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Validation of the international classification of functioning, disability and health (ICF) core sets from 2001 to 2019 – a scoping review

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ABSTRACT

Objective: To investigate and summarize the literature on the validation of International classification of functioning, disability and health (ICF) core sets from 2001 to 2019 and explore what research methods have been used when validating ICF core sets.

Methods: The current study is a scoping review using a structured literature search.

Results: In total, 66 scientific articles were included, of which 23 ICF core sets were validated. Most validation studies were conducted in Europe using a quantitative methodology and were validated from the perspective of patients. Analysis methods differed considerably between the studies, and most ICF core sets were validated only once for a single target population or from a single perspective. The comprehensive core sets were validated more often than the brief core sets, and core sets for stroke and low back pain were validated most often.

Conclusion: The results of the current study show that only 66% of the existing ICF core sets are validated. Many of the validation studies are conducted in a European context and from a single perspective. More validation studies of ICF core sets from the perspective of both patients and professionals are needed.

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KEYWORDS

ICF; international classification of functioning; disability and health; core set; validation; psychometrics; review

► IMPLICATIONS FOR REHABILITATION

- ICF core sets aim to facilitate assessments in clinical settings and research.
- Validation studies indicate in general that the ICF core sets are valid and relevant for patients and professionals in the specific areas explored and thus can be used in rehabilitation settings.
- To improve the quality of ICF core sets, more validation studies are needed for ICF core sets not yet tested and for ICF core sets that have been validated only in one study or for one specific population or target group.

Introduction

The International Classification of Functioning, Disability and Health (ICF) was endorsed by the World Health Organization (WHO) in 2001, and it is a classification and framework to describe health [1]. The ICF model presents a multidimensional and biopsychosocial view of health (Figure 1) and can be used for all individuals regardless of their health condition or degree or cause. The classification is based on the individual in a specific context, where the interaction between all ICF parts is important. One of the aims of the ICF is to use numerical codes to serve as a common language for health professionals to describe the functioning of individuals with a health condition and thereby make the results of studies (using the ICF) comparable at national and international levels. The ICF may also be used in research studies, political decisions and within the field of education [1], as it serves as a common language in these areas as well. The ICF consists of 1495 numerical codes arranged in a hierarchy consisting of three parts: *body functions and body structures*, *activity and participation* and *contextual factors*. Each part is divided into chapters (1st

level), and then categories are arranged at different levels (2nd–4th levels). For each level, the category, which includes a definition of the content, becomes more specific [1].

Because of the great extent of ICF, so-called “core sets” have been developed. A core set is a shortlist of selected categories from the whole ICF, specified for a specific health condition (e.g., hearing loss), circumstance (e.g., pregnancy) or situation (e.g., vocational rehabilitation). There are two kinds of core sets: comprehensive core sets, consisting of all ICF categories relevant to the specific area, and brief core sets, which are more compressed versions of the comprehensive core sets [2]. Until 2017, 35 core sets for different health conditions, circumstances, and situations, as well as generic core sets, have been developed [3].

When developing ICF core sets, there are guidelines to follow (Figure 2) [2]. The guidelines include a process of three steps, starting with four preparatory studies: (a) an empirical multicenter study to investigate which functional problems are most frequently experienced in a population with respect to a specific health condition, (b) a systematic literature review, (c) a

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qualitative study focusing on the people experiencing the specific health condition and (d) an experts' survey [2]. The results of preparatory studies are linked to ICF categories [2], and in the next phase, the results are presented at a consensus conference. At the conference, the first version of a brief, comprehensive core set for the specific health condition is created. The final step, Phase II, is the validation of the first version of the core sets [2]. For the validation phase, there are further guidelines, as described by Grill [4].

Quality, in the form of validity, is important for all types of instruments that are intended to be used in both clinical settings and for research purposes. Therefore, when developing and evaluating an instrument, validation is one of the most fundamental issues [5]. There are several kinds of validity, including content, construct and criterion validity. The domain validity can be defined as "the degree to which an outcome measure measures the construct it purports to measure" [6]. Validation can also be described as "the process in which we gather and evaluate the evidence to support the appropriateness, meaningfulness, and usefulness of the decisions and inferences" [7, p.9]. An ICF core set is not an instrument, but it can serve as the foundation for developing instruments for clinical settings and research. Therefore, it is important to ensure that the core set measures

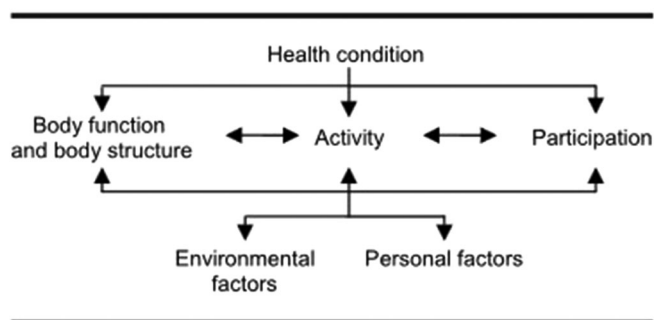


Figure 1. The ICF bio-psycho-social model of health [1].

and captures what it is supposed to, in other words, that the core set has satisfying validity. To ensure the different aspects of the validity, it is possible to evaluate one or several kinds of validity (e.g., content-construct and criterion validity) and other psychometric aspects, such as reliability and responsiveness [6].

When reading the literature about the validation of ICF core sets, it must be noted that the validation studies were conducted differently and with different methods and analyses and from different perspectives.

To date, four literature reviews have been conducted on ICF [8–10] and ICF core sets [11]. The literature reviews show that most ICF studies have been conducted in Europe or the United States, and almost no studies have been conducted in African countries [9,10]. The same trend can be identified for studies focusing on developing ICF core sets [11]. In 2012, 166 studies described the development of ICF core sets for a total of 18 different health conditions, circumstances, or situations. According to Yen et al. [11], the first ICF core set development study was published in 2001, but most studies were published in 2004–2005 and 2010–2012. The most common journals for publications were *Disability and Rehabilitation*, followed by the *Journal of Rehabilitation and Medicine* [11].

The literature studies that have been conducted since 2001 have focused on ICF in general [8–10] or the development of ICF core sets [11], but thus far, no literature reviews are focusing on the validation of ICF core sets. An initial search of validation literature indicates that the recommended guidelines, described by Grill [4], have been followed differently and that many different methods have been used in validation processes. Since validation is the final phase when developing ICF core sets [2] and is an important part of developing new instruments [5], a review study focusing on the validation of ICF core sets is needed. It will serve as a useful and important introduction to the topic when further studying and validating ICF core sets. Hence, this study aims to investigate and summarize the literature on validating ICF core sets from 2001 to 2019. The aim is further to explore what research methods have been used when validating ICF core sets.

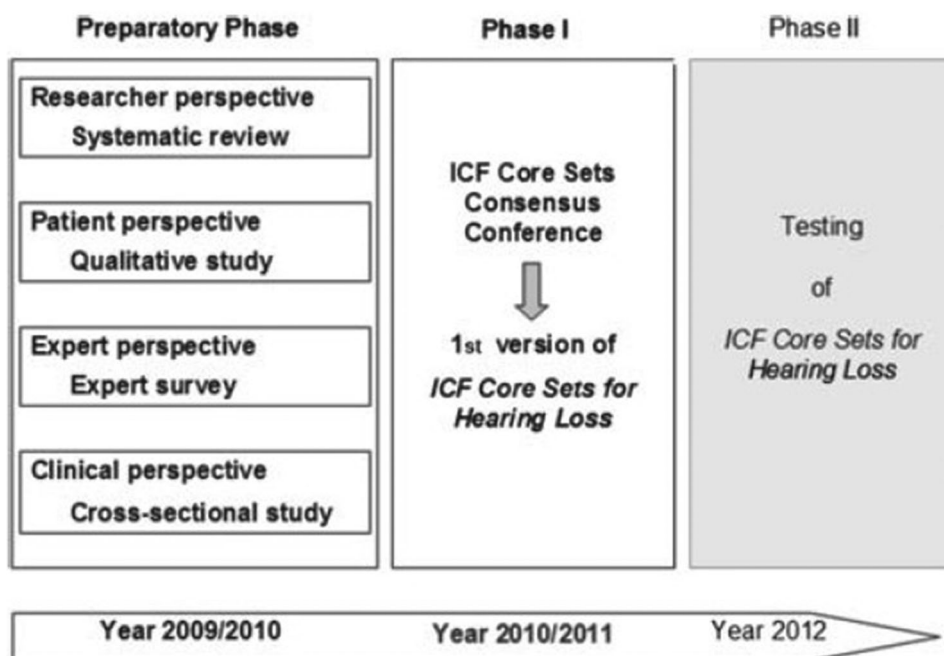


Figure 2. The development process of the ICF core sets for hearing loss [85].

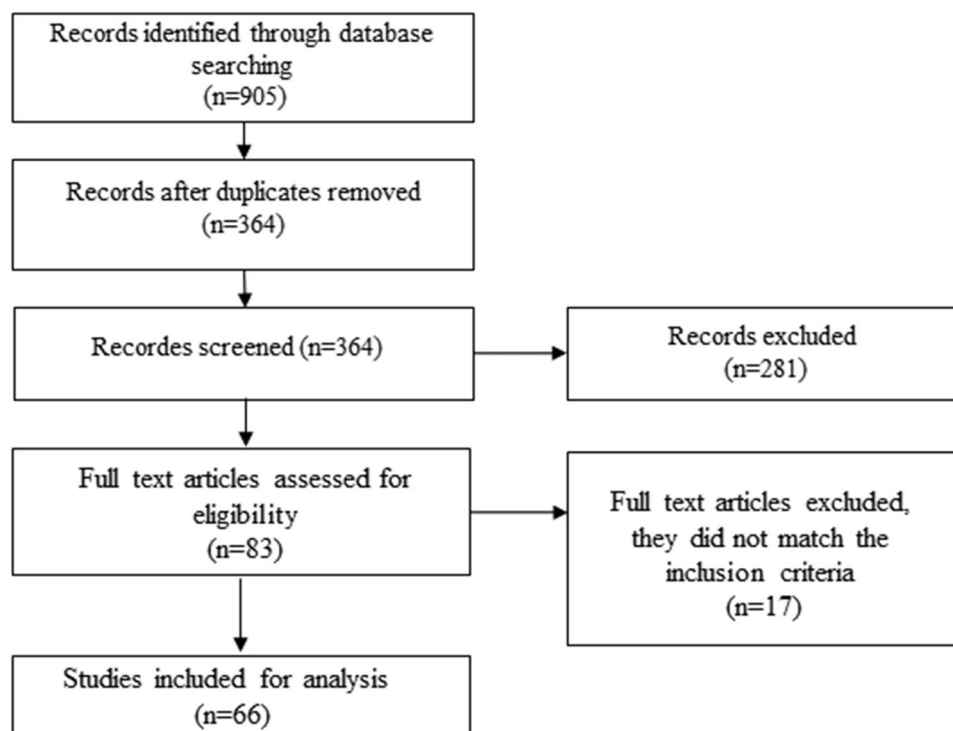


Figure 3. Flowchart of the inclusion process of validation studies.

Materials and methods

Search strategy

The present study is a scoping review following the methodology described by Kahlil et al. [12]. Relevant articles were identified by searches in 10 different scientific online databases: AMED, CINAHL, ERIC, PubMed, Scopus, Sociological Abstracts, Social Services Abstracts, SveMed+, PsycINFO and Web of Science. The search was conducted using both thesaurus and Boolean search methods, and the keywords used were ICF, International classification of functioning disability and health, Core set, Core sets, validation, validity, psychometric and psychometrics. Because ICF terms were endorsed in 2001, the search was limited to articles published between January 1, 2001, and December 31, 2019. No other limits were used. A full search of the PubMed database is shown in [Appendix 1](#).

Selection criteria

Since 2001, when the ICF core set project started, core sets within 35 different areas/health conditions have been developed (including conditions and settings such as neurological conditions and post-acute care) [3]. When developing ICF core sets, there is a certain development process to follow [2], and only core sets that had been developed according to these guidelines were included in the present review to narrow the data and increase the reliability. Furthermore, to narrow the extent of the literature review, only core sets for adults were included, and core sets for children and youth (ICF-CY) were excluded. Articles were included if they met the following inclusion criteria: they were published between January 2001 and December 2019, "ICF core set" was mentioned in the title or abstract, the language of the article was English and the article focus was psychometric testing, mainly a validation of an ICF core set. Articles focusing on reliability or other psychometric aspects were also included in the first stage.

Articles were excluded from the present study if they were (1) not original articles, for example, editorials, letters, commentary notes or conference papers, (2) published in languages other than English, (3) validation studies of ICF-CY or focusing on people aged ≤ 18 years and (4) not a validation of core sets as defined, for example, by validation of ICF in general or were instruments based on ICF core sets. The last exclusion criterion was set to limit the search and because it was hard to assess to what degree each instrument was based on ICF core sets (in total or in some parts) and thus should be included.

Data extraction and analysis

Two reviewers independently reviewed all abstracts. In the next step, both reviewers read the full text of all selected articles, and data were extracted based on a data entry sheet created for this study. The content of the data sheet was based on what is recommended for scoping reviews [12–14], and the variables first author, publication year, place of origin, journal, kind of core set (e.g., comprehensive or brief), core set, study population, sample size, study method (e.g., quantitative, qualitative or mixed methods), analysis method (e.g., statistics, content analysis), and kind of validity examined were examined. The data extraction was performed with a focus on which core sets had been validated and which methods had been used. For analysis, descriptive statistics were used, and the frequency of the variables was calculated. The software Statistical Package for Social Sciences (SPSS) was used for analysis.

Results

Included studies

In total, 905 articles were identified in the initial database search. After removing duplicates and articles not meeting the inclusion criteria, 83 studies were included. The full text of these was read,

and from these, 66 were included [15–80]. The data collection process is described in Figure 3.

Core sets

Twenty-three different core sets were validated, and those most examined included the ICF core sets for stroke and low back pain followed by osteoarthritis, multiple sclerosis and rheumatoid arthritis (Table 1). The 23 core sets were validated in 66 studies, and three studies included validations of more than one core set. In a minority of the studies ($n = 3$), brief core sets were validated. The comprehensive ICF core set, or both comprehensive and brief core sets together, was validated in 63 studies.

Publications

The ICF core set validation studies were published in 38 scientific journals; the nine journals with more than one publication are presented in Figure 4. The scientific journal with the most frequent publication of ICF validation studies was Disability and Rehabilitation (29%). The second-most frequent journal was the Journal of Rehabilitation and Medicine (18%), followed by the

Table 1. Number of validation studies.

Core set ($n = 23$)	Number of validation studies ($n = 66^*$)
Stroke	11
Low back pain	9
Osteoarthritis	7
Multiple sclerosis	5
Rheumatoid arthritis	5
Diabetes mellitus	4
Breast cancer	3
Obstructive pulmonary diseases	3
Head and neck cancer	2
Neurological conditions	2
Neuromuscular diseases	2
Post-acute rehabilitation facilities	2
Schizophrenia	2
Spinal cord injury	2
Vocational rehabilitation	2
Cardiopulmonary diseases	1
Chronic obstructive pulmonary diseases	1
Chronic widespread pain	1
Geriatric	1
Geriatric post-acute rehabilitation facilities	1
Hand conditions	1
Hearing loss	1
Musculoskeletal diseases	1

*3 studies examined/validated more than one core set $n = 69$.

European Journal of Physical and Rehabilitation Medicine (16%). The first validation study was published in 2005, and the last study included in the present study was published in 2019. Most studies were published between 2009 and 2015, with a peak in 2011, when 12 validation studies were published (Figure 5).

Place of origin

There were 53 different people named as first authors in the studies, and the studies originated from 64 different countries (Table 2); the majority were from European countries (80%), where most originated in Germany and Switzerland. Only 11% of the studies were based in Asia, 5% in South America and Australia and 3% in North America. There were no ICF core set validation studies from Africa.

Methods used in the validation studies

Most of the studies used a quantitative methodology ($n = 50$, 76%), while 13 used a qualitative methodology (20%) and three studies used a mixed methodology (5%). Most investigated the content validity ($n = 59$, 89%), and in six of these studies, both content and criterion validity were examined. A few studies investigated only criterion validity ($n = 4$, 6%) or construct validity ($n = 3$, 5%).

The analysis methods varied depending on methodology and the kind of validity examined. The most commonly used method of data collection was the Delphi method, followed by interviews and, finally, comparisons with questionnaires used in clinical settings and research using ICF linking as the analysis method. ICF linking means that meaningful units in health-related information are identified and linked to ICF according to the linking rules [81]. For analysis, the most common methods were statistical methods such as descriptive statistics and modern test theory ($n = 49$, 74%), followed by qualitative analysis such as content analysis or thematic analysis ($n = 13$, 20%) and linking to other questionnaires ($n = 4$, 6%).

Validation study populations

Most of the validation studies identified in this study examined the validation of core sets from the perspective of patients and professionals ($n = 64$, 97%). Of these 64 studies, approximately one-third ($n = 22$, 34%) investigated validity from a professional/clinical perspective. In the group of professionals, seven different

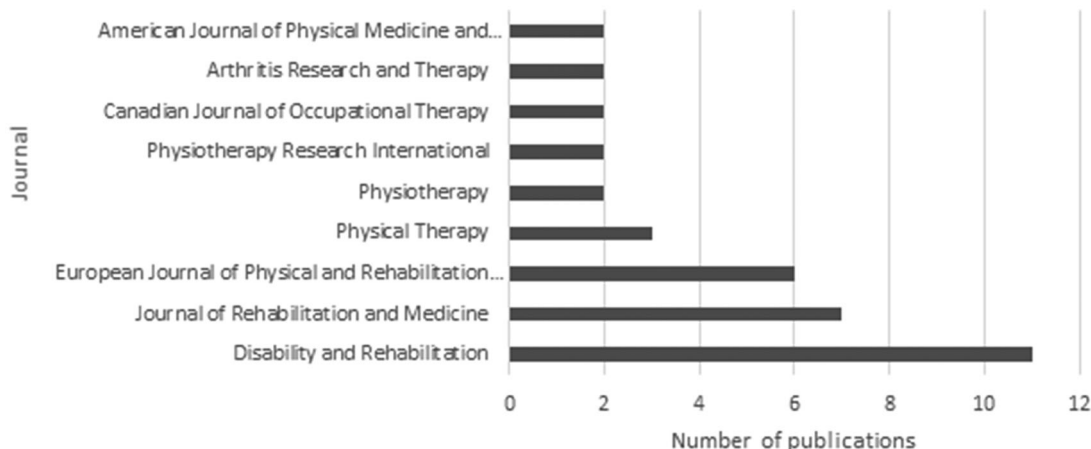


Figure 4. Number of publication studies in different scientific journals.

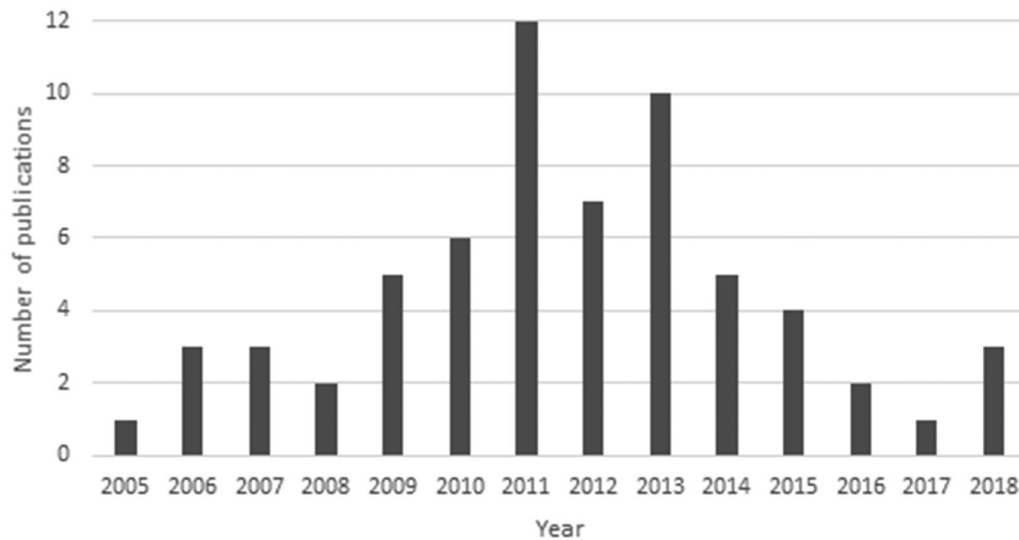


Figure 5. Publication years.

Table 2. Place of origin for the included studies, presented by continent and country.

Place of Origin	Number of Publications
Europe	51
Germany	23
Switzerland	8
Turkey	4
Norway	3
Spain	3
Netherlands	2
Sweden	2
Austria	1
Finland	1
Ireland	1
Italy	1
Portugal	1
United Kingdom	1
Asia	7
Japan	2
Singapore	2
China	1
Kingdom of Saudi Arabia	1
Malaysia	1
Africa	0
Australia	3
Australia	3
South America	3
Brazil	3
North America	2
Canada	1
US	1

occupations were identified, most commonly physiotherapists (36%), followed by occupational therapists (18%) and physicians (18%). All study populations are shown in Table 3. Two studies (3%) compared the core sets with other instruments, so there were no study populations.

Discussion

Results

This scoping review explored the validation of ICF core sets. A total of 66 studies were included in the review, reporting validation processes for 23 different core sets. Most of the validation

Table 3. Study populations of patients and professionals.

Study population	Number of studies (n = 64)
Patients	42
Professionals	22
Occupational therapists	4
Physiotherapists	8
Nurses	2
Physicians	4
Psychologists/psychiatrists	2
Speech and language therapists	1
Undefined occupation	1

studies used quantitative methodology and investigated content validity. The perspective most validated was the patient perspective, followed by the professional perspective. The vast majority of the studies originated in Europe, and the studies were foremost published in rehabilitation journals.

Validation process and methods

When developing new instruments, it is important to examine psychometric properties such as validity and reliability [5], and this also applies to ICF core sets. Therefore, the final step described in the development process of ICF core sets is validation and implementation [2]. Considering this, it is noteworthy that only 66% of the core sets have been validated, even though it has been several years since the first versions of the core sets were developed. The validation phase is important in ensuring the validity of the core sets for the target group and in different cultural settings. Valid ICF core sets promote the robustness of instruments developed based on the ICF core set, and the questionable validity of core sets is a less than ideal foundation for an instrument. However, the use of validated instruments, in general, may be uncommon in clinical settings; for example, studies in the audiological field showed that many of the instruments used in audiological rehabilitation have not been validated, and there is a need for evidence-based instruments [81,82]. These examples from the audiological field can be assumed to be similar to and representative of other fields.

The results show that it is common to investigate the validity of the comprehensive core set alone or both the comprehensive and brief core sets together during the validation process. In only a few studies, the brief core set alone was validated. There is

Table 4. Protocol for the current scoping review.

First author	Publication year	Source of origin	Journal	Kind of Core set	Core set	Study population	Sample size	Method	Validity	Analyze methods
Abullah.M.	2011	Malaysia	Annal academy of medicine	Comprehensive	Diabetes Mellitus	Patients	100	Quantitative	Content and criterion	Statistics
Aichini.B. Alfakir. R.	2015 2015	Italy USA	Disability and rehabilitation International journal of audiology	Comprehensive Brief	Vocational rehabilitation Hearing loss	Patients Patients	24 49	Qualitative Quantitative	Content Construct	Content analysis Statistics
Algurén.B. Awad.H.	2010 2013	Sweden Kingdom of saudi Arabia	Disability and rehabilitation American journal of physical medicine and rehabilitation	Comprehensive Comprehensive	Stroke Diabetes Mellitus	Patients Physical therapists	99 30	Quantitative Quantitative	Content Content	Statistics Statistics
Bagraith.K.S.	2013	Australien	Journal of rehabilitation and medicine	Comprehensive and Brief	Low back pain	Patients	33	Qualitative	Content	Linking
Bagraith.K.S.	2018	Australien	International association of the study of pain	Comprehensive and Brief	Low back pain	Patients	7	Qualitative	Content	Linking
Bautz-Holter.E.	2008	Norway	European journal of physical and rehabilitation medicine	Comprehensive	Low back pain	Patients	118	Quantitative	Content	Statistics
Becker.S. Berno.S. Bos.I.	2010 2012 2013	Germany Germany Netherlands	Psycho-Oncology Journal of neurology European journal of physical and rehabilitation medicine	Comprehensive Comprehensive Comprehensive	Head and neck cancer Multiple sclerosis Neuromuscular diseases	Psychologists Physicians	34 99	Quantitative Quantitative Quantitative	Content Content Criterion	Statistics Statistics Statistics
Bossmann.T. Coenen.M	2011 2006	Germany Germany	Physiotherapy Arthritis research and therapy	Comprehensive Comprehensive	Osteoarthritis Rheumatoid arthritis	Physical therapists Patients	77 49	Quantitative Qualitative	Content Content	Statistics Content analysis
Conrad.A.	2012	Germany	Scandinavian journal of occupational therapy	Comprehensive	Multiple sclerosis	Occupational therapists	61	Quantitative	Content	Statistics
Conrad.A. Cooney.M. Ewert.T.	2012 2013 2010	Germany Ireland Germany	Physical therapy Disability and rehabilitation Disability and rehabilitation	Comprehensive Comprehensive Comprehensive and Brief	Multiple sclerosis Breast cancer Rheumatoid arthritis, Low back pain, Osteoarthritis, obesity, stroke, neurological conditions, early post- acute facilities	Physical therapists Patients Patients	80 34 475	Quantitative Qualitative Quantitative	Content Content Content	Statistics Content analysis Statistics
Gebhardt.C	2010	Germany	Journal of rehabilitation and medicine	Comprehensive	Rheumatoid arthritis	Physicians	45	Quantitative	Content	Statistics
Glaessel/Glässel.A. Glaessel/Glässel.A.	2011 2014	Switzerland Switzerland	Physiotherapy European journal of physical and rehabilitation medicine	Comprehensive Comprehensive	Breast cancer Stroke	Physiotherapists Patients	59 24	Quantitative Qualitative	Content Content	Statistics Content analysis
Glaessel/Glässel.A. Glaessel/Glässel.A. Glaessel/Glässel.A.	2012 2011 2010	Switzerland Switzerland Switzerland	Disability and rehabilitation Physical therapy Canadian journal of occupational therapy	Comprehensive Comprehensive Comprehensive	Stroke Stroke Stroke	Patients Physiotherapists Occupational therapists	60 146 69	Qualitative Quantitative Quantitative	Content Content Content	Content analysis Statistics Statistics
Grill.E.	2006	Germany	American journal of physical medicine and rehabilitation	Comprehensive and Brief	Post-acute rehabilitation facilities			Quantitative	Criterion	Linking
Herrmann.K.H	2011	Germany	Spinal cord	Comprehensive and Brief	Spinal cord injury	Occupational therapists	67	Quantitative	Content	Statistics
Hiebinger.R.	2009	Germany	Arthritis research and therapy	Comprehensive	Chronic widespread pain	Patients	33	Qualitative	Content	Content analysis
Jobst.A.	2013	Germany	The open respiratory medicine journal	Comprehensive	Chronic obstructive pulmonary diseases	Physicians	76	Quantitative	Content	Statistics

(continued)

Table 4. Continued.

First author	Publication year	Source of origin	Journal	Kind of Core set	Core set	Study population	Sample size	Method	Validity	Analyze methods
Karhula.M.E.	2013	Finland	Disability and rehabilitation	Comprehensive and Brief	Multiple sclerosis	Patients	113	Quantitative	Criterion	Statistics
Kinoshita.S.	2016	Japan	Journal of rehabilitation and medicine	Comprehensive	Stroke and Neurological conditions	Patients	117	Quantitative	Criterion	Statistics
Kirchberger.I.	2009	Germany	Diabetic medicine	Comprehensive	Diabetes Mellitus	Patients	40	Qualitative	Content	Content analysis
Kirschberger.I.	2007	Germany	Canadian journal of occupational therapy	Comprehensive	Rheumatoid arthritis	Occupational therapists	41	Quantitative	Content	Statistics
Kirschneck.M.	2011	Germany	Manual therapy	Comprehensive	Low back pain	Physical therapists	84	Quantitative	Content	Statistics
Kurtais.Y.	2011	Turkey	BMC Musculoskeletal disorders	Comprehensive	Osteoarthritis	Patients	100	Quantitative	Construct	Statistics
Kus.S.	2011	Germany	Hand therapy	Comprehensive	Hand conditions	Patients	260	Quantitative	Content	Statistics
Köseoglu.B.F.	2013	Turkey	Turkish journal of geriatrics	Comprehensive	Stroke	Patients	101	Quantitative	Content and criterion	Statistics
Leib.A.	2012	Switzerland	Head and neck	Comprehensive	Head and neck cancer	Physicians	55	Quantitative	Content	Statistics
Lage.S.M.	2018	Brazil	Disability and rehabilitation	Comprehensive and Brief	Obstructive pulmonary diseases	Patients	35	Mixed method	Content	Statistics and linking
Lemberg.	2010	Germany	European journal of physical and rehabilitation medicine	Comprehensive	Stroke	Experts on stroke rehabilitation	54	Quantitative	Content	Statistics
Lygren.H.	2013	Norway	Physiotherapy research international	Comprehensive and Brief	Low back pain	Patients	98	Mixed method	Content	Content analysis and Statistics
Marques.A.	2013	Portugal	Disability and rehabilitation	Comprehensive	Obstructive pulmonary diseases	Patients	51	Qualitative	Content	Content analysis and linking
Kaech.M.V.M.	2016	Switzerland	Physical therapy	Comprehensive	Vocational rehabilitation	Physical therapists	62	Quantitative	Content	Statistics
Khan.F.	2012	Australia	Journal of rehabilitation and medicine	Comprehensive	Breast cancer	Patients	85	Quantitative	Content	Statistics
Muller.M.	2011	Germany	Journal of rehabilitation and medicine	Comprehensive and Brief	Post-acute rehabilitation facilities	Patients	165	Quantitative	Content	Linking
Muller.M.	2011	Germany	Journal och rehabilitation and medicine	Comprehensive	Neuromuscular diseases, Musculoskeletal diseases and Cardiopulmonary diseases	Patients	391	Quantitative	Content	Statistics
Mullis, R	2007	United Kingdome	Journal of rehabilitation and medicine	Comprehensive and Brief	Low back pain	Patients	402	Quantitative	Content	Statistics
Nuno.L.	2018	Spain	Journal of pychiatric research	Comprehensive and Brief	Schizofrenia	P-sychiatrists	352	Quantitative	Content	Statistics
Nuno.L.	2019	Spain	International journal of mental health nursing	Brief	Schizofrenia	Nurses	101	Quantitative	Content	Statistics
Oberhauser.C.	2013	Germany	Arthritis care and research	Brief	Osteoarthritis	Patients	879	Quantitative	Content	Statistics
Paanalahiti.M.	2014	Sweden	International journal of rehabilitation	Comprehensive	Stroke	Patients	22	Qualitative	Content	Content analysis
Rauch.A.	2009	Germany	Journal of nursing studies	Comprehensive	Rheumatoid arthritis	Nurses	50	Quantitative	Content	Statistics
Rauch.A.	2009	Switzerland	Physiotherapy research international	Comprehensive	Obstructive pulmonary diseases	Physiotherapists	91	Quantitative	Content	Statistics
Renom.M.	2014	Spain	International journal of language and communication disorders	Comprehensive	Multiple sclerosis	Speech- and language therapists	34	Quantitative	Content	Statistics
Riberto.M.	2012	Brazil	Disability and rehabilitation	Comprehensive	Stroke	Patients	132	Mixed method	Content	Statistics
Riberto.M.	2014	Brazil	European journal of physical and rehabilitation medicine	Comprehensive	Low back pain	Patients	135	Quantitative	Content	Statistics
Roe.C.	2009	Norway	rehabilitation medicine	Comprehensive	Low back pain	Patients	118	Quantitative	Content	Statistics

(continued)

Table 4. Continued.

First author	Publication year	Source of origin	Journal	Kind of Core set	Core set	Study population	Sample size	Method	Validity	Analyze methods
Sjoorenberg.S.L.W. Stamm.T.	2015 2005	Netherlands Austria	European journal of physical and rehabilitation medicine Disability and rehabilitation Arthritis and rheumatism (arthritis care and medicine)	Comprehensive	Geriatric Rheumatoid arthritis	Patients	267	Quantitative	Content	Statistics
				Comprehensive		Patients	21	Qualitative	Content	Content analysis
Stier-Jarmer.M.	2011	Germany	Journal of rehabilitation and medicine	Comprehensive	Geriatric post-acute rehabilitation facilities	Patients	209	Quantitative	Content	Statistics
Tath.U.H.	2019	Turkey	Turkish journal of physical medicine and rehabilitation	Brief	Spinal cord injury	Patients	120	Quantitative	Construct	Statistics
Tsutsui.H.	2015	Japan	Cinical and experimental nephrology	Comprehensive	Diabetes Mellitus	Patients	176	Quantitative	Content and criterion	Statistics
Wang.P. Wieg.M.	2014 2017	China Germany	Clinical rehabilitation Disability and rehabilitation	Comprehensive	Stroke	Patients	208	Quantitative	Content	Statistics
				Comprehensive	Osteoarthritis	Patients	375	Quantitative	Content and criterion	Statistics
Xie.F.	2007	Singapore	Journal of rheumatology	Comprehensive	Osteoarthritis	Patients	122	Quantitative	Content and criterion	Statistics
Xie.F.	2008	Canada	Scandinavian journal of rheumatology	Brief	Osteoarthritis	Patients	122	Quantitative	Content	Statistics
Xie.F.	2006	Singapore	Annals of rheumatic diseases	Comprehensive and Brief	Osteoarthritis	Patients	41	Qualitative	Content	Content analysis
Öztuna.D.	2011	Turkey	Turkish journal of rheumatology	Comprehensive	Low back pain	Patients	100	Quantitative	Content and criterion	Statistics

All included validation studies are presented.

strength in validating both core sets simultaneously, since the items in the brief core set are included in the comprehensive core set. This means that all the included ICF categories are validated at the same time. On the other hand, the brevity of the brief core set makes it more useful in clinical settings and research, and because of this usefulness, it may be more relevant to validate only the brief ICF core sets to avoid using invalid versions of instruments.

In most validation studies, a quantitative methodology was used (76%), which is a common method in validation studies and is also recommended for the validation of ICF core sets [4]. Other possible methods include different qualitative methods and mixed methods, which have also been used in ICF core set validation studies. The most common kind of validity examined in ICF core set validation studies is content validity, which is an elemental kind of validity [5,6], and only a few studies have investigated construct validity or criterion validity, which are also important aspects of validity [5,6]. Construct validity shows whether an instrument is unidimensional or if there are items that do not fit the model, while criterion validity compares the items with other instruments used in the same field to confirm whether they are relevant [5]. These aspects were not captured in most ICF core set validation studies, which can be considered a shortcoming.

The choice of analysis methods in the validation studies varied considerably based on the methodological approach and the aim of the study. The most common analysis method in the studies was to follow the analysis methods described in Grill's validation recommendations [4] or to use the so-called Delphi survey method using statistical analysis. The Delphi methodology was commonly used for studies conducted in Germany and Switzerland.

For whom is the core set valid?

A question to be asked when exploring validation of the ICF core sets is for whom the core set is valid? The core sets that had been validated most often included the core sets for *stroke*, *low back pain*, *osteoarthritis*, *multiple sclerosis* and *rheumatoid arthritis*. These core sets were validated from the perspectives of different stakeholders, such as patients and rehabilitation professionals. To gain a comprehensive understanding of the functioning and health of individuals living with a specific health condition, validation of the corresponding core set from different perspectives is warranted. There were no validation studies identified for the core sets for *vertigo*, *sleep*, *inflammatory bowel diseases*, *ankylosing spondylitis*, *osteoporosis*, *traumatic brain injury*, *bipolar disorders* and *depression*. However, most of these health conditions are highly relevant with respect to rehabilitation interventions and call for validation if they are to be used in clinical rehabilitation practice.

The study populations consisted mostly of patients with specific health conditions (based on the core set investigated) or professionals working in the specific field. Within the group of professionals, validation was common with occupations working within rehabilitation settings, such as physiotherapists, occupational therapists, psychologists and speech therapists as well as physicians and nurses. These findings support the fact that ICF is applied within the rehabilitation field and is used for target groups and organizations where it is to be practiced [1]. However, depending on which profession was involved in the validation, the perspectives may differ. For example, the profession most frequently involved in the validation process is physiotherapy, which focuses on certain aspects of rehabilitation, which is within the

scope of the profession. Other professions focus on other aspects of the same health condition. To make a multidimensional instrument as valid as possible, different perspectives are needed for the same core set. Thus, even if a core set is validated from one professional perspective, adding other perspectives will further increase the validity. A similar argument can be made for the patient perspective in the validation process, and combined validation from both the patient and professional perspectives may be preferable to obtain theoretical, clinical and individual perspectives.

From a diversity perspective, most validation studies included both sexes, even though there was a slight tendency for women to be overrepresented. This could be because some health conditions, such as breast cancer, were investigated specifically in women [37,83]. Age is another variable to consider in validation studies; these studies focused mainly on adults in general, with a mean approximate age of 60 years. Only a few studies have focused on a specific age group, "older adults" [72]. The ICF categories in each core set may be of different importance for different age groups, which could be identified in the validation process. The level of education was rarely described in validation studies, and in the few studies where it was examined, the terminology used differed. Hence, validity for a diverse population is less explored, meaning that diversity is an important factor to include in future validation studies.

One fact of note in this scoping review (Table 4), as in previous ICF review studies, is that most of the studies were conducted in Europe or the United States. This applies to ICF studies in general [8–10] and studies focusing on the ICF development process [11]. Of the validation studies, 80% were conducted in Europe, and only a few were conducted in the United States. Most ICF development studies were conducted in Germany, the Netherlands and Switzerland, where the ICF research branch is located [84]. The current study also noted that no core sets have been validated in African countries. This finding is expected, as few other ICF core set studies have taken place in this region [11]. Additionally, this lack of cultural diversity is a disappointing finding, as ICF core sets need to be valid in all cultural contexts, including high- and low-income countries; this is also recommended when validating new instruments in general [5]. Previous ICF review studies have highlighted the "information paradox" identified by the WHO, meaning that there are information gaps for countries with a high health burden [9]. This seems to be confirmed with respect to ICF validation studies as well.

The quality and the results of validation studies were not analyzed in the current study, but when reading through, the results indicated in general that core sets are valid and thus relevant for patients and professionals in the specific area explored.

Publications

In total, 66 published validation studies were included in this review. Most of these studies were published in scientific journals, focusing on rehabilitation and medicine, which is in line with the fields where ICF is practiced [1] and with previous review studies of ICF [9–11]. The first ICF validation study was published in 2005, four years after the classification was introduced and the first core sets were initiated [9–11]. Validation studies have been published at a similar pace, with a few years of delay after the specific ICF core sets were developed. This time frame is reasonable, considering that the development of core sets is an extensive process including several research studies and a consensus conference [2].

Strengths and limitations

It is important to acknowledge that the scoping review methodology contains both strengths and limitations. For the search strategy, guidelines from the Örebro University library were used to identify relevant databases and the keywords most appropriate for the study area. This is considered a strength, as the quality of a study is dependent on identifying relevant articles. However, it is possible that some relevant publications were not included due to the choice of search strategies and keywords, even though the choices were made in line with established guidelines for literature reviews.

In the literature search, concepts related to validity (e.g., psychometrics and reliability) were included. This resulted in a more extensive number of articles to read and assess, but it decreased the risk of excluding relevant articles. The inclusion criteria required that ICF core sets be developed according to the recommendations, so studies involving the development of core sets using another methodology were excluded. For this reason, it is possible that some relevant publications were not included.

A limitation of this scoping review is that it does not include studies examining the validation of instruments that have been developed from ICF core sets. These studies were excluded because it was difficult to assess the extent to which the instruments were developed on the basis of ICF core sets, whether it was based on the core set in full or only on certain parts.

In line with the scoping review methodology, the quality of the articles included was not assessed [12]. This could make it hard to identify research gaps due to poor quality. However, by not addressing quality appraisal issues, this study potentially includes a great range of study designs and empirical methods, which is a strength. However, it was noted during the selection process that the quality differed among the included studies, which makes it relevant to include this aspect in future review studies.

Conclusion

The results show that additional validation studies are needed, especially from the perspectives of different stakeholders with different characteristics, such as patients of different ages and professionals from diverse disciplines. This fact indicates that the validation of ICF core sets in general has just begun, and more validation studies are needed, both for the core sets not yet tested and for the core sets only validated in one study or for one population or target group.

Disclosure statement

The authors report no declaration of interest.

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Appendix 1

Full electronic search strategy for the database pubmed 12 february 2019

Search information

The search was made 12 February 2019. In total, this search resulted in 176 articles. A final complementary search were made 2 December 2019 to include articles from 2019.

Limitations

Articles published between January 1, 2001, and December 31, 2018.

Search strategy for ICF core sets

- #1 ICF
- #2 International classification of functioning disability and health
- #3 Core set
- #4 Core sets

Search strategy for validation

- #5 validation
- #6 validity
- #7 psychometric
- #8 psychometrics

Search strategy for all

- #9. ((#1) OR (#2) OR (#3) OR (#4))
- #10 ((#5) OR (#6) OR (#7) OR (#8))
- #11 ((#9) AND (#10))