OUTCOME MEASUREMENT OF ADULT UPPER LIMB AMPUTEES

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Abstract

Fifty-five subjects after unilateral upper limb amputation were assessed with OPUS Upper Extremity Functional Status (a questionnaire specifically developed for upper limb amputees) and ABILHAND (a generic measure for subjects with upper limb impairments). Results were analyzed according to the Rasch model. Both scales had some weaknesses, needed rating-scale modification, and had too few difficult and too many easy activities for most of our subjects. Combining both into one scale would produce a better targeting of item difficulty to subject ability.

INTRODUCTION

The last years have seen a very rapid development in the field of upper limb prosthetic components and care. Several new myoelectric prosthetics such as hands, wrists, elbows and also a myoelectric shoulder have been developed. With target muscle reinnervation it is now possible to have multiple control sites (1), allowing the clinician to combine several myoelectric components in subjects with high or bilateral amputations. Most of these components and procedures are expensive, hence the need for objective evaluation of their effectiveness.

There are several modes for measuring outcome in subjects after an upper limb amputation, e.g. degree of hand function, amputee's level of functioning, quality of life and also satisfaction with prosthesis. At all levels, it is possible to use generic or pathology-specific outcome measures. The measure used must demonstrate sound psychometric properties.

In recent years, there has been a growing trend to use the Rasch model to facilitate the development and validation of outcome instruments (2). Rasch analysis provides psychometric information that is not obtainable through classical test theory (3, 4), including: 1) the functioning of rating scale categories; 2) the validity of a measure by evaluating the fit of items to the latent trait; and 3) the consistency of item difficulty with the expectations of the construct (and hence a description of the range and hierarchical relationship of the variable). In fact, Rasch analysis has been recommended as a method for assessing scale properties in addition to classical psychometric criteria for reviewing and assessing surveys and questionnaires for disability outcome research (5).

The purpose of this study was to evaluate and compare two outcome measures, the OPUS Upper Extremity Functional Status (OPUS-UEFS, a questionnaire specifically developed for upper limb amputees) and ABILHAND (a generic measure developed for subjects with upper limb impairments).

METHODS AND SUBJECTS

Methods

Clinical data (age, age at time of amputation, cause of amputation, time since amputation and fitting with the first prosthesis, dominance before amputation, types of prosthesis used) were collected via structured interview. Subjects were also interviewed with ABILHAND (46 items, 5-point rating scale) (6) and OPUS-UEFS (23 items, 5-point rating scale) (7). Results were analyzed by WINSTEPS software (8). The following aspects underwent Rasch analysis: 1) the functioning of rating scale categories; 2) the validity of a measure by evaluating the fit of items to the latent trait; and 3) the consistency of item difficulty with the expectations of the construct (and hence a description of the range and hierarchical relationship of the variable).

Subjects

Fifty-five adults, 42 (76.4%) men and 13 (23.6%) women who had had an upper limb amputation and had completed rehabilitation at the Institute for Rehabilitation in Ljubljana at least one year prior were included in our study. At the time of testing subjects had a mean age of 55 years (s.d. 17.4 years, range 19-85) and the amputation had occurred on average 31

years before testing (s.d. 17.2 years, range 1-61). Thirty-seven subjects had trans-radial, 9 trans-humeral and 2 partial hand amputation, 4 wrist and 3 shoulder disarticulation. At the time of testing 44 subjects wore passive, 7 body-powered and 2 myoelectric prostheses.

RESULTS

The rating scale diagnostics showed that some levels of the rating categories did not comply with the criteria for category functioning. The criteria were met by combining levels 1 ("very difficult") and 2 ("slightly difficult") of OPUS-UEFS, and category 3 ("slightly difficult") and 4 ("very difficult") of ABILHAND into a single category. After this rating-scale modification, 12 of the 46 ABILHAND items resulted redundant ("overfit"), 8 did not behave according to the Rasch model ("misfit") and 8 showed a marked dependency of the measure on study group characteristics such as age, sex, level of amputation and dominance (differential item functioning, DIF). Two of the 23 OPUS-UEFS items misfitted and none overfitted. Among the remaining items, 7 were the same in both questionnaires.

DISCUSSION

The purpose of this study was to evaluate and compare two outcome measures, the OPUS-UEFS and ABILHAND. Both misfitting items from the OPUS-UEFS were the same as in our previous study (7). Most of the overfitting items are very easy items, usually performed by one (the dominant) hand only and probably too easy for our subjects. On the other hand, most misfitting items are the hardest ones to perform, usually done by both hands. Because we included only amputees several years after amputation, some of them had developed compensatory strategies for performing these activities in an easy way or avoid doing them.

The main advantage in using a general outcome measure for upper limb impairments is its ability to permit comparisons between subjects with different upper limb problems (i.e. amputees, stroke patients, patients with rheumatoid arthritis and others). For instance, half of the ABILHAND items that had no fitting problems in our population are the same as described for stroke patients (9) and the order of difficulty is similar. On the other hand, as shown by the items that demonstrated DIF in ABILHAND, a specific measure could be more appropriate to provide insight on the effect of the prosthetic device on the subject's functional status.

After combining the two measures into a new one, to test if its metric properties were satisfactory we performed preliminary analysis which resulted in a Rasch model that covered the study population better than ABILHAND or OPUS-UEFS alone.

CONCLUSION

Both scales have some weaknesses, in particular not enough very hard activities and too many easy activities for most of our subjects. Promising results, in terms of a better agreement between subject abilities and item difficulty, were obtained by combining both scales into a new one. Further studies are needed to give more reliable psychometric information on the new scale.

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