical experience in BPIs aimed at achieving consensus on a single version of BrAT in Brazilian Portuguese (T12).

(4) Back-translation. Two native-speaking English translators with fluency in Brazilian Portuguese performed two independent back translations (BT1 and BT2) of T12 into English. Both translators were English teachers living in Brazil.

(5) Back-translation review. The objective of this step was to review the back translations against the original version of BrAT, to ensure conceptual equivalence of the instruments. This stage was conducted by the project manager, the same two physiotherapists of step 3 and the BrAT developer, to assist in resolving difficult issues.

(6) Harmonization. This stage comprises a harmonization of all BrAT back-translation versions that arose from different cross-cultural adaptation processes, in order to detect cultural variations.

(7) Cognitive debriefing. This step assessed the level of comprehensibility and translation equivalence through a Delphi Study comprising physiotherapists and a Pilot Study that involved patients with traumatic BPI.

(7.1) Delphi Study. The Brazilian Portuguese version of BrAT was submitted to the opinion of Brazilian physiotherapists from the five country regions. For this aim, thirty professionals with previous experience in managing patients with traumatic BPI were invited to respond a 7-item form, divided into 3 central categories: questionnaire content, structure and cross-cultural adaptation. The participants were asked to respond using a 5-point Likert scale, which considers the degrees of agreement to each assertion (1 representing total disagreement, 5 representing total agreement). If the participant did not answer "I totally agree", they could justify or make suggestions. (Hill, et. Al. 2019; Magalhães, et. al. 2017). Although literature requires an agreement level >60%, (Hill, et. Al. 2019; Magalhães, et. al. 2017). the researchers established a minimal agreement level of 80%, where of participants answered, "I totally agree". Where consensus was not established in at least one of the statements, participants were invited to choose from three assertion options. Once this process was completed, the Brazilian version of BrAT was reviewed by patients with BPI.

(7.2) Pilot study. A pilot study was carried out in order to assess patients' comprehension regarding the Brazilian version of BrAT. Ten participants from a Peripheral Nerve Outpatient Clinics were invited, using the same eligibility criteria adopted by Hill et al. (2016). Inclusion criteria were: (1) medical diagnosis of traumatic BPI, confirmed by nerve conduction studies, magnetic resonance imaging, clinical assessment or intraoperative findings; (2) participants aged > 18 years old (Hill et al., 2016). Exclusion criteria were: (1) patients who did not provide informed consent; (2) presented with at least one of the following conditions: a preexisting upper limb condition that could affected ADLs performance, spinal cord injury, brachial plexus birth palsy or patients who were non-weight bearing on the affected limb.15 Participants were questioned regarding their comprehension on each question of Brazilian version of BrAT and, in case of any misunderstanding, they could suggest amendments for the instrument. Additionally, sociodemographic and clinical information were collected through a form developed by the project manager.

(8) Review of cognitive debriefing. Once cognitive debriefing was fully completed, the results were reviewed by the project manager in order to incorporate possible findings of the debriefing process, thus improving the translation and culturally adapted version.

(9) Proofreading. In this step, the translated version of BrAT was checked for minor errors which may have been missed throughout the translation process. In this step, a third Brazilian physiotherapist was invited.

(10) Final report. The final step comprises an explanation of the translation and cross-cultural adaptation of the BrAT instrument process, the main purpose of the present paper.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) software, version 22.0. Descriptive statistics were used to report the Delphi study results and characterization of both physiotherapists and patients who participated in the cognitive debriefing phase.

3. Results

Forward translation

Table 1 describes the discrepancies that occurred throughout the translation process of BrAT between translators, as well as the synthetized translated version.

Table 1. Description of the discrepancies identified in steps 2 (Forward translation) and 3 (Reconciliation) of the translation and cultural adaptation process of the Brachial Assessment Tool for Brazilian population.

Item	Original version	Translation 1	Translation 2	Synthesis of translations
Introduction	"Your clinician will explain (…)"	"Seu fisioterapeuta irá te explicar (...)"	"Seu médico explicará (...)"	"Seu avaliador te explicará (...)"
1	"Use both arms to put on a T-shirt"	"Usar ambos os braços para colocar uma camiseta"	"Usar ambos os braços para vestir uma camiseta"	"Usar ambos os braços para vestir uma camiseta"
2	"Use both arms to put on a pair of trousers e.g. jeans"	"Usar ambos os braços para vestir calças"	"Usar ambos os braços para vestir uma calça"	"Usar ambos os braços para vestir uma calça"
4	"Use both hands to put toothpaste on a toothbrush"	"Usar ambas as mãos para colocar pasta de dente na escova"	"Usar ambas as mãos para colocar creme dental na escova de dentes"	"Usar ambas as mãos para colocar pasta de dente na escova"
8	"Use both hands to do up tight trouser buttons e.g. jeans"	"Usar ambas as mãos para aproximar botões, por ex: zíper em calça jeans"	"Usar ambas as mãos para abotoar botões apertados, por ex: botões de calça jeans"	"Usar ambas as mãos para abotoar uma calça apertada, por ex.: calça jeans"
11	"Use both hands to do up zip including putting ends together"	"Usar ambas as mãos para subir um zíper"	"Usar ambas as mãos para fechar um zíper"	"Usar ambas as mãos para fechar um zíper"
12	"Use both hands to spread butter or jam on a piece of bread"	"Usar ambas as mãos para espalhar manteiga ou geleia em um pedaço de pão"	"Usar ambas as mãos para espalhar manteiga ou geleia em uma fatia de pão"	"Usar ambas as mãos para espalhar manteiga ou geleia em um pedaço de pão"
16	"Carry an object only using your affected arm so your other arm/hand is free to do another task"	"Carregar um objeto usando apenas o seu braço afetado para que seu outro braço/mão fique livre para fazer outra coisa"	"Carregar um objeto usando apenas o seu braço afetado para que seu outro braço/mão fique livre para desempenhar outra atividade"	"Carregar um objeto usando apenas o seu braço **afetado** para que seu outro braço/mão fique livre para fazer outra coisa"
26	"Maintain control of your affected arm so you don't need to wear a sling"	"Manter controle do seu braço afetado para que você não precise usar uma tipóia"	"Manter controle do braço afetado para que não seja necessário usar uma tipoia"	"Manter controle do braço afetado para que você não precise usar uma tipoia"
28	"Hold an object draped over your affected forearm, e.g. an article of clothing"	"Segurar um objeto pendurado em seu antebraço afetado, por ex.: uma peça de roupa"	"Segurar um objeto pendurado em seu antebraço afetado, por ex.: uma peça de roupa"	"Manter um objeto pendurado em seu antebraço afetado, por ex.: uma peça de roupa"
31	"Roll over when sleeping without having to wake to move your affected arm"	"Virar de lado ao dormir sem ter que acordar para mover seu braço afetado"	"Rolar ao dormir sem ter que acordar para mover seu braço afetado"	"Virar de lado ao dormir sem ter que acordar para mover seu braço afetado"

Note: The underlined expressions are the ones in which translation divergences were identified.
Source: https://www.brachialplexus.scot.nhs.uk/documents/BrAT

Overall, there were 11 translation divergences, nine were structural (i.e. the translators used different words for the same content, without compromising the expressions' meanings). In this case, the reconciliation committee chose the expression that could keep the instrument as simple and comprehensible as possible.

The other two divergences were semantic differences between translators: in the introduction, the word "clinician" had two different translations, as well as the expression "to do up tight trouser buttons" (item 8). After analyzing the manual skill this item assesses, the reconciliation committee adopted a translated version of the expression that could be better understandable for patients and healthcare professionals.

Back translation

Table 2 describes the discrepancies that occurred throughout the back- translation process, as well as the comparison among the back-translation versions against the original version of BrAT.

Table 2. Description of the discrepancies identified in steps 4 (Back-translation) and 5 (Back-translation review) of the translation and cultural adaptation process of the Brachial Assessment Tool (BrAT) for Brazilian population.

Item	Original version	Back translation 1	Back translation 2	Changes in T12
2	"Use both arms to put on a pair of trousers"	"To use both arms to put on pants"	"To use both arms to put on pants"	No change was applied.
8	"Use both hands to do up tight trouser buttons e.g. jeans"	"Use both hands to button tight pants, e.g. jeans"	"Use both hands to button tight pants, e.g. jeans"	No change was applied.
13	"Use both hands to tie up a rubbish bag and put in the bin"	"Use both hands to tie up a trash bag and put it in the trash"	"Use both hands to tie up a trash bag and put it in the trash"	No change was applied.
16	"Carry an object only using your affected arm so your other arm/hand is free to do another task"	"Carry an object using only the affected arm so your other arm is free to do something else"	"Carry an object using only the affected arm so your other arm is free to do something else"	No change was applied.
18	"Hold a pot of food with 1 hand and stir it with the other"	"Hold a food bowl with one hand and stir it using the other one"	"Hold a food bowl with one hand and stir it using the other hand"	No change was applied.
19	"Use both arms/hands to change the sheet on a bed"	"Use both hands and arms to change bed sheets"	"Use both hands and arms to change bed sheets"	No change was applied.
21	"Use both arms to peg clothes on the washing line"	"Use both arms to hang clothes on a clothesline"	"Use both arms to hang clothes on a clothesline"	"Usar ambos os braços para pendurar roupas em um varal" was replaced for "Usar ambos os braços para prender uma roupa no varal com um pegador de roupas"
26	"Maintain control of your affected arm so you don't need to wear a sling"	"Keep control of the affected arm so there is no need to wear a sling"	"Maintain control of the affected arm so there is no need to wear a sling"	No change was applied.
27	"Hold an object between your affected upper arm and your chest wall, e.g. a book'	"Hold an object between your affected arm and your chest, e.g.: a book"	"Hold an object between your affected arm and your chest, e.g.: a book"	"Segurar um objeto entre o seu braço afetado e seu peito, por ex: um livro" was replaced for "Segurar um objeto sob a sua axila, por ex.: um livro"
28	"Hold an object draped over your affected forearm e.g. an article of clothing"	"To keep an object hanging at your affected forearm, e.g. a garment"	"Keep an object hanging at your affected forearm, eg. a clothe"	No change was applied.

Note: The underlined expressions are the ones in which translation divergences were identified. T12 = Synthesized version of BrAT forward translations. Source: https://www.brachialplexus.scot.nhs.uk/documents/BrAT.

Ten items presented discrepancies. The majority were between the back-translations against the original version. Most differences were only at a structural level, not compromising the T12 version.

Items 21 and 27 were the only ones that raised semantic problems throughout the translation process. In both cases, the forward translations misunderstood the intended meaning of original BrAT. Thus, the back-translation review process

identified these mistakes and new forward-translated items were developed to present semantic equivalence with the original version. After this process, the first Brazilian Portuguese version of BrAT was developed.

As this is the first study involving translation and cross-cultural adaptation of the BrAT, no other back-translation versions currently exist, therefore the harmonization process could not be carried out.

Cognitive Debriefing – Delphi study

Thirty Brazilian physiotherapists were invited to take part in a Delphi Study. Ten provided answers, representing a 33.3% response rate.

The sample comprised mostly females (60%, n = 6), All five Brazilian regions were represented by at least one person, most from the Northeast region (40%, n = 4), followed by South and Southeast regions (20%, n = 2 each), North and Central-west regions (10%, n = 1 each).

The majority had a Masters' degree (40%, n = 4), followed by Specialist degree (30%, n = 3), while two were graduated Physiotherapists (20%) and one had a PhD degree (10%). Most (80%, n = 8) had 2 to 5 years professional experience, while the others (20%, n = 2) had more than 5 years of experience.

The Delphi Study comprised only one phase, as a consensus equal or greater than 80% was achieved in all items in round 1 (Table 3). No amendments were proposed by the judges; therefore, the Brazilian version of BrAT proceed for the cognitive debriefing step: piloting with patients with BPI.

Table 3. Results of the Delphi Study carried out in the Cognitive Debriefing (step 7.1) of the translation and cultural adaptation process of the Brachial Assessment Tool (BrAT) for Brazilian population.

Statement	Agreement
1 – Considering that BrAT was developed for assessing functionality of adults with brachial plexus injury, the items presented in the translated version of the questionnaire truly reflect the proposed content.	90%
2 – The questionnaire items in Brazilian Portuguese are understandable to the evaluator.	90%
3 – The four alternative answers are suitable for the question 1 to 31 of the Brazilian version of BrAT.	100%
4 – The translated version of the questionnaire reflects the original English version in terms of semantics (meaning of words in their context).	100%
5 – The items of the Brazilian version reflect daily tasks of Brazilian population.	80%
6 – After reading the instructions for application, as well as the entire BrAT questionnaire in Brazilian Portuguese, the evaluator will be able to understand how to apply this questionnaire.	90%
7 – After reading the instructions for application, as well as the entire BrAT questionnaire in Brazilian Portuguese, the evaluator will be able to understand how the individual's functionality is scored in each item, as well as each subscale score and overall score.	100%

Source: https://www.brachialplexus.scot.nhs.uk/documents/BrAT

Cognitive Debriefing – Pilot study

Twenty-one patients with BPI participated in the pilot study. The sample was mostly male (93.1%, n = 19), with mean age of 28.6 years (standard deviation ± 16.7). Further sociodemographic and clinical data are detailed in Table 4.

Table 4. Sociodemographic and clinical data of participants with brachial plexus injury who participated in the Cognitive Debriefing – Pilot study (step 7.2) of the translation and cultural adaptation process of the Brachial Assessment Tool (BrAT) for Brazilian population.

Characteristics		**(%) n = 21**
Schooling level	Illiterate	4.8
	Elementary school	19
	Middle school	14.3
	High school	57.1
	College	4.8
Monthly family income	< 1 minimum wage	20
	1 minimum wage	30
	1 to 2 minimum wages*	45
	2 to 4 minimum wages*	0
	4 or more minimum wages*	5
Affected upper limb	Right upper limb	42.9
	Left upper limb	57.1
Did the injury affect your dominant side?	Yes	52.4
	No	47.6
Causal factor of the injury	Motorcycle accident	76.2
	Car accident	4.8
	Firearm projectile	4.8
	Fall	4.8
	Piercing-sharp objects	4.8
	Other	4.8
Classification of brachial plexus injury	Complete lesion (ST + MT + IT)	47.6
	Partial lesion (ST + MT + IT)	9.5
	ST	19
	ST + MT	4.8
	Infraclavicular lesion	4.8
	Non-specified	14.3

(*) Brazilian minimum wage in 2019: R$ 998.00 BRL.
IT = Inferior trunk; MT = Middle trunk; ST = Superior trunk.
Source: https://www.brachialplexus.scot.nhs.uk/documents/BrAT

The items of the translated version of BrAT were understood by participants, who did not suggest any amendment for the instrument. The results of cognitive debriefing were reviewed by the project manager (step 8) and a third physiotherapist conducted the proofreading of the instrument (step 9), conducting minor adjustments, such as punctuation and page numbering. After that, the final Brazilian version of BrAT (BrAT-Brasil) was fianlized (see Appendix).

4. Discussion

This study presents the Brazilian version of the first PROM instrument specially developed for evaluating use of the upper limb after adult traumatic BPI.15 Considering that the incidence of traumatic BPI has been increasing in Brazil, given the incremental rise in motorcycle accidents (Flores, 2006) such injury requires further attention in terms of measuring health and disability using a holistic, patient centered approach. As the first PROM developed specifically for and by people with BPI, the BrAT may provide an in-depth understanding and sound measurement of the impact of BPI on the individual.

The translation and cultural adaptation of a PROM requires a long, systematic, complex and rigorous methodological process (César et al., 2016). However, this process minimizes the risk of poorly translated instruments which may compromise research data validity (Wild et al., 2005). In addition, as far as we know BrAT-Brasil is the first culturally-adapted version of the original BrAT, thus representing an initial dissemination of the instrument to non-native English-speaking countries.

There were few discrepancies throughout the translation and cultural adaptation process of BrAT for a Brazilian population. Firstly, the introduction uses the word "clinician", which was translated into two different words; In English language, that means healthcare professionals in general, however, Brazilian Portuguese does not have a word whose meaning matches such expression. Thus, the word "avaliador" (i.e. "evaluator") was chosen, as an attempt to cover all rehabilitation and healthcare categories able to administer the instrument.

The expression "to do up tight trouser buttons", in the 8th item, also raised different comprehensions between translators. The first forward translator interpreted such expression as the act of bringing the trousers' button and buttonhole close together, while the second translator focused on the act of passing the button through the buttonhole. On BrAT-Brasil, both movements were combined using the expression "abotoar uma calça apertada" (i.e. to button tight trousers), as that maintained the item meaning and matches the original intention.

The importance of the back-translation was highlighted in the translation and adaptation of item 21 ("Use both arms to peg clothes on the washing line"). The expression "to peg clothes on the washing line" could be expressed in Portuguese as "putting laundry on a line", without focusing on the action of fixing the clothes with a peg itself. As that was identified in step 5, we have developed the version "prender uma roupa no varal com um pegador de roupas" (i.e., to fix a cloth on the washing line using a peg), in order to make it clear the pinch grip movement.

Item 27 also deserved careful attention, being significantly adjusted throughout the back-translation review process. In the forward-translation phase, the original item "Hold an object between your affected upper arm and your chest wall, e.g. a book" was interpreted as holding an object against the anterior portion of chest wall, inducing an internal rotation of shoulder joint. In step 5, however, the original BrAT developer clarified that this item actually focuses on holding an object against the lateral portion of chest wall, therefore comprising shoulder adduction movement. As a result, this item was adapted as follows: "Segurar um objeto sob a sua axila, por ex.: um livro" (e.g. To maintain an object under your armpit, e.g. a book).

With regards to the Delphi study, a concordance equal or greater than 80% was achieved in all items, being higher than the levels previously required in literature. (Hill, et. Al. 2019; Magalhães, et. al. 2017). The lowest percentage was observed in the statement "The items of the Brazilian version reflect daily tasks of Brazilian population". This may be a reflection of the differing lifestyle and cultural aspects seen in the five Brazilian regions represented in this project. However, the remaining 20% chose the option "I partially agree", demonstrating that no specialist in fact disagreed from the proposed statement. In Delphi study, no amendments were proposed by the judges, so the version developed at the end of step 5 proceed for the next stages.

The pilot study comprised a sample whose sociodemographic characteristic were similar to previous studies addressing BPI: the majority of patients were young males who suffered a motorcycle accident (Flores, 2006; Magalhães et al.,

2017). In spite of the low socioeconomic levels presented by the target population, the items of BrAT-Brasil were clearly understandable by all patients, including those who presented with lower schooling levels. We note that the original version of BrAT was designed to be administered by a clinician or self-administered. (Mancuso, et. al. 2015). In our study, the instrument was only administered by clinicians, given that the Brazilian population that suffers traumatic BPI usually presents with low schooling levels, potentially compromising the reading and interpretation of written material. Therefore, we could not ensure that a self-administered instrument would guarantee consistent results as. We strongly suggest that BrAT-Brasil is administered by healthcare professionals only.

In addition to the translation and cultural adaptation of PROMs, assessing validity and conceptual equivalence of new translated instruments requires post-hoc psychometric validation (Wild et al., 2005). which is the main limitation of our study. In spite of it, this preliminary paper illustrated the entire translation and cultural adaptation of BrAT in a very detailed way, and the psychometric properties will be further evaluated by our study group in the future.

5. Conclusion

In conclusion, BrAT-Brasil proved to be well adapted to the cultural scenario of a Brazilian population, as it exhibited successful results in all stages recommend by the international guideline on translation and cultural adaptation of PROMs. We highlight, however, that clinical and research application of this instrument still requires the assessment of its psychometric properties.

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