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Cross-cultural translation, validity, and reliability of the French version of the Neurophysiology of Pain Questionnaire

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3 the Neurophysiology of Pain Questionnaire

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7 Abstract

8 Pain physiology education is an important component in the management of patients with
9 chronic musculoskeletal pain. The Neurophysiology Pain Questionnaire (NPQ) was
10 developed in English to assess pain physiology knowledge in patients. This study aimed to
11 translate the NPQ into French (NPQ-Fr) and to investigate the main psychometric properties
12 of the NPQ-Fr. The translation was performed using the best practice translation guidelines.
13 One hundred and one French-speaking patients with chronic non-specific spinal pain
14 completed the NPQ-Fr to assess its acceptability and presence of floor/ceiling effects. The
15 construct validity was tested by comparing the patients' NPQ-Fr scores to those of 17
16 physiotherapists and investigating its correlation with subscales of the Short Form-36
17 questionnaire. The reliability (i.e., internal consistency and test-retest reliability) was also
18 investigated. To test the test-retest reliability, 70 patients were asked to complete the NPQ-Fr
19 twice with one week in between. Regarding the NPQ-Fr psychometric properties, a)
20 acceptability was good; b) internal consistency reached a Cronbach α -coefficient of 0.44; c)
21 no floor and ceiling effects were observed in patients; d) construct validity was good; e)
22 reliability was good (intraclass correlation coefficient = 0.644; standard error of measurement
23 = 1.5). The NPQ-Fr has satisfactory basic psychometric properties in patients with chronic
24 spinal pain.

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27 Keywords: low back, pain, spine, questionnaire, translation, validation, reliability,
28 psychometric properties, education, neurophysiology

29

INTRODUCTION

Low back pain and neck pain belong to the five major conditions defined in the Global Burden of Disease (GBD) 2010 Study. (March et al., 2014; Murray et al., 2012) Although a rapid decrease in pain and incapacity often occurs within the first month following the onset of low back pain, estimates suggest that 23% of patients experience persistent symptoms of whom 11-12% report substantial levels of disability; (Balague, Mannion, Pellise and Cedraschi, 2012) higher percentages have even been reported for neck pain. (Borghouts, Koes and Bouter, 1998; Bovim, Schrader and Sand, 1994; Cohen, 2015) Several studies reported the lack of knowledge and/or the misbeliefs of patients (Foster et al., 2008; Main, Foster and Buchbinder, 2010; Nijs et al., 2013) (e.g., they believe that pain means that the tissues are damaged) and their consequences (e.g., increased pain and disability, fear of movement, catastrophizing (Leeuw et al., 2007; Pincus et al., 2006; Rainville et al., 2011)). Therefore, the relevance of pain neurophysiology education has been growing recently (Louw, Diener, Butler and Puentedura, 2011) and is now being considered as a key component in the management. (Nijs et al., 2014) Preliminary evidence suggests that pain neurophysiology education is effective to positively influence these consequences. (Louw, Diener, Butler and Puentedura, 2011; Moseley, 2002)

The Neurophysiology Pain Questionnaire (NPQ) was developed in English by Moseley et al. to assess whether health professionals and patients could accurately understand the neurophysiology of pain. (Moseley, 2003) This 19-item true-false questionnaire was developed from examination papers given to post-graduate pain medicine students. In 2013, the psychometric properties of a modified NPQ (slightly different from the original version regarding the wordings of some items) were examined by conducting a Rasch Analysis from a sample of 300 chronic spinal pain patients. (Catley, O'Connell and Moseley, 2013) Acceptable internal consistency and test-retest reliability were reported but 7 redundant items were found which negatively influenced the psychometric properties. The authors concluded that the modified NPQ had adequate psychometric properties for use with

chronic spinal pain patients but that further research was needed. The NPQ has been used in both clinical practice and in several studies investigating knowledge improvements following specific education sessions. (Louw, Diener and Puentedura, 2015; Meeus, Nijs, Van Oosterwijck, et al., 2010; Moseley, 2004) It was also used in a very recent study which concluded that knowledge uptake causes a reduction in catastrophizing and is directly related to clinically relevant changes in the outcomes (pain and function). (Lee et al., 2016)

However, according to our knowledge, the NPQ has been translated and cross-culturally validated only in Dutch (in patients with chronic fatigue syndrome). (Meeus, Nijs, Elsemans, et al., 2010) Therefore, the aim of this study was to translate the modified NPQ into French (NPQ-Fr) and to investigate the main psychometric properties (i.e., acceptability, floor/ceiling effects, construct validity and reliability (i.e. internal consistency and test-retest reliability)) of this new version in patients with chronic non-specific spinal pain. As suggested by Catley et al., (Catley, O'Connell and Moseley, 2013) we also investigated the psychometric properties of a shortened version of the NPQ-Fr.

METHODS

The present study was carried out in two steps. The first one was the cross-cultural translation of the English NPQ modified by Catley et al. (Catley, O'Connell and Moseley, 2013) into a French version (NPQ-Fr). The second step was designed to test the psychometric properties of both the long and short version of the NPQ-Fr.

Step 1: Translation

The translation of the questionnaire went through several phases according to Beaton et al.: (Beaton, Bombardier, Guillemin and Ferraz, 2000)

Phase 1: contact with the team that originally validated the questionnaire. (Catley, O'Connell and Moseley, 2013)

Phase 2: forward translations by two bilingual translators.

Phase 3: synthesis of the translations.

85 *Phase 4:* back-translation by two translators (blind to the original version of the NPQ)
86 *Phase 5:* expert committee (two methodologists, one health professional expert in pain
87 neurophysiology, one French language professional, and the four translators) resulting in a
88 pre-final version of the NPQ-Fr.
89 *Phase 6:* test of the pre-final version of the NPQ-Fr. Considering the fact that the NPQ is a
90 knowledge questionnaire including several unusual terms for the general population, it was
91 decided to test it with 9 health care professionals (manual therapists) specialized in pain
92 neurophysiology education. They completed it and were questioned about any difficulties
93 encountered in completing the questionnaire. Following the interview process, the expert
94 committee proposed the final version of the NPQ-Fr.
95 *Phase 7:* the final version of the NPQ-Fr was submitted to the developer of the instrument.

97 Step 2: Psychometric properties

99 *Participants*

100 French-speaking patients referred by a general practitioner or a medical specialist to
101 a rehabilitation centre or a private physiotherapy unit in Belgium/France were contacted.
102 Patients who met the following inclusion criteria were eligible for the study: patients with
103 chronic (>3months) spinal pain, aged 18 years or more, able to read and understand French.
104 Exclusion criteria were specific underlying spinal pain conditions (e.g., trauma, fracture,
105 infection, inflammatory disease, tumor), history of spine surgery within the last 3 months and
106 history of specific pain neurophysiology education courses within the last 12 months.

107 To study the construct validity (discriminative validity) of the NPQ-Fr, a group of
108 French-speaking physiotherapists specialized in musculoskeletal disorders who had received
109 in the past specific education on pain neurophysiology education was also included.

111 *Experimental Procedure*

112 A battery of questionnaires including a general questionnaire, a pain visual analogue
113 scale (VAS), the Short Form-36 (SF-36) health survey and the NPQ-Fr was given to the
114 patients and completed at baseline; the health care professionals only completed the NPQ-
115 Fr. These data were used for investigating acceptability (by measuring time required for
116 patients to answer the NPQ and analysing the presence or absence of missing or multiple
117 responses), floor and ceiling effects, internal consistency and discriminative validity. The
118 latter psychometric property was tested by comparing the NPQ-Fr scores in patients and
119 health-care professionals. Construct validity was further investigated by measuring the
120 discriminant (divergent) validity; it was tested by studying the correlations (which were
121 expected to be low) between the NPQ-Fr scores and the vitality, general health and social
122 functioning scores items of the SF-36. One week later, 70 patients were asked to fill in the
123 NPQ-Fr again to measure test-retest reliability.

124 As suggested by Terwee et al., (Terwee et al., 2007) the study sample size consisted
125 of at least 50 patients for test-retest reliability and construct validity and of at least 100
126 responders for internal consistency.

127

128 *The questionnaires*

129 - The general questionnaire included questions about age, sex, duration of pain and
130 disability, localization of pain (neck and/or thoracic and/or lumbar), highest diploma obtained
131 and work status.

132 - The NPQ-Fr consists of 19 (True/False/I do not know) questions. The overall NPQ-Fr score
133 ranges from 0 to 19 (sum of all correct items) or is expressed in percentage. Taking into
134 account the suggestion from Catley et al. (Catley, O'Connell and Moseley, 2013) to exclude 7

items (i.e., item numbers 1,5,7,11,12,14,19), the score of the short version of NPQ-Fr (ranging from 0 to 12) was also calculated.

- Pain intensity over the past week was assessed by means of a self-administered VAS consisting of a 100 mm long line, whose ends were labelled as “no pain at all” (scored as 0) and “the worst imaginable pain” (scored as 100). (Huskisson, 1974)

- The SF-36 is a widely used generic outcome measure, which consists of eight domains: physical function, role-physical, pain, general health, vitality, social functioning, role-emotional and mental health. It is self-explanatory and takes about 10 min to complete. The SF-36 score ranges from 0 to 100, 0 indicating extreme problems and 100 indicating no problem. We used the validated French version of the questionnaire. (Leplege, Ecosse, Verdier and Perneger, 1998)

Our study was accepted by the Ethical committee of the University of Liege and informed written consent was provided by all patients.

Statistical analysis

All statistical analyses have been made using the SPSS 16.0 for Windows. A Shapiro-Wilk test verified the normal distribution for all parameters. Quantitative variables that were normally distributed were expressed as mean $\pm$ standard deviation (SD) and quantitative variables that were not normally distributed were expressed as median (percentile 25, percentile 75). The level of significance was set at 0.05.

The floor and ceiling effects were analysed by calculating the percentage frequency of lowest or highest possible score achieved by respondents. Floor and ceiling effects of less than or equal to 15% were considered to be acceptable. (Terwee et al., 2007)

To investigate discriminative validity, an independent samples t-test was used to compare the NPQ-Fr scores in patients and health-care professionals. The discriminant

validity was evaluated by the Spearman correlation coefficient according to the following criteria: high ($\rho \geq 0.60$), moderate ($\rho < 0.60 - \geq 0.30$) or low ($\rho < 0.30$). (Andresen, 2000)

Internal consistency, which is the estimation of item homogeneity, was examined using Cronbach α . A value ranging from 0.70 to 0.95 is generally recommended. (Terwee et al., 2007)

To analyse the test-retest reliability of the overall NPQ-Fr score, the intra-class correlation coefficient (ICC) using an absolute agreement definition and assessed from a two-way random effects model was calculated. An ICC value of less than 0.40 indicated poor reliability whereas values between 0.40 and 0.75 indicated fair to good reliability; an ICC value of greater than 0.75 showed excellent reliability. (Fleiss, 1986) Besides, the standard error of measurement (SEM), determined by the formula $SEM = SD \times \sqrt{1-R}$ (where SD was the average standard deviation of the scores initially and at retest, and R was the test-retest correlation coefficient), was also calculated. Additionally, Cohen's Kappa and PABAK (Prevalence Adjusted Bias Adjusted Kappa) tests (the latter not being influenced by the distributions of data across the categories (Byrt, Bishop and Carlin, 1993)) were used to evaluate item-by-item agreement. It was defined as slight (0.01-0.20), fair (0.21-0.40), moderate (0.41-0.60), substantial (0.61-0.80) or almost perfect (0.81-1.00). (Landis and Koch, 1977)

Ninety-five percent confidence intervals (CI) were calculated for ICC, Kappa and PABAK values.

RESULTS

Regarding the cross-cultural translation of the NPQ into a French version (NPQ-Fr), the nine health care professionals (mean age of 39.2 (5.5) years) who tested the pre-final version in phase 6 scored very well (mean score of 17 (0.9) out of 19). Regarding the few failed questions, although most of them resulted from careless mistakes according to them,

some translation issues were also suggested for some items (i.e., item numbers 1, 4, 8, 9 and 14). After discussion within the expert committee and with the developer of the NPQ, it was decided to slightly change these 5 items. Table 1 provides the French translated final version of the NPQ (NPQ-Fr).

Insert Table 1 around here

A hundred and one patients with chronic spinal pain were included in the present study (see Table 2). A substantial proportion (67.4%) of the population experienced spinal pain for more than 12 months. The 17 health care professionals (7 females and 10 males) specialized in musculoskeletal disorders had a mean age of 27.7 (4.8) years (mean time since obtaining a diploma: 5.1 (3.8) years)).

Insert Table 2 around here

Acceptability

Patients took less than 5 minutes (260 ± 60 s) to fill in the NPQ-Fr (19 items). Neither missing nor multiple responses were observed. While no item could be considered too easy (95% of patients answering correctly), two items (item numbers 2 and 15) could be considered too hard (less or equal to 5% of patients answering correctly).

Floor and ceiling effects

There were no floor and ceiling effects. Neither the maximal nor the minimal NPQ-Fr scores were observed in any of the versions. The mean score $\pm$ SD (min-max) was 7 ± 2.6 (1 – 15) out of 19 (i.e., 36.8%), and 5.6 ± 1.8 (1 – 10) out of 12 (i.e., 46.7%) for both versions, respectively.

Construct validity

The discriminative validity analysis indicated that the health-care professionals had highly significantly higher NPQ-Fr scores than the patients both for the full version (15.8 ± 1.9 vs 7 ± 2.6 , $p < 0.001$) and for the shortened one (9.9 ± 1.3 vs 5.6 ± 1.8 , $p < 0.001$). A complementary analysis of the professionals' answers revealed a minimal score of 13/19, a maximal score of 19/19 and that more than 50% of them answered 2 questions incorrectly (items: 2 and 11). Regarding the discriminant validity analysis, the expected low and non-significant ($p > 0.1$) correlations found between the total score of the NPQ-Fr and the vitality, general health and social functioning scores of the SF-36 ($\rho = 0.005$, 0.07 and 0.08 , respectively) suggest the discriminant validity of the NPQ-Fr. Similar findings were observed when analysing the shortened NPQ-Fr.

Reliability

The Cronbach α coefficient, reflecting internal consistency, was 0.44 and 0.30 for the full (19 items) and shortened (12 items) versions, respectively. The alternative exclusion of an item did not substantially modify that coefficient.

Seventy patients filled in the NPQ-Fr again one week later to investigate the test-retest reliability. No significant differences were observed between test and retest regarding the overall NPQ-Fr score (7.1 ± 2.5 vs 7.3 ± 2.8 , $p = 0.490$). The calculated ICC was 0.644 (95% CI, $0.484 - 0.763$) and the SEM was 1.5 . The short NPQ-Fr version (12 items) had a lower reliability (ICC = 0.482 , 95% CI, $0.279 - 0.644$; SEM = 1.2) than the full version. The item-by-item agreement analysis is presented in Table 3. For all items, the proportion of patients who answered exactly the same (i.e., "true", "false" or "I don't know") at the pre and post-test ranged from 34% to 66%. Whereas the Cohen's Kappa coefficients remained below 0.50 , the PABAK ranged from 0.38 to 0.89 (except for item 8).

Insert Table 3 around here

DISCUSSION

The results of the present study demonstrate that the NPQ-Fr is acceptable, valid and reliable in patients with chronic spinal pain. Translating the NPQ into French is particularly relevant, as French is the fifth most spoken language (274 million total speakers) and guidelines recommend the use of the NPQ. (Nijs et al., 2011)

According to this study, the NPQ-Fr is acceptable for the patients. It did not take a lot of time to answer and all items had a 100% response rate. As reported by Meeus et al., (Meeus, Nijs, Elsemans, et al., 2010) the results of the present study also suggest that the inclusion of an undecided option was relevant. Indeed it might have prevented some people from guessing the correct answer which might overestimate the knowledge level of some subjects.

The absence of floor and ceilings effects observed was also reported in the previous studies investigating the psychometric properties of the NPQ. (Catley, O'Connell and Moseley, 2013; Meeus, Nijs, Elsemans, et al., 2010)

Considering the lack of a 'gold standard' to assess pain neurophysiology knowledge, validity was mainly tested by comparing NPQ scores of patients and professionals as was done by Meeus et al. (Meeus, Nijs, Elsemans, et al., 2010). In accordance with their results, we observed highly significant differences between groups, suggesting the discriminative validity of the test. Although the overall NPQ score of the health care professionals included in the present study ($83.2\% \pm 10\%$) was higher than the score ($78\% \pm 21\%$) reported by Moseley et al. in trained health professionals (Moseley, 2003) and by Meeus et al. ($56.3\% \pm 16\%$) in medical students and professionals, (Meeus, Nijs, Elsemans, et al., 2010) it suggests that some educated professionals have some misconceptions or lack of knowledge or that a few items might be confusing. The results of the discriminant validity analysis corroborate the validity of the questionnaire.

The Cronbach's alpha coefficient characterizing the internal consistency of the NPQ-Fr was 0.44, i.e., lower than reported in these two other studies which reported acceptable (0.84) and fair (0.77) internal consistency, respectively. Methodological differences might partly explain these differences. Although it is frequently used when investigating the

clinimetric properties, the Cronbach's alpha coefficient is not easy to interpret. (Sijtsma, 2009; Streiner, 2003) The lower Cronbach's alpha found in the present study might result from the fact that some items (questions) were more difficult to answer than others.

Therefore, we do not think it is a reason to consider the NPQ-Fr as inappropriate for use.

Test-retest reliability of the NPQ-Fr was found to be good (ICC = 0.644) but lower than in the literature. Indeed, whereas Catley et al. reported ICC of 0.971 in patients prior to attending an education course, (Catley, O'Connell and Moseley, 2013) Meeus reported ICC of 0.756. (Meeus, Nijs, Elsemans, et al., 2010) The short interval in-between used in literature (ranging from 24 hours (Meeus, Nijs, Elsemans, et al., 2010) to two to five days (Catley, O'Connell and Moseley, 2013) versus 7 days in the present study), which might have enabled participants to remember their previous answers, might be one of the main methodological differences likely to explain such differences. The population (patients with chronic fatigue syndrome (Meeus, Nijs, Elsemans, et al., 2010) or with chronic spinal pain (Catley, O'Connell and Moseley, 2013)) or the version of the NPQ used (original (Meeus, Nijs, Elsemans, et al., 2010) or modified (Catley, O'Connell and Moseley, 2013) version) might be another explanation. The agreement analysis of each item also revealed satisfactory agreement for most items. Considering the fact that the minimal detectable change (MDC) can be calculated as: $1.96 \times \text{SEM} \times \sqrt{2}$, our results suggest that clinicians should conclude that a change in knowledge took place only when a change higher than four points of the NPQ total score occurs.

Another originality of the present study is the analysis of the psychometric properties of the short version (12 items) proposed by Catley et al. (Catley, O'Connell and Moseley, 2013) Although the shortened version is a bit quicker to fill in, it did not have better psychometric properties than the long version, and even had a lower test-retest reliability. Therefore, our results question the use of the shorten version of the NPQ.

A limitation of the current study might be the sample size. However, although up to twenty subjects by items is included in some studies, there is a lack of consensus regarding the optimal sample size in studies investigating the psychometric properties of a

questionnaire (Anthoine, Delmas, Couterut and Moret, 2014). Furthermore, we included more than a hundred of participants in the present study i.e. more than the minimal number recommended. The inclusion of only patients with no history of specific pain neurophysiology education courses might be another limitation. Contrary to us, Catley et al. considered the preeducation NPQ score of some participants and the posteducation NPQ score of others.

CONCLUSIONS

The translation of the NPQ questionnaire was shown to be linguistically accurate, acceptable for use by French speaking patients in Belgium/France and characterized by good basic psychometric properties. Further studies should investigate additional properties e.g., its responsiveness. The NPQ-Fr is quick to complete and will be of potential interest for the French speaking medical and scientific community for assessing pain physiology knowledge and measuring the influence of educational sessions in clinical practice and research.

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DECLARATION OF INTEREST

The authors report no declarations of interest.

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