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Reliability and Validity of the Finnish Version of the Neck Disability Index and the Modified Neck Pain and Disability Scale

Petri Salo, MSc,*† Jari Ylinen, MD, PhD,* Hannu Kautiainen, BA,‡§
Marja Arkela-Kautiainen, PhD,¶ and Arja Häkkinen, PhD*†

Study Design. Translation and psychometric testing.

Objective. To cross-culturally adapt the Neck Disability Index (NDI) to the Finnish language and to assess the reliability and validity of the Finnish version of the Neck Disability Index (NDI-FI) and the modified Neck Pain and Disability Scale (mNPDS-FI) in Finnish patients with neck pain.

Summary of Background Data. Although largely used, no previous reports exist on the translation process or the testing of the psychometric properties of the Finnish version of the NDI or the mNPDS used in Finland.

Methods. The translation of the questionnaire from English into Finnish was done in accordance with the published guidelines. A total of 101 patients with neck pain participated in the study. The reliability of the questionnaires was tested using a test–retest procedure at 2-week intervals. Further psychometric testing was done by assessing the construct validity and internal consistency of the questionnaires.

Results. Test-retest reliability (intraclass correlation coefficients) was excellent for the NDI-FI (0.94) and mNPDS-FI (0.91). Factor analysis identified 1 factor for the NDI-FI and 3 factors for the mNPDS-FI; pain intensity, work ability, and activities of daily living. The internal consistency value (Cronbach α) for the NDI-FI was 0.85, and 0.84, 0.83, and 0.82, respectively, for the 3 factors of the mNPDS-FI. The correlation between neck pain and the NDI-FI was 0.58 ($P < 0.001$) and 0.72 for the mNPDS-FI ($P < 0.001$). A statistically significant linear relationship was observed between self-estimated coping and the outcomes of the NDI-FI and the mNPDS-FI.

Conclusion. The NDI-FI and the mNPDS-FI are reliable, valid instruments for assessing disability among Finnish patients with neck pain.

Key words: neck disability questionnaires, reliability, validity, neck pain. **Spine 2010;35:552–556**

From the *Department of Physical and Rehabilitation Medicine, Central Finland Health Care District, Jyväskylä, Finland; †Department of Health Sciences, University of Jyväskylä, Jyväskylä, Finland; ‡ORTON Foundation, Helsinki, Finland; §Unit of Family Practice, Central Hospital of Middle Finland, Jyväskylä, Finland; and ¶Faculty of Social and Health Care, Lahti University of Applied Sciences, Lahti, Finland.
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Address correspondence and reprint requests to Petri Salo, Department of Physical and Rehabilitation Medicine, Central Finland Health Care District, Keskussairaalantie 19, FI-40620 Jyväskylä, Finland; E-mail: petri.k.salo@jyu.fi

Self-administered questionnaires are commonly used in clinical practice to assess pain, function, disability, and the psychosocial status in patients with neck pain.[1] Other purposes for the use of questionnaires include setting treatment goals, monitoring disease progression, monitoring response to treatment, improving physician–patient communication, and standardizing interactions between health care providers and patients.[2] Nordin *et al*[1] lists several standard scales measuring neck pain or dysfunction developed and published in the English language. However, to be able to make reliable comparisons between different patient populations with different languages and cultural backgrounds, a translation procedure and cross-cultural adaptation of the questionnaire of interest is required.[3] Moreover, to avoid multiplication of outcome measures and to enhance cohesion in neck pain research, a translation and adaptation process is recommended rather than creating a new questionnaire.

One of the most commonly reported questionnaires concerning the neck region is the Neck Disability Index (NDI),[4] which has been translated into and validated in several languages.[5–11] Another widely used questionnaire is the Neck Pain and Disability Scale (NPDS), originally reported by Wheeler *et al*[12] and also translated into several languages.[5–7,13,14]

The Finnish versions of the NDI and the modified NPDS have been in use for a long time, but to our knowledge their psychometric properties have not been previously evaluated. Consequently, the purpose of this study was to cross-culturally adapt the NDI to the Finnish language, and to demonstrate the reliability and validity of the Finnish version of the Neck Disability Index (NDI-FI) and the modified Neck Pain and Disability Scale (mNPDS-FI) among Finnish patients with neck pain.

■ Materials and Methods

Study Population

The candidates for the study included patients with neck pain who were referred for special consultation to the physical and rehabilitation outpatient clinic in Jyväskylä Central Hospital by their general practitioners and occupational physicians in central Finland, which has a population of over 260,000 inhabitants. The inclusion criteria were age 18 years or older, experiencing neck pain, and the ability to communicate in the written Finnish language. There were no specific exclusion criteria. The patients were sent the first questionnaire approximately 2 weeks before their scheduled appointment at the outpatient clinic. After arrival at the clinic, the patients completed the second questionnaire. Patients completing both questionnaires

and provided written informed consent were included in the study. The patients with neck pain were categorized into 3 diagnosis groups: muscle induced, degenerative, and other (*e.g.*, whiplash) according to the physician's clinical examination during their visit to the outpatient clinic. The design of the study was approved by the local Ethics Committee.

Measurements

The first questionnaire contained questions on demographic variables, health condition, smoking habits, alcohol use, length of sick leave during the past 12 months, work status, and physical activity. A visual analog scale (VAS, scale 0–100 mm)[15] was used to assess possible pain in the neck, head, and upper limbs during the previous week. Depressive symptoms were assessed with a 10-item depression scale (DEPS, scale 0–30).[16] The patients were also asked to rate, on a 5-step scale, how they coped compared with other people of their own age: excellently, well, moderately, badly, or very badly. For the statistical analyses, these were collapsed to 3 groups: well (excellently and well), moderately, and badly (badly and very badly).

The NDI-FI and the mNPDS-FI were completed twice at 2-week intervals. The second questionnaire also included a question about whether the patient's neck symptoms were stable, worse, or better compared with their situation when they first completed the questionnaire.

NDI

The NDI was modified from the Oswestry Low Back Pain Disability Questionnaire[17] by Vernon and Mior,[4] and consists of 10 items concerning pain intensity, personal care, lifting, reading, headache, concentration, work, driving, sleeping, and recreation. Each item is scored from 0 (no disability) to 5 (greatest disability). The total score is the sum of each completed item expressed as a percentage of the maximum possible points of all the completed items.[17]

NPDS

The NPDS, introduced in 1999 by Wheeler *et al*,[12] was modeled after the Million Visual Analogue Scale[18] and has been widely used. However, as early as in 1988, Viikari-Juntura *et al*[19] introduced the mNPDS-FI questionnaire, using the questionnaire developed by Million *et al*[20] as a template. The mNPDS-FI has since been actively used in clinics in Finland. The questionnaire consists of 13 items that measure the intensity of pain and how pain interferes with daily activities and work ability. In each item, a VAS of 100 mm is used. In this scale, 0 represents no pain or disability and 100 represents the most severe pain or disability. The total score is the mean value of all the items completed.

Procedure

Translation of the NDI Questionnaire Into the Finnish Language. The translation process was conducted according to the guidelines proposed by Beaton *et al*.[3] The NDI questionnaire was translated by a forward and backward translation procedure. Translation into Finnish was performed independently by 2 persons; an experienced researcher (AH) and an experienced physiotherapist (PS), who produced a written version identifying uncertainties or particularly challenging phrases. Using these 2 translated versions along with the original English version, the translators synthesized the translations. This translation was then compared to the NDI version already in use in Finland to produce a consensus version. The consensus version was then blindly translated back into English by a native English linguist to assure that the central meanings of the items were preserved. The Finnish version of the NDI was finally evaluated by a Finnish linguist.

Table 1. Demographic and Clinical Characteristics of the 101 Patients With Neck Pain

Variables	Values
Female/male, n	59/42
Age, years, mean (SD)	50 (12)
Body Mass Index, mean (SD)	27 (4)
Smoking, n, yes/no	24/75
Alcohol usage, n, yes/no	59/38
Work status, n	
Physically light work	13
Physically medium work	31
Physically heavy work	20
Not working	34
Sick leave, days, mean (SD), n = 58	90 (88)
Depression scale, (scale 0–30), mean (SD)	8 (6)
Pain (Visual Analog Scale, scale 0–100 mm), mean (SD)	
Neck pain, n = 97	61 (26)
Headache, n = 86	46 (29)
Upper limb pain, n = 82	53 (31)
Diagnosis group, n	
Muscle induced	50
Degenerative	39
Others	12

Statistical Methods

The results are expressed as means with standard deviation (SD) and 95% confidence intervals (95% CIs). The percentage of single and total scores reaching floor or ceiling levels was calculated. Test–retest reliability of the NDI-FI and the mNPDS-FI were evaluated by calculating the intraclass correlation coefficient (ICC) with the patients that reported that their symptoms were stable in the second questionnaire. Factor structure among the NDI-FI and the mNPDS-FI was analyzed using factor analysis with varimax rotation. Statistical significance for hypotheses of linearity was evaluated by bootstrap type analysis of variance, with covariates when appropriate. Correlation coefficients between the NDI-FI and mNPDS-FI and neck pain, headache, and upper limb pain assessed with the VAS were calculated using Pearson correlation coefficients. Kendall's coefficient of concordance was calculated to assess the degree of agreement among the NDI-FI and the mNPDS-FI as ranking raters. Correlation coefficients between the NDI-FI, mNPDS-FI, and DEPS were calculated by the Spearman method using Sidak-adjusted probabilities. Cronbach α was used to estimate internal consistency. The α level was set at 0.05 for all tests.

■ Results

A total of 101 (59 females and 42 males) consecutive patients with neck pain completed the 2 questionnaires. Mean (SD) neck pain among the study group was 61 (26) mm on the VAS. The demographic and clinical characteristics of the study group are shown in Table 1.

At the first completion of the questionnaire, the mean (SD) total score for the NDI-FI was 37.6 (15.3) and 48.9 (19 to 0) for the mNPDS-FI. The response rate

Table 2. Characteristics of the NDI-FI* and the mNPDS-FI† Items and Total Score

Scale/Item	Score Mean (SD)	Response Rate (%)	Floor (%)	Ceiling (%)
NDI-FI (rating 0–5)				
Pain intensity	2.3 (1.0)	99	4	0
Personal care (washing, dressing etc.)	0.7 (0.8)	100	51	0
Lifting	2.0 (1.4)	98	14	3
Reading	2.3 (1.2)	99	8	0
Headaches	2.2 (1.4)	100	12	9
Concentration	1.0 (1.0)	98	37	0
Work	2.0 (1.3)	94	14	3
Driving	2.0 (1.2)	81	15	4
Sleeping	2.3 (1.2)	99	6	3
Recreation	2.1 (1.0)	97	6	0
Total score (0–100)	37.6 (15.3)	100	0	0
mNPDS-FI (rating 0–100)				
How severe is your pain?	56.4 (24.7)	97	2	1
How severe is your pain at night?	48.7 (29.2)	97	1	0
Do you get relief from pain killers?	50.0 (27.6)	94	1	1
Do you have any stiffness in the neck?	56.5 (26.3)	98	0	2
Do you have discomfort when looking upwards?	53.7 (29.1)	95	2	0
Do you have discomfort when turning your head to the sides?	54.5 (27.2)	97	1	0
Does your pain interfere with your ability to work with hands overhead?	60.2 (28.0)	97	0	1
Does your pain interfere with your ability to comb your hair?	28.5 (28.8)	95	5	0
Does your pain interfere with your ability to put on your coat?	24.3 (25.5)	94	4	0
How severe is your pain when lying down in bed?	44.9 (28.5)	97	0	0
What is your overall handicap in your complete lifestyle because of your pain?	49.3 (24.5)	98	1	1
To what extent does your pain interfere with your work?	58.2 (28.5)	94	1	4
To what extent have you had to modify your work in order to be able to do your job	50.0 (33.2)	80	4	3
Total score (0–100)	48.9 (19.0)	98	0	0

*Neck Disability Index.
†Modified Neck Pain and Disability Scale.

varied from 81% to 100% on the NDI-FI items and from 80% to 98% on the mNPDS-FI items. No values reaching floor or ceiling on total scores of the NDI-FI or the mNPDS-FI were detected. In the NDI-FI items of personal care and concentration, a floor effect was observed more frequently than in the other items (Table 2).

Between the first and second completion of the questionnaires, the mean change (95% CIs) in the NDI-FI total scores among the patients reporting their symptoms to have worsened (n = 16) was 3.9 (0.5–7.3), being stable (n = 65) −3.3 (−4.9 to −1.8), and improved (n = 17) −5.1 (−10.1 to −0.3) ($P < 0.001$ for linearity). Between the first and second completion of the questionnaires, the mean change (95% CIs) in the mNPDS-FI total scores among the patients reporting their symptoms to have worsened (n = 15) was −0.2 (−3.2 to 2.4), being stable (n = 64) −2.9 (−5.8 to −0.4), and improved (n = 17) −11.3 (−2.7 to 0.4) ($P = 0.032$ for linearity) (Figure 1).

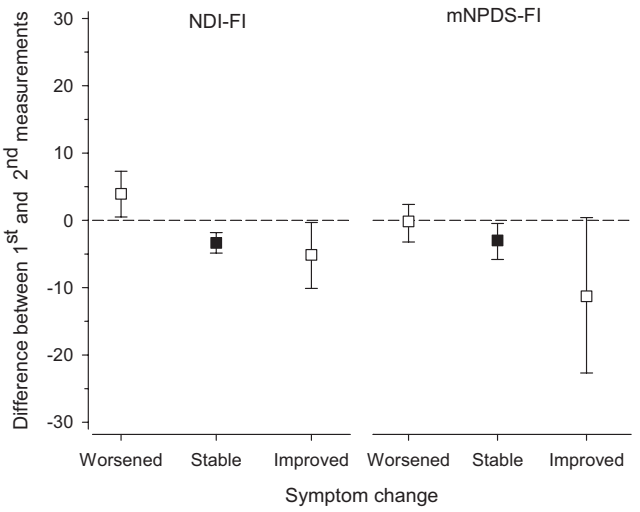

Figure 1. Mean change in total score of the Neck Disability Index—Finland (NDI-FI) and the modified Neck Pain and Disability Scale—Finland (mNPDS-FI) between the first and second completion of the questionnaires. Error bars indicate 95% confidence intervals.

The test–retest reliability using ICC (95% CIs) among patients reporting "stable" was 0.94 (0.90–0.96) for the total NDI-FI score and 0.91 (0.86–0.95) for the total mNPDS-FI score.

Construct Validity

Factor analysis showed that the NDI-FI was loaded on 1 factor explaining 41% of the total variance. For the mNPDS-FI, 3 factors were identified (activities of daily living, pain, and work ability) explaining 60% of the total variance (Table 3).

A linear relationship was observed between self-estimated coping and the outcomes of the NDI-FI and the mNPDS-FI ($P < 0.001$) (Table 4). The NDI-FI was associated with neck pain (0.53; $P < 0.001$), headache (0.43; $P < 0.001$), and upper limb pain (0.36; $P = 0.001$). Comparably, mNPDS-FI was associated with neck pain (0.69; $P < 0.001$), headache (0.44; $P < 0.001$), and upper limb pain (0.58; $P < 0.001$). Kendall's coefficient of concordance between the NDI-FI and the mNPDS-FI was 0.46 (Figure 2).

The NDI-FI was also associated with the DEPS (0.43; $P < 0.001$), but no association between the mNPDS-FI and the DEPS was observed. Also, no association between diagnosis group or length of sick leave and the NDI-FI or the mNPDS-FI was found.

The internal consistency value was 0.85 for the NDI-FI and 0.90 for the mNPDS-FI. For the 3 factors of the mNPDS-FI, the internal consistency values were 0.84 (activities of daily living), 0.83 (pain), and 0.82 (work ability).

Table 3. Explanatory Factor Analysis With Varimax Rotated Factor Loadings of the mNPDS-FI* Function Items†

Item	ADL‡	Pain	Work Ability
1. How severe is your pain?		0.73	
2. How severe is your pain at night?		0.84	
3. Do you get relief from pain killers?		0.41	
4. Do you have any stiffness in the neck?	0.67		
5. Do you have discomfort when looking upwards?	0.70		
6. Do you have discomfort when turning your head to the sides?	0.79		
7. Does your pain interfere with your ability to work with hands overhead?	0.51		
8. Does your pain interfere with your ability to comb your hair?	0.61		
9. Does your pain interfere with your ability to put on your coat?	0.51		
10. How severe is your pain when lying down in bed?		0.81	
11. What is your overall handicap in your complete lifestyle because of your pain?			0.56
12. To what extent does your pain interfere with your work?			0.92
13. To what extent have you had to modify your work in order to be able to do your job?			0.62

*Modified Neck Pain and Disability Scale.
†Coefficients with values <0.40 not shown.
‡Activities of Daily Living.

■ Discussion

The aim of this study was to adapt the NDI to the Finnish language and to examine the reliability and validity of the introduced NDI-FI and the mNPDS-FI. The translation procedure was completed according to the guidelines established by Beaton *et al*.[3] No major cultural differences came up during the translation process and the measurement properties of the original NDI seemed to be well retained.

Floor and Ceiling Effect

Floor or ceiling effects up to 15% have been suggested to meet the standards for individual patient-monitoring in clinical practice.[2] Only 2 items in the NDI-FI questionnaire reached the floor value of 15%, and no other observations overreaching the 15% values for floor or ceiling effects were detected in the NDI-FI or the mNPDS-FI questionnaires. Therefore, it can be reasonably concluded that both instruments can assess the full range of severity related to neck pain.

Table 4. Mean Scores (SD) of the Subjects for the NDI-FI* and the mNPDS-FI† in Relation to Self Reported Coping Compared to People of Own Age

	Coping Well n = 19	Coping Moderately n = 51	Coping Badly n = 30	*P* for Linearity
NDI-FI, score (SD)	27.4 (14.5)	35.1 (12.7)	47.9 (14.0)	<.001
mNPDS-FI, score (SD)	37.1 (21.9)	44.1 (16.0)	64.0 (11.7)	<.001

*Neck Disability Index.
†Modified Neck Pain and Disability Scale.

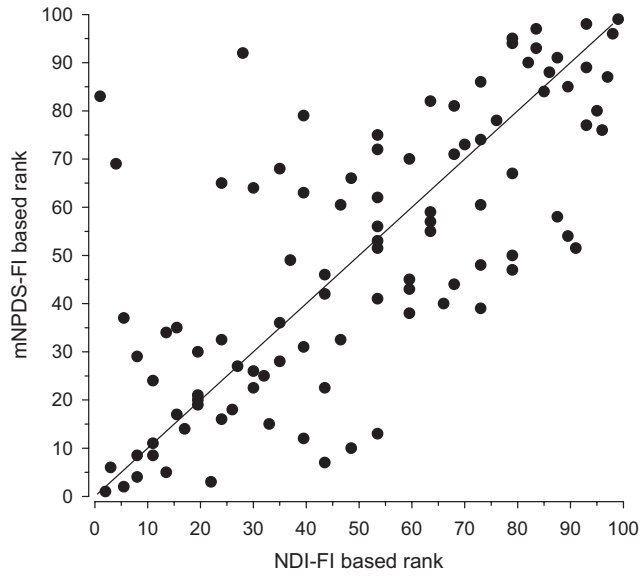

Figure 2. Correlation between the Neck Disability Index—Finland (NDI-FI) and the modified Neck Pain and Disability Scale—Finland (mNPDS-FI) as ranking raters.

Reliability

The test–retest reliability was high for both questionnaires and is unlikely to be explained by memorizing, since an average time of over 2 weeks passed between the completion of the questionnaires, which also included several additional questions. Test–retest reliability of the NDI has been evaluated in several studies. In studies most comparable to ours[8,10,11] with over 50 subjects in each study and the time between completion of questionnaires 7 days or longer, the ICC values have been similar to ours, varying between 0.88 and 0.95.

Both questionnaires showed good internal consistency, while Cronbach α values ranged from 0.85 to 0.90 for the NDI-FI and mNPDS-FI total scores, and from 0.82 to 0.84 for the 3 factors of the mNPDS-FI. Previously, Cronbach α levels for the NDI have been reported to range from 0.74 to 0.93.[6,7,9]

Construct Validity

In the present study, only 1 factor was identified for the NDI-FI that explained 41% of the variance. Our findings are in line with 3 other studies, where factor analysis has extracted a one-factor solution for the NDI explaining 45% to 59% of the variance.[6,21,22] In a French validation study, Wlodyka-Demaille *et al*[5] suggested 2 factors for the NDI: the first factor was identified as function and disability and the second factor as neck pain. However, these 2 factors accounted for no more than 55% of the total variance.[5]

For the mNPDS-FI, 3 factors were identified. Comparison of the mNPDS-FI and the original NPDS is not relevant because the NPDS has 20 items and the modified Finnish version has only 13 questions. Differences occurred in items concerning emotions and concentration that were included in the original NPDS, but which are not included in the mNPDS-FI.

Both questionnaires showed a linear association with patient's self-perceived estimation concerning coping. In addition, the NDI-FI and the mNPDS-FI were both positively associated with VAS assessed neck pain. Thus, by showing a good convergent validity, the construct validity of both scales is reinforced. As would have been expected, the association between both of the instruments and headache measurement was clearly weaker than with neck pain, suggesting good discriminative validity. The mNPDS-FI showed a high correlation with upper limb pain, which implies the ability to react to conditions where symptoms of upper extremities are present.

The concordance between the NDI-FI and the mNPDS-FI as ranking raters was modest, revealing the property of arranging the patients in somewhat different order. The difference between the NDI-FI and the mNPDS-FI is also highlighted by the positive association between the NDI-FI and the mental screening instrument, DEPS, which was not found between the mNPDS-FI and the DEPS.

Both instruments had 1 item with a clearly lower response rate than the other items. While not all respondents drive a car, the lower response rate for the item that concerned driving on the NPD-FI is easily explained. Missing values concerning the same item, driving, have been reported in several other studies.[5–7,10] In many cases where 1 item is missing, several authors have chosen to report the total score as a percentage of completed items.[23] This is also the instruction in the original paper by Fairbank *et al*.[17] In the mNPDS-FI, the item concerning change of work had the lowest response rate. This may be because 35% of the respondents were not working during the completion of the questionnaire. Therefore, it might not be possible to answer the question concerning change of work. The response rate was good for the other items, at 94% or more in both of the instruments.

■ Conclusion

This study shows that the NDI-FI and the mNPDS-FI are reliable, valid instruments for assessing disability among Finnish patients with neck pain. Furthermore, the NDI-FI appeared highly comparable to the reliability and validity values reported in previous studies in different languages. For this reason, the NDI-FI can be used to compare different patient populations with different native languages and cultural backgrounds.

■ Key Points

- A successful cross-cultural adaptation of the Neck Disability Index (NDI) to the Finnish language was obtained, producing the NDI-FI.
- The reliability and validity of the NDI-FI and the modified Neck Pain and Disability Scale used in Finland (mNPDS-FI) was established among patients with neck pain.
- The results of the present study confirm that the NDI-FI and mNPDS-FI are suitable instruments for assessing disability among patients with neck pain in clinical and research settings.

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