ACTIVLIM - Stroke

ACTIVLIM-Stroke:
A Crosscultural Rasch-Built Scale of Activity Limitations in Patients With Stroke

- Clinical Study & Results
- Full complete ACTIVLIM-Stroke Questionaire/Test (in appendix)

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Background and Purpose—This study describes the development of a Rasch-built scale measuring activity limitations in stroke patients, named ACTIVLIM-Stroke.

Method—This new Rasch-built measure was constructed based on stroke patients' perceptions of difficulty in performing daily activities. Patients were recruited from inpatient and outpatient rehabilitation departments in Belgium and Benin. A 73-item questionnaire was completed by 204 participants. A random subsample of 83 subjects was given the questionnaire a second time. Data were analyzed using RUMM2030 software.

Results—After successive Rasch analyses, the ACTIVLIM-Stroke questionnaire, a unidimensional and linear 20-item measure of activity limitations, was constructed. All 20 items fulfilled Rasch requirements (overall and individual item fit, category discrimination, invariance, local response independence, and nonredundancy in item difficulty). This simple patient-based scale encompasses a large range of activities related to self-care, transfer, mobility, manual ability, and balance. The ACTIVLIM-Stroke questionnaire exhibited high internal validity, excellent internal consistency, and good crosscultural validity. The test–retest reliability of item difficulty hierarchy (intraclass correlation coefficient=0.99) and patient location (intraclass correlation coefficient=0.92) were both excellent. Furthermore, it showed good external construct validity using correlations with the Functional Independence Measure motor and the Barthel Index and a higher discriminating capacity than either of these widely used indices.

Conclusions—The ACTIVLIM-Stroke questionnaire has good psychometric qualities and provides accurate measures of activity limitations in patients with stroke. It is recommended for evaluating clinical and research interventions in patients with stroke, because it provides a higher discrimination and might be more sensitive to change. **(*Stroke*. 2012;43:815-823.)**

Key Words: activity limitations ■ measurement ■ Rasch model ■ scales ■ stroke recovery

The increasing use of patient-reported outcomes has encouraged the development of several questionnaires to evaluate individual functioning based on the International Classification of Functioning, Disability and Health framework. The International Classification of Functioning, Disability and Health, a classification of health and health-related domains, describes individual functioning in 3 domains: (1) body functions and anatomic structures; (2) activity; and (3) participation.[1] Problems in each domain are, respectively, impairments, activity limitations, and participation restrictions. In the activity domain, the International Classification of Functioning, Disability and Health defines activity limitations as the difficulties a person might have in executing daily activities. Activity limitation is a behavior that is a combination of motor function, compensatory behavior of individuals, and personal (eg, age, lifestyle, motivation) and environmental (eg, architectural characteristics, ground type) factors. Therefore, limitation of activity cannot be measured directly but can be inferred from an individual's perception of the difficulty of performing activities.

Despite the wide range of instruments currently available, only few are identified as meeting rigorous, evidence-based modern psychometric standards for a rating scale.[2,3] Earlier tools were developed following traditional standards of measurement science, concentrating on key aspects such as reliability and validity. More recently, a greater emphasis has been given to more powerful diagnostic approaches, which examine a wider range of attributes such as response category functioning and differential item functioning (DIF). Among the new approaches, the Rasch measurement model is the most commonly used.[4] Over the last 15 years, Rasch analysis has been widely used in health science.[5–9] Some Rasch-built scales such as the ABILHAND scale (a measure of manual ability),[10] the ABILOCO scale (a measure of locomotion ability),[11] and the EG Motor Index (a measure of mobility)[12] assess the functioning of patients with stroke. The Stroke

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Impact Scale, developed in 1999,[13] has been refined in 2003 using Rasch analysis.[14] However, most stroke-specific Rasch-built scales evaluate only some aspects of activity limitations as defined by the International Classification of Functioning, Disability and Health.[1] ABILHAND, ABILOCO, and the EG Motor Index assess specific aspects of activity limitations and are important in trials designed to evaluate the effect of particular interventions focused on a specific skill, for example manual ability or mobility. However, they cannot be used as a comprehensive measure of whole activity limitation. The Stroke Impact Scale is a broad assessment tool of physical function and not a measure specific to activity limitations, because it includes items from the body function domain (eg, "bladder and bowel control"), activity domain (eg, "move from a bed to a chair," "bathe yourself"), and participation domain (eg, "go shopping").

A full assessment of a stroke patient's functional ability should consider the broad range of activity limitations as a whole variable, as did Vandervelde et al[15] in the ACTIVLIM scale, a Rasch-built measure of activity limitations in children and adults with neuromuscular disorders. However, the use of the ACTIVLIM questionnaire for patients with stroke would require a validation in that diagnosis. Moreover, given the increase in multicenter international studies, so facilitating comparison of the outcome of across different populations, crosscultural validated outcome measures are also required. Consequently, this current study aimed to calibrate and validate the ACTIVLIM questionnaire for patients with stroke from Europe (Belgium) and Africa (Benin).

Methods

Data were collected from French language-speaking communities in European (Belgium) and African (Benin) patients with stroke. This study was approved by the Ethics Committee of the Université catholique de Louvain in Belgium and the local ethics committees of the participating caregiver centers and hospitals in Benin. Patients signed an informed consent form before being included.

Subjects

Patients were recruited from rehabilitation departments, including patients with stroke currently undergoing rehabilitation and those discharged. Patients who had been discharged were identified from patient registers at the recruitment centers. The study was restricted to patients presenting no major cognitive deficit that could potentially prevent them from completing a self-report questionnaire ($\geq$24 of 30 on the Mini-Mental State Examination).[16,17]

Patient Assessment and Outcome Measures

In addition to demographic and clinical data, assessment included the ACTIVLIM-Stroke questionnaire, the Functional Independence Measure (FIM),[18] and the Barthel Index (BI).[19]

ACTIVLIM-Stroke Questionnaire

A preliminary list of 81 items generated by Vandervelde et al[15] was submitted to physical therapists, occupational therapists, and medical doctors involved in stroke rehabilitation. They were asked to identify which items were not relevant for patients with stroke, resulting in deletion of 5 items. Three other items that concerned specific lifestyle aspects with no direct correspondence to 1 of the countries studied were removed from the original list. For example, getting on an escalator was deleted because escalators are not common in Benin. A set of 73 items was submitted to both European and African patients with stroke. Patients were asked to provide their perceived difficulty in performing each activity if completed without technical or human assistance. The response format was a 3-level scale labeled and scored as impossible (0), difficult (1), or easy (2). Unfamiliar activities were recorded as missing responses.

BI and the FIM

The BI and FIM are observer-rated generic measures of disability widely used in rehabilitation.[20] They are accepted as functional-level assessment tools evaluating the functional status of patients throughout the rehabilitation process. The FIM comprises 18 items,[18] and Linacre et al[21] found that these items define 2 statistically and clinically different indicators: (1) FIM–motor, which assesses disability in motor functions (13 items); and (2) FIM–cognitive, which assesses disability in cognitive functions (5 items). The BI is a 10-item scale assessing different aspects of functional ability for self-care and daily activities.[19] The FIM, although limited, is commonly used by clinicians and researchers as indicated by recent review studies.[22] In a more recent meta-analysis study (2011), it appears that FIM–motor scale and the BI are still used as the main outcome in some randomized controlled trials.[23]

Data Analysis

Rasch Analysis and Item Selection

The Rasch analysis tests whether data from a scale satisfy the rules for constructing interval scale measurement.[24] Based on a mathematical model, it estimates person ability and item difficulty by examining a matrix of these items on a common scale comparing individual response patterns with the response pattern of the entire sample.[4] In other words, it is a probabilistic model that converts ordinal scores into interval measures and, in the process, examines other key attributes such as unidimensionality, invariance, sample targeting of a scale, the appropriateness of response format, hierarchy of item difficulty, and the local independence of items within a scale. Consequently, Rasch analysis enables evaluation of the internal construct validity of a scale, and this is judged through overall fit statistics including item fit, person fit, and total χ^2 probability, which evaluates the extent to which the scale fits the Rasch model. The reliability of the scale was examined using the Person Separation Index, which indicates the extent to which the questionnaire distinguishes distinct ability levels. Rasch analysis and its applications and advantages are described in detail elsewhere.[8,25–30]

Patients' responses to the ACTIVLIM-Stroke questionnaire and selected personal factors were analyzed using RUMM2030 software for Rasch analysis,[31] under an unrestricted partial credit model. During successive analyses, the following criteria were used for item selection: (1) missing responses: items presenting a missing response rate of $\geq$20% were removed before analyzing the entire item set; (2) category discrimination: for each item, the 3-level response format was applied defining 2 thresholds of increasing order. Threshold 1 (t1) was between the categories "impossible" and "difficult" and was expected to be followed by threshold 2 (t2) between the categories "difficult" and "easy." Subjects with higher ability should score higher than subjects with lower ability, indicating correct category discrimination. When the categories were not discriminated as expected, reversed thresholds were observed and these items were deleted; (3) item fit to the model: individual item fit was examined through fit residuals and χ^2 statistics. Residuals indicated the deviations of items from the expected model score. Only items with residuals within the range $\pm$2.5 were considered as fitting model expectations, and others were removed. Because significant χ^2 probability (below the Bonferroni adjusted value) indicates misfit, these items were removed; (4) DIF: 4 personal factors were used dichotomously to check the invariance of the item difficulty hierarchy: age ($\leq$55 years old, $>$55 years old), sex (male, female), affected side (left, right), and country (Belgian, Benin). The age cutoff of 55 years was based on the median value of our sample's age distribution, which was 55. Items with DIF were deleted; (5) local dependency: within a scale, local dependency of items affects the test score because it inflates the scale in a particular direction.[32] When items are highly correlated, a patient's response to 1 item will influence the

INSTRUCTIONS FOR THE ACTIVLIM QUESTIONNAIRE

The ACTIVLIM questionnaire

ACTIVLIM-Stroke questionnaire, measuring activity limitations in patients with stroke. Patients were asked to provide their perceived difficulty in performing each activity if completed without technical or human assistance. The response format was a 3-level scale labeled and scored as impossible (0), difficult (1), or easy (2). The 20 items of ACTIVLIM-Stroke defined a valid, reliable and reproducible scale. ACTIVLIM was originally developed using the Rasch measurement model. It allows to convert ordinal scores into linear measures located on a unidimensional scale.

Evaluation

The **patient** fills in himself the questionnaire by estimating their own difficulty or ease in performing each activity.

The activities should be done:

- **Without technical or human help** (even if the patient actually uses help in daily life)
- Irrespective the limb(s) actually used to achieve the activity
- Whatever the strategy used (any compensation is allowed)

Three responses are presented. These assess the perception of the difficulty/ease depending on whether the activity is “impossible”, “difficult” or “easy”. Activities not attempted in the last 3 months are not scored and entered as missing responses (to tick the question mark).

So, for any activity, the four potential answers are:

- **Impossible:** The patient is unable to perform the activity without using any other help**.**
- **Difficult:** The patient is able to perform the activity without any help but experiences some difficulty.
- **Easy:** The patient is able to perform the activity without any help and experiences no difficulty.
- **Question mark:** The patient cannot estimate the difficulty of the activity because he has never done the activity.

Watch out!! If the activity was never attempted because it is impossible, then it must be scored "impossible" rather than "question mark".

Activities order

The activities of the ACTIVLIM questionnaire are presented in a random order to avoid any systematic effect. Ten different random orders of presentation are used. The rater must select the next one of the 10 orders for each new assessment, no matter which patient is tested.

Package content

- 1 instruction sheet.
- Testing forms of ACTIVLIM in 10 random orders (1 sheet for each)

Appendix:

ACTIVLIM-Stroke Questionnaire

Name: ..... Date: .....

Could you, please, indicate how difficult you perceive each of the following activities?

- Considering that you perform the task without technical or human assistance, whatever the strategy involved
- Tick "?" for unfamiliar activities you cannot estimate the difficulty (because you never need to do them, not because they are impossible).

		Impossible	Difficult	Easy	?
01	Walking more than one kilometer				
02	Ringing a doorbell				
03	Carrying a heavy load				
04	Picking up something from the floor				
05	Using the toilet				
06	Getting out of bed				
07	Brushing one's teeth				
08	Taking a shower				
09	Putting on socks				
10	Getting out of a car				
11	Turning in bed				
12	Tying one's laces				
13	Taking off a t-shirt				
14	Opening a door				
15	Sweeping or vacuuming				
16	Putting the dishes in the cupboard				
17	Getting up from a chair				
18	Standing for a long time without support				
19	Walking upstairs				
20	Putting a key in a lock				

Please, make sure you have read and completed all items.

Order 1

Batcho CS, Tennant A, Thonnard J-L. ACTIVLIM-Stroke: A Crosscultural Rasch-Built Scale of Activity Limitations in Patients With Stroke. ***Stroke. 2012;43:815-823.***