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UPDATE, TRANSLATION, CROSS-CULTURAL ADAPTATION, AND VALIDATION OF NOTTINGHAM STROKE DRESSING ASSESSMENT INTO SPANISH

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Authors Contributions

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE): Substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of data; drafting the article; or revising it critically for important intellectual content.

PBZ: reading of literature, translation, obtaining ethics committee approval, data analysis and interpretation, patient recruitment, validation, writing, review, supervision.

JAMB: reading of literature, conceptualization, design, analysis and interpretation of data, validation, review, supervision.

AJFS: reading of bibliography, analysis and interpretation of data, review.

MRB: reading of bibliography, analysis and interpretation of data, review.

ACS: translation, analysis and interpretation of data, review.

EG: reading of bibliography, design analysis and interpretation of data, review.

MW: reading of bibliography, conceptualization, analysis and interpretation of data, review.

DPC: reading of literature, obtaining ethics committee approval, data analysis and interpretation, validation, review, supervision.

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No potential conflict of interest was reported by the authors.

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Most of the research data is included in the manuscript. Additional research details are available upon request from the corresponding author.

ABSTRACT

The Nottingham Stroke Dressing Assessment (NSDA) is a scale for assessing the ability and independence to dress people who have suffered a stroke. The objective of this study was to update the original scale and create its Spanish version. The NSDA scale was reviewed, translated, cross-culturally adapted, and validated. A standardised multi-step translation and updating protocol was implemented to achieve optimal conceptual and semantic equivalence and validate it. The Spanish version was validated in 110 stroke survivors. The exploratory analysis generated 12 factors. Internal consistency was satisfactory ($\alpha = 0.92$). Intra-rater reliability was high (ICC = 0.92). The correlation between the ENVI-R and the FMA was demonstrated and significant ($r = 0.34–0.5$). The updated, translated, and culturally validated Spanish version of this scale can be used reliably and validly in research and clinical practice after demonstrating adequate and significant psychometric properties. The use of these scales will improve the quality of stroke-dressing assessment and allow for reliable comparisons.

Keywords: Cerebrovascular Accident; Psychometrics; Validation Study; Clothing; ENVI-R.

INTRODUCTION

Stroke is the second cause of death and the third cause of disability worldwide[1-4]. Fifteen million people suffer a stroke each year worldwide; of these, 5 million die, and another 5 million are permanently disabled, placing a burden on the family and community[1]. The burden of disability after stroke is significant and increasing very rapidly[1-4].

In Spain, stroke is the leading cause of adult disability and the second cause of dementia[3-5].

Stroke dysfunctions, which primarily manifest as motor, perception, and cognitive impairments, frequently impair the performance of activities of daily living, affecting daily living tasks such as dressing, feeding, or bathing, and causing the loss of autonomy in activities of daily living (ADLs) and dependence on others to perform them[6-14].

The ability to dress independently is a basic activity of daily living that enables people to be independent in their daily lives. Due to motor, perceptual, and cognitive impairments after suffering a stroke, the ability to functionally perform the basic ADL of dressing is altered[15-17]. It is estimated that around 54% of stroke survivors have difficulty dressing independently 6 months after stroke[17,18]. Therefore, the evaluation of dressing in post-stroke patients is necessary to determine their level of independence in this ADL[16,17,19]. The ability to monitor patient progress of activity dressing allows rehabilitation teams to define specific and personalised goals that optimise treatment selection and functional and independence recovery[20,21]. There are a multitude of assessment tools that have a clothing assessment subdomain. Some of them are Barthel Index (BI), Functional Independence Measure (FIM), Frenchay Activity Index (FAI), Nottingham Extended Activities of Daily Living (NEADL), etc.[22–28] However, dressing involves a multitude of options and a display of motor, perceptual, and cognitive skills, which requires more specific assessments. In this regard, there are only three few scales that allow the comprehensive assessment of dressing in people with stroke: Upper-Body Dressing Scale (UBDS)[29,30], Nottingham Stroke Dressing Assessment (NSDA)[16,17,31-33], and Jacket Test[34].

The NSDA is the oldest of the three scales, making it the most widely used tool and the one with the greatest presence in scientific literature related to dressing problems in the population that has suffered a stroke[16,17,31-33]. In the authors' opinion, it is the most comprehensive dressing assessment scale, as it takes into account different items of clothing, not just one upper garment like other scales, and breaks down the process of putting on different items of clothing into steps to identify at which stage of the dressing activity the error occurs, assessing whether the error is motor, cognitive, or behavioural in nature. In addition, the NSDA scale has been developed in a Western culture, which is more similar to the Spanish culture, unlike the UBDS[29,30] or Jacket Test[34], which have been developed in Eastern cultures.

NSDA was originally published in English by Marion Walker in 1991[32]. This tool was designed as a comprehensive assessment measure for dressing ADLs, evaluating many garments, breaking down the donning process into steps, and awarding a score adjusted for independence or needing assistance in dressing at each step. In turn, it analyses whether the origin of the errors is motor, cognitive, perceptual, motivational, or a combination of these, which is not considered in other scales. Finally, it reflects a total score of the independence that the person who has suffered a stroke has in dressing their entire body independently, not just a part of it[16,17,19,35,36.]

A comprehensive linguistic translation process and a cross-cultural adaptation process are necessary to ensure the construct validity and reliability of the adapted instrument[37-39]. These aspects become more relevant in the case of occupational therapy, which has a smaller number of assessment scales compared to other disciplines. For this reason, updating, translating, cross-culturally adapting, and validating a dressing scale, an activity specific to occupational therapy, is significantly relevant to this discipline, particularly in Spain, where there are no standardised tools to assess dressing as an ADL[36] to the authors' knowledge.

Therefore, this study pursued three sequential objectives: (1) to review and update the original NSDA, generating an updated version named the Nottingham Stroke Dressing Assessment–Revised (NSDA-R); (2) to translate and cross-culturally adapt the NSDA-R into Spanish using a standardised multi-step procedure, resulting in the Escala Nottingham de Vestido en Ictus–Revisada (ENVI-R); and (3) to evaluate the psychometric properties of the official Spanish version (ENVI-R) in a sample of post-stroke patients.

MATERIALS AND METHODS

Study design

A review and update study was conducted on the original NSDA to the updated Nottingham Stroke Dressing Assessment-Revised (NSDA-R). This was followed by a translation, cross-cultural adaptation, and validation study of the NSDA-R into Spanish, resulting in the ENVI-R.

The Nottingham Stroke Dressing Assessment

NSDA consists of three documents[32]:

- The first document contains instructions for administering the scale, recommendations for the therapist, and the item-by-item and final scoring system.
- The second document is a quantitative evaluation. It has two versions: female and male. It consists of a scoring table and an observations section. It shows the different garments and closures most commonly used. For each garment, there is a breakdown of the different steps involved, from picking up the garment to putting it on. This considers the different dressing strategies that can be employed.
- The third document is a qualitative assessment. It is a table analysing the most common errors made during dressing due to various factors, including motor, cognitive, and perceptual factors.

Each step or pledge closure of the second document is scored on a 3-point ordinal scale (0 = needs physical assistance to perform it, 1 = needs non-physical assistance, and 2 = does it independently) [32].

Review and update the process of the scale

The process of reviewing and updating the NSDA-R was carried out through a multi-step process, with several phases of review by multiple professionals with clinical experience in stroke and clothing assessment, as well as research and clinimetric experience. These phases included a comprehensive analysis of the scale, several meetings of the expert committee, and consultations with the authors of the original version.

The criterion for modifying, deleting, or retaining items from any of the three documents of the scale was that more than 85% of the committee members agreed with the change.

Throughout this review and update process, all members of the expert committee always took into account the relevance, comprehensibility, and completeness of the content of the scale and its items.

Translation, cultural adaptation, and validation process

The process of translation, cross-cultural adaptation, and validation of the ENVI-R was carried out in two phases: (1) the translation and cross-cultural adaptation of the ENVI-R and (2) the validation of the scale.

Phase 1. Review and update process

Since the scale was published in 1990[31,32], clothing trends have changed significantly. After contacting the author of the original version, it was deemed appropriate to revise the scale and propose an update to facilitate and speed up the administration of this test. For this purpose, a committee of experts[14] was formed, consisting of eight occupational therapist researchers. They all demonstrated fluency in English, which allowed for greater accuracy and rigour in the translations and committee meetings. Each of the experts reviewed the scale individually, proposing any modifications they deemed appropriate.

The author of the original version of the scale was contacted[31,32] to clarify certain issues that would facilitate updating the assessment tool.

The principal investigator made the modifications agreed upon by the entire committee, and thoroughly reviewed the scale after each meeting, identifying points of conflict and interest from the review to be addressed by the expert committee at subsequent meetings[37,39].

Following the review and update, the scale was renamed as ‘Nottingham Stroke Dressing Assessment-Revised (NSDA-R)’ with the consent and approval of the author of the original version.

Phase 2. Translation and cross-cultural adaptation process

All documents included in the scale, as detailed above, were translated. The translation process followed the methodological procedure recommended by the ISPOR guide[37].

Two independent researchers translated the NSDA-R scale into Spanish and sent it to the expert committee to review both versions. The expert committee then met to compare the two versions and combine them into an initial Spanish version. That first Spanish version was translated back into English by a native English speaker.

The expert committee and the author of the original version then compared the original English version with the new English version to unify the two English versions.

Once the new English version was generated, the principal investigator translated that English version into Spanish, producing the Spanish version in its entirety. The expert committee met again to review the final Spanish version, make final observations and changes, and approve the final version, resulting in the final Spanish version called 'Escala Nottingham del Vestido en Ictus-Revisada (ENVI-R)'.

The expert committee consisted of six Spanish occupational therapists. All of them were fluent in both languages, which made this translation process efficient. Figure 1 shows the flowchart of the multi-step translation and cross-cultural adaptation process.

Phase 3. Validation process

The scale was validated by studying its psychometric properties in the stroke population based on the COSMIN methodology[40,41].

To validate ENVI-R, this scale was administered to 110 post-stroke patients. This sample size was considered appropriate for this exploratory validation phase, as a sample exceeding 100 participants is commonly regarded as acceptable for examining structural validity through exploratory factor analysis and for estimating preliminary reliability parameters in psychometric research[42,43]. Patients included in the study were in both the acute and chronic phases of stroke and met the following inclusion and exclusion criteria.

Inclusion criteria: (a) adults (≥18 years), (b) having suffered at least one stroke, and (c) being able to actively move (Daniels 4/5)[44] the 'healthy' hemibody.

Exclusion criteria: (a) absence/decreased response to the environment (Glasgow score less than 15)[45], (b) inability to understand the therapist's instructions (patients were required to demonstrate sufficient receptive language comprehension to follow simple verbal instructions during the initial assessment session), (c) being on basic life support, (d) aggression or posing a risk to self or others (this was determined based on documented behavioral observations in the patient's medical record and direct assessment by the rehabilitation team. Patients with active behavioural disorders, severe agitation, or documented risk behaviors that could compromise safety during the assessment were excluded, in accordance with institutional safety protocols), and (e) being bed-bound.

These criteria were determined by a clinical evaluation conducted by the therapists at the rehabilitation center, together with the principal investigator. The sample was not selected based on motor, cognitive, or functional level. It included the general stroke population who met the previously described criteria. However, detailed standardized measures of motor function, cognitive status, activities of daily living, and baseline dressing independence were not systematically collected beyond the predefined eligibility criteria. Therefore, the influence of these variables on ENVI-R performance, including possible ceiling effects, could not be formally examined in this study. The sample was obtained through convenience sampling carried out in each neurorehabilitation center between February and March 2024.

Process

All patients potentially eligible to participate in the study were informed and asked to read and sign an informed consent form containing all information regarding the research and their participation. Once signed, they were given a specific date at their referral rehabilitation centre to participate in this study through evaluation using the ENVI-R and Fugl-Meyer Assessment (FMA)[46,47] scales.

A re-evaluation by the same therapist as the initial assessment was conducted in 59.1% of the sample. This re-evaluation was conducted between 1 and 4 weeks after the initial assessment.

All questions and uncertainties identified during the trial were reported and reviewed by the expert committee to reach a consensus on the final version of ENVI-R.

Statistical analysis

Sociodemographic and clinical variables were expressed as means and percentages. Age, phase (acute/chronic), geographic location, and sex were specified.

The analysis of the scale's psychometric properties was carried out based on the methodology used by the COSMIN regulations[40,41].

The Kaiser-Meyer-Olkin (KMO) test measured sampling adequacy and Bartlett's test of sphericity was used to check for redundancy between variables: KMO >0.5 was considered good, together with significant values for Bartlett's test of sphericity. Exploratory factor analysis (EFA) with maximum likelihood extraction and varimax rotation was estimated for the internal structure of the new questionnaire[48].

An EFA was performed to examine the structural validity of the adapted instrument, as recommended by the COSMIN guidelines for the evaluation of measurement properties[40,41].

The questionnaire's internal consistency was measured using Cronbach's α statistical analysis[49].

Intraclass correlation coefficient (ICC) was used to measure intra-observer reliability[50,51].

The Standard Error of Measurement (SEM) was used to know the measurement error.

The Spearman correlation coefficient was used to evaluate hypothesis testing for construct validity between the ENVI-R and the FMA. To carry out the correlations, the Kolmogorov-Smirnov test was first used to determine whether the data followed a normal distribution and thus allowed for parametric or nonparametric analysis. Since this was a significant nonparametric sample, the Spearman test was used to obtain correlation coefficients. It is hypothesised that both scales will have a significant positive correlation between 0.2 and 0.8[52-54].

A statistical significance level of 0.05 was considered for all hypothesis tests. Statistical analysis was performed using SPSS (IBM, USA), except for factor analysis, which used JASP software.

Ethical considerations

This research was approved by the Ethics Committee of the University of Malaga, with registration number 7-2024-H, and respects the fundamental ethical precepts according to the Declaration of Helsinki and the Belmont Report, in addition to the legal regulations in force in our country regarding clinical research, especially Law 14/2007, of July 3, on Biomedical Research. The protection and confidentiality of information were always guaranteed, as the processing, communication, and transfer of personal data of all participating subjects will comply with the provisions of Organic Law 3/2018, of December 5, on the protection of personal data and the guarantee of digital rights and its data development regulations.

RESULTS

Participants

The 110 patients who met the inclusion criteria were included in the study sample[42,43]. No patients were lost during data collection. Of the study participants, 73.64% were in the chronic phase (n = 81), and 26.36% were in the acute phase (n = 29). The mean patient age was 62 ± 13.62 years. Men represented 60% of the total sample (n = 66), and women 40% (n = 44).

Phase 1. Review and update process

The committee of experts conducted several individual and collective reviews of the scale and unanimously agreed on the changes to be made. Over the course of eight meetings, different aspects of the original scale were discussed for modification; after each meeting, the two principal investigators made the modifications agreed upon by more than 85% of the eight committee members, and critical points and points of interest to be addressed in subsequent meetings were noted.

Among the modifications made for the update were: (a) modification of the instructions for administration and use of the scale to facilitate understanding by therapists and the interpretation of different situations that may arise during administration of the scale (document 1); (b) unification of the scoring tables for men and women scales in document 2; (c) inclusion and/or modification of garment names in the titles of the clothing categories (document 2), whose putting on steps coincided with each other and were included in the same clothing item; (d) inclusion of photographs in the items of the scoring table (document 2) to facilitate understanding and speed up administration; (e) modifications to the explanation and definition of the items in the 'Analysis of Action Errors' document to facilitate understanding and speed up completion (document 3).

Therefore, the scale continued to maintain the first 'Instructions for Therapists' document with some modifications that facilitated its understanding, implementation, and interpretation.

The structure and layout of the 'Rating Scale' from the second document were also maintained, but the items for men and women were combined into a single table. Photographs of each item were included.

Within each category are the items or steps that must be scored. This score and the final score remains the same as the original version.

The third document, 'Analysis of Action Errors', presents an improved explanation of how this error interferes with any of the previously presented items, influencing the creation of the garment. This document allows provide qualitative information for the evaluation.

The steps for putting on the garment were the least modified, as the way of dressing with the garments presented in the scale had not changed over time and did not require updating.

The criterion to do any modify, remove, or retain items from any of the three scale documents, over 85% of the committee members needed to agree to the change. However, all decisions made in this regard were approved by 100% of the committee members.

Throughout this entire process of review and update, all members of the expert committee always took into consideration the relevance, comprehensibility and comprehensiveness of the content of the scale and the items.

The updated version of NSDA was called 'Nottingham Stroke Dressing Assessment-Revised' (NSDA-R).

Phase 2. Translation and cross-cultural adaptation process

The first version of the NSDA-R in Spanish were translated from English by two independent translators (T1 and T2). The differences were addressed during the review by the expert group (R1), resulting in the merging of the two versions into a single version (V1).

After the scale was translated back into English by a native English speaker (T3), it was compared with the previously updated English scale (NSDA-R), and the expert committee (R2) clarified any linguistic and terminological inconsistencies that arose. The scale was subsequently revised by the author of the original version and an occupational therapist involved in the Danish translation (R2). Both resolved the discrepancies that arose during this step, achieving a unified version and facilitating the process of producing an improved English version (V3).

It was translated back into Spanish (V4), and the expert committee compared the revised Spanish version with the previous Spanish version (V1). After this final step, the Spanish version of the NSDA-R was obtained, called 'Escala Nottingham de Vestido en Ictus-Revisada' (ENVI-R) (Figure 1).

Throughout this entire process of review and update, all members of the expert committee always took into consideration the relevance, comprehensibility and comprehensiveness of the content of the scale and the items.

ENVI-R contains 12 categories: (1) fasteners (7 items); (2) bra/top (8 items); (3) tank top (3 items); (4) T-shirt, short-sleeved sweater (3 items); (5) dress (3 items); (6) shirt, jacket, coat (3 items); (7) T-shirt, long-sleeved sweater (3 items); (8) skirt (5 items); (9) panties, briefs (2 items); (10) pants, leggings (2 items); (11) stockings, tights, socks (2 items); (12) footwear (3 items). It has a total of 44 items scored from 0 to 2, with a total possible score from 0% (totally dependent to dress) to 100% (totally independent to dress).

Phase 3. Clinical validation

150 patients diagnosed with stroke were assessed for eligibility. Of these, 120 met the inclusion and exclusion criteria; but 10 patients declined to participate. Demographic data (age, sex, rehabilitation centre), stroke recovery stage (acute/chronic), assessment date, ENVI-R score, FMA score for lower limbs, and FMA score for upper limbs were recorded for each study participant.

During this phase, the professionals administering the scale were asked to report any difficulties in understanding it, whether with the instructions or the items, on the part of either the therapists or the participants. No issues were reported, 100% of the evaluators and participants confirmed that the scale was well understood and the items allowed the desired construct to be measured. Thus verifying the absence of difficulties in understanding the measurement instrument. ENVI-R proved easy to use and understand, so no further modifications to its final format were necessary.

Exploratory factor analysis

The translated version of the scale was subjected to exploratory factor analysis. The Bartlett's Test of Sphericity score was significant ($X^2 = \infty$; df = 1035.000; $p < 0.001$), and for the Chi-squared Test, it was also significant (Value = 8586.907; df = 549; $p < 0.001$). Therefore, the

data were subjected to an exploratory factor analysis with maximum likelihood extraction and Varimax rotation. The Eigenvalue > 1 and the Screeplot (Figure 2) showed a twelve-factor solution that explained 84% of the total variance.

The loading of each item on each factor was determined by a loading greater than 0.4. None of the questionnaire items cross-loaded on more than one factor. Two items were eliminated because the factor loading was insufficient (<0.30) (Tables 1 and 2).

Internal consistency

ENVI-R showed good overall internal consistency values (α = 0.921). Regarding internal consistency by factors, the scale showed good internal consistency values, with the highest for items 2a.1 and 2a.2 (α = 0.923) and the lowest for items 1.8, 3.1, 3.2, 3.3, 6.1, and 6.2 (α = 0.918) (Table 3).

Intra-rater reliability

Intra-rater reliability was measured using ICC. ENVI-R demonstrated very good reliability when administered a second time to 65 patients (59.1% of the sample) at an average of two weeks after the initial assessment, achieving a correlation coefficient of 0.92 (ICC 95% Confidence Interval (CI) 0.90 to 0.93).

Measurement error

The measurement error showed a Standard Error of Measurement score of 18.03, with 0 missing values.

Hypothesis Testing

ENVI-R showed a correlation when its total score was compared with the FMA score for both the upper extremity (FMA-UE) and lower extremity (FMA-LE). A significant correlation was confirmed between ENVI-R and the FMA-UE (r = 0.34), FMA-LE (r = 0.39), and the complete FMA (r = 0.50) (p<0.01). Therefore, the previously stated hypothesis can be confirmed.

Final version of ENVI-R

Based on the methodology implemented during the process and the statistical analysis of the psychometric properties, and after reaching consensus by the expert committee, minor changes were made to refine and finalise the final Spanish version of ENVI-R.

Thus, the validation of the ENVI-R scale into Spanish was completed.

DISCUSSION

The objective of the present study was to develop a review and update of the NSDA for subsequent translation and cross-cultural adaptation into Spanish (ENVI-R) and its validation in a sample of post-stroke patients. To achieve this, a rigorous review and update process was adopted, followed by translation, cross-cultural adaptation, and clinical validation[37-39].

Clinical validation of the Spanish version of ENVI-R was subjected to a statistical analysis of the psychometric properties. These statistical properties were adequate and significant[50,52]. Clinical validation provided information for the final adjustments made to the official Spanish version developed from ENVI-R. Offering a highly valid and recommended version for assessing dressing capacity and performance in people who have suffered a stroke.

After submitting ENVI-R through a process of translation and cultural adaptation, the absence of difficulties in understanding the items of the Spanish version was verified, showing the questionnaire as an easy and understandable instrument for 100% of therapists and the target population.

This article represents the first factorial analysis of ENVI-R, since there are no other translations or validations, and the psychometric properties analysed above were reliability[17,55] and level of agreement[17]. The EFA yielded a twelve-factor model, which explained 84% of the total variance[48]. After carrying out the EFA, the sample was found to be adequate. This variance is greater than that shown in the scale UBDS, in which 2 components were found, with a greater load towards the first component (0.65–0.83) and a total variance percentage of 62.3%[29]. This is possibly due to the fact that UBDS is a smaller scale, which only evaluates one garment, so it offers fewer possibilities for several factors to arise between its items.

The main objective of this study was not only to evaluate patients' dressing performance but also to examine the psychometric properties of the adapted version of the ENVI-R, including its internal structure. In accordance with current recommendations for cross-cultural validation studies, an exploratory factor analysis was conducted to assess the dimensionality of the instrument in the target population and to explore whether the items showed a coherent underlying structure in the adapted version.

The 12-factor solution obtained in this study should be interpreted as a preliminary exploratory structure rather than as a definitive dimensional model of dressing performance. This solution may reflect the complexity and multidimensional nature of dressing activity, in

which motor, perceptual, sequential, and executive demands interact across tasks; however, the specific interpretation of each factor should be considered with caution.

From a clinical perspective, this exploratory analysis provides additional information about how the items may cluster within the adapted instrument, which may help to improve the interpretability of the scale. Nevertheless, further studies with larger samples and confirmatory analyses are needed before attributing stable subscale meaning or making stronger inferences about the internal structure of the ENVI-R.

As for the internal consistency of ENVI-R, very good levels of internal consistency were found[50] with a high Cronbach's Alpha score (α = 0.92) for the scale in general. These values are higher than those on the scale UBDS (α = 0.88). This is because the scale ENVI-R has undergone a rigorous translation and validation process that allows it to continue accurately measuring the original construct, both in general and for each item. These items have presented highly significant scores ranging from α = 0.918 to α = 0.923, which have only been analysed in this study of the scale ENVI-R.

The intra-rater reliability of the Spanish questionnaire was assessed through an ICC, which showed a very good reliability properties[51], with a score of 0.92 (ICC 95% CI 0.90 to 0.93). The scale assesses a relatively stable construct, so even though the re-evaluation was carried out between 1 and 4 weeks after the initial assessment, the possibility of clinical fluctuations that may have affected the reliability estimates is reduced, since no relevant clinical changes or significant interventions were recorded during the period between the two assessments. The score obtained in ENVI-R is slightly lower than that obtained in NSDA (ICC = 0.99)[17,55] but equally high and significant. When compared with other scales that allow the evaluation of clothing, such as UBDS, similar reliability values are observed for the same population, showing an ICC of 0.87-1.00 for inter-rater[42], and 0.76 to 0.91 for test-retest reliability[56]. This range is because the time subscale was evaluated separately from UBDS and the score subscale of UBDS. However, both scales have shown very good reliability properties. This can also be compared with the reliability shown by the Jacket Test, whose psychometric properties were evaluated in a study conducted in a population with chronic stroke[34] where a high reliability score was found (ICC = 0.78–1.00). This is consistent with what was shown previously, suggesting that any of the three tests would be reliable for evaluating the dress. They differ only in the method of evaluation since ENVI-R analyses the dressing of all garments step by step, while UBDS only evaluates the wearing of a shirt step by step, and the Jacket Test evaluates the wearing and unwearing of a jacket.

The authors used the total score of ENVI-R and FMA to measure hypothesis testing for construct validity, showing positive correlations in both cases (Spearman rho: ENVI-R vs. FMA-UE = 0.34; ENVI-R vs. FMA-LE = 0.39; ENVI-R vs. FMA = 0.50), so that the variables vary, without implying causality, and that the distribution of the variable is non-parametric[53,54]. Other studies also assessed the correlation between their dress scales and FMA, as in the case of UBDS, where there was a significant moderate negative correlation both with FMA-UE (r = -0.58) and with FMA-LE (r = -0.18)[56]. In the case of Jacket Test, the correlation with FMA was from r = -0.285 for the affected side, and of r = -0.75 for the healthy side[34]. These correlation scores are significantly adequate for all three scales because FMA does not assess clothing but instead evaluates the sensorimotor function of the upper and lower limbs. No correlations could be established between scales

assessing the same construct (dress in post-stroke people) because there are very few scales that evaluate this variable. In the case of ENVI-R, it has not been possible to compare them because the Spanish version of UBDS and Jacket Test are not available.

Limitations and strengths of the study

A limitation of this study is that, although the sample size was acceptable for an initial exploratory analysis, it was not sufficient to support a confirmatory factor analysis[40,41,42]. Therefore, the factor structure identified should be considered preliminary and must be confirmed in future studies with larger samples.

This sample was obtained through convenience sampling, in which the patient agreed to participate in their rehabilitation centre after being invited by the researcher to participate in the study. In addition, detailed standardized measures of motor function, cognitive function, activities of daily living, and baseline dressing independence were not systematically collected. Consequently, the potential influence of clinical heterogeneity and the presence of possible ceiling effects could not be specifically analysed. The Content Validity Index (CVI) could not be specified for the review and update process. For the test-retest reliability analysis, a larger sample size should have been re-evaluated; this fact is considered a limitation of the study. Not performing the evaluations by two independent evaluators prevented the evaluation of inter-rater reliability[57], due to a limitation arising from the study because there was no other evaluator available. More scales that allow the evaluation of dress would be needed, as well as the translation, cross-cultural adaptation, and validation of these scales to allow the evaluation of correlations between scales that evaluate the same construct in the same population. These limitations suggest caution when using both the NSDA-R and ENVI-R before conducting a more extensive evaluation of the psychometric properties in a broader population, both Spanish and English.

Its main strength is that this article represents the first update of the NSDA scale to the NSDA-R. It also represents the first translation, cross-cultural adaptation, and validation of the NSDA-R to the ENVI-R in the Spanish population and language, which is widely spoken globally.

ENVI-R presents similar values for some psychometric properties, such as reliability, and even higher values in the case of hypothesis testing validity and factor analysis. With these findings, it can be stated that ENVI-R may currently be the only scale in Spanish that specifically and comprehensively assesses dressing in people who have suffered a stroke. It has demonstrated good psychometric properties after translation, cross-cultural adaptation, and validation. Therefore, its use is recommended for the Spanish population who have suffered a stroke and who experience dressing difficulties.

The benefits of this research are that the scores obtained for the psychometric properties have proven to be excellent for the Spanish version of the NSDA-R (ENVI-R) in people who have suffered a stroke, allowing for effective monitoring of the patient's progress. The

update, translation, cross-cultural adaptation and validation of the NSDA into NSDA-R and ENVI-R in Spanish, facilitates its widespread implementation in clinical practice and research in Spain, allowing an accurate assessment of the performance and independence in the dressing activity of daily living in Spanish people who have suffered a stroke.

Future research includes expanding the sample size to allow for a more in-depth analysis of the psychometric properties, conducting confirmatory factor analysis applying oblique rotations instead of orthogonal ones for said analysis; studying inter-rater reliability, and finding correlations between these scales and other questionnaires. Cross-cultural adaptations of the NSDA-R and ENVI-R would be advisable to enable their application to other populations with dressing difficulties.

CONCLUSIONS

The process of updating, translating, cross-cultural adapting, and subsequently validating demonstrated that the final versions of NSDA-R and ENVI-R are tools that could be used in English and Spanish populations, respectively, to assess clothing activity. The results obtained for the psychometric properties were also verified to be adequate and significant for the use of the ENVI-R in a sample of stroke patients in the Spanish population. Based on these results, using the Spanish translation (ENVI-R) in research and clinical practice can be recommended and defended. This updated scale, translated and validated in Spanish, will allow for identifying occupational dysfunctions in dressing activities in the post-stroke population and, therefore, will allow for reliable comparison of stroke outcomes across regions, both in clinical practice and in research.

Conflict of Interest Statement

No potential conflict of interest was reported by the authors.

Declaration of generative AI in scientific writing

The researchers have not used AI for any of the research phases, nor for the preparation of this manuscript.

Authors Contributions

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE): Substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of data; drafting the article; or revising it critically for important intellectual content.

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Table 1: Factor characteristics

	Rotated Solution			
	Eigenvalues	SumSq Loadings	Proportion var.	Cumulative
Factor 1	12.067	5.198	0.113	0.113
Factor 2	6.275	5.118	0.111	0.224
Factor 3	3.903	3.506	0.076	0.300
Factor 4	3.371	3.447	0.075	0.375
Factor 5	3.129	3.195	0.069	0.445
Factor 6	2.570	3.086	0.067	0.512
Factor 7	2.223	3.064	0.067	0.579
Factor 8	1.737	3.057	0.066	0.645
Factor 9	1.411	2.984	0.065	0.710
Factor 10	1.262	2.431	0.053	0.763
Factor 11	1.192	1.961	0.043	0.805
Factor 12	1.053	1.608	0.035	0.840

Table 2: Factor loadings

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12
ENV 9.1	0.936											
ENV 12.1	0.936											
ENV 9.2	0.906											
ENV 12.2	0.902											
ENV 10.1	0.823											
ENV 10.2	0.796											
ENV 12.3	0.557											
ENV 5.2		1.120										
ENV 5.1		1.059										
ENV 5.3		1.050										
ENV 8a.1		0.852										
ENV 8a.2		0.827										
ENV 8b.1			1.037									
ENV 8b.2			1.037									
ENV 8b.3			1.037									
ENV 1.7			0.588									
ENV 2b.2				1.036								
ENV 2b.3				1.036								
ENV 2b.1				1.036								

ENV 1.4				0.521					
ENV 6.2					1.079				
ENV 6.3					1.074				
ENV 6.1					1.057				
ENV 3.2		1.091							
ENV 3.3		1.043							
ENV 3.1		0.992							
ENV 4.2			1.031						
ENV 4.1			1.014						
ENV 4.3			0.949						
ENV 2c.3				0.991					
ENV 2c.2				0.989					
ENV 2c.1				0.986					
ENV 7.2						1.020			
ENV 7.3						0.983			
ENV 7.1						0.981			
ENV 1.2					0.880				
ENV 1.1					0.660				
ENV 1.6					0.540				
ENV 1.5					0.484				
ENV 1.3					0.424				
ENV 2a.1							1.044		
ENV 2a.2							0.978		
ENV 11.2									0.831

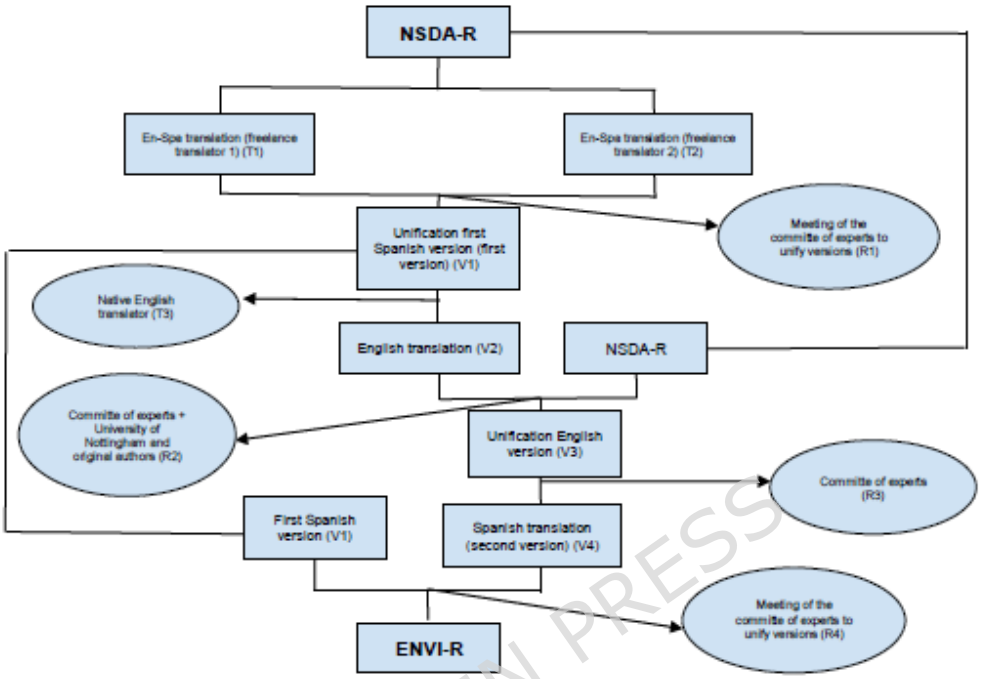
ENV 11.1

Table 3: Cronbach's alpha if the item is deleted

	Cronbach Alpha if the item is deleted
ENV 1.1	0.919
ENV 1.2	0.919
ENV 1.3	0.919
ENV 1.4	0.920
ENV 1.5	0.920
ENV 1.6	0.918
ENV 1.7	0.921
ENV 2a.1	0.923
ENV 2a.2	0.923
ENV 2b.1	0.919
ENV 2b.2	0.919
ENV 2b.3	0.919
ENV 2c.1	0.922
ENV 2c.2	0.922
ENV 2c.3	0.922
ENV 3.1	0.918
ENV 3.2	0.918
ENV 3.3	0.918
ENV 4.1	0.921
ENV 4.2	0.921
ENV 4.3	0.921
ENV 5.1	0.920
ENV 5.2	0.919
ENV 5.3	0.919
ENV 6.1	0.918
ENV 6.2	0.918
ENV 6.3	0.919
ENV 7.1	0.920
ENV 7.2	0.920
ENV 7.3	0.919
ENV 8a.1	0.919
ENV 8a.2	0.919

ENV 8b.1	0.921
ENV 8b.2	0.921
ENV 8b.3	0.921
ENV 9.1	0.920
ENV 9.2	0.920
ENV 10.1	0.919
ENV 10.2	0.919
ENV 11.1	0.919
ENV 11.2	0.919
ENV 12.1	0.919
ENV 12.2	0.919
ENV 12.3	0.920

Figure 1: Translation process flowchart



Abbreviations: NSDA-R=Nottingham Stroke Dressing Assessment-Revised; ENVI-R=Escala Nottingham de Vestido en Ictus-Revisada