

Cross-cultural adaptation of the Motor Assessment Scale (MAS) for Brazil

Elaine Lima Silva Wanderley¹, Luci Fuscaldi Teixeira-Salmela², Glória Elizabeth Laurentino³, Luan César Simões⁴, Andrea Lemos³

ABSTRACT

Objective: To make a cross-cultural adaptation of the MAS for Brazil. **Method:** The process of cross-cultural adaptation took place in five stages: 1) translation of the original version of the MAS by two independent bilingual translators; 2) synthesis of translations (creation of version 1); 3) back-translation (version 1 in Portuguese was reversed to English by two independent bilingual translators); 4) analysis by the specialists committee (four translators and two physiotherapists); 5) pre-test (application of the instrument in the target population). A Delphi study was also performed and the instrument was submitted to the approval of ten physiotherapists from different states in the country. **Results:** The consensus about the clarity, semantic equivalence, and technical-scientific relevance of MAS-Brazil was obtained in the second phase of the Delphi study, with agreement between 80 and 100%. In the first phase of the Delphi study, suggestions were made to improve the clarity of the items, which resulted in the Delphi-2 list. **Conclusion:** The MAS-Brazil was created through an appropriate process of cross-cultural adaptation, ensuring its semantic equivalence and cultural adequacy. It is still necessary to verify the measuring properties of this version for its appropriate use clinically and in research.

Keywords: Stroke, Validity of Tests, Reproducibility of Results

¹ Masters in Physiotherapy.

² Physiotherapist, Tenured Professor at the Universidade Federal de Minas Gerais – UFMG.

³ Physiotherapist, Adjunct Professor at the Universidade Federal de Pernambuco – UFPE.

⁴ Physiotherapist, Lecturer at the Faculdade Estácio do Rio Grande do Norte.

Mailing address:

Departamento de Fisioterapia da Universidade
Federal de Pernambuco (UFPE)
Elaine Lima Silva Wanderley
Av. Prof. Moraes Rego, 1235
CEP 50670-901
Recife – PE
E-mail: elainelcs@yahoo.com.br

Received on March 29, 2015.

Accepted on April 30, 2015.

DOI: 10.5935/0104-7795.20150014

INTRODUCTION

The impairment of motor function in patients after a stroke usually consists of hemiparesis/hemiplegia: a clinical sign characteristic of the disease.¹⁻³ The presence of this motor dysfunction reverberates in the activities of daily and occupational living and in the social participation of individuals.¹⁻³ This is why an increase in social welfare and hospital costs is observed, which drains both public and private funds.⁴⁻⁶

In this context, the rehabilitation of motor function after a stroke is one of rehabilitation's essential pillars for this population and thus requires rigorous evaluation processes via measuring instruments with the right properties.⁷⁻¹⁰

In the literature (MEDLINE/PUBMED, LILACS, CINAHL, SCOPUS and WEB OF SCIENCE), 11 instruments for assessing the motor function of individuals after a stroke were found translated into Brazilian Portuguese.¹¹⁻²¹ However, only three of them (*Motor Assessment Scale*, *Rivermead Mobility Index*, and *Fugl-Meyer Scale*)¹¹⁻¹³ evaluate motor function globally, including the trunk as well as upper and lower limbs. Among them, the *Motor assessment scale (MAS)* stands out because it evaluates motor function through observing the performance of functional activities, with emphasis on the quality of movement during transfers and in manual activities.^{22,23}

The MAS was created in 1985 in Australia by two physiotherapists, Janet Carr and Roberta Shepherd,²² and it is recognized in international literature as an instrument whose proper reliability, validity, and responsiveness were determined^{22,24-30} in the English language. In addition, it also has good features such as ease in application, objectivity, clinical relevance, and is a predictor of functional performance.^{22,23,31} However, the version available in Brazil is merely a literal translation from English into Portuguese and it has not been properly validated.

In order for the MAS to be used in Brazil either in clinical practice or in research, and also because it is an instrument created in another country with a different culture and language, it is necessary to perform a cross-cultural adaptation process. This process demands the use of a standardized method to make it possible to reach equivalence between the original version and the target version, where the items should not only be well translated linguistically, but also culturally adapted to maintain the content validity of the instrument in different cultures.³²⁻³⁷

OBJECTIVE

The objective of the present study was to perform the cross-cultural adaptation of the MAS for Brazil and to analyze its semantic equivalence, clarity of items translated, and technical and scientific relevance.

METHOD

This qualitative study on cross-cultural adaptation sought to produce the Brazilian version of the MAS (MAS-Brazil). The cross-cultural adaptation process involved five stages, in accordance with the recommendations of Beaton et al.³² and of the *Consensus-based Standard for the selection of health Measurements Instruments (COSMIN)*,³⁵⁻³⁷ after previous authorization by the original authors of the scale, as follows:

Stage 1 (Translation): The original English version of MAS, the eight items, and the general rules for their use were translated independently into Brazilian Portuguese by two bilingual translators (official language: Brazilian Portuguese). Translator 1 was a physiotherapist, who dominated the instrument's content, and Translator 2 was an English teacher, with knowledge of the instrument's content and the ability to identify ambiguities in the translation.

Stage 2 (Synthesis of translations): Translators 1 and 2 met to discuss and solve the discrepancies between their initial translations, so that those two translations could be synthesized into a single Brazilian Portuguese version (version 1). An observer (ELSW) documented all the ambiguities and their respective solutions.

Stage 3 (Back Translation): This version 1 in Brazilian Portuguese was independently back-translated into the original language (English) by two other translators (official language: English) to verify that it reflected the content of the original version. Translators 3 and 4 were English teachers, had no previous contact with the original MAS scale, and met after the back translations were done to verify ambiguities between the original instrument and the back-translated versions. An observer (ELSW) documented the results of that meeting.

Stage 4 (Revision by a specialists committee): A committee of specialized judges consisting of four translators and three physiotherapists (among them a university professor), who were fully versed on the instrument's content, analyzed all the translation material

and the original MAS version and prepared version 2 of the MAS-Brazil.

After the revision by the specialists committee, since the instrument presents technical language and content, a Delphi study was developed where version 2 was submitted to the opinion of rehabilitation professionals from different parts of the country.³⁷⁻³⁹ The objective of the Delphi study was to verify the semantic equivalence, clarity of items translated, and the technical and scientific relevance of the MAS-Brazil, through an analysis of the level of agreement between the participating professionals.

Professionals were invited according to the following inclusion criteria: minimum experience of five years in clinical care and/or teaching and academic research in the area of Physiotherapy as applied to Neurology; a recognized level of expertise in the rehabilitation area or similar; and fluency in English and Portuguese. In order for there to be a minimum of ten participants, 16 professionals were invited.^{38,39}

To do the Delphi study, a Delphi list 1 was built, consisting of 13 statements about the MAS-Brazil version 2 to be answered through the Likert scale (1= totally disagree, 2=partially disagree, 3=indifferent, 4=partially agree, and 5=totally agree). It was determined previously, as an agreement criteria for the items on the Delphi lists, that at least 80% of the participants should choose scores of either 4 or 5.³⁸⁻⁴⁰

As recommended, a pilot Delphi study was first made, with the participation of two local physiotherapists, following pre-established eligibility criteria.^{38,39} The participants in this pilot study filled in the Delphi list 1 and an agreement between them was reached in the first phase.

After the pilot study, the first phase of the Delphi study began, where the Delphi list 1 was sent to the ten professionals via e-mail. In this first phase, the participants were instructed to determine their degree of agreement with the 13 statements proposed and when the option was different from "totally agree," they should justify their answers, which conferred a qualitative character to this phase, according to the recommendations.^{38,39}

The results obtained through the Delphi list 1 were organized and sent to the participants in the form of a report, giving them the chance to review their answers and compare them with the other participants. The answers in the first phase were considered for the construction of the Delphi list 2.^{38,39} In this second phase, the questionnaire was composed of 14 statements, also answered through the

Likert scale, without the need to justify their answers. After reaching a consensus, all the modifications resulting from the Delphi study were made to the instrument, which created the MAS-Brazil version 3, which was then submitted to the pre-test.

Stage 5 (Pre-test): In order to apply the version 3, the evaluator had been prepared by reading and interpreting the items and general rules for the use of the MAS and applying the scale on ten stroke survivors.

Other individuals who had also suffered a stroke were recruited in the rehabilitation services of Recife and in the Metropolitan Region (Olinda, Paulista, and Jaboatão dos Guararapes) in the state of Pernambuco, Brazil. The participants' contact information was obtained by the recommendations of the professionals responsible for the rehabilitation units and by consulting the waiting lists for those services. All the individuals who wished to participate signed a Free and Informed Consent form after being oriented as to the objectives and procedures of the study. The project was approved by the Committee for Ethics in Research Involving Humans at the UFPE Center for Health Sciences under CAAE No. 01646812.2.0000.5208.

To be included, the participants had to be clinically diagnosed with primary or recurrent stroke for at least 30 days, with the presence of hemiparesis/hemiplegia, to be older than 21 years. To be excluded, the following were considered: to have cognitive impairment as evaluated through the Brazilian version of the Mini-Mental State Examination (cut-off scores of 18/19 for illiterate individuals and of 24/25 for individuals with schooling),⁴⁰ have another neurological and/or orthopedic deficiencies not related to stroke, or to have auditory disorders or aphasia that could interfere with the communication with the evaluators.

Descriptive statistics were used with the SPSS statistic package for Windows (version 20.0) for the characterization of the sample and of the specialists participating in the Delphi study, as well as for the analysis of the Delphi study results. The qualitative data from the cross-cultural adaptation stages and from the first phase of the Delphi study were grouped and tabulated.

RESULTS

Stages 1 and 2: Translation and synthesis of the translations

Table 1 shows the results of the independent initial translations into Brazilian

Portuguese, where the items that had some discrepancy are indicated along with their respective solutions (consensus between the translators).

Stage 3: Back Translation

In general, no semantic differences were found between the back-translated translations into English and the original MAS version. Table 2 shows the results from the back translation for the items presented in Table 1.

Stage 4: Specialists committee and Delphi study

After analyzing the material resulting from the translations, the synthesis of translations, and the back translations, the specialists committee created version 2 of the MAS-Brazil. In that version, they chose to replace the terms *braço* (arm) and *perna* (leg) for *membro superior* (upper limb) and *membro inferior* (lower limb), respectively, in items 1 (scores from 1 to 5), 2 (score 3), 3 (scores from 4 to 6), 5 (score 1), and 6 (scores from 1 to 5). In item 2, the term *cama* (bed) was replaced for the term *leito* (hospital bed). In item 1 (score 1), the term *lado sã*o (intact side) was replaced by *lado não parético* (non-paretic side).

There was a consensus between the committee members on the translation of the term "stand-by help," present in items 2 (scores from 3 to 6), 4 (scores 5 and 6), and 5 (scores from 1 to 3), and it was decided to keep the term *ajuda de prontidão* in the version 2 of the MAS-Brazil. Finally, in the title of

item 2, *supino para sentado na lateral do leito*, it was chosen to add the explanation (*pernas para fora/legs to the outside*) to better interpret the final posture expected in this item.

The specialists committee also analyzed the list of materials needed to apply the MAS and agreed that some items should be described more appropriately to be better understood in Portuguese, as shown in Chart 1. In addition, the items *mesa* (table) and *escada de canto* (staircase corner) were added because, although there are activities performed with these materials, they were not mentioned in the list of the original instrument.

Delphi Study

Two physiotherapists from Pernambuco participated in the Delphi pilot study; they had an average age of 29.5 years (0.7 SD), average time of professional activity of 5.2 years (3.1 SD), with clinical and research experience in the area of the neurological rehabilitation.

For the Delphi study, 16 professionals were invited, 13 of whom accepted, but only 10 actually sent the answers to phases 1 and 2. Among those 10 participants, 90% were females, with average age of 38.2 years (5.0 SD). Their average time of professional activity was 14.9 years (6.2 SD), with 40% having clinical experience and 60% having clinical and academic experience in the area of Neurofunctional Physiotherapy. The participants were 30% from the state of Pernambuco, 20% from the state of Paraíba, 20% from Minas Gerais, and 30% from São Paulo.

Table 1. Results from stages 1 and 2 (translation and synthesis of translations) of the Brazilian version of the Motor Assessment Scale (MAS-Brazil) cross-cultural adaptation

Item/ Score	Original version	Translation		Synthesis of translations (consensus)
		Translator 1	Translator 2	
Item 1	Supine to side lying onto intact side.	Supino para decúbito lateral sobre o lado sã	Supino para decúbito lateral sobre o lado intacto.	Supino para decúbito lateral sobre o lado sã
Item 1/score 5	Moves arm and leg and rolls to side but overbalances.	Move braço e perna e rola para o lado, porém desequilibra-se.	Move braço e perna e rola para o lado, porém "emborcare-se".	Move braço e perna e rola para o lado, porém desequilibra-se.
Item 2	Supine to sitting over side of bed.	Supino para sentado pelo lado da cama.	Supino para sentado sobre o lado da cama.	Supino para sentado sobre a lateral da cama.
Item 2/ score 3*	Therapist gives stand-by help by assisting legs over side to bed.	Terapeuta fornece uma "ajuda de apoio" ajudando as pernas pelo lado da cama.	Terapeuta fornece uma "ajuda se necessário" apoiando as pernas sobre o lado da cama	Terapeuta fornece uma "ajuda de prontidão" apoiando as pernas do paciente sobre o lado da cama
Item 3	Balanced sitting	Sentar equilibrado	Sentado equilibrado	Sentado equilibrado
Item 5	Walking	Caminhando	Andando	Caminhando
Item 5/scores from 3 to 6	"aid"	"Auxílio"	"Ajuda"	"Auxílio"
Item 6	Upper-Arm function	Função do braço superior	Função do braço	Função do braço (proximal)
Item 7	Hand movements	Movimentos da mão	Movimentos manuais	Movimentos da mão

* The term "stand-by help" is found in other items of the instrument, where the solution chosen was repeated

Table 2. Results from stage 3 (back translation) of the Brazilian version of the Motor Assessment Scale (MAS-Brazil) cross-cultural adaptation

Item/Score	Synthesis of translations (Consensus)	Back Translation		Original version
		Translator 3	Translator 4	
Item 1	Supino para decúbito lateral sobre o lado sã.	Supine to lateral position over the healthy side.	Supine to lateral decubitus on the healthy side.	Supine to side lying onto intact side.
Item 1/score 5	Move braço e perna e rola para o lado, porém desequilibra-se.	Move the arm and leg and rolls to the other side, but unbalanced.	Move the arm and leg, rolls to the side, but unbalanced.	Moves arm and leg and rolls to side but overbalances.
Item 2	Supino para sentado sobre a lateral da cama.	Supine to a sitting position over side of the bed.	Supine to seated on the side of the bed.	Supine to sitting over side of bed.
Item 2/score 3*	... (Terapeuta fornece uma "ajuda de prontidão" apoiando as pernas do paciente...)	... (Therapist supplies "ready assistance", helping legs (of patient...))	... (Therapist provides "ready assistance", helps the legs (of the patient...))	... (Therapist gives stand-by help by assisting legs...)
Item 3	Sentado equilibrado	Balanced Sitting	Balanced Sitting	Balanced sitting
Item 5	Caminhando	Walking	Walking	Walking
Item 5/ scores 3- 6	"Auxílio"	"Assistance"	"aid"	"aid"
Item 6	Função do braço (proximal)	Function of the upper arm	Function of the upper arm	Upper-Arm function
Item 7	Movimentos da mão	Hand movements	Hand movements	Hand movements

* The term "stand-by help" is found in other items of the instrument, where the solution chosen was repeated

Chart 1. Adaptations of the materials needed to use the Brazilian version of the Motor Assessment Scale (MAS-Brazil)

Description of the material (Original MAS)	Description of the material (MAS-Brazil)
1 low and large base	1 tablado
1 bench	1 banco (com altura regulável)
1 chronometer	1 cronômetro
1 polystyrene (Styrofoam) cup	1 copo de poliestireno (isopor) de 300 ml
2 tea cups	2 xícaras de chá
1 rubber ball (14 cm of diameter)	1 bola de borracha (14 cm de diâmetro)
1 comb	1 pente
1 dessert spoon with water	1 colher de sobremesa com água
1 pen with a cap	1 caneta com tampa
1 sheet of paper prepared to draw lines with one vertical line on the right side	1 folha de papel preparada para desenhar linhas com uma linha vertical na lado direito da folha
1 small bag of sand	1 pequeno saco de areia (200 g de areia).
1 cylindrical object as a jar	1 copo de acrílico rígido de 300 ml (14,5 cm de altura e 6 cm de diâmetro)
8 jelly beans	8 balas de goma (jujubas)

As a result of the first phase (Delphi List 1), they reached an agreement percentage greater than 80% in all the items (Table 3). However, although the participants had agreed, further suggestions were given to improve the understanding (clarity) of some items (Table 4). Those suggestions were the basis for creating the list in the second phase of the Delphi study.

In Table 4, the results of the second phase are described (Delphi List 2), which was finished in this phase since it satisfied the stipulated agreement ($\geq 80\%$).

Stage 5: Pre-test

This stage involved 10 hemiparetic individuals with mean age of 63.30 years (9.74 SD), with nine (90%) males. Among them, eight individuals (80%) presented only one stroke, one (10%) presented two strokes, and another (10%) had suffered three strokes. The average time after the stroke was 65.5 months (69.7 SD). In seven cases (70%), the stroke had been ischemic and in three cases (30%), it had been hemorrhagic, with six individuals (60%) presenting hemi-

paresis on the left side and all of them being under physiotherapeutic treatment.

After the application to the target population, no need for new adjustments was seen in the instrument. Even the use of the materials, as determined by the specialists committee proved to be viable. Therefore, version 3 represented the final version of the MAS-Brazil.

In the final version of the MAS-Brazil, the eight items of the instrument are written as follows: 1) *Supino para decúbito lateral sobre o lado não parético* (Supine to side lying onto intact side); 2) *Supino para sentado na lateral do leito* (Supine to sitting over side of bed); 3) *Equilíbrio sentado* (Balanced sitting); 4) *Sentado para de pé* (Sitting to standing); 5) *Marcha*, (Gait); 6) *Função do membro superior* (Upper limb function); 7) *Movimentos da mão* (Hand movements); 8) *Atividades elaboradas da mão* (Elaborate hand activities).

DISCUSSION

The final version of the MAS-Brazil was produced through an appropriate cross-cultural adaptation process, as recommended in the literature.³²⁻³⁷ During the entire adaptation process, the term "stand-by help" (items 2, 4, and 5) was the one that created the most disagreements and questions. During stages 1 and 2, the consensus was that none of the translation options (translator 1 = *ajuda de apoio* (support help) and translator 2 = *ajuda, se necessário* (help, if needed)) would represent the original phrase semantically in Portuguese, so a third translation was used-*ajuda de prontidão*.

Nevertheless, this phrase *ajuda de prontidão* was still considered inappropriate in the first phase of the Delphi study and it was replaced by *supervisão* (supervision). In that way, the term *Supervisão*, in addition to clarifying the language of the items in which it is inserted, represented exactly what is being explained in the general rules of use for the MAS-that is: that the evaluator must remain close to the patient and give him support, if needed, but not help him actively.

Another point of disagreement, verified in stages 1 and 2, was the translation of the term "overbalances" (item 1 - score 5). It was understood that the term suggested by Translator 2 (fall over), in addition to not representing technical language, would indicate a fall into the prone position during the passage from supine to lateral decubitus, an unexpected motor behavior for an individual who would receive a score of 5 (almost the maximum

Table 3. Medians and percentage of agreement for each item in the Delphi List 1 of the Brazilian version of the Motor Assessment Scale (MAS-Brazil)

Statements	Median	Agreement (%)
The 8 items represent relevant points of motor function.	5	100
The content of the items and their scores reflect the motor function evaluated.	5	100
The scores present a gradation of the motor function evaluated.	5	100
The content of MAS observes what would be important to evaluate in motor function.	5	100
The Portuguese version semantically reflects the original version.	4	100
The Portuguese version presents common professional language.	5	100
The items and scores show clarity.	4,5	80
After reading the scale and rules, it is possible to understand their application.	5	100
After reading the scale and rules, it is possible to understand how the items are scored.	5	100
The materials used are easily found.	5	100
The description of materials is satisfactory.	5	100
The selection of materials used complies with the standard of the original scale.	5	100
The Brazilian version is adapted for use in research and in the clinics.	5	100

Table 4. Medians and percentage of agreement for each item of the Delphi List 2 of the Brazilian version of the Motor Assessment Scale (MAS-Brazil)

Statements	Median	Agreement (%)
In item 1 (score 2): "Move ativamente o membro inferior parético, transpassando-o para o outro lado e a parte inferior do corpo acompanha", corpo (body) must be replaced by tronco (trunk).	5	90
In item 1 (score 3): "O membro superior não parético eleva o membro superior parético, transpassando-o para o outro lado do corpo. O membro inferior parético é movido ativamente e o corpo acompanha em bloco", corpo (body) must be replaced by tronco (trunk).	5	90
In item 2, the explanation pernas para fora (legs to the outside) is not necessary.	4,5	90
In item 2 (score 2): the term "controla a cabeça o tempo todo" will be replaced by "durante todo o movimento".	5	100
In items 2, 4, and 5, the term "ajuda de prontidão", must be replaced by "supervisão", for better understanding.	5	80
In item 3, the term "Sentado equilibrado" must be replaced by "Equilíbrio sentado".	5	100
In item 3, the term "senta" must be replaced by "mantém-se sentado" in the 1, 2, and 3 scores and by "sentado" in the 4, 5, and 6 scores, because the first indicates movement towards the seated position, but in the entire item the individual must already be seated.	5	90
In item 3 (score 2): Sem se segurar, joelhos e pés juntos, pés podem estar apoiados no chão, "podem" must be replaced by "devem", so that the final wished position is standardized.	5	90
In item 5, the term "Caminhando" must be replaced by "Marcha", because it is a more technical term.	5	90
In scores from item 5, the word "caminha" must be replaced by "deambula", because it is a more technical term.	5	100
In item 5 (scores de 3 a 6): the term "auxílio" must be replaced by "dispositivo de auxílio à marcha", because it represents its meaning better within the item's context.	5	90
In items 3 and 4, the term "não permitir" must be replaced by "não é permitido", because the first seems to indicate that the evaluator should actively prevent the movement not allowed, when in fact, the patient should already be oriented not to do it.	5	80
In item 7 (score 4): "Sentado, desloca-se para frente, pega uma bola grande de 14 cm (5 polegadas) de diâmetro com ambas as mãos e coloca-a embaixo de volta." The term "pega" must be replaced by "ergue" and the term "e coloca-a embaixo de volta" must be replaced by "e coloca-a de volta sobre a mesa"..."	5	80
In item 8, the title "Atividades avançadas da mão" must be replaced by "Atividades elaboradas da mão".	4	80

score of 6) in this function. There was a consensus that the term *em desequilíbrio* (unbalanced) (suggested by Translator 1) would be more appropriate to this situation.

One more relevant point of disagreement between translators 1 and 2 was about the item 2 "*Supine to sitting over side of bed.*" They had a consensus that the replacement of

the phrase *lado da cama* by the phrase *lateral da cama* would represent more exactly the location where the patient should sit, which would be on the edge of the bed. The phrase *sentado no lado da cama* could lead to confusion for users of the instrument that the patient should sit outside the bed, that is, in some place beside the bed.

During the analysis stage of the specialists committee meeting, one of the decisions was to replace the term *lado são* by the term *lado não parético*, for it better represents the clinical condition of the ipsilateral hemibody on the side affected by the encephalic lesion. Another important aspect in this stage was the fact that, after analyzing the materials used, it was considered necessary to describe them more in detail, in order to provide a better standardization. It was not necessary to replace any of the materials used, since all of them are available in Brazil. In the Delphi study, there was a consensus among the professionals that the description of materials used in the Brazilian version was satisfactory and that the materials were easily found in the region where they lived.

The Delphi study also contributed towards clarifying the meaning of the term "aid" from item 5 (Gait). It was found by some of the participants, during the first phase of the Delphi study that, within the context, the term "aid" was an auxiliary device to the gait and not any type of external aid or support. In addition, help on the part of another person is represented by the term "stand-by help." Then, in the second phase of the Delphi study, there was a consensus among the professionals that the term *dispositivo de auxílio à marcha* be used in the Portuguese version, instead of just *auxílio*, which was seen in version 2.

A cross-cultural adaptation process, according to the literature, involves only five stages: translation, synthesis of translations, back translation, specialists committee, and pre-test.³²⁻³⁷ However, the Delphi study added relevance to the process, since the instrument could be verified in its area of application by experienced professionals from different regions in the country.

The objective of the Delphi study was to reach a consensus among professionals with relevant experience on a specific theme. For this, the participants answered structured questionnaires about the target theme (called phases) and the answers from each phase were considered in the reformulation of the subsequent questions, until a consensus was reached. Generally, a maximum of three phases is enough to reach a consensus. An advantage to this method is that the participants

are not identified until the end of the process, the questionnaires are filled in anonymously, and the opinions of the specialists are combined without any physical contact and are, therefore, considered in a non-adversarial manner.³⁸⁻⁴⁰

The scientific merit of the results of a Delphi study depends on the quality of the specialists panel. Therefore, in the present study, this parameter was observed in the inclusion criteria, where not only professionals with experience in research or teaching participated, but also professionals with clinical experience in neurological rehabilitation.³⁸⁻⁴⁰

Furthermore, the participation of the professionals from different states of the country (the Southeastern and Northeastern areas) made it possible to investigate the language adaptation of the items and materials used in different regions. The contribution of the participants was important for the final adjustments in the translation and cross-cultural adaptation of the instrument, validating it for understanding and semantics.

There is no consensus in the literature on the agreement criteria of a Delphi study for they range from 55 to 100%.^{38,39} The demand is that the agreement criteria be defined previously. In the present study, the agreement criteria previously defined set at 80% was based on Delphi studies made recently, where the Likert scale was used for the answer options.^{35,38-40}

In cross-cultural adaptation studies, it is recommended that the instrument be applied on the target population before its measuring properties are analyzed.³²⁻³⁷ The size of the pre-test sample can range between five³³ and 30 individuals,³² however, this population must be described through epidemiological data (age, gender), disease characteristics (signs, symptoms, severity, time of evolution, treatment), origin (general population, hospital, rehabilitation clinics), to enable the generalization of results.³⁵⁻³⁷ The sample of individuals who have had a stroke that participated in the pre-test (last stage of cross-cultural adaptation) was selected and described in accordance with those criteria, thus reinforcing a part of the external validity during this process.

Merely performing a cross-cultural adaptation does not guarantee that the measuring properties of the instrument (reliability, validity, and responsiveness) will be maintained.^{10,32-37} Therefore, the Brazilian version of the MAS needs to be verified for reliability and validity.^{10,35-37} Moreover, because it is an evaluating instrument that seeks to follow the

evolution of the motor function, its responsiveness should also be investigated for its appropriate use in clinical and research contexts.^{10,35-37}

CONCLUSION

The cross-cultural adaptation process of the MAS for Brazil followed the procedures recommended by current literature. The evaluation of language clarity, semantic equivalence, and technical and scientific relevance were observed through the adaptation stages, and reinforced by the Delphi study, where the instrument was submitted to the opinion of rehabilitation professionals from different regions of Brazil. In addition, the target population for this instrument was also involved in the process, contributing to the validity of its cross-cultural adaptation. Nevertheless, for the MAS-Brazil to be properly used in clinical and research contexts, it is still necessary to analyze its measuring properties.

REFERENCES

- Hendricks HT, van Limbeek J, Geurts AC, Zwarts MJ. Motor recovery after stroke: a systematic review of the literature. *Arch Phys Med Rehabil.* 2002;83(11):1629-37. DOI: <http://dx.doi.org/10.1053/apmr.2002.35473>
- Viana FP, Lorenzo AC, Oliveira EF, Resende AM. Medida de independência funcional nas atividades de vida diária em idosos com seqüelas de acidente vascular encefálico no Complexo Gerontológico Sagrada Família de Goiânia. *Rev Bras Geriatr Gerontol.* 2008;11(1):17-28.
- Falcão IV, Carvalho EMF, Barreto KML, Lessa FJD, Leite VMM. Acidente vascular cerebral precoce: implicações para adultos em idade produtiva atendidos pelo Sistema Único de Saúde. *Rev Bras Saúde Matern Infant.* 2004;4(1):95-102. DOI: <http://dx.doi.org/10.1590/S1519-38292004000100009>
- Rodgers H, Greenaway J, Davies T, Wood R, Steen N, Thomson R. Risk factors for first-ever stroke in older people in the north East of England: a population-based study. *Stroke.* 2004;35(1):7-11. DOI: <http://dx.doi.org/10.1161/01.STR.0000106914.60740.78>
- Chong JY, Sacco RL. Epidemiology of stroke in young adults: race/ethnic differences. *J Thromb Thrombolysis.* 2005;20(2):77-83. DOI: <http://dx.doi.org/10.1007/s11239-005-3201-9>
- Marini C, Russo T, Felzani G. Incidence of stroke in young adults: a review. *Stroke Res Treat.* 2010;2011:535672.
- Ceccato RB, Almeida CI. O planejamento da reabilitação na fase aguda após o acidente vascular encefálico. *Acta Fisiatr.* 2010;17(1):33-47.
- Sampaio RF, Mancini MC. Estudos de revisão sistemática: um guia para síntese criteriosa da evidência científica. *Rev Bras Fisioter.* 2007; 11(1):83-98. DOI: <http://dx.doi.org/10.1590/S1413-35552007000100013>

- Soriano FFS, Baraldi K. Escalas de avaliação funcional aplicáveis a pacientes pós acidente vascular encefálico. *ConScientiae Saúde.* 2010;9(3):521-30.
- Terwee CB, Bot SD, de Boer MR, van der Windt DA, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol.* 2007;60(1):34-42. DOI: <http://dx.doi.org/10.1016/j.jclinepi.2006.03.012>
- Maki T, Quagliato EMAB, Cacho EWA, Paz LPS, Nascimento NH, Inoue MMEA, et al. Estudo de confiabilidade da aplicação da escala de Fugl-Meyer no Brasil. *Rev Bras Fisioter.* 2006;10(2):177-83. DOI: <http://dx.doi.org/10.1590/S1413-35552006000200007>
- Pavan K, Cruz LC, Nunes MF, Menezes LG, Marangoni BE. Cross-cultural adaptation and validation of the Rivermead Mobility Index in stroke patients within the Brazilian cultural and language context. *Arq Neuropsiquiatr.* 2010;68(1):52-5. DOI: <http://dx.doi.org/10.1590/S0004-282X2010000100012>
- Conte AL, Ferrari PP, Carvalho TB, Relvas PCA, Neves RCM, Rosa SF. Confiabilidade, compreensão e aceitação da versão em português da Motor Assessment Scale em pacientes com acidente vascular encefálico. *Rev Bras Fisioter.* 2009;13(5):405-411. DOI: <http://dx.doi.org/10.1590/S1413-355520090005000056>
- Ferreiro KN, Santos RL, Conforto AB. Psychometric properties of the portuguese version of the Jepsen-Taylor test for adults with mild hemiparesis. *Rev Bras Fisioter.* 2010;14(5):377-82. DOI: <http://dx.doi.org/10.1590/S1413-35552010005000018>
- Saliba VA, Magalhães LV, Faria CDCM, Laurentino GEC, Cassiano JG, Teixeira-Salmela LF. Adaptação transcultural e análise das propriedades psicométricas da versão brasileira do instrumento Motor Activity Log. *Rev Panam Salud Publica.* 2011;30(3):262-71. DOI: <http://dx.doi.org/10.1590/S1020-49892011000900011>
- Cincura C, Pontes-Neto OM, Neville IS, Mendes HF, Menezes DF, Mariano DC, et al. Validation of the National Institutes of Health Stroke Scale, modified Rankin Scale and Barthel Index in Brazil: the role of cultural adaptation and structured interviewing. *Cerebrovasc Dis.* 2009;27(2):119-22. DOI: <http://dx.doi.org/10.1159/000177918>
- Michaelsen SM, Natalio MA, Silva AG, Pagnussat AS. Confiabilidade da tradução e adaptação do Test d'Évaluation des Membres Supérieurs de Personnes Âgées (TEMPA) para o português e validação para adultos com hemiparesia. *Rev Bras Fisioter.* 2008; 12(6):511-9. DOI: <http://dx.doi.org/10.1590/S1413-35552008005000012>
- Castelassi CS, Ribeiro EAF, Fonseca VC, Beinotti F, Oberg TD, Lima NMFV. Confiabilidade da versão brasileira da escala de deficiências de tronco em hemiparéticos. *Fisioter Mov.* 2009;22(2):189-99.
- Pereira ND, Michaelsen SM, Menezes IS, Ovando AC, Lima RC, Teixeira-Salmela LF. Reliability of the Brazilian version of the Wolf Motor Function Test in adults with hemiparesis. *Rev Bras Fisioter.* 2011;15(3):257-65. DOI: <http://dx.doi.org/10.1590/S1413-35552011000300013>
- Yoneyama SM, Roiz RM, Oliveira TM, Oberg TD, Lima NMFV. Validação da versão brasileira da Escala de Avaliação Postural para Pacientes após Acidente Vascular Encefálico. *Acta Fisiatr.* 2008;15(2):96-100.
- Lima NMFV, Rodrigues SY, Fillipo TM, Oliveira R, Oberg TG, Cacho EWA. Versão brasileira da Escala de Comprometimento do tronco: um estudo de validade em sujeitos pós-acidente vascular encefálico. *Fisioter Pesq.* 2008;16(3):248-253.

22. Carr JH, Shepherd RB, Nordholm L, Lynne D. Investigation of a new motor assessment scale for stroke patients. *Phys Ther.* 1985;65(2):175-80.
23. Tuak C, Scott J, Kirkman A, Singer B. Relationship between initial Motor Assessment Scale scores and length of stay, mobility at discharge and discharge destination after stroke. *NZ J Physioter.* 2010;38(1):7-13.
24. O'Connell C, Galvin R, Varghese AC, Lamson J, Stokes E. Analysis of the inter-rater reliability of the Motor Assessment Scale and the Fugl-Meyer Scale. Dublin: Trinity College, Faculty of Health Sciences; 2002.
25. Poole JL, Whitney SL. Motor assessment scale for stroke patients: concurrent validity and interrater reliability. *Arch Phys Med Rehabil.* 1988;69(3 Pt 1):195-7.
26. Malouin F, Pichard L, Bonneau C, Durand A, Corriveau D. Evaluating motor recovery early after stroke: comparison of the Fugl-Meyer Assessment and the Motor Assessment Scale. *Arch Phys Med Rehabil.* 1994;75(11):1206-12. DOI: [http://dx.doi.org/10.1016/0003-9993\(94\)90006-X](http://dx.doi.org/10.1016/0003-9993(94)90006-X)
27. Aamodt G, Kjendahl A, Jahnsen R. Dimensionality and scalability of the Motor Assessment Scale (MAS). *Disabil Rehabil.* 2006;28(16):1007-13. DOI: <http://dx.doi.org/10.1080/096382805000476188>
28. Miller KJ, Slade AL, Pallant JF, Galea MP. Evaluation of the psychometric properties of the upper limb subscales of the Motor Assessment Scale using a Rasch analysis model. *J Rehabil Med.* 2010;42(4):315-22. DOI: <http://dx.doi.org/10.2340/16501977-0519>
29. Hsueh IP, Hsieh CL. Responsiveness of two upper extremity function instruments for stroke inpatients receiving rehabilitation. *Clin Rehabil.* 2002;16(6):617-24. DOI: <http://dx.doi.org/10.1191/0269215502cr530oa>
30. English CK, Hillier SL, Stiller K, Warden-Flood A. The sensitivity of three commonly used outcome measures to detect change amongst patients receiving inpatient rehabilitation following stroke. *Clin Rehabil.* 2006;20(1):52-5. DOI: <http://dx.doi.org/10.1191/0269215506cr877oa>
31. Langhammer B, Stanghelle JK. Can physiotherapy after stroke based on the Bobath concept result in improved quality of movement compared to the motor relearning programme. *Physiother Res Int.* 2011;16(2):69-80. DOI: <http://dx.doi.org/10.1002/pri.474>
32. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976).* 2000;25(24):3186-91. DOI: <http://dx.doi.org/10.1097/00007632-200012150-00014>
33. Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, et al. Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. *Value Health.* 2005;8(2):94-104. DOI: <http://dx.doi.org/10.1111/j.1524-4733.2005.04054.x>
34. Maher CG, Latimer J, Costa LOPA. importância da adaptação transcultural e clinimétrica para instrumentos de fisioterapia. *Rev Bras Fisioter.* 2007;11(4):245-52.
35. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, et al. The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international Delphi study. *Qual Life Res.* 2010;19(4):539-49. DOI: <http://dx.doi.org/10.1007/s11136-010-9606-8>
36. Mokkink LB, Terwee CB, Knol DL, Stratford PW, Alonso J, Patrick DL, et al. The COSMIN checklist for evaluating the methodological quality of studies on measurement properties: a clarification of its content. *BMC Med Res Methodol.* 2010;10:22. DOI: <http://dx.doi.org/10.1186/1471-2288-10-22>
37. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *J Clin Epidemiol.* 2010;63(7):737-45. DOI: <http://dx.doi.org/10.1016/j.jclinepi.2010.02.006>
38. Powell C. The Delphi technique: myths and realities. *J Adv Nurs.* 2003;41(4):376-82. DOI: <http://dx.doi.org/10.1046/j.1365-2648.2003.02537.x>
39. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *J Adv Nurs.* 2000;32(4):1008-15.
40. Lourenço RA, Veras RP. Mini-exame do estado mental: característicaspsicométricas em idosos ambulatoriais. *Rev Saude Pub.* 2006;40(4):712-9. DOI: <http://dx.doi.org/10.1590/S0034-89102006000500023>