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Cross-Cultural Adaptation and Validation of the Brazilian Portuguese Version of the Neck Disability Index and Neck Pain and Disability Scale

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Study Design. This study's design was a cross-cultural validation of the Neck Disability Index and Neck Pain and Disability Scale.

Objectives. This study's objective was to translate, culturally adapt, and validate a Brazilian Portuguese version of the Neck Disability Index (NDI-BR) and the Neck Pain and Disability Scale (NPDS-BR).

Summary of Background Data. Although several valid measures exist for measurement of neck pain and functional impairment, these measures have yet been validated in Brazilian Portuguese. Successful linguistic and cultural translation may allow appropriate cross-cultural comparison for clinical and laboratory research analysis.

Methods. The NDI-BR and NPAD-BR were culturally and linguistically translated from English into Brazilian Portuguese. The translated version of the instrument was administered to 203 patients at a midsize hospital in southern Brazil. Psychometric evaluation included factor analysis, internal reliability measures, test-retest reliability at 1 and 7 days, and criterion validity comparison with the Brazilian version of the SF-36.

Results. Factor analyses demonstrated a single-factor subscale for the NDI-BR and three subscales for the NPDS-BR. An item analysis showed a high degree of internal consistency for the NDI-BR ($r = 0.74$) and the three subscales of the NPDS-BR (subscale 1, $r = 0.89$; subscale 2, $r = 0.81$; subscale 3, $r = 0.72$). Test-retest reliability was also acceptable at for the NDI-BR (0.98 at baseline and 0.48 at 7 days) and subset one (0.96 at baseline and 0.91 at 7 days), subset 2 (0.96 at baseline and 0.62 at 7 days), and subset 3 (0.52 at baseline and 0.45 at 7 days) of the NPDS-BR. Construct validity was established during comparison of the Brazilian version of the SF-36. Only items associated with physical role, bodily pain, and emotional role failed significant correlation.

Conclusions. A reliable and valid Portuguese version of the Neck Disability Index and Neck Pain and Disability Scale was developed, which will facilitate the examination of functional performance within a large patient population, as well as cross-cultural comparisons.

Key words: Neck Disability Index, Neck Pain and Disability Scale, SF-36, validity, reliability. **Spine 2006;31: 1621–1627**

Mechanical neck pain and/or dysfunction is a major causal factor in disability and loss of workdays.[1] This dysfunction is nearly as prevalent as low back pain,[2] and almost as important a cause for disability and lost workdays. Although in many cases the exact cause of mechanical neck pain and/or dysfunction remains elusive, a broad spectrum of physical, psychologic, and social medical factors may contribute to patient prognosis.[3] Most likely, these medical factors influence functional activities in ways beyond the traditional investigation of general signs and symptoms thus necessitate the use of a functional outcome questionnaire. Functional outcome questionnaires comprise the ability to gauge the impact of disease process on the performance of daily activities.[4] Region-specific functional outcome questionnaires concentrate on specific areas of the body and may measure dysfunction with greater responsiveness than a scale that measures overall health and wellness.[5]

Two region specific questionnaires for the cervical spine are the Neck Disability Index (NDI) and the Neck Pain and Disability Scale (NPDS). The NDI is designed to measure activity limitations due to neck pain and disability,[6] whereas the NPDS purportedly measures report of problems with neck movements, neck pain intensity, effect of neck pain on emotion and cognition, and the level of interference during life activities.[7] Both scales have been regularly used in previous studies that have investigated functional status,[8–11] although the NDI has been used more frequently.[5]

Translating a questionnaire instead of creating a questionnaire allows comparisons of different populations,[4] permits researchers to examine functional status across a broad spectrum of people, and permits the exchange of information across cultural and linguistic barriers.[5] It is now widely recognized that questionnaires intended for use across cultures must not only be translated well linguistically but also adapted culturally in order to maintain the content validity of the instrument.[12] To our knowledge, we are aware that the original English version of the NDI has

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been successfully translated into French[13] and Swedish (though modified),[6] whereas the English version of the NPDS has been translated to French[13] and Turkish.[4] In the present study, we describe the translation, cultural adaptation, and validation of a Brazilian Portuguese version of two questionnaires, the Neck Disability Index and the Neck Pain and Disability Scale.

■ Materials and Methods

Neck Disability Index. The NDI[14] is a 10-item questionnaire designed to assess neck pain and disability. This questionnaire is based on the Oswestry Index[15] a 10-item measure designed to assess pain-related limitations in activities of daily living.[16] The NDI is scored using a percentage of the maximal pain and disability score. The items are organized by type of activity and followed by six different assertions expressing progressive levels of functional capability. The NDI is a one-dimensional questionnaire, suggesting that the scale measures a single construct.[5] Although the responsiveness of the NDI is unknown, concurrent validity when compared with the Visual Analog Scale has been reported at 0.60.[14] The questionnaire has shown moderate differences in reliability and validity with different patient populations.[5]

Neck Pain and Disability Scale. The NPDS[7] is a 20-item questionnaire modeled after the Million Visual Analogue Scale.[17] Each single question has a visual analog scale graded from 0 (normal function) to 5 (the worst possible situation your pain problem has taken you). The NPDS is a multidimensional questionnaire, involving four dimensions: neck problems, pain intensity, effect of neck pain on emotion, and effect on life activities.[5] Because the NPDS is a multidimensional scale, a coefficient alpha, which theoretically measures one construct, is not appropriately measured. Like the NDI, the responsiveness of the NPDS is unknown. Only face validity, a severely limited indicator of validation has been evaluated in past analyses.[5]

Initial Translation Into the Brazilian Portuguese Language. Initially, the NDI and NPDS were forward translated from English into Brazilian Portuguese. Specifically, since translations into the native language are thought to more accurately reflect the nuances of the language,[18] three translations were performed independently by bilingual translators with Brazilian Portuguese as their native tongue. Two of the translators were aware of the concepts being examined in the questionnaire, and the third translator was neither aware nor informed of conceptual content (*i.e.*, a "naïve" translator). Each translator produced a written report of their translation, identifying specific challenging phrases or uncertainties, along with the rationale for their choices.

Translation Synthesis. Using the original English iterations of both questionnaires as well as the three translated versions, the three translators and a recording observer synthesized the translations, yielding one common translation each for both questionnaires. A written report carefully documented the synthesis process, specifying each of the issues addressed and the means of resolution. In all instances, resolution was achieved by consensus.

Back-Translation to English. Using the synthesized version of the instrument and blind to the original version, two different bilingual translators whose native tongue was English and who did not participate in the initial translation, back translated the initial translation into English. The back translators were neither aware nor informed of the concepts explored in the NDI and the NPDS. The purpose of the back translation was to identify inconsistencies or conceptual errors in translation. Both versions were analyzed and compared, and a final version was obtained.

Expert Committee. The final translated versions were submitted to a committee consisting of clinical, psychometric, and language experts. Each committee member was asked to consolidate all of the versions of the questionnaire and develop the prefinal version of the questionnaire for field testing. The committee reviewed all of the translations and translator reports and reached consensus on discrepancies. Specifically, equivalence was reached between the source and target version in four areas[19]: semantic equivalence (*i.e.*, ensuring that the words mean the same thing), idiomatic equivalence (*i.e.*, formulation of equivalent expressions for colloquialisms), experiential equivalence (ensuring that each item properly captured the experience of daily life in the target culture), and conceptual equivalence (ensuring that items hold the same conceptual meaning).

Test of Final Version. The translated version of the instrument was administered to 203 patients at a midsize hospital in southern Brazil. Patients 18 years and older were included the study if they presented with a cervical contusion, fracture, or upper and lower limb and back arthrosis. Patients were excluded if they did not understand the questions due to psychiatric or neurologic problems, and exhibited neurologic diseases that affected the patient's ability to move the upper and lower limbs, or the back. Patients who participated in test-retest reliability checks were randomly chosen using a table containing random numbers.

Evaluation of Psychometric Properties. On translation, the NDI and the NDPS were subsequently retitled the Brazilian version of the NDI (NDI-BR) and the Brazilian version of the NDPS (NDPS-BR). First, the factor structure of both the NDI-BR and NDPS-BR was analyzed and subscales were defined. Internal consistency of the NDI-BR was then examined with Cronbach's alpha. Alpha values greater than 0.70 were deemed acceptable. Test-retest reliabilities were analyzed at 1 day ($n = 10$) and 7 days ($n = 10$). Individual Cronbach alphas for each of the dimensions of the NDPS-BR were also examined. Like the NDI-BR, test-retest reliabilities were analyzed at 1 day ($n = 10$) and 7 days ($n = 9$) for the first dimension and 10 for the remaining 3 dimensions. Validity (defined as the ability of the instruments to measure what it is intended to measure) was also evaluated. Specifically, both questionnaires were correlated to the Brazilian version of the SF-36,[16] and NDI-BR and NDPS-BR scores were examined against the number of regions of reported functional limitation (one region *vs.* two or more regions).

Statistical Methods. All statistical analyses were performed using Stata version 8.0 for Linux (Stata Corp., College Station, TX). Initially, descriptive analyses using means and percentages with 95% confidence intervals were used to establish the demographic and clinical characteristics of the sample. Correlational analyses examined the test-retest reliability of the scale,

Table 1. Baseline Participant Demographics (N = 203; Age Mean ± SD, 43.05 ± 16.49 Years; Age Range, 18–89 Years)

Variable	N	Frequency/Mean	%
Gender			
Female	77	77	37.93
Male	126	126	62.07
Marital status			
Married	127	127	62.56
Divorced	11	11	5.42
Single	46	46	22.66
Widow(er)	19	19	9.36
Education			
None	8	8	3.94
Unfinished elementary	28	28	13.79
Elementary	40	40	19.70
Mid school	33	33	16.26
Unfinished high school	3	3	1.48
High school	55	55	27.09
Unfinished graduate school	6	6	2.96
Graduate school	30	30	14.78
Diagnosis			
Contusions	87	87	42.86
Arthrosis	42	42	20.69
Postural syndromes	17	17	8.37
Fractures	15	15	7.39
Comorbidities			
Heart attack	19	19	9.36
Heart failure	10	10	4.93
Stroke	5	5	2.96
Asthma	7	7	3.45
Emphysema/chronic Bronchitis	8	8	3.94
Limb involvement			
Upper	37	37	18.23
Lower	12	12	5.91

and Cronbach alpha reliability coefficients were computed for each subscale. Instrument validity was determined using correlational and *t* test analyses, and factor structure was analyzed using factor analysis with varimax rotation.

■ Results

Baseline Characteristics

The majority of the 203 respondents were male (n = 126, 62%) and has less than a high school education (n = 168, 73%) (Table 1). Most participants were married (n = 127, 63%) and had some form of insurance (n = 190, 94%). Slightly less than 2% of the respondents were illiterate and required assistance for completion of both scales. None of the subjects were found to have a diagnosis of cancer, although contusions were common (n = 87, 43%), arthrosis were frequently diagnosed (n = 42, 21%), along with occasional cases of postural syndromes (n = 17, 8%), and fractures (15, 7%). A minority of patients reported comorbidities such as a history of heart attack (n = 19, 9%), heart failure (n = 10, 5%), stroke (n = 6, 3%), asthma (n = 7, 3%), and/or emphysema or chronic bronchitis (n = 8, 4%).

Response Frequencies of the NDI-BR and the NPDS-BR

Response frequencies among the two scales demonstrated a wide range of reported severity among subjects.

Table 2. Factor Loadings for the One-Factor Solution of the NDI-BR

Item	Factor 1 Activities
Pain intensity	0.315
Personal care (washing, dressing, etc.)	0.557
Lifting	0.534
Reading	0.460
Headaches	0.224
Concentration	0.263
Work	0.677
Driving	0.165
Sleeping	0.537
Recreation	0.634

Generally, nearly 50% to 60% of the subjects selected the midrange Likert selections, the remaining dispersed among the lower and upper selections. In general, more subjects selected the higher pain-oriented responses than the questions associated with activities of daily living.

Psychometric Characteristics of the NDI-BR and the NPDS-BR

Factor Analysis of the NDI-BR and NPDS-BR. Factor analyses (with varimax rotation) of the 10 items of the NDI and of the 20 items of the NPDS were performed (Tables 2, 3). The NDI-BR yielded one factor solution identified as activities. Although 2-, 3-, and 4-factor solutions were performed for the NPDS-BR, the 3-factor solution was most interpretable. The three subscales were identified as cervical dysfunction related to general activities (10 items), cervical dysfunction related to activities of the cervical spine (3 items), and pain (4 items). Three items, how bad is your pain with walking, does pain interfere with driving or riding in a car, and how much trouble do you have working overhead, failed to distill into a subscale. After the factor was identified, further reliability and validation procedures were conducted, including a comparison of the newly identified subscales to those of the Brazilian SF-36.

Scale Reliability Indexes. Cronbach alpha indexes were 0.74 for the NDI-BR activities subscale. Test-retest reliability indexes for the NDI-BR were 0.92 at 1 day (n = 10, 2%) and 0.48 at 7 days (n = 10, 2%) (Table 4). Unlike past studies that suggested four dimensions to the English iteration of the NPDS, a factor analysis with varimax rotation distilled three main factor solutions. The Cronbach alpha reliability indexes for the NDPS-BR were 0.89 for the cervical dysfunction related to general activities subscale, 0.81 for the cervical dysfunction related to activities of the cervical spine subscale, and 0.72 for the pain subscale. Test-retest reliability indexes for the NDPS-BR subscales were 0.96 at day 1 (n = 10, 2%) and 0.91 at 7 days (n = 9, 2%) for the cervical dysfunction related to general activities subscale, 0.96 at day 1 (n = 10, 2%) and 0.62 at day 7 (n = 10, 2%) for the cervical dysfunction related to activities of the cervical spine subscale, and 0.52 at day 1 (n = 10, 2%) and 0.45 at day 7 (n = 10, 2%) for the pain subscale.

Comparison of the NDI-BR and the NPDS-BR to Brazilian SF-36

The NDI-BR functional scores presented significant correlations, in the expected directions, with all Brazilian SF-36 subscales except for Physical Role (RP), Emotional Role (RE), and Bodily Pain (BP) (Table 5). The most

Table 3. Factor Loadings for Three-Factor Solution of the NPDS-BR

Item	Factor 1: Cervical Dysfunction Related to General Activities	Factor 2: Cervical Dysfunction Related to Activities of the Cervical Spine	Factor 3: Cervical Pain
How bad is your pain today?			0.537
How bad is your pain on the average?			0.780
How bad is your pain at its worst?			0.652
Does your pain interfere with your sleep?	0.494		
How bad is your pain with standing?	0.373	0.080	0.340
How bad is your pain with walking?	0.437		
Does your pain interfere with driving or riding in a car?	0.381	−0.094	−0.100
Does your pain interfere with social activities?	0.580		
Does your pain interfere with recreational activities?	0.479		
Does your pain interfere with work activities?	0.470		
Does your pain interfere with your personal care (eating, dressing, bathing, etc.)?	0.694		
Does your pain interfere with your personal relationship (family, friends, sex, etc.)?	0.667		
How does your pain change your outlook on life and future (depression, hopelessness)?	0.614		
Does your pain affect your emotions?	0.599		
Does your pain affect your ability to think or concentrate?	0.531		
How stiff is your neck?		−0.657	
How much trouble do you have turning your neck?		−0.847	
How much trouble do you have turning your neck (look up and down)?		−0.675	
How much trouble do you have working overhead?	0.206	−0.334	0.247
How much do pain pills help?			0.433

convincing pattern emerged for Physical Function ($r = -0.41$, $P < 0.0001$). The NPDS-BR functional scores presented significant correlations in each of the three subscales. The cervical dysfunction related to general activities subscale failed to meet significance with Bodily Pain (BP), but did demonstrate strong associations with Physical Function ($r = -0.32$, $P < 0.0001$), Social Function ($r = -0.46$, $P < 0.0001$), Mental Health ($r = -0.29$, $P < 0.0001$), and Vitality ($r = -0.28$, $P < 0.0001$). The subscale cervical dysfunction related to activities of the cervical spine was significant with all the Brazilian SF-36 scales except Physical Role (RP), Emotional Role (RE), and Bodily Pain (BP). Persuasive relationships were noted with Physical Function ($r = -0.26$, $P < 0.0001$), Social Function ($r = -0.28$, $P < 0.0001$), and Vitality ($r = -0.23$, $P < 0.0001$). The pain subscale was significant with all SF-36 subscales with the exception of Physical Role (RP), Emotional Role (RE), and Bodily Pain (BP). Notable relationships were noted with Physical Function ($r = -0.28$, $P < 0.0001$), Social Function ($r = -0.28$, $P < 0.0001$), Mental Health ($r = -0.25$, $P < 0.0001$), and Vitality ($r = -0.24$, $P < 0.0001$). Additionally, all subscales of the NPDS-BR were correlated with the NDI-BR, the two yielding compelling relationships with cervical dysfunction related to general activities ($r = 0.56$, $P < 0.0001$), cervical dysfunction related to activities of the cervical spine ($r = 0.46$, $P < 0.0001$), and pain ($r = 0.45$, $P < 0.0001$).

Table 4. Scale Reliability Indices for NDI-BR and NPDS-BR

Instrument Subscale	Cronbach Alpha	Test (day 1)	Retest (day 7)
NDI: Activities	0.74	0.92	0.48
NPDS: Cervical dysfunction related to general activities	0.89	0.96	0.91
NPDS: Cervical dysfunction related to activities of the cervical spine	0.81	0.96	0.61
NPDS: Pain	0.72	0.62	0.52

■ Discussion

A Brazilian Portuguese version of the Neck Disability Index (NDI-BR) and the NPDS scale (NPDS-BR) demonstrated sufficient scale reliability and validity. Factor analyses resulted in a 1-factor solution for the NDI-BR and a 3-factor solution for the NPDS-BR. The single factor for the NDI-BR was identified as activities, while the three factors of the NPDS-BR represented the subscales of cervical dysfunction related to general activities, cervical dysfunction related to activities of the cervical spine, and pain. Both the NDI-BR and the newly identified subscales of the NPDS-BR demonstrated good internal reliability with the exception of the NPDS-BR subscale pain, which demonstrated fair to moderate reliability. All three of the newly identified subscales of the NPDS-BR established significant correlations, with the majority of the subscales of the validated Brazilian SF-36, while the NDI-BR yielded fewer but nonetheless notable correlations.

Table 5. Comparison of NDI-BR and NPDS-BR to Brazilian SF-36

Instrument Subscales	GH	PF	SF	MH	RP	RE	BP	VT
NDI: Activities	−0.26	−0.41	−0.29	−0.27	−0.19	−0.16	0.13	−0.27
	0.007	<0.001	0.002	0.004	0.145	0.210	0.183	0.004
NPDS: Cervical dysfunction related	−0.22	−0.32	−0.46	−0.29	−0.28	−0.21	−0.07	−0.28
to general activities	0.002	<0.001	<0.001	<0.001	0.006	0.030	0.333	<0.001
NPDS: Cervical dysfunction related	−0.16	−0.26	−0.28	−0.27	−0.07	0.01	−0.09	−0.23
to activities of the cervical spine	0.026	<0.001	<0.001	<0.001	0.504	0.936	0.189	0.001
NPDS: Pain	−0.22	−0.28	−0.28	−0.25	−0.18	−0.06	−0.12	0.45
	0.001	<0.001	<0.001	<0.001	0.088	0.521	0.070	<0.001

The internal consistency coefficients (0.74 for the activities subscale) and the test-retest reliability indexes (0.97 at day 1 and 0.48 at day 7) for the NDI-BR were acceptable. One reason the values were below those of the NPDS-BR was the problem associated with the item regarding driving. Since a number of the participants did not drive and subsequently did not respond to the item, recoding was required, which lowered the reliability. These results are slightly different from those of Vernon and Mior[14] in the initial validation of the original English-version of the NDI who reported internal reliability coefficients of 0.80 and test-retest reliability scores of 0.89 for baseline and 2-day analyses on a small population of whiplash-injured patients from an outpatient clinic. In the validation of a French-version of the NDI, Wlodyka-Demaille *et al*[13] reported similar figures for test-rested reliability at day 1 and day 2 (r = 0.93). Internal consistency was not reported. Recently, validation of a slightly modified version of the NDI for a Swedish speaking population[6] was reported and like the French iteration,[13] the study failed to report internal consistency. The researchers divided the sample into two groups, an acute and chronic cervical pain population. Test-retest measures were 0.99 at 48 hours, 0.95 at 3 weeks, 0.94 at 3 months, and 0.99 at 48 hours after 3 months for the chronic group. The acute group was slightly less resolute demonstrating 0.89 at 48 hours and 0.81 at 48 hours after 3 months. In summary, the present findings of our study suggest the NDI-BR is a stable internal and temporal instrument and has demonstrated similar findings as those reported by the English,[14] French,[13] and Swedish[6] validations but may exhibit weaknesses if a sample includes individuals who do not drive.

The internal consistencies of the NPDS-BR yielded similarly strong correlations. The original English validation of the NPDS and a follow-up study by the same group reported a single coefficient alpha of 0.93, suggesting a high degree of internal consistency among the 20 items. Another study that validated a Turkish version of the NPDS similarly reported a single value (r = 0.86).[4] Because the identification of a single alpha value for a multidimensional scale is not appropriate, we divided the questionnaire into three factor solutions. Within the three solutions, the coefficient alpha was 0.88 for the subscale cervical dysfunction related to general activities, 0.81 for the subscale, cervical dysfunction related to activities of the cervical spine, and 0.72 for the pain subscale. The French-version validation failed to report an internal consistency.[13]

The 3-factor loadings for the test-retest findings of the NPDS-BR also necessitate separate reliability analyses. The subscale cervical dysfunction related to general activities at day 1 and day 7 yielded values of 0.96 and 0.90, respectively. The subscale cervical dysfunction related to activities of the cervical spine was moderately reliable yielding values of 0.96 and 0.63 at day 1 and day 7. The pain subscale demonstrated only fair to moderate reliability yielding values of 0.52 at day 1 and 0.45 at day 7. The lower values may relate to the recovery process of the pain episode. The original English version of the NPDS did not report test-retest reliability; nevertheless, a follow-up study by the chief investigators of the original version reported test-retest values of 0.97 between baseline and follow up analysis during a 1-week timeframe. Their analysis did not include an assessment of test-retest correlation of subscales. The baseline and day 2 test-retest findings for the French version of the NPDS were also reported as one single value for the instrument (r = 0.93) and yielded similar findings. Eight patients were removed from the analyses because their clinical status changed within the first and second evaluation in the 2-day time period. Bicer *et al*[4] did not report a test-retest analysis in the Turkish-version of the NPDS.

In the original introduction of the NDI, Vernon and Mior[14] did not perform a factor analysis for classification of subscales. In a follow-up analysis, Hains *et al*[20] reported that the psychometric properties of an English version of the NDI were one-dimensional. In our factor analysis of the NDI-BR, we examined several models and found a single factor solution that emerged as the cleanest separation between factors. This single subscale identified as activities is in contrast to the findings of the French validation[13] that suggested two principle factors: 1) function and disability and 2) neck pain.

The original design was created with six main divisions and was further distilled to 4 main factor loadings. In our validation of the NPDS-BR a 2-, 3-, and 4-factor analysis resulted in the identification of three main factor solutions. The greater degree of emotional and cognitive influences of one of the four original subscales failed to meet our criteria for a separate category. In the factor

analysis, the three subscales (cervical dysfunction related to general activities, cervical dysfunction related to activities of the cervical spine, and pain) were factored out and are identical to those discovered by the French translation of the NPDS.[13]

There was a notable correlation between the subscale of the NDI-BR and the subscale of the NPDS-BR. Although the NDI-BR and the NPDS-BR are, respectively, one and multiple dimensional scales, this finding suggests that the two scales measure very similar psychometric constructs. The NPDS-BR uses a modified version of a visual analog scale as opposed to the ordinal assertions of the NDI-BR, but both provide wide latitude for functional self-assessment. It appears that the use of both condition-specific functional measures to increase the collection of data are not necessary.

One of the methods we used to establish construct validity was to compare the NDI-BR and the NPDS-BR to the subscales of the Brazilian SF-36. Significant correlation with the literal (English) and adapted (Brazilian-Portuguese) versions of the SF-36 have been reported advocating similar clinical and laboratory measures for validity.[21] In our assessment, we compared the single NDI-BR subscale to the eight SF-36-BR subscales and found variable results. Three SF-36-BR subscales failed to reach significance levels: Physical Role (RP), Emotional Role (RE), and Bodily Pain (BP). There may be potential explanations for this finding. First, the NDI-BR identifies three items that when factored were less associated with activities and more potentially associated with neck pain, a finding suggested by others.[13] These items, pain intensity, headaches, and concentration, demonstrated lower factor loadings than the remaining activity related items. Ackleman and Lindgren[6] propose that headaches are not always associated with neck pain and, thus, may not be appropriate for measurement of pain level during use of the NDI. Intuitively, concentration may also fail to meet the criteria when coupled with bodily pain. Second, in our study, a fair number of the conditions were chronic, suggesting that patients have learned to compensate for his/her disorder in different emotional and physical mechanisms.[6] The English version of the NDI has shown moderate differences in reliability and validity when different levels of chronicity are examined.[5] On the other hand, Riddle and Stratford[22] demonstrated that the physical and mental components of the English version of the SF-36 are highly correlated with the English version of the NDI. They suggest that the NDI is effective in measuring aspects of functional status measured by physical and mental/emotional components, represented by the SF-36. Future investigation of these findings is suggested.

To our knowledge, we are the first to examine the association of any language version of the NPDS and the SF-36. All three NPDS-BR subscales failed to meet significance when associated with Bodily Pain (BP). Furthermore, the subscales of cervical dysfunction related to activities of the cervical spine and pain, did not achieve significance for the SF-36-BR items of Physical Role (RP) and Emotional Role (RE). These findings are similar to those of the NDI-BR, further suggesting that the two revised scales measure similar concepts.

Limitations

Limitations of the study should be recognized. Our population was limited to trauma patients at a regional medical center, which may limit the generalizability of the findings to other populations. Our study did consist of some missing values, and the NDI has been shown to be susceptible to missing data on activities associated with the items of driving and reading.[5]

■ Conclusion

This study demonstrated adequate translation, cultural adaptation, and validity of Brazilian versions of the NDI and NPDS. Scale reliability ranged from fair to excellent, and factor analyses yielded a 1-factor solution for the NDI-BR and a 3-factor solution for the NPDS-BR. The 3-factor solution of the NPDS-BR is different from the 4-factor solution found in the English iteration of the NPDS. Both scales were measured for construct validity against the Brazilian version of the SF-36. It was concluded that a reliable and valid Brazilian Portuguese version of both scales was developed, although future studies should investigate the failure to achieve significance in the SF-36 items of physical role, emotional role, and bodily pain. A Brazilian version of the NDI and NPDS will facilitate the examination of functional performance within a large patient population and across cultures.

■ Key Points

- The NDI and NPDS appear to measure similar constructs as the Brazilian SF-36.
- The NDI and NPDS exhibited 1- and 3-factor subscales.
- The Brazilian versions of the NDI and NPDS appear to measure similar constructs.

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