J Rehabil Med 2007; 39: 537–546

ORIGINAL REPORT

PSYCHOMETRIC PROPERTIES OF AN INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH (ICF)-ORIENTED, ADAPTIVE QUESTIONNAIRE FOR THE ASSESSMENT OF MOBILITY, SELF-CARE AND DOMESTIC LIFE

Erik Farin, Annette Fleitz and Christian Frey

From the University Medical Center Freiburg, Department of Quality Management and Social Medicine, Freiburg, Germany

Objective: **Development of an adaptive, International Classification of Functioning, Disability and Health (ICF)-oriented patient questionnaire on mobility and self-care based on an item response theory model (MOSES questionnaire).**
Methods: **Using item reconstruction rules, items were developed for the ICF chapters "mobility", "self-care" and "domestic life". The resulting instrument, together with other instruments (SF-36, Short Musculoskeletal Function Assessment Questionnaire (SMFA), MacNew, Functional Independence Measure (FIM), Barthel) was presented to 549 patients with musculoskeletal disease, 212 patients with cardiac disease and 258 neurological rehabilitation patients in rehabilitation clinics in Germany.**
Results: **The MOSES questionnaire includes 58 items on 12 scales and fulfills the requirements of the 1-parameter item response theory model (Rasch model). The results indicate good reliability and high construct validity and sensitivity to change of the instrument. In the construction and selection of items, ICF contents that include complex processes of evaluation, and which presuppose skills that are not acquired prior to the individual learning process, were omitted due to a lack of unidimensionality.**
Conclusion: **The successful implementation of the concept of applying rules to ICF categories in formulating the items of a patient questionnaire showed that the goal of a theory-driven measurement of activities using the ICF is feasible. The results of the project also raise questions as to the homogeneity of the contents of some ICF categories.**

Key words: ICF, item response theory, questionnaires, outcome assessment (healthcare), rehabilitation.

J Rehabil Med 2007; 39: 537–546

Correspondence address: Erik Farin, University Medical Center Freiburg, Department of Quality Management und Social Medicine, Breisacher Str. 62 / Haus 4, DE-79106 Freiburg, Germany. E-mail: erik.farin@uniklinik-freiburg.de

Submitted June 29, 2006; accepted February 16, 2007

INTRODUCTION

The International Classification of Functioning, Disability and Health (ICF) passed by the World Health Organization (WHO) in May 2001 differentiates between 3 components of functioning: body functions, body structures, and activities and participation; and takes into consideration personal and environmental factors as variables that influence health. The ICF presents a terminology system for an international uniform classification for the description of problems associated with health conditions and relevant environmental factors and could assume the function of a common language of the professional groups involved in medical rehabilitation (1). However, classification as an ordering description does not replace measurement, especially as the reliability of an ICF-oriented classification is often not very high (2).

Measurement and classification interact closely, especially in rehabilitation. A patient receiving rehabilitation is assessed at the beginning of treatment on the basis of an ICF classification as to the extent of the limitation of activities and participation; rehabilitation goals to be addressed during therapy are set, therapy schedules are made and implemented, and the success of the measures is evaluated using an assessment procedure. Various studies have already examined existing instruments with respect to coverage of the ICF categories in order to describe congruency between the ICF and the measurement instruments used in rehabilitation (e.g. 3). An alternative method could be to develop new assessment instruments that could be applied directly to the ICF categories (e.g. cf. 4). Assessment instruments were also developed for the previous version of the ICF (ICIDH), but were subjected only to a limited extent to psychometric examination.

The disadvantage of developing a new instrument is that already published procedures that are widespread and have many reference data are not covered. However, one advantage is that this would result in a theory-driven and unified approach to measuring activity and participation. Thus far, there are many questionnaires that claim to include aspects of activity limitations and participation restrictions and were often developed for the same diseases. The lack of uniformity of the procedures and contents of questions is due less to disagreement in the underlying aspects of conceptualization of activities and participation than to the lack of a framework for the standardization of concrete operationalization of the items in the questionnaire (5). This leads to data sets that are not comparable for different studies, making it difficult to integrate findings for more efficiency in rehabilitation.

A further advantage of developing a new ICF-oriented measurement instrument is that there would be an instrument that

 ISSN 1650-1977
doi: 10.2340/16501977-0083

would be directly applicable to an ICF-oriented description of the patient's problems and the setting of suitable rehabilitation goals, so that assessment procedure and system of classification would "speak the same language" and the assessment procedure would include all relevant ICF categories. Currently available measurement instruments often offer only limited coverage of the ICF categories within one section of the ICF (6).

The goal of this study is to develop and psychometrically test a patient questionnaire oriented to ICF content and structure including the ICF chapters "mobility", "self-care" and "domestic life" (MOSES).[1] Reliability, unidimensionality, construct validity (correlations with established assessment instruments) and responsiveness (changes following rehabilitation) were examined. Two current trends of outcome research are addressed: the application of item response theory (IRT) and the methodology of adaptive testing. IRT models specify the correlation between the observed response behaviour of a respondent and the respondent's localization on a latent trait (7). The most often used item response model is the 1-parameter IRT model (Rasch model), which assumes a logistic function between the latent dimension and the manifest response behaviour (8).

In rehabilitation there is a problem in that the outcome to be measured is multifaceted and the patient's range of limitations is large. On the other hand, the patient's essential problems need to be compiled as precisely as possible. Jette & Haley (9) described this as the "precision vs feasibility dilemma". Adaptive testing is one solution to this dilemma. The respondent is presented with different questions depending on his previous response behaviour. The goal is to evaluate the characteristics of the respondents on the basis of the previous responses and then present those questions from the pool of items that are most suited to his skill level. In the ideal form, adaptive testing should be computer-supported to enable a completely flexible selection of items (10). In this study, a paper-and-pencil version of adaptive testing is used, since the questionnaire to be developed is to be used routinely in the quality assurance program of the statutory health insurers in Germany (11) and the data processing prerequisites for providing computer-supported tests are not yet available in all rehabilitation clinics concerned.

Only a few studies have attempted to develop assessment instruments for activity levels that are based strictly on the contents and structures of the ICF. The only studies we are aware of that are based on IRT models are those by Haley et al. (for example, 4, 12), in which a measure (Activity Measure for Postacute Care) for surveying daily activities was developed. In contrast to Haley et al., our study employs a direct reference to the 3-digit ICF categories and covers all the contents of the ICF chapters "mobility", "self-care" and "domestic life". The MOSES questionnaire does not cover the contents of the other ICF chapters in the activities domain.

The MOSES questionnaire has been tested in 2 studies thus far. The first study was conducted in 2004 and was limited largely to the calibration of items (13). The study presented here replicates those results in another sample, examines responsiveness and carries out comprehensive analyses of unidimensionality and construct validity.

METHODS

Instrument construction

Under the assumption, which will be tested during the study, that the constructs of the 3-digit ICF categories from the chapters "mobility", "self-care" and "domestic life" usually represent a unidimensional latent dimension, an attempt will be made to compile the contents of each 3-digit category in one scale at a time. In order to present the ICF structure and make separate scales available for the individual 3-digit ICF categories, scales formed at the level of 3-digit ICF categories should not be further combined. Usually, one item is constructed for each 4-digit ICF category. To generate items from the content of the ICF, so-called "item construction rules" were created, details of which are available from the corresponding author.

A review of the ICF chapters "mobility", "self-care" and "domestic life" on the basis of the above criteria led to an initial version of the MOSES questionnaire that included a total of 95 items. With respect to deriving concrete questions from the ICF categories, this was done in co-ordination by 2 evaluators, who reviewed the congruency of the results and discussed discrepancies. An essential element of the MOSES questionnaire are the graphically designed skip commands, which have the function of making the questionnaire adaptive, so that the patient can skip questions that are irrelevant to their situation and is not irritated or upset by questions that are obviously irrelevant to their health situation (e.g. questions about walking distances for a bed-ridden patient).

Study design, sample and instruments

In the period May to September 2005, 549 patients with musculoskeletal disease, 212 patient with cardiac disease and 259 neurology rehabilitation patients were questioned. On admission and discharge, the patients were given the MOSES questionnaire, the SF-36 (MOS-36 Item Short Form Health Survey (14)) and, depending on the disease, the SMFA questionnaire (Short Musculoskeletal Function Assessment Questionnaire, German version SMFA-D (15)) (musculoskeletal diseases) or the MacNew questionnaire (16) (cardiac diseases). At the conclusion of the test, the patients were asked to evaluate the questionnaire using 4 categories – *stimulating, boring, inconvenient, or unpleasant*. Medical variables (e.g. diagnosis, rehabilitation motivation, chronicity, and severity of the disease) were provided by the attending physicians. No reliability or validity values are available for these variables. In the case of neurological diseases, the physicians also provided, depending on the existing specific clinic regulations on assessments, either the Functional Independence Measure (FIM™) (17) or the Barthel Index (18).

Analyses

IRT analyses, unidimensionality and reliability. We applied the 1-parameter IRT model for 2 reasons. First, it yields more clinically interpretable results (19) and secondly, stable estimates of parameters can be achieved using smaller sample sizes (20). The Masters' partial credit model (PCM model) was used (21). The results were analysed with the WINSTEPS program (22). Infit and outfit mean square statistics (Infit MNSQ, Outfit MNSQ) and the item discrimination index were used as goodness-of-fit statistics. The infit statistic provides information about responses within a patient's ability level, while the outfit statistic is an outlier-sensitive statistic that assesses items that are far beyond a person's ability level (such as failure to perform much easier tasks). Both statistics have an expected value of 1.0. Since we applied Likert items in the MOSES questionnaire, poor item fit was defined as infit or outfit < 0.6 or > 1.4 (23, p. 179). The item discrimination index describes the departure from the model across

[1]The development of the MOSES questionnaire is a development project within the framework of the quality assurance program of the statutory health insurers in Germany ("QS Reha procedure", see (11) and www.qs-reha.de) and has received financial support from the statutory health insurers.

ability groups. It also has an expected value of 1.0. Values lower than 0.8 indicate that the item fails to differentiate among ability groups as well as other items, whereas values greater than 1.2 indicate that the item differentiates better than required by the model (19).

We chose 2 methods to assess whether items are unidimensional. First a principal component (PC) analysis of the residuals from the Rasch calibrations was made (as in (4)) using the PC approach provided by the WINSTEPS software. Secondly, we made exploratory factor analyses (EFA; with SPSS 14.0) and confirmatory factor analyses (CFA; with AMOS 6 software) to investigate the assumption of unidimensionality for each scale of the MOSES questionnaire. Model fit was evaluated using the comparative fit index (CFI) (24), the Tucker-Lewis index (TLI) (25) and the root mean square error of approximation (RMSEA). CFI and TLI values > 0.90 are an indication of good fit. RMSEA values < 0.08 suggest adequate fit; values < 0.05 are a good fit (24).

For determining reliability, Cronbach's alpha and the person separation index are determined. Cronbach's alpha should be greater than 0.70. Person separation index describes the number of performance levels the test measures in a particular sample. It is equal to the square root of true person variance divided by the error variance due to measurement imprecision. The index must exceed 2 in order to attain a level of reliability of at least 0.80 (26).

Responsiveness. To determine responsiveness, effect sizes (differences between pre-test and post-test scores divided by the standard deviation at pre-test) are calculated with confidence intervals. For our analyses, the effect size was viewed as an adequate responsiveness coefficient, as we did not anticipate any identifiable subgroups of patients with varying change and because no external standard for the evaluation of changes is available (cf. 27). The confidence intervals were determined as in Algina et al. (28) using a bootstrapping method. To do so, the respective authors' software was used. In addition, the reliable change index RCI_{indiv}, as in Hageman & Arrindell (29), was determined with confidence interval, in order to determine the percentage of patients with a clinically significant change. Since a change on a scale is to be expected only if the patient has at least a slight limitation, the assessments of responsiveness will be carried out on both the entire group of patients and on the patient subgroup that is at least minimally limited, i.e. those that do not skip the respective question section entirely. However, this assessment must take into consideration that due to the selection of extreme cases, the artefact "regression to the mean" can lead to a slight overestimation of sensitivity of change. As in Cohen (30), effect sizes of 0.20 were considered "small", around 0.50 "medium", and > 0.80 were deemed "large".

Construct validity. To determine the construct validity of the MOSES questionnaire, 5 analyses were carried out:

1. Calculation of the intercorrelation of the scales of the MOSES questionnaire to SF-36: it was expected that all scales of the MOSES questionnaire would have a definite positive correlation with the SF-36 scales "physical function" and "bodily pain". In the sense of discriminating validity, it was expected that there would be only a slight correlation with the scales "emotional role function" and "mental health".
2. With respect to musculoskeletal diseases, the intercorrelation of the scales of the MOSES questionnaire with the SMFA questionnaire was calculated. All MOSES scales that include substantial use of the lower extremities (those are all except for "use of hands and arms", "self-care" and "eating and drinking"), should correlate substantially (> 0.30, see (30)) with the SMFA scales "daily activities" and "mobility" and with the dysfunction index. MOSES scales that mainly include the use of the arms and hands should correlate substantially with the SMFA scale "function of the arm and hand". Finally, for discriminatory validity, it is to be expected that all MOSES scales show only weak correlation with the SMFA scale "emotionality".
3. For the calculation of the intercorrelation of the scales of the MOSES questionnaire with the MacNew questionnaire with respect to cardiac diseases, the hypothesis was suggested that all MOSES scales would correlate substantially with the MacNew dimension "physical score", but that no significant correlations with the MacNew dimension "emotional score" would result.
4. For the calculation of the intercorrelation of the scales of the MOSES questionnaire with the FIM™ or Barthel Index with respect to neurological diseases, it was anticipated that the MOSES scales would correlate substantially with the FIM™ subscales "self-care", "transfers" and "locomotion", but only slightly with the items concerning "comprehension" and "social cognition". Substantial correlations with the Barthel Index were also expected.
5. In addition, a regression analysis tested whether the MOSES scales on mobility (changing a body position, maintaining a position, carrying objects, lower extremities, use of hands and arms, walking without equipment) were predictors of the scales on self-care and domestic life (self-care, dressing, eating and drinking, acquiring the necessities of life, household tasks), as elementary mobility skills are factors of influence for the more complex activities (cf. (31), which demonstrates the differentiability of elementary and more complex activities).

RESULTS

Drop-out and respondent characteristics

The portion of patients that did not complete the questionnaire was on average 30.4% (23.5% of patients with musculoskeletal disease, 24.6% cardiac patients, 56.9% neurology patients). In all 3 disease groups, non-responders were on average 4 years older than responders. Among patients with musculoskeletal diseases and cardiac diseases, the percentage of female non-responders was smaller than in the overall study; among neurology patients, the percentage of female non-responders was higher. For orthopaedic/cardiac patients, the most important reasons for non-inclusion were refusal to participate (64%/61%) and cognitive limitations (17%/25%). The most important reasons for neurology patients were: cognitive limitations (61%), refusal to participate

Table I. *Respondent characteristics*

	Musculoskeletal diseases (n = 549)	Cardiac diseases (n = 212)	Neurological diseases (n = 258)
Average age (years) (SD)	69.8 (8.7)	68.6 (8.5)	64.0 (13.8)
Gender (% women)	64.8	33.8	53.1
Pensioners (% pensioners)	86.6	86.2	77.4
Sick days in the past 12 months* (mean (SD))	14.1 (34.2)	11.1 (17.5)	18.3 (38.3)
Three most common diagnoses (ICD 10) (%)	M16: 25.3 M17: 25.3 Z96: 8.4	I25: 54.7 I35: 11.3 Z95: 8.0	I63: 34.1 G35: 11.6 I61: 4.3
Duration of symptoms of the main disease, n			
< 1 year	17.7	40.6	20.4
1–5 years	44.7	26.1	8.3
6–10 years	9.0	7.7	3.8
> 10 years	16.2	4.8	13.3
Acute event	8.3	16.9	50.4

*How many days in the past 12 months were you so sick that you had to stay in bed?

M16: coxarthrosis; M17: gonarthrosis; Z96: presence of other functional implants; I25: chronic ischaemic heart disease; I35: non-rheumatic aortic valve disorders; Z95: presence of cardiac and vascular implants and grafts; I63: cerebral infarction; G35: multiple sclerosis; I61: intracerebral haemorrhage; SD: standard deviation.

(13%), speech difficulties (12%) and physical limitations (8%). Table I provides information on the patients in the study.

Item reduction

After the PCM analysis and the implementation of the item selection criteria described above, 58 of 95 items remained, distributed over 12 scales, (see Table II). An English translation of the items and skip commands is given in the Appendix. The 3-digit ICF categories that were already omitted from the MOSES questionnaire due to the previously mentioned item reconstruction rules were not taken into consideration (these include "d480 Riding animals for transportation", "d570 Looking after one's health", and "d660 Assisting others"). Three other 3-digit ICF categories or their respective scales failed to meet the requirements of the PCM model. These concerned complex activities whose performance requires skills that must be acquired: "d470 Using transportation", "d475 Driving", d650 Caring for household objects". For all other 3-digit categories of the chapters "mobility", "self-care", and "domestic life", scales conforming with the Rasch model could be developed, for which at times – in accordance with the previously mentioned item construction rules – 3-digit ICF categories were combined.

Acceptance and practicability

Patients needed an average of 19 minutes to complete the MOSES questionnaire, the time varying slightly among the different disease groups. If more than 3 scales could be skipped using the skip command, completion time was reduced to an average of 15 minutes. The patients were asked to evaluate the questionnaire. Over half (53.0%) of the patients found the questionnaire stimulating and enlightening, 14.9% found it "rather boring", 27.3% said it was "inconvenient", and only 4.8% described it as "quite unpleasant".

The skip commands form an important element of the MOSES questionnaire. The empirical response pattern indicates that the construction principle was understood. When the response to a skip command meant that the entire block of questions needed to be completed, the percentage of missing values for items in that block was on average only 3.3%. There was a substantial percentage of patients who gave a positive response to a skip command and could thus skip a scale, ranging from 9.8% (for the scale "carrying objects") to 82.1% (for the scale "eating and drinking").

IRT analyses and reliability

The person separation index values of the scales (Table II) are generally over 2.0; for the scales "eating and drinking" and "acquiring the necessities of life", they were slightly less. For the scale "maintaining a body position", the value of 1.58 was not satisfactory. Cronbach's alpha was generally between 0.82 and 0.95, indicating good to very good internal consistency. One exception to this was the scale "maintaining a body position", with a Cronbach's alpha of 0.70.

Since Cronbach's alpha is dependent on the number of items (it is more difficult to achieve high values on short scales) and the number of items is relatively small on several MOSES scales, high internal consistency of the questionnaire can be assumed.

Table III shows the Infit MNSQ values, the Outfit MNSQ values, and the item discrimination index. The Infit MNSQ values are all in an acceptable range. The Outfit MNSQ values indicate a poor item fit for 3 items (30STAIRS, 45SOCKS

Table II. *Scales of the MOSES questionnaire*

Scale	Assigned 3-digit ICF categories	Cronbach's α	Person separation index
Changing a body position (7 items)	d410 Changing basic body position d420 Transferring oneself	0.90	2.63
Maintaining a body position (3 items)	d415 Maintaining a body position	0.70	1.58
Carrying objects (3 items)	d430 Lifting and carrying objects	0.92	2.33
Lower extremities (4 items)	d435 Moving objects with lower extremities	0.90	2.76
Use of hands and arms (6 items)	d440 Fine hand use d445 Hand and arm use	0.93	2.01
Walking (without equipment) (8 items)	d450 Walking d455 Moving around (without using equipment) d460 Moving around in different locations	0.93	2.84
Moving around (using equipment) (7 items)	d465 Moving around using equipment	0.89	2.47
Self-care (3 items)	d510 Washing oneself d520 Caring for body parts d530 Toileting	0.91	2.49
Dressing (4 items)	d540 Dressing	0.82	2.47
Eating and drinking (4 items)	d550 Eating d560 Drinking	0.85	1.90
Acquiring the necessities of life (3 items)	d610 Acquiring a place to live d620 Acquisition of goods and services	0.91	1.90
Housework (6 items)	d630 Preparing meals d640 Doing housework	0.95	3.07

Item response categories: no difficulty / mild difficulty / moderate difficulty / severe difficulty / impossible.

Table III. *Item characteristics*

	Item calibration (SE)	Infit MNSQ	Outfit MNSQ	Item DI
Changing a body position				
1CHAIR	1.34 (0.05)	0.85	0.82	1.18
2BED	1.36 (0.05)	0.90	0.93	1.12
3SQUAT	–1.36 (0.05)	1.17	1.15	0.82
4FLOOR	–2.18 (0.05)	1.05	0.90	0.97
5BEND	–0.10 (0.04)	0.98	1.02	1.01
6STRETCH	0.30 (0.04)	1.09	1.11	0.89
7SLIDE	0.65 (0.05)	0.95	1.01	1.03
Maintaining a body position				
8STAND	–0.18 (0.05)	0.90	0.91	1.09
9SIT	2.55 (0.06)	1.03	1.11	0.94
10KNEEL	–2.37 (0.06)	1.00	0.98	0.99
Carrying objects				
11LIFT	1.61 (0.10)	0.82	0.88	1.15
12TABLE	–0.40 (0.10)	0.96	0.81	1.05
13CARRY	–1.21 (0.10)	1.10	1.23	0.81
Lower extremities				
14PUSHL	1.89 (0.07)	1.15	1.25	0.80
15PUSHH	–1.35 (0.07)	0.81	0.80	1.20
16PULLL	1.38 (0.07)	1.06	1.04	0.92
17PULLH	–1.92 (0.07)	0.90	0.87	1.10
Use of hands and arms				
18GRASP	–0.50 (0.08)	1.10	1.09	0.89
19PICK	–0.65 (0.08)	1.10	1.09	0.88
20BUTTON	–0.30 (0.08)	1.03	1.01	0.98
21WRITE	0.39 (0.08)	1.04	1.05	0.98
22PULLF	0.74 (0.09)	0.72	0.78	1.28
23PUSHF	0.32 (0.08)	0.94	0.98	1.04
Walking (without equipment)				
24W20M	4.13 (0.06)	1.11	1.13	0.89
25W200M	2.03 (0.06)	0.98	0.91	1.05
26W2KM	–0.97 (0.07)	0.83	0.69	1.17
27WHILL	–1.57 (0.07)	0.87	0.77	1.14
28WPATH	–0.34 (0.07)	0.91	0.85	1.10
29WICY	–0.96 (0.07)	0.98	0.83	1.04
30STAIRS	0.45 (0.06)	1.25	1.46	0.69
31RUN	–2.79 (0.09)	0.99	0.72	1.03
Moving around (using equipment)				
32W20M	2.26 (0.06)	0.94	0.91	1.07
33W200M	0.72 (0.05)	0.98	0.95	1.03
34WHILL	–2.30 (0.07)	0.98	0.85	1.05
35WPATH	–1.64 (0.07)	1.00	0.94	1.00
36PUBLICT	–1.01 (0.06)	1.04	1.06	0.95
37TAXI	0.93 (0.06)	1.05	0.99	0.96
38CAR	1.05 (0.06)	1.01	0.98	0.98
Self-care				
39WASH	0.08 (0.13)	1.20	1.15	0.80
40TEETH	–0.31 (0.13)	0.77	0.67	1.28
41HAIR	0.23 (0.12)	0.96	0.96	1.00
Dressing				
42SHIRT	2.75 (0.08)	0.73	1.02	1.18
43SWEAT	0.60 (0.07)	0.77	0.78	1.19
44UPANTS	–0.42 (0.07)	0.75	0.75	1.21
45SOCKS	–2.94 (0.07)	1.38	1.54	0.42
Eating and drinking				
46BREAD	1.07 (0.12)	1.16	1.16	0.84
47JAM	–1.73 (0.10)	0.95	0.91	1.05
48GLASS	1.78 (0.11)	0.93	0.79	1.09
49BOTTLE	–1.12 (0.10)	0.96	0.94	1.04
Acquiring the necessities of life				
50RENT	–0.08 (0.06)	0.91	0.91	1.06
51REFURN	–0.88 (0.06)	0.80	0.71	1.22
52GROCER	0.97 (0.06)	1.23	1.22	0.76
Housework				
53MEAL	1.69 (0.06)	1.02	1.28	0.94
54WASHC	0.13 (0.05)	1.09	1.19	0.87
55DISHES	1.31 (0.06)	0.75	0.85	1.25
56DUST	0.95 (0.05)	0.84	0.79	1.17
57SCRUB	–1.82 (0.06)	1.00	0.87	1.02
58WINDOW	–2.25 (0.06)	1.21	1.48	0.79

Item DI: Item Discrimination Index; MNSQ: mean square.
For abbreviations please see Appendix.

and 58WINDOW), but these items were retained for reasons of content validity as the other quality indices indicated satisfactory values.

Unidimensionality

For all 12 MOSES scales the Kaiser-Meyer-Olkin statistics for the residual matrices were in the "miserable" range according to Kaiser's criteria (32) (median = 0.203). This finding indicates there is too little shared variation to be segmented by a PC analysis. Furthermore, the scree plots showed no clear break. An EFA of the raw value matrices produced scree plot analyses that support one dominant factor with the first factor explaining 60.0–84.5% of data variance (median = 73.0%). In the CFA the ranges and medians of the fit indexes were: CFI: 0.994–1.000 (median = 0.999), TLI: 0.976–1.000 (median = 0.996), RMSEA: 0.0–0.122 (median = 0.035). Although the RMSEA value for 2 of the 12 scales was not sufficient for an adequate fit, the results nevertheless support the assumption of unidimensionality of the MOSES scales.

Responsiveness

Table IV indicates that the MOSES questionnaire shows medium to large effects on all scales and for all diseases in the patient group with at least a slight limitation. One exception is the scale "moving around using equipment", which, however, is relevant only for persons who use aids for walking. If the analysis includes patients with no limitations at all, medium effects are still shown on many scales. The responsiveness of the MOSES questionnaire is supported by the reliable change index. Generally, the percentage of patients that have experienced improvement as defined by the reliable change index is between 30% and 70%. However, due to the not very large number of cases, the confidence intervals of the responsiveness indexes are rather large.

Construct validity

All hypotheses concerning the correlations with SF-36 were confirmed. All the scales of the MOSES questionnaire showed a positive correlation with the SF-36 scale "physical function"

Table IV. *Responsiveness*

		Effect size (95% CI)		Reliable change index (RCI_{indiv}) % improved (95% CI)	
		All patients	Without unlimited patients	All patients	Without unlimited patients
Changing a body position	Musc.	0.51 (0.60; 0.43)	0.58 (0.68; 0.50)	34.6 (27.4; 41.8)	43.3 (35.9; 50.7)
	Card.	0.45 (0.58; 0.33)	0.88 (1.15; 0.66)	29.8 (17.6; 42.0)	58.2 (45.4; 71.0)
	Neuro.	0.37 (0.47; 0.29)	0.53 (0.67; 0.39)	21.9 (10.2; 33.6)	31.5 (18.2; 44.8)
Maintaining a body position	Musc.	0.61 (0.74; 0.50)	0.78 (0.90; 0.66)	*	31.3 (22.4; 40.1)
	Card.	0.47 (0.60; 0.34)	0.95 (1.25; 0.71)	*	54.8 (40.4; 69.2)
	Neuro.	0.39 (0.52; 0.27)	0.67 (0.88; 0.48)	*	*
Carrying objects	Musc.	0.31 (0.43; 0.21)	0.47 (0.64; 0.33)	20.9 (12.4; 29.5)	26.4 (17.1; 35.6)
	Card.	0.24 (0.36; 0.13)	0.53 (0.75; 0.36)	18.8 (5.0; 32.5)	36.7 (21.8; 51.6)
	Neuro.	0.33 (0.47; 0.21)	0.61 (0.85; 0.36)	26.3 (12.8; 39.8)	41.6 (27.5; 55.7)
Lower extremities	Musc.	0.48 (0.56; 0.39)	0.83 (0.96; 0.70)	37.5 (30.0; 45.1)	53.6 (45.4; 61.8)
	Card.	0.42 (0.53; 0.32)	0.97 (1.24; 0.70)	29.8 (17.6; 42.0)	57.6 (41.9; 73.3)
	Neuro.	0.40 (0.54; 0.27)	0.89 (1.23; 0.61)	29.9 (16.6; 43.1)	52.6 (37.2; 68.1)
Use of hands and arms	Musc.	0.10 (0.17; 0.03)	0.35 (0.53; 0.17)	10.5 (1.1; 19.8)	25.8 (5.0; 46.5)
	Card.	0.19 (0.30; 0.07)	0.84 (1.26; 0.51)	11.2 (0; 25.4)	46.7 (20.5; 72,8)
	Neuro.	0.41 (0.53; 0.29)	0.78 (1.05; 0.53)	28.2 (14.6; 41.8)	48.6 (32.1; 65.2)
Walking (without equipment)	Musc.	0.37 (0.47; 0.28)	0.44 (0.59; 0.33)	29.4 (21.4; 37.3)	29.9 (20.1; 39.7)
	Card.	0.49 (0.65; 0.36)	0.84 (1.11; 0.64)	40.3 (27.9; 52.7)	58.6 (45.1; 72.1)
	Neuro.	0.32 (0.46; 0.20)	0.58 (0.82; 0.40)	24.8 (11.1; 38.6)	32.3 (15.5; 49.0)
Moving around (using equipment)	Musc.	0.71 (0.84; 0.59)	0.75 (0.89; 0.63)	49.6 (42.0; 57.1)	50.9 (42.8; 59.0)
	Card.	0.26 (0.59; 0.01)	0.26 (0.72; –0.16)	33.3 (0.7; 66.0)	31.3 (0; 71.9)
	Neuro.	0.35 (0.52; 0.22)	0.38 (0.58; 0.22)	25.3 (8.2; 42.3)	27.2 (8.6; 45.7)
Self-care	Musc.	0.29 (0.35; 0.23)	0.98 (1.25; 0.74)	18.1 (9.3; 26.9)	68.8 (56.4; 81.3)
	Card.	0.21 (0.31; 0.11)	1.14 (1.86; 0.75)	11.1 (0; 24.9)	84.2 (66.3; 100)
	Neuro.	0.40 (0.52; 0.28)	1.17 (1.58; 0.84)	24.2 (10.4; 38.0)	63.8 (48.3; 79.3)
Dressing	Musc.	0.49 (0.57; 0.40)	1.18 (1.39; 1.00)	28.8 (20.4; 37.2)	69.3 (61.4; 77.1)
	Card.	0.26 (0.35; 0.16)	1.12 (1.68; 0.71)	11.5 (0; 25.5)	61.5 (37.7; 85.4)
	Neuro.	0.41 (0.52; 0.31)	1.03 (1.39; 0.76)	22.3 (8.1; 36.5)	60.3 (44.8; 75.9)
Eating and drinking	Musc.	0.08 (0.15; 0.00)	0.50 (0.89; 0.17)	5.6 (0; 15.3)	40.5 (15.7; 65.4)
	Card.	0.16 (0.24; 0.06)	0.79 (1.48; 0.36)	6.9 (0; 21.2)	46.2 (6.3; 86.0)
	Neuro.	0.34 (0.46; 0.21)	1.42 (1.97; 1.05)	15.4 (1.0; 29.8)	66.7 (49.8; 83.5)
Acquiring the necessities of life	Musc.	0.36 (0.47; 0.26)	0.53 (0.67; 0.41)	28.7 (19.7; 37.8)	31.3 (22.0; 40.5)
	Card.	0.33 (0.44; 0.22)	0.85 (1.10; 0.62)	22.6 (7.9; 37.4)	42.2 (27.4; 56.9)
	Neuro.	0.40 (0.56; 0.26)	0.76 (1.05; 0.53)	28.3 (13.6; 43.1)	31.6 (16.4; 46.8)
Housework	Musc.	0.43 (0.52; 0.35)	0.48 (0.57; 0.38)	39.6 (31.6; 47.6)	41.0 (32.9; 49.0)
	Card.	0.34 (0.44; 0.24)	0.46 (0.58; 0.34)	31.3 (18.1; 44.6)	37.3 (23.5; 51.1)
	Neuro.	0.36 (0.48; 0.26)	0.48 (0.66; 0.33)	36.7 (23.9; 49.6)	41.2 (28.1; 54.4)

*Reliability of pre-post difference scores ≤ 0.40.
Musc.: musculoskeletal disease; Card.: cardiac disease; Neuro.: neurological disease; CI: confidence interval.

(median of the 12 correlations = 0.56; all correlations were significant, $p < 0.001$). The median of the correlations with the scale "bodily pain" was 0.34. There was only slight correlation with the scales "emotional role function" and "mental health" (median 0.14 and 0.20, respectively).

The hypotheses on the correlations with the SMFA questionnaire were also confirmed. MOSES scales concerned with the use of the lower extremities correlate substantially with the SMFA scales "daily activities" and "mobility" and with the dysfunction index. The correlations generally lie in the range 0.50–0.75; all correlations were significant ($p < 0.001$). MOSES scales that essentially deal with the use of the arms and hands ("use of hands and arms" and "eating and drinking") also correlate substantially with the SMFA "function of the arm and hand" (correlations 0.64 and 0.61, respectively, $p < 0.001$). By contrast, the median of the correlations of the MOSES scales to the SMFA scale "emotionality" was only 0.29.

Most, but not all, of the hypotheses regarding the MacNew questionnaire for cardiac diseases were confirmed. The correlations of MOSES scales to the MacNew dimension "physical score" were all significant ($p < 0.05$), but the median of the correlations was only 0.36. The median regarding the MacNew dimension "emotional score" was 0.27. The not very high correlation with the physical scales of the MacNew questionnaire can probably be attributed to the fact that this scale primarily measures symptoms and pain, and to a lesser degree, limitations of activity.

An examination of the correlations of the MOSES scales to the FIM™ or the Barthel index for neurology patients confirmed the hypotheses. Although the MOSES assessments were made by the patients and the FIM™/Barthel values by the physician, thus requiring that the varying perspectives of the assessor also be taken into consideration, the MOSES scales clearly correlated with the FIM™ subscales for "self-care",

"transfers" and "locomotion" – the medians were 0.47, 0.42 and 0.40, respectively. With the exception of the correlation with the MOSES scales "use of hands and arms" and "eating and drinking" all correlations were significant, $p < 0.005$). The correlations with the scales "comprehension" and "social cognition" are very slight in comparison (0.11 and 0.05).

Finally, an analysis was made as to how far the complex activities covered in the MOSES questionnaire could be predicted using the scales on mobility. Here there were also plausible relations fitting the hypotheses. The explained variance of the more complex activities fluctuated between 28.7% and 58.7%; the more complex activities for housework and acquisition of necessities of life showed a higher variance explanation than the elementary areas "self-care", "dressing" and "eating/drinking" (see Table V). As expected, use of hands and arms, changing position, use of lower extremities, and walking were relevant to the scales "self-care" and "dressing". The values of the scale "eating and drinking" could be largely predicted by the degree of limitation of use of hands and arms, and to a lesser degree by the use of the lower extremities.

DISCUSSION

The MOSES questionnaire is an adaptive, Rasch-scaled assessment instrument, which, to a great extent, covers the contents of the ICF chapters "mobility", "self-care" and "domestic life" and reflects the structure of the classification system on the level of 3- and 4-digit categories. Contents that are only slightly relevant for the daily lives of most people in North America or Europe, that are relevant only in special life situations, and that require complex cognitive and social judgement processes were disregarded *a priori. A posteriori*, some categories that presupposed skills that must be learned in an individual learning process (e.g. driving, taking care of household objects) proved to be unsuitable for an assessment based on the PCM model. These complex activities appear not to be a unidimensional construct as required by the measurement theory. In the case of such activities, which must be learned, it appears to be difficult to enable patients to differentiate between the limitation of the activity stemming from learning deficits and the limitation caused by health status.

As this problem was anticipated, an additional response category "I haven't learned to do this" was added to these items and a health attribution was introduced (cf. also 33) in which the instruction expressly emphasized that it was important to estimate how difficult it was to perform this activity due to the health situation; these measures did not, however, lead to the desired result, and the corresponding ICF categories are not represented in the MOSES questionnaire. While it is possible that this problem arose from the operationalization of the items we selected, we find it more likely that it is a general problem of the ICF: for some ICF categories, it cannot be decided unequivocally whether a limitation is due to a health problem or a poorly developed or lacking skill.

Within the scales of the MOSES questionnaire (which generally correspond to the 3-digit ICF categories) the attempt was made to construct an item for each 4-digit ICF category. For the scales "maintaining a body position", "carrying objects", "self-care" and "eating and drinking" this resulted in a substantial reduction by more than one-third in the numbers of items. The clearest reduction was on the scale "self-care", as only 3 of the original 9 items remained. The lack of unidimensionality is apparent in that the originally developed items often correlated less with the scale on self-care than with other scales. The item "cutting toenails" for example, correlated more with the scales for "changing a body position" and "dressing" than with "self-care". This is understandable, since cutting the toenails requires a change of position and the movement is more closely related to putting on shoes and socks than to washing at the sink or brushing teeth (2 items of the scale "self-care"). In general, the ICF principle of grouping activities with a similar purpose (e.g. caring for body parts) is understandable in theory, but due to the varying underlying sequences of movement (which are, for example, quite different for brushing teeth than for cutting toenails) unidimensionality is difficult to achieve. One solution was to include in the scale "self-care" only those items which contained comparable sequences of movements. Thus, activities that require use of the lower extremities (e.g. "getting into the bathtub") were omitted. However, since the MOSES questionnaire includes a separate scale for "using the lower extremities", this procedure appears acceptable regarding content validity.

The MOSES scales remaining after item selection meet the requirements of the PCM model. For a small number of items, incorporation into a scale was made contingent not only on statistical criteria, but was also based on considerations of

Table V. *Prediction of the 5 scales on self-care and domestic life through the 6 scales on mobility*[*]

Criterion	Explained variance (corr. R^2) (%)	Significant predictors (in order of significance)
Self-care	28.7	Use of hands and arms
		Changing a body position
		Lower extremities
Dressing	41.6	Use of hands and arms
		Changing a body position
		Lower extremities
		Walking (without equipment)
Eating and drinking	38.0	Use of hands and arms
		Lower extremities
Acquiring the necessities of life	53.9	Walking (without equipment)
		Carrying objects
		Lower extremities
Housework	58.7	Walking (without equipment)
		Carrying objects
		Lower extremities
		Use of hands and arms
		Changing a body position

*The following scales were used as predictors: changing a body position, maintaining a body position, carrying objects, lower extremities, use of hands and arms, walking (without equipment). The scale "moving around (using equipment)" was not taken into consideration, as it is relevant only for persons who use equipment. A linear regression analysis (method: stepwise) was calculated.

the structure of the ICF categories. Studies such as Beaton et al. (34) showed that such a "concept-retention" method could lead to comparable or even superior validity and responsiveness values.

In this study, 2 items could not be incorporated which had been included in the first study on the development of the MOSES questionnaire (see 13). This is possibly due to the use of different samples, but also to the IRT software used (WINSTEPS was used in this study, WINMIRA in (13)).

The drop-out rate for the MOSES questionnaire is within the usual range of prospective studies in rehabilitation for musculoskeletal and cardiac diseases. For neurological diseases, the drop-out rate was, as anticipated, very high because many patients are not capable of completing a questionnaire on their own. Therefore, in addition to the patient version of the MOSES questionnaire, an analogous version to be completed by the physician or therapist was compiled. This instrument will be presented in a separate publication.

The analyses of responsiveness show that the MOSES questionnaire can demonstrate the effects of in-patient rehabilitation. The effects are usually higher than in comparable prospective studies in the German-speaking region that attempt to demonstrate the functional outcome after inpatient rehabilitation with other generic instruments (for example, cf. 35). The areas which present a relatively rare rehabilitation goal because the patients often have no limitations in that area (e.g. "eating and drinking" for cardiac patients) result, as expected, in only slight effects. The results of the construct validity provide evidence that the MOSES questionnaire in fact measures functional limitation regarding mobility and self-care and that the individual scales each measure the intended aspects of mobility and self-care.

The main limitations of the study are related to the generalizability of the results, the still-pending analyses of differential item functioning, and the number of items per scale. The property of sample independence of the PCM model is given only if the model is valid in the respective population. The validity of the Rasch model shown for this study is limited to rehabilitation patients with musculoskeletal, cardiac and neurological diseases who take advantage of rehabilitation measures provided by the statutory health insurance and who are willing and able to complete questionnaires on their own. It would be desirable to replicate the findings for other diseases, for patients from other insurers in Germany (e.g. the German Pensioners Insurance, for which occupational re-integration is a central factor), and in an international context. When using a generic measurement instrument, such as the MOSES questionnaire, it is important to know whether the item parameters are similar for different groups of persons. If this is not the case, the assumption of unidimensionality is not correct and the values in the respective groups cannot be compared with one another. An examination of differential item functioning in the MOSES questionnaire has yet to be made. This should address, in particular, the differences between diseases, between age groups, and between male and female patients. The number of items per scale is often quite small, which is cost-effective for a paper-and-pencil version of the instrument. Despite the relatively small number of items, an adaptive approach with skip commands was chosen so that the patient is not distracted by questions inapplicable to him or her. But for the computer-supported adaptive version of the MOSES questionnaire we are planning (e.g. 10), the item pool needs to be expanded and a new analysis carried out.

Despite these limitations, the underlying concept of the study – using the contents of the ICF categories as the basis for a patient questionnaire – has been shown to be effective. This theory-driven approach to standardization appears to be more promising than a purely empirical approach (as, for example, in Long & Pavalko (5)) that attempts to unify the contents of the questions of functional questionnaires via predictions of the items regarding global outcome criteria.

REFERENCES

1. Dahl TH. International classification of functioning, disability and health: an introduction and discussion of its potential impact on rehabilitation services and research. J Rehabil Med 2002; 34: 201–204.
2. Okochi J, Utsonomiya S, Takahashi T. Health measurement using the ICF: test-retest reliability study of ICF codes and qualifiers in geriatric care. Health Qual Life Outcomes 2005; 3: 46.
3. Cieza A, Geyh S, Chatterji S, Kostanjsek N, Üstün TB, Stucki G. ICF linking rules: an update based on lessons learned. J Rehabil Med 2005; 37: 212–218.
4. Haley SM, Coster WJ, Andres PL, Ludlow LH, Pengsheng N, Bond TLY, et al. Activity outcome measurement for postacute care. Med Care 2004; 42: I49–61.
5. Long JS, Pavalko E. Comparing alternative measures of functional limitation. Med Care 2004; 42: 19–27.
6. Cieza A, Brockow T, Ewert T, Amman E, Kollerits B, Chatterji S, et al. Linking health-status measurements to the international classification of functioning, disability and health. J Rehabil Med 2002; 34: 205–210.
7. Hays RD, Morales LS, Reise SP. Item response theory and health outcomes measurement in the 21st century. Med Care 2000; 38 (9 suppl II): II28–42.
8. Fischer GH, Molenaar IW, editors. Rasch models – foundations, recent developments, and applications. New York: Springer; 1995.
9. Jette AM, Haley SM. Contemporary measurement techniques for rehabilitation outcomes assessment. J Rehabil Med 2005; 37: 339–345.
10. Ware JE, Bjorner JB, Kosinski M. Practical implications of item response theory and computerized adaptive testing. Med Care 2000; 38 (suppl II): II73–82.
11. Farin E, Follert P, Gerdes N, Jäckel WH, Thalau J. Quality assessment in rehabilitation centres: the indicator system "Quality Profile". Disabil Rehabil 2004; 26: 1096–1104.
12. Haley SM, Siebens H, Coster WJ, Tao W, Black-Schaffer RM, Gandek B, et al. Computerized adaptive testing for follow-up after discharge from inpatient rehabilitation: I. Activity outcomes. Arch Phys Med Rehabil 2006; 87: 1033–1042.
13. Farin E, Fleitz A, Follert P. Entwicklung eines ICF-orientierten Patientenfragebogens zur Erfassung von Mobilität und Selbstversorgung. Phys Med Rehab Kuror 2006; 16: 197–211.
14. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): Conceptual framework and item selection. Med Care 1992; 30: 473–483.
15. Kirschner S, Walther M, Bohm D, Matzer M, Heesen T, Faller H, et

al. German short musculoskeletal function assessment questionnaire (SMFA-D): comparison with the SF-36 and WOMAC in a prospective evaluation in patients with primary osteoarthritis undergoing total knee arthroplasty. Rheumatol Int 2003; 23: 15–20.
16. Dixon T, Lim LLY, Oldridge N. The MacNew heart disease health-related quality of life instrument: reference data for users. Qual Life Res 2002; 11: 173–183.
17. Linacre JM, Heinemann AW, Wright BD, Hamilton BB, Granger CV. The structure and stability of the functional independence measure. Arch Phys Med Rehabil 1994; 75: 127–132.
18. Mahoney FI, Barthel DW. Functional evaluation: the Barthel index. Md State Med J 1965; 14: 61–65.
19. Coster WJ, Haley SM, Andres PL, Ludlow LH, Bond TLY, Pengsheng N. Refining the conceptual basis for rehabilitation outcome measurement. Personal care and instrumental activities domain. Med Care 2004; 42: I62–72.
20. Conrad KJ, Smith EV. International conference on objective measurement. Applications of Rasch analysis in health care. Med Care 2004; 41 (suppl 1): I1–6.
21. Masters GN. Rasch model for partial credit scoring. Psychometrika 1982; 47:149–174.
22. WINSTEPS Rasch Measurement (Version 3.60.1) (Software); 2006.
23. Bond TG, Fox CM, editors. Applying the Rasch model: fundamental measurement in the human sciences. Mahwah, NJ: Lawrence Erlbaum Associates; 2001.
24. Hu LT, Bentler P. Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. Struct Equation Model 1999; 6: 1–55.
25. Tucker L, Lewis C. A reliability coefficient for maximum likelihood factor analysis. Psychometrika 1973; 38: 1–10.
26. Prieto L, Alonso J, Lamarca R. Classical test theory versus Rasch analysis for quality of life questionnaire reduction. Health Qual Life Outcomes 2003; 28: 27.
27. Stratford P, Riddle D. Assessing sensitivity to change: choosing the appropriate change coefficient. Health Qual Life Outcomes 2005; 3: 23.
28. Algina J, Keselman HJ, Penfield RD. Effect sizes and their intervals: the two-level repeated measures case. Educ Psychol Meas 2005; 65: 241–258.
29. Hageman WJ, Arrindell WA. Establishing clinically significant change: increment of precison and distinction between individual and group level of analysis. Behav Res Ther 1999; 37: 1169–1193.
30. Cohen J, editor. Statistical power analysis for the behavioral sciences (2nd edn). New York: Academic Press; 1988.
31. Jette AM, Haley SM, Kooyoomjian JT. Are the activity and participation dimensions distinct? J Rehabil Med 2003; 35: 145–149.
32. Kaiser HF, Rice J. Little Jiffy, Mark IV. Educ Psychol Meas 1974; 34: 111–117.
33. Dubuc N, Haley SM, Kooyoomjian JT, Jette AM. Assessing disability in older adults: the effects of asking questions with and without health attribution. J Rehabil Med 2004; 36: 226–231.
34. Beaton DE, Wright JG, Katz JN, The Upper Extremity Collaborative Group. Development of the QuickDASH: comparison of three item-reduction approaches. J Bone Joint Surgery Am 2005; 87: 1038–1046.
35. Farin E, Glattacker M, Follert P, Kuhl C, Jäckel WH. Effekte und Prädiktoren des Outcomes in der Rehabilitation muskuloskelettaler Erkrankungen. Phys Med Rehab Kuror 2004; 14: 123–133.

APPENDIX. *Items and skip commands of the MOSES questionnaire*

Changing a body position

Skip question: Can you kneel down and stand up again or squat down and stand up again without any difficulty or pain?

1CHAIR	Sit on a chair and stand up again
2BED	Lie down on a bed and stand up again
3SQUAT	Squat down and stand up again
4FLOOR	Kneel on the floor and stand up again
5BEND	Bend down and pick up a small object (e.g. crumpled up paper)
6STRETCH	Stretch to get a book from a high shelf
7SLIDE	Slide from a chair to a bed placed next to it without standing up

Maintaining a body position

Skip question: Can you remain in a kneeling or standing position for long periods without any difficulty or pain?

8STAND	Stand without interruption for a long period (e.g. waiting 20 minutes in line)
9SIT	Sit on a chair for a long time (e.g. for the length of a meal)
10KNEEL	Kneel on the floor for a long time (e.g. when cleaning)

Carrying objects

Skip question: Can you lift heavy objects of daily life (e.g. a full bucket of water or a case of beverages) from the floor to a table without any difficulty or pain?

11LIFT	Lift a heavy object (e.g. a 10 kg bucket of water)
12TABLE	Lift a heavy object from the floor to the table (e.g. a 10 kg bucket of water)
13CARRY	Carry a heavy object (e.g. a 10 kg bucket of water) 10 metres

Lower extremities

Skip question: Can you use your feet or legs to pull a heavy object (e.g. a chair) towards yourself or push it away without any difficulty or pain?

14PUSHL	Push and move a light object (e.g. a ball) using your the feet or legs
15PUSHH	Push and move a heavy object (e.g. a chair) using your feet or legs
16PULLL	Pull a light object (e.g. a crumpled piece of paper) towards yourself with your feet
17PULLH	Pull a heavy object (e.g. a chair) towards yourself with your feet

Use of hands and arms

Skip question: Can you grasp small objects with your fingers and hands and pick up small objects (e.g. coins) with you fingers without any difficulty or pain?

18GRASP	Grasp and hold objects (e.g. a hammer) in your hands
19PICK	Pick up small objects (e.g. coins) with your fingers

APPENDIX contd.

20BUTTON	Button your clothes
21WRITE	Write with a pen
22PULLF	Pull objects with your fingers and hands (e.g. pull a door closed)
23PUSHF	Push objects away with your fingers and hands (e.g. push a package across the table)
Walking (without equipment)	
Skip question: Can you run for a short stretch or walk up a slope without any difficulty or pain?	
24W20M	Walk short distances (e.g. inside the home, up to 20 metres)
25W200M	Walk distances in the building (up to 200 metres)
26W2KM	Walk long distances (more than 2 kilometres)
27WHILL	Walk up a steep slope (e.g. on a hill)
28WPATH	Walk on an unlevel, rocky path
29WICY	Walk along an icy path in winter
30STAIRS	Climb two flights of stairs
31RUN	Run a short distance
Moving about (using equipment)	
Skip question: Do you use any equipment for walking such as crutches or a walker? (no further skip question)	
32W20M	Walk short distances (e.g. inside the home, up to 20 metres)
33W200M	Walk distances in the building (up to 200 metres)
34WHILL	Walk up a steep slope (e.g. on a hill)
35WPATH	Walk on an uneven, rocky path
36PUBLICT	Use public transportation (e.g. bus, train)
37TAXI	Use a taxi
38CAR	Get into a car as a passenger
Self-care	
Skip question: Can you wash yourself and brush you teeth without any help and without any difficulty or pain?	
39WASH	Wash at the sink
40TEETH	Brush your teeth
41HAIR	Take care of your hair (e.g. comb, shave, style)
Dressing	
Skip question: Can you put on and take off socks and underwear without any help and without any difficulties or pain?	
42SHIRT	Put on and take off a shirt
43SWEAT	Put on and take off a sweater
44UPANTS	Put on and take off underpants
45SOCKS	Put on and take off socks
Eating and drinking	
Skip question: Can you open jars and bottles and drink out of a bottle without any help and without any difficulty?	
46BREAD	Eat a slice of bread
47JAM	Open a jar of jam
48GLASS	Lead a glass to the mouth and drink
49BOTTLE	Open a bottle of water and drink from the bottle
Acquiring the necessities of life	
(No skip question)	
50RENT	Look for and rent a new apartment
51REFURN	Refurnish the apartment when necessary
52GROCER	Buy groceries
Housework	
(No skip question)	
53MEAL	Prepare a simple meal (e.g. rice pudding)
54WASHC	Wash clothes by hand if necessary
55DISHES	Wash dishes in the sink
56DUST	Dust
57SCRUB	Scrub the floor
58WINDOW	Wash windows