ORIGINAL REPORT

BRIEF ICF CORE SET FOR PATIENTS IN GERIATRIC POST-ACUTE REHABILITATION FACILITIES

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Objective: To identify candidate categories for International Classification of Functioning, Disability and Health (ICF) Core Sets for the reporting and clinical measurement of functioning in older patients in early post-acute rehabilitation facilities.
Design: Prospective multi-centre cohort study.
Patients: Older patients receiving rehabilitation interventions in early post-acute rehabilitation facilities.
Methods: Functioning was coded using the ICF. The criterion for selecting candidate categories for the brief ICF Core Sets was based on their ability to discriminate between patients with high or low functioning status. Discrimination was assessed using multivariable regression models, the independent variables being all of the ICF categories of the respective comprehensive ICF Core Set. Analogue ratings of overall functioning as reported by patients and health professionals were used as dependent variables.
Results: A total of 209 patients were included in the study, mean age 80.4 years, 67.0% female. Selection yielded a total of 29 categories for the functioning part and 9 categories for the contextual part of the ICF.
Conclusion: The present selection of categories can be considered an initial proposal, serving to identify the issues most relevant for the clinical assessment and monitoring of functioning in older patients undergoing early post-acute rehabilitation.

Key words: ICF; health status measurements; outcome assessment; classification; regression analysis; rehabilitation; aged 80 and over; clinical.

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INTRODUCTION

Although individuals of older age are not necessarily disabled, the incidence and prevalence of acute disease, disability and chronic conditions increase with age. An older person suffering an accident or an acute episode of illness may have several additional problems complicating the acute event and leading to functional decline and subsequent need for nursing home placement. There has been increasing awareness of the risks created by hospitalization and medical and surgical procedures in older individuals, namely incontinence, infections, malnutrition and immobility (1). Thus, older patients are more vulnerable to functional decline and require particular attention and specialized rehabilitation care (2). Early post-acute rehabilitation for older patients may be provided either in dedicated units of an acute care hospital or in specialized rehabilitation facilities. In some countries, such as Germany, there are units caring exclusively for older patients. An interdisciplinary team of physicians, nurses and therapists specialized in rehabilitation care cooperates to manage the demands of early post-acute rehabilitation (3–4).

In situations entailing post-acute and long-term rehabilitation, professionals specialized in rehabilitation care provision should share a common understanding of functioning, and utilize clinical assessment instruments that are based on a standard model of functioning in order to optimize the management of the rehabilitation process. It is known that systematic geriatric assessment in the course of rehabilitation improves outcomes (5). Hence, a multitude of measuring instruments has been used in older patients. However, a conference on healthcare outcomes of geriatric rehabilitation stated that the degree of detail and measurement complexity in geriatric assessment varies according to health domain. While domains of activities of daily living are well covered by various health status instruments, there are specific gaps regarding environmental factors, namely access to care, resources and support by others (6). While there is now a minimum data-set for older patients in clinical trials (7), there is still no consensus on which instruments are to be used consistently in rehabilitation practice (8), nor is there a conceptual framework unifying the different approaches to geriatric assessment. Thus, there is a need for implementing improved and standardized outcome measurement in geriatric rehabilitation.

The International Classification of Functioning, Disability and Health (ICF), a part of the family of international classifications of the World Health Organization (WHO), provides

a common framework for describing and classifying health and disability. The ICF classifies domains of functioning, along with their contextual factors, which are encountered in human life. As such, the ICF may arguably constitute a comprehensive framework and a guide for healthcare planning and for measuring the changes brought by interventions across a multitude of dimensions, from body functions to personal activities, societal participation and environmental factors. It also provides the potential framework for transition along the continuum of care. A classification must be exhaustive by its very nature and becomes highly complex in daily use unless it is transformed into practice-friendly tools. Comprising over 1400 categories, the entire volume of the ICF cannot be applied by the clinicians to all their patients. In daily practice clinicians will need only a fraction of the categories found in the ICF. Although there are generic instruments based on the ICF that are designed as practical translations of the ICF and are usable across a wide range of applications, the generic character may be a drawback in specific settings. Thus, in this trade-off between generalizability and the need to capture detail, the ICF must be adapted to the perspectives and needs of different users. The need to tailor ICF to the needs of particular contexts is the primary motivation behind the ICF Core Set project, which aims to extract selections of ICF categories from the entire classification that are relevant to specific health conditions or care situations. This on-going project of selection of the so-called ICF Core Sets will define common standards for what should properly be measured and reported.

In general, the ICF Core Set project seeks to define on an empirical basis the ICF categories relevant for the condition and rehabilitation of typical patients after an acute episode, especially when applied as an end-point in clinical trials, or if it was identified as being relevant following discussion among health professionals (9). By including all theoretically relevant categories, the selection process is comprehensive, omitting only those factors that proved to be irrelevant to designing treatment strategy or assessing outcome. Due to the consensus process, the ICF Core Sets in their present version are comprehensive, with applicability for the assessment of individual problems and needs. As such, they permit the estimation of prognosis and the potential for rehabilitation, with general applicability for assessment of functioning in any rehabilitation situation. A comprehensive ICF Core Set for older patients has been developed (9) and validated in the patients' and healthcare professionals' perspective (10–12). The Core Set is intended to be practical and useful for healthcare professionals specialized in rehabilitation and involved in interdisciplinary rehabilitation teams. They are based on the experience of patients in need of medical, nursing and therapeutic management.

The comprehensive geriatric ICF Core Set includes 123 second-level ICF categories. However, a minimally sufficient data-set, which is feasible in clinical practice may encompass only 20 different concepts or topics, but not much more. To give an example, the Geriatric Minimum Data Set identified 25 salient items that were also translated into ICF categories (13). Thus, subsets can be created from the comprehensive Core Set, according to specific needs of the individual user.

Specific methods have been proposed for identifying candidate categories for brief ICF Core Sets, selected from the comprehensive post-acute ICF Core Sets (14).

The objective of this study was to identify candidate categories for brief ICF Core Sets out of the comprehensive geriatric ICF Core Sets for the reporting and measurement of functioning in patients in geriatric rehabilitation facilities.

METHODS

Detailed methods of the ICF Core Set development have been described elsewhere (14). In brief, a prospective multi-centre cohort study was conducted from May 2005 to August 2008 in 5 facilities specialized in geriatric rehabilitation in Germany and Austria. Patients were eligible for inclusion if they were over 65 years of age and fulfilled the criteria for post-acute geriatric rehabilitation, namely frailty and multi-morbidity. Frailty is commonly defined as a state of declining ability of physiological systems to respond to external stressors resulting in vulnerability to adverse outcomes (15).

As noted above, we have developed the comprehensive ICF Core Sets in order to facilitate and encourage the use of the ICF in clinical practice and research. The comprehensive ICF Core Sets are selections from the entire list of ICF categories, which emerged from a multi-stage consensus process seeking to identify those aspects of functioning most relevant for patients in specific settings or with specific health conditions or with specific characteristics such as old age. As such, a comprehensive ICF Core Set for older patients does not relate to a specific health condition, but includes all health conditions that might necessitate rehabilitation care. A comprehensive ICF Core Set for older patients in early post-acute rehabilitation facilities (16) was developed in a multiprofessional formal decision process integrating evidence gathered from preliminary studies including focus groups, a systematic review from the literature, and a empirical study in older patients (9). The current study made use of this comprehensive Core Set for patient assessment.

For scoring of the Core Set, the ICF suggests assigning qualifiers ranging from 0 to 4 for each category. Because the properties of all qualifiers are not yet sufficiently evaluated, in the present study we used a simplified qualifier, defined as follows. Each category of the components Body Functions and Activities and Participation was graded with the qualifiers 0 for "no impairment/limitation/restriction", 1 for "moderate impairment/limitation/restriction", and 2 for "severe impairment/limitation/restriction". The categories of the component Body Structures were graded with the qualifiers 0 for "no impairment" and 1 for "impairment". The categories of the component Environmental Factors were graded with 0 for "no barrier/facilitator" and 1 for "barrier/facilitator". Impairments of body functions or structures, and limitations or restrictions of activities and participation were reported if they were directly associated with the need for rehabilitation, regardless of the underlying health condition.

To describe an overall view of functioning, the patients were asked to appraise their personal limitations in overall functioning using a horizontal visual analogue scale, ranging from zero, for complete limitation in all aspects of functioning to 10, for no limitation in functioning). Independently, and blinded to the patients' responses, the health professionals were asked to appraise their patients' functioning on the same analogue scale.

Patients were recruited and interviewed by health professionals trained in the application and principles of the ICF. Data was collected primarily from patients' medical record sheets, by interview with health professionals in charge of the patients, and by patient interviews. ICF Core Set categories were assessed within the first 24 h after admission (baseline). Written informed consent was obtained from the patient or from the patient's care-giver in cases where the patient was unable to make an informed decision.

The criterion for selecting candidate categories for the brief ICF Core Set was based on their ability to discriminate between patients

with high or low functioning status. Discrimination was assessed using multivariable regression models, in which the independent variables were all of the ICF categories of the comprehensive ICF Core Set. Analogue ratings of overall functioning as reported by patients and health professionals were used as dependent variables. To improve prediction accuracy, and to derive small subsets of independent variables having the strongest effects on the dependent variable, we used the least absolute shrinkage and selection operator (LASSO) (17). This procedure minimizes the residual sum of squared errors with a bound on the sum of the absolute values of the coefficients. To avoid large variance, as often occurs in ordinary least square regression, the LASSO sets some regression coefficients to zero and shrinks others based on a preset regularization parameter, the so-called penalty. Thus, the method acts recursively to select valid subsets with adequate discrimination.

To validate the approach for selection of an ICF Core Set described above, we additionally used the Random Forest algorithm, which is based on Classification and Regression Trees (CART) non-parametric regression techniques. CART divides a population into several subpopulations depending on certain characteristics defined by successive binary splits in predictor variables. In the course of the iterations, successive subpopulations emerge as increasingly homogenous with respect to the outcome variable, which in this case is the overall functioning as reported by patients and health professionals. Of the many different ways to construct CART, we employed the technique proposed by Breiman et al. (18–19).

All data analyses were carried out with R 2.9.0 (20).

RESULTS

A total of 209 patients were included in the study. The mean age of included patients was 80.4 years, and 67.0% were female. The mean length of stay in the rehabilitation facility was 24.1 days. The most frequent diagnoses are shown in Table I. Patients reported a mean functioning score of 5.0 (95% confidence interval (CI) 4.8–5.3) at admission and of 6.8 (95% CI 6.5–7.0) at discharge. The difference in functioning from admission to discharge was significant.

Statistical selection of ICF categories yielded 7 categories for the component Body Functions, 15 categories for the component Activities and Participation, 7 categories for the component Body Structures and 9 categories for the component Environmental Factors, i.e. a total of 29 categories for the functioning part and 9 categories for the contextual part of the ICF.

Selection of categories along with information on the corresponding comprehensive ICF Core Set is shown in Tables II–V.

DISCUSSION

From a sample of 209 patients we identified candidate categories for a brief ICF Core Set extracted from the comprehensive ICF Core Set for patients in geriatric early post-acute rehabilitation facilities. These candidate categories represent a practical alternative to the lengthy comprehensive sets, in providing a minimal standard for measuring and communicating patients' functioning.

The results of the selection process have high face validity, as the selected categories arguably represented the relevant issues for older patients in the early post-acute situation.

The selected categories of the component Body Functions reflect a small, but important, spectrum of problems associated with functioning in older patients, namely sleep, respiration, and urination. There is evidence that increased daytime sleeping in older patients indicates worse functional status and recovery (21). In the ageing individual, respiratory function undergoes a number of changes (22). Thus, breathing and the ability to clear secretions has to be monitored in particular, in order to avoid complications such as pneumonia. Additionally, incontinence is a typical geriatric syndrome precipitated by acute illness that predicts functional decline (23).

The component Activities and Participation was represented by a number of categories from the chapters "Mobility" and "Self Care". Indeed, precisely these aspects are also covered by existing measurement instruments that are commonly used in the post-acute situation (24) and that are also recommended as a minimum data-set for clinical trials in older individuals (7). Similarly, the ability to maintain activities of daily living was shown to predict mortality among older patients in hospital (25). Additionally, aspects of participation such as family relationships and economic transactions arose as candidates for a brief ICF Core Set, which is consistent with current recommendations (6).

In the component Environmental Factors, categories dealing with attitudes, societal norms and social security were selected as candidates. This reflects the conceptual idea of successful reintegration into the community by providing ongoing assistance or by planning any kind of organized assistance for the time after inpatient rehabilitation.

The aim of this study was to define a practical and applicable brief ICF Core Set with no more than 20 items or ICF categories. Setting this upper limit was based on the precedent

Table I. *Most frequent diagnoses responsible for inpatient stay (International Statistical Classification of Diseases and Related Health Problems (ICD 10)),* n = 209

	n (%)
Diseases of the respiratory system (J00–J99)	10 (4.8)
Diseases of the circulatory system other than cerebrovascular diseases (I00–I52 and I70–I99)	26 (12.4)
Cerebrovascular diseases (I60–I69)	19 (9.1)
Diseases of the nervous system (G00–G99)	13 (6.2)
Diseases of the musculoskeletal system and connective tissue (M00–M99)	16 (7.7)
Injury, poisoning and certain other consequences of external causes (S00–T98)	59 (28.2)
Neoplasms (C00–D48)	5 (2.4)
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)	28 (13.4)
Other diagnoses	33 (15.8)

Table II. *International Classification of Functioning, Disability and Health (ICF) – categories of the component Body Functions contained in the comprehensive ICF Core Set and proposed as candidates for the brief ICF Core Set for older patients*

ICF	Category description	Candidates for the brief ICF Core Set
b110	Consciousness functions	
b114	Orientation functions	
b117	Intellectual functions	
b130	Energy and drive functions	
b134	Sleep functions	×
b140	Attention functions	
b144	Memory functions	
b147	Psychomotor functions	
b152	Emotional functions	
b156	Perceptual functions	
b167	Mental functions of language	
b176	Mental function of sequencing complex movements	
b180	Experience of self and time functions	
b210	Seeing functions	
b215	Function of structures adjoining the eye	
b230	Hearing functions	
b240	Sensations associated with hearing and vestibular function	
b260	Proprioceptive function	
b265	Touch function	
b270	Sensory functions related to temperature and other stimuli	
b280	Sensation of pain	
b320	Articulation functions	
b410	Heart functions	
b415	Blood vessel functions	
b420	Blood pressure functions	
b430	Haematological system functions	
b435	Immunological system functions	×
b440	Respiration functions	
b450	Additional respiratory functions	
b455	Respiratory muscle functions	×
b460	Sensations associated with cardiovascular and respiratory functions	×
b510	Ingestion functions	
b525	Defecation functions	
b530	Weight maintenance functions	
b535	Sensations associated with the digestive system	
b540	General metabolic functions	
b545	Water, mineral and electrolyte balance functions	
b620	Urination functions	×
b630	Sensations associated with urinary functions	×
b710	Mobility of joint functions	
b715	Stability of joint functions	
b730	Muscle power functions	
b735	Muscle tone functions	
b755	Involuntary movement reaction functions	
b760	Control of voluntary movement functions	
b765	Involuntary movement functions	×
b770	Gait pattern functions	
b780	Sensations related to muscles and movement functions	
b810	Protective functions of the skin	
b820	Repair functions of the skin	
b840	Sensation related to the skin	

Table III. *International Classification of Functioning, Disability and Health (ICF) – categories of the component Activities and Participation contained in the comprehensive ICF Core Set and proposed as candidates for the brief ICF Core Set for older patients*

ICF	Category description	Candidates for the brief ICF Core Set
d130	Copying	
d155	Acquiring skills	
d177	Making decisions	
d230	Carrying out daily routine	×
d240	Handling stress and other psychological demands	
d310	Communicating with – receiving – spoken messages	
d315	Communicating with – receiving – nonverbal messages	
d330	Speaking	
d335	Producing nonverbal messages	
d360	Using communication devices and techniques	×
d410	Changing basic body position	×
d415	Maintaining a body position	×
d420	Transferring oneself	×
d440	Fine hand use (picking up, grasping)	
d445	Hand and arm use	
d450	Walking	×
d460	Moving around in different locations	×
d465	Moving around using equipment	×
d510	Washing oneself	×
d520	Caring for body parts	×
d530	Toileting	×
d540	Dressing	
d550	Eating	×
d560	Drinking	
d570	Looking after one's health	×
d760	Family relationships	×
d770	Intimate relationships	
d860	Basic economic transactions	×
d930	Religion and spirituality	
d940	Human rights	

Table IV. *International Classification of Functioning, Disability and Health (ICF) – categories of the component Body Structures contained in the comprehensive ICF Core Set and proposed as candidates for the brief ICF Core Set for older patients*

ICF	Category description	Candidates for the brief ICF Core Set
s110	Structure of brain	×
s120	Spinal cord and related structures	
s320	Structure of mouth	×
s410	Structure of cardiovascular system	
s430	Structure of respiratory system	×
s610	Structure of urinary system	×
s620	Structure of pelvic floor	
s710	Structure of head and neck region	
s720	Structure of shoulder region	×
s740	Structure of pelvic region	
s750	Structure of lower extremity	×
s760	Structure of trunk	
s770	Additional musculoskeletal structures related to movement	×
s810	Structure of areas of skin	

Table V. *International Classification of Functioning, Disability and Health (ICF) – categories of the component Environmental Factors contained in the comprehensive ICF Core Set and proposed as candidates for the brief ICF Core Set for older patients*

ICF	Category description	Candidates for the brief ICF Core Set
e110	Products or substances for personal consumption	×
e115	Products and technology for personal use in daily living	
e120	Products and technology for personal indoor and outdoor mobility and transportation	
e125	Products and technology for communication	
e140	products and technology for culture, recreation and sport	
e145	Products and technology for the practice of religion or spirituality	
e150	Design, construction and building products and technology of buildings for public use	
e240	Light	
e245	Time-related changes	×
e250	Sound	
e310	Immediate family	
e315	Extended family	
e320	Friends	
e325	Acquaintances, peers, colleagues, neighbours and community members	
e330	People in position of authority	×
e355	Health professionals	×
e360	Health related professionals	
e410	Individual attitudes of immediate family members	
e415	Individual attitudes of extended family members	
e420	Individual attitudes of friends	
e425	Individual attitudes of acquaintances, peers, colleagues, neighbours and community members	×
e430	Individual attitudes of people in positions of authority	
e450	Individual attitudes of health professionals	×
e455	Individual attitudes of other professionals	
e460	Societal attitudes	×
e465	Social norms, practices and ideologies	×
e570	Social security, services, systems and policies	×
e580	Health services, systems and policies	

of generic health status measures. The briefer ICF Core Set emerging in the present study is generally feasible in geriatric rehabilitation facilities, albeit it contains slightly more categories. To assess functioning, we proposed a total of 22 categories from the components Body Functions and Activities and Participation, electively, supplemented by 9 categories from Environmental Factors. Use of categories from Body Structures would depend on the underlying health condition, as required by the routine medical assessment.

Among the limitations of this study, it must be considered that selection bias may have occurred due to the use of a convenience sample of patients. Still, the spectrum of impairments and limitations encountered here was consistent with the results from similar studies (26). Another limitation might arise from the statistical selection process. Although we used

two established methods, a split sample approach might have proved superior validation of the results. However, this approach was not possible because of the limited sample size. Further studies of sufficient size would more firmly establish the validity of the proposed selection, and would yield more insights into the association structures and potential scale attributes of the categories (27–28).

Defining an ICF Core Set for geriatric rehabilitation has the advantage of providing the potential framework for standardized reporting and measurement and setting the framework along the continuum of care. ICF Core Sets encourage the measurement of health status from a patient-centred and multiprofessional perspective. This is not a generic but a focused approach, taking into consideration the special needs and characteristics of that population. It must be noted, however, that the rehabilitation pathways and care options described in this paper are limited to institutional models. Rehabilitation of older persons can occur and, indeed, is frequently offered in community-based settings. Thus, the applicability of both the brief and comprehensive ICF Core Set should also be examined in the hand of long-term care providers.

In conclusion, the present selection of categories can be considered an initial proposal, serving to identify the issues most relevant for the assessment and monitoring of functioning in older patients. The main strength of the study lies in the selection of fewer categories facilitating the inclusion of the ICF Core Set into daily clinical routine. If there are categories missing from this smaller Set, the comprehensive ICF Core Set can easily be used to reconfigure the assessment. Also, for multi-morbid patients, a more generic Set could contain all categories from the 3 post-acute ICF Core Sets, completed by the ICF Core Set for older persons. Another advantage of the proposed selection is derived from its participatory approach, taking into consideration the perspectives both of patients and healthcare professionals. Thus, the ICF Core Sets for older patients can contribute substantially to the optimal management of patients, the teaching of health professionals, the planning of studies and the development of new assessment instruments.

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