

Original Article

Translation and cross-cultural adaptation of the Nottingham Clavicle Score to Danish

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ABSTRACT

INTRODUCTION. The Nottingham Clavicle Score (NCS) is a patient-reported outcome measure (PROM) that addresses injuries to the clavicle, acromioclavicular joint (ACJ) and sternoclavicular joint. The aim of this study was to translate and culturally adapt the original NCS to Danish, providing a basis for future validation and clinical use in Denmark.

METHODS. The translation process followed best-practice guidelines from the International Society for Pharmacoeconomics and Outcomes Research. It was conducted using the cross-cultural adaptation guidelines described by Beaton. Two independent translators and an expert committee performed the translation from English into Danish. The final NCS translation was presented to Danish patients undergoing treatment for a clavicle fracture or an ACJ dislocation.

RESULTS. The NCS was translated into Danish and cross-culturally adapted. The translation process included forward and backward translations, expert committee review and pilot testing by nine patients. The Danish version was well-understood by the target population, and only minimal adjustments were needed to achieve conceptual and linguistic equivalence. Patients reported that the questionnaire was relevant and comprehensible.

CONCLUSIONS. The NCS has been translated and cross-culturally adapted to Danish. It was well-received by the target population, with patients finding it relevant and comprehensible. However, further validation is required to confirm its reliability and consistency in a Danish population.

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Injuries to the shoulder and clavicle are multifaceted, often involving several muscles and tendons. Clavicle fractures, acromioclavicular joint (ACJ) dislocations and sternoclavicular joint (SCJ) injuries are common among young, active individuals engaged in high-impact sports [1-3]. These injuries impair upper limb function, impacting performance and quality of life (QOL) [4].

Patient-reported outcome measures (PROMs) are increasingly used to capture patients' perspectives on their functional status, QOL and treatment outcomes. PROMs provide direct insights into how patients perceive their health and recovery [5].

Various PROMs have been developed to target specific areas and diseases, primarily in English [6-8]. To ensure that these tools are effective across cultures and languages, a thorough translation and cross-cultural adaptation process is required to maintain their validity and reliability.

Shoulder-specific questionnaires have been translated into various languages, including Danish. However, PROMs specifically targeting the clavicle, ACJ and SCJ regions are lacking. The Nottingham Clavicle Score (NCS), validated in 2013, was developed to address this gap by providing a ten-item PROM designed to assess the level of function and disability in these regions following traumatic injuries [9].

The NCS was developed by Charles et al. [9] as a useful PROM for clavicle, ACJ and SCJ conditions, with reported internal consistency and correlation with existing PROMs such as the Oxford Shoulder Score. However, its content and construct validity remain doubtful due to limited patient involvement during development and reliance on basic psychometric methods. Despite these limitations, it is probably the best available clavicle-specific tool and is expected to be used in international studies.

This makes it particularly suitable for translation and adaptation to Danish, as pursued in this study. The NCS has already been translated and cross-culturally adapted into several languages, including Italian, German and Turkish [10-12].

This study aimed to translate the original English version of the NCS into Danish and adapt it cross-culturally.

Methods

The translation and cross-cultural adaptation were performed between April 2017 and October 2018, according to Beaton [13]. All included patients were under surgical treatment for either clavicle fractures or ACJ/SCJ joint dislocations at the Department of Orthopaedic Surgery, Kolding Hospital, Denmark. They were all seen 12 weeks post-operatively. Patients were included if they were above 18 years and able to participate in a phone interview. Interviews were conducted 3-12 months post-injury.

The NCS consists of ten items. Pain is assessed in items 1-4, strength, functional abilities in items 5 and 6, aesthetic satisfaction in item 7 and symptoms of movement or clicking in item 8. Neurological symptoms such as tingling, numbness, dragging sensation and heaviness in the upper limb are evaluated in items 9 and 10. Each score is assessed on a scale of 2-10, yielding a maximum score of 100 points. Final scores range from excellent (80-100 points) to good (60-79 points), fair (40-59 points) and poor (< 40 points).

Translation and cultural adaptation of the PROM followed best-practice guidelines from the International Society for Pharmacoeconomics and Outcomes Research and the guidelines described by Beaton, which involved the following stages [13, 14]:

- *Forward translation:* Two independent forward translations from English to Danish were performed (T1 and T2). The two translators were bilingual, with one having a medical background and the other having neither a medical nor a clinical background. Each translator made a written report of the translation, including the challenges and uncertainties they experienced. Moreover, they reported the rationale behind their choices.

- *Synthesis of the forward translation:* By discussing their results, the two translators reached a consensus and agreed on a common version (T12). A complete synthesis report was conducted again to document all discrepancies, challenges and uncertainties and to describe how consensus had been reached.

- *Backward translation:* Two bilingual translators with no medical background and English as their native language performed the backward translation of T12 into English. Both backwards translators were blinded to the original version and made two backwards translation versions (BT1 and BT2). Discrepancies between BT1 and BT2, on the one hand, and the original NCS, on the other, were thoroughly compared, and inconsistencies were addressed and taken into account. After discussion and once a consensus had been reached, the primary T12 was adapted, and a refined T12 version was prepared.

- *Expert committee:* An expert committee was established, comprising health professionals, methodologists and a language professional. The translated versions were reviewed, and a consensus was reached.

- *Pilot-testing:* The pre-final version ([Supplementary 1](#)) was tested on patients from the target population. They had all been treated due to a traumatic injury affecting the clavicle, SCJ or ACJ. The patients were interviewed in a neutral manner while answering the questionnaire. They were asked whether they had any difficulty understanding the questions or whether any of the questions were redundant. Furthermore, they were asked whether the questionnaire was relevant to their problems, whether the answers were relevant and whether the answer options met their needs.

Ethics

Under Danish legislation, this study did not require approval by the Danish Scientific Ethics Committee. The patients participated voluntarily and were free to withdraw at any time during the process. They were given oral and written information about the purpose of the study, and they were informed that the interviews were confidential.

Trial registration: not relevant.

Results

The original NCS was translated into Danish and cross-culturally adapted ([Appendix 1](#)). The Danish version of the NCS was well received by the target population and no issues were reported.

Forward translation

The translations performed by the translators did not present any major issues.

Backward translation

The backward translation and the original version were compared. This magnified and highlighted any discrepancies between the original and the translated version. This process was interesting as it proved to be a constructive step that allowed for the identification of subtle differences in meaning while ensuring that the translated version retained the nuances of the original.

Expert committee

The expert committee met and discussed the results at various stages. They focused on ensuring that the translation achieved semantic, idiomatic, experiential and conceptual equivalence between the original and Danish versions [15]. The expert committee adapted the questions to ensure a natural fluency in Danish. Thus, questions 3, 4 and 5 were adapted by translating “how much” into “I hvilken grad”, which would be “to what extent”. This did not change the meaning of the sentence.

The word “happy” in question seven was substituted by “tilfreds”, directly translated to “satisfied”. The expert committee found that these two words held the same conceptual meaning in the context.

Question number ten proposed the biggest challenge as “Dragging sensation” had been translated into “træg fornemmelse”. The expert committee reached a consensus agreeing that even though “træg” is a more old-fashioned word, using this word was the best possible way to express the sensation in question.

Pilot testing

This stage involved nine patients from the target population. Patient characteristics are presented in **Table 1**. The patients reported that they did not experience any challenges regarding its interpretation. They found the

questionnaire relevant and felt that it sufficiently addressed their experienced symptoms, without any issues in interpretation while responding.

TABLE 1 Patient characteristics.

Patients, N	9
<i>Sex, n (%)</i>	
Male	6 (66.7)
Female	3 (33.3)
Age at follow-up, mean (range), yrs	53.4 (21-78)
<i>Diagnosis, n</i>	
Clavicle fracture	7
Acromioclavicular joint dislocations	2

Patient four, a 21-year-old patient, mentioned that he read question ten twice, but that the context was understandable even though the expression “træg fornemmelse” was a bit old-fashioned. He did not have other suggestions for synonyms that could substitute the above-mentioned term. The same patient stated that he understood “følelse af tunghed i armen”, but that this expression seemed more abstract. This patient did not experience any of the above.

Patient nine, who was 25 years old, reported that the questions made sense and that he occasionally experienced these sensations.

The pilot testing results indicate that the target population found the translation to be cross-culturally well-adapted and fully comprehensible. Therefore, the translation was not adapted further.

Discussion

The NCS was translated into Danish because there were no PROMs specifically targeting the clavicle, ACJ and SCJ in Danish. However, the NCS has not yet been validated in Danish. Therefore, it should be used with caution in clinical contexts.

In addition, the content validity of the score is questionable, as patients were involved only in part of its development, and interpretive limitations should therefore be expected.

Furthermore, some items in the NCS are double- or triple-barreled, combining multiple concepts into a single question. This may make it difficult for patients to respond accurately and may reduce the sensitivity and specificity of the answers. Despite this limitation, the NCS remains the most appropriate clavicle-specific PROM available.

Clinicians have realised that PROMs are important as they help convey the patient’s perception of their situation. As creating a new PROM can take several years and may require considerable resources, translating and culturally adapting an existing PROM is often a more efficient alternative [14].

However, it may be advantageous to develop a new PROM when existing measures fail to capture specific cultural nuances or when the clinical context differs substantially. In such cases, a new PROM may provide greater sensitivity and relevance [16]. In this case, the authors assessed that using an already established PROM like the NCS would offer a more time-efficient path towards clinical implementation [17].

The NCS has previously been translated and validated into Italian, German and Turkish language versions, showing a high reliability and consistency when compared to the original English version. This study presents the first translation and cross-cultural adaptation of the NCS to Danish, and it is the first Danish PROM focused on assessing outcomes related to the SCJ and ACJ.

The translation followed Beaton's guidelines, including forward translation, backward translation, expert committee and pilot testing to ensure a high-quality Danish version. The Danish version was well-understood and required no major cultural adaptation. Question number ten was translated using the term "træg fornemmelse" and was described as a bit old-fashioned Danish. However, in general, it was considered the best translation choice for the Danish target population.

One of the reasons why the pilot test went smoothly without patients experiencing major difficulty when answering the questionnaire may be that the interviewing method employed. Patients participated via phone, which may have increased their comfort compared to answering in a hospital setting. Other studies have had participants answer questionnaires in a hospital setting rather than via phone calls [10, 11]. Some patients feel stressed and frightened when in a hospital. This setting often leads to confusion or poor concentration, thereby affecting any pilot testing.

However, while phone interviews provided a comfortable setting that may have encouraged patient openness, the ability of this approach to capture non-verbal cues such as hesitation or facial expressions is limited. Such cues are crucial for assessing item clarity and cultural relevance, and these aspects are better captured during face-to-face interviews, which are considered the standard in cross-cultural adaptation. These cues can offer critical insights during questionnaire adaptation. Future studies could benefit from in-person interviews to enhance cross-cultural adaptation. Furthermore, it is crucial that the translation is performed thoroughly, as a poor translation process can lead to an instrument that is not equivalent to the original PROM. The Beaton guidelines allowed us to ensure a very detailed and specific analysis of the questionnaire, thereby preserving the meaning of the NCS.

Regarding the translation stages, it is essential to note that the forward and backward translators were fluent in both languages. Additionally, they understood the cultures, ensuring experiential, conceptual and semantic equivalence between the source and the target versions.

The backward translation was used to highlight any inconsistencies, but it will not necessarily catch all mistakes. Therefore, the composition of the expert committee can help secure a high-quality translation. Although the NCS was translated and cross-culturally adapted to Danish, it must still undergo psychometric validation. Therefore, this paper sets the stage for testing the translation's consistency and reliability before using it in clinical settings.

Conclusions

In this study, the original NCS was translated into Danish and cross-culturally adapted. Following pilot testing within the target population, no further adaptation was needed. The Beaton guidelines were an essential tool in the process, ensuring a high-quality translation. However, further research is needed to ensure a validated translation of high consistency and reliability while guaranteeing the comparability of the Danish NCS PROM.

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