Linking the Spinal Function Sort and Functional Capacity Evaluation Tests to the International Classification of Functioning, Disability and Health Core Set of Vocational Rehabilitation

Lassfolk, M.; Escorpizo, R.; Korniloff, K.; Reneman, M.

Published in:
Journal of Occupational Rehabilitation

DOI:
10.1007/s10926-020-09905-y

Journal of Occupational Rehabilitation (2021) 31:166–174
https://doi.org/10.1007/s10926-020-09905-y

Linking the Spinal Function Sort and Functional Capacity Evaluation Tests to the International Classification of Functioning, Disability and Health Core Set of Vocational Rehabilitation

M. Lassfolk[1] · R. Escorpizo[2,3] · K. Korniloff[4] · M. Reneman[5]

Published online: 4 June 2020

Abstract
Purpose The International Classification of Functioning, Disability and Health (ICF) Comprehensive Core Set for Vocational Rehabilitation (CSVR) is a shortlist of functioning domains developed for use with people of working age that experience limitation in their work-related functional capacity. Functional capacity can be measured by, for example, Spinal Function Sort pictorial questionnaire and Functional Capacity Evaluation tests such as the: Complete Minnesota Dexterity Test, grip strength test, pushing, pulling, progressive iso-inertial lifting and carrying. However, these tests have not yet been linked to the CSVR. The objective of this study was to evaluate the extent to which the Spinal Function Sort and Functional Capacity Evaluation tests could be mapped to the ICF categories of the CSVR. *Methods* Two raters independently performed the linking of the Spinal Function Sort and the Functional Capacity Evaluation related tests to the CSVR according to established ICF linking rules. If an item could not accurately be linked to a CSVR category, the item was linked to the most fitting ICF category. Disagreements were resolved in a consensus meeting. Interrater agreement between raters was expressed in percentage agreement. *Results* The Spinal Function Sort and Functional Capacity Evaluation tests described a total of 39 unique ICF categories, out of which only six (15%) came from the CSVR. Interrater agreement ranged between 17 and 91%. *Conclusions* The study found six categories including vestibular functions, muscle power functions, writing, lifting and carrying objects, fine hand use and hand and arm use within the CSVR using the Spinal Function Sort and The Complete Minnesota Dexterity Test. With the rest of the items, the CSVR was considered too broad.

Keywords Lifting · Carrying · Pushing · Pulling · Complete minnesota dexterity test · Grip strength · Spinal function sort · ICF

Introduction

The International Classification of Functioning, Disability and Health (ICF) was developed to describe functioning as a dynamic interaction between the person's health condition and contextual factors. The ICF includes more than 1400 categories and to make the ICF easy to use, comprehensive and brief core sets have been developed. These sets contain a shortlist of items that are suitable to a particular situation or a health condition and can serve as a standard to assess functioning. The comprehensive core set for vocational rehabilitation (CSVR) includes 90 categories [1] for use with people of working age that experience limitations in their work-related functional capacity or restricted work participation [2, 3]. Functional capacity can be measured by self-report and based on performance [4–12] such as the Spinal Function Sort pictorial questionnaire (SFS) and

✉ M. Lassfolk
marika.lassfolk@multi.fi

1 University of Eastern Finland, Kuopio, Finland

2 Department of Rehabilitation and Movement Science, The University of Vermont, Burlington, VT, USA

3 Swiss Paraplegic Research, Nottwil, Switzerland

4 School of Health and Social Studies, JAMK University of Applied Sciences, Jyväskylä, Finland

5 Department of Rehabilitation Medicine, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands

Functional Capacity Evaluation (FCE) tests (Complete Minnesota Dexterity Test (CMDT), grip strength test, pushing, pulling, progressive iso-inertial lifting (PILE) and carrying).

The SFS contains pictures representing both work-related tasks and activities of daily living [4–7]. The patient is asked to look at each picture and rate his/her abilities related to task or activity. The SFS is predictive of future work status [4–7]. FCEs are assessments of work-related functional capacity [8, 14] and consist of several tests, with each representing a work-related activity. An evaluation of functional capacity is relevant to facilitate and implement return-to-work strategies, and if necessary help in the process of receiving disability benefit and whether early retirement is an option for the individual [8, 13, 14]. Functional capacity as a concept can be considered as an indicator of a worker's potential or realized ability to engage in work-related activities or tasks needed to meet job expectations [14]. Defined within the context of the ICF, "an FCE is an evaluation of capacity of activities that is used to make recommendations for participation in work while considering the person's body functions and structures, environmental factors, personal factors and health status" [8]. The FCE provides "some measure of the physical capabilities of a worker relative to the physical and psychological demands of a specific setting or environment" [10] and have been shown to complement the assessment of work ability of claimants with musculoskeletal disorders [6, 12–17].

Because the ICF is a reference framework to describe work functioning it is important to link common work capacity tests to the ICF with potential to develop an international database for work-related functional tests that follow a biopsychosocial framework. Such a database would help professionals in selecting appropriate tests when assessing work-related functioning and when recommending interventions. Additionally, ICF linked tests will provide a classified terminology, providing professionals with a common and standardized language to describe work functioning, and interpreting and comparing results of different studies possible [8, 18–20]. Even though, both the SFS and the FCE tests are well known in rehabilitation settings worldwide, and FCE has been conceptually positioned within ICF, no attempts have been made to link the SFS and FCE tests to the CSVR to understand the biopsychosocial aspects of work-related functional capacity that the SFS and FCE tests intend to measure. Therefore, the objective of this study was to link the SFS and six FCE-related tests (CMDT, grip strength test, pushing, pulling, PILE and carrying), to CSVR categories and thereby evaluate the extent to which these could be mapped to the CSVR categories.

Methods

Design and Procedures

The linking was based on established linking rules. The linking rules provide standardized ways of how to link concepts to specific ICF categories [21], and ensure consistency amongst raters. The process started by identifying the purpose of the test to be linked, identifying main and additional concepts and identifying and documenting the perspective of those concepts. The "meaningful" concepts were then identified within each item of each test. Next, the tests were linked to the CSVR. If a meaningful concept could not accurately be linked to a CSVR ICF category, the item was linked to best fitting ICF category. The purpose of allowing other than CSVR categories was to analyze how well it is possible to describe work-related tasks with this particular shortlist. For example, pushing and pulling, lower from bench to the floor were all linked to, 3rd level categories, d4451 (pushing), d4450 (pulling) and d4305 (putting down objects) respectively [22]. Hereafter, comparison between raters linking results were done. In case of a disagreement, a third person, who is a senior researcher with focus on the ICF and vocational rehabilitation, was consulted. Finally, percentage of agreement of linking tests to the ICF was calculated.

Raters

The SFS items and FCE tests (description under the heading comparator tests) were independently linked to the CSVR (see description under reference) by two raters. Both raters are physical therapist and have experience in work disability-related research and practice. Rater one has 22 years of experience in conducting evaluation of functional capacity and three years of conducting FCEs according to the protocol by Matheson and Associates and is knowledgeable of the ICF, while rater two is a senior researcher with research related experience in ICF since 2000. The knowledge and skills of both raters complement each other.

Reference

The CSVR contains 90 categories ranging from body functions (17 categories), activities and participation (40 categories), and environmental factors (33 categories). It was intended for use with people of working age that experience work-related limitation and restriction [23].

Comparator Tests

SFS

The SFS is a picture-based questionnaire and consists of 50 both work related activities and activities of daily living. The tasks include a wide range of daily living and vocational activities graded from light to heavy material handling. The patient rates each task on a separate evaluation sheet on a 5-point scale. Separate tasks are counted together by the assessor and a single rating of perceived functional ability ranging from 0 to 200 is obtained. For example, an SFS score of < 100, is categorized as having "minimal" working capacity and > 196 as "very heavy" work capacity. The score is categorized according to the work demands as defined by the Dictionary of Occupational Titles (DOT), thereby allowing a comparison with perceived functional ability and work [4, 24].

FCE

For the purpose of this study six FCE – related tests from the protocol by Matheson and Associates were selected. The CMDT was initially developed to screen personnel for jobs requiring arm and hand dexterity, but is now also often used in FCEs. The test evaluates manual speed, including eye-hand coordination, repetitive pinching and repetitive light palmar pinch and repetitive forearm supination/pronation. With CMDT test, sustained and repetitive horizontal reaching, standing, stooping and neck flexion can be evaluated [25]. The grip strength test is used when testing a person with an upper limb disorder in an attempt to quantify tolerated physical exposure at work. The test is performed isometrically using a dynamometer. Grip strength is measured in a 3-trial procedure and the average amount of kilogram force is documented [15, 26–28]. To evaluate pushing and pulling capacity, a sled to be pushed and pulled with varying weights is used [29]. A PILE test includes lifting floor to knuckle, knuckle to waist, waist to shoulder and shoulder to overhead [30, 31]. The carrying task is administered based on the protocol for dynamic carrying, where the subject will carry a box with varying weights a distance of 10 m [30, 31].

Analyses

Frequency distribution of the ICF categories for each test (SFS, Grip strength, CMDT, Lifting, Carrying, Pushing and Pulling) was performed indicating how many times each ICF category was used to describe the items of each test. With regard to the linking process, an inter-rater agreement was calculated and expressed in absolute percentage of agreement [2, 21, 32]. Agreement was calculated separately for each given ICF category. The agreement can range between 0 and 100%, with higher scores representing better agreement [33].

Results

Linking results

The SFS and the FCE-related tests contained 73 items in total. For example, an item from the SFS was; carry a 30-lb bucket 50 feet, from the grip test; sit on a chair feet on the floor and from the PILE; lifting floor to knuckle. From these items, 144 meaningful concepts (for example from the item; carry a 30-lb bucket 50 feet, two meaningful concepts; carry and walk, from the grip test; sitting and from the lifting floor to knuckle; lifting and carrying) were identified and linked to a total of 56 ICF categories out of which 44 were 3rd level and 12 were 2nd level categories (3rd level categories are a specification of 2nd level categories). From the 56 categories, 12 categories (21.4%) and 38 linked concepts belonged to *Body functions and structures* and 44 categories (78.6%) and 133 linked meaningful concepts to *Activities and Participation*. One concept referred to *Personal factors* (Table 1).

Table 1 Number of items, concepts and ICF categories of the Spinal Function Sort pictorial questionnaire (SFS) and Functional Capacity Evaluation tests (FCE)

	SFS	FCE					
		Grip	CMDT	Lift	Carry	Push	Pull
Items linked (n)	50	3	13	4	1	1	1
Concepts (n)	102	3	28	8	2	2	2
Unique ICF components/categories, n							
Body function (2nd level)	5 (3)	1 (0)	1 (0)	2 (0)	1 (0)	1 (0)	1 (0)
Activities and participation (2nd level)	26 (5)	3 (0)	4 (2)	4 (1)	3 (1)	2 (0)	2 (0)
Personal factors	0	0	1	0	0	0	0
ICF categories in total (2nd level)	31 (8)	4 (0)	5 (2)	6 (1)	4 (1)	3 (0)	3 (0)

ICF the international classification of functioning, disability and health, *SFS* spinal function sort, *FCE* functional capacity evaluation, *CMDT* Complete Minnesota Dexterity Test

From the SFS, items could be linked to 2nd level categories from both the Body function and the Activities and Participation component. From the six FCE tests the CMDT, lifting and carrying tests could be linked to the 2nd level categories from the Activities and Participation component. Out of 9 unique 2nd level ICF categories, 6 were from the CSVR (Table 2).

The 2nd level categories of *body function* (component) were only found in the SFS and are mostly in chapter 2 (sensory and pain) and chapter 7 (neuromusculoskeletal and movement-related functions) of the ICF. The categories found in the SFS describe vestibular functions, mobility of joints and muscle power. The 2nd level categories of the *activity and participation* (component) were found in the SFS, CMDT, lifting and carrying and are found in chapter 1 (learning and applying knowledge), chapter 4 (mobility) and chapter 6 (domestic life). The categories found were related to writing, lifting and carrying, fine hand use and hand and arm use. Housework was just found in the SFS (Table 3).

Both the SFS and the FCE tests address ICF components up to 3rd level. The 3rd level categories, a total of 44 (78.6%), are divided between the components *Body function* and *Activities and Participation.* Out of these 44 3rd level categories 30 were unique (Table 4).

The 3rd level categories of the *body function* (component) are exclusively found in chapter 7 (neuromusculoskeletal and movement-related functions). The categories found in the FCE tests and the SFS were related to mobility of joints, muscle power, coordination and control of voluntary movement functions (Table 5).

The 3rd level categories of the *Activity and Participation* (component) were found in chapter 4 (mobility)

Table 2 ICF contents up to 2nd level categories of SFS and FCE tests by chapter and the categories from the CSVR. ICF categories not found from the CSVR are marked *

ICF category (CSVR)	SFS item	FCE test
Body functions		–
Chapter 2: Sensory and pain		
b235 Vestibular functions	5, 38	
Chapter 7: Neuromusculoskeletal and movement-related functions		
b710 Mobility of joint functions*	6, 17, 18, 49, 50	–
b730 Muscle power functions	7–16, 33–36, 41–48	–
Activity and participation		
Chapter 1: Learning and applying knowledge		
d170 Writing	–	CMDT
Chapter 4: mobility d430 Lifting and carrying objects	5, 6, 13, 15, 50	Lifting, carrying
d440 Fine hand use	27	CMDT
d445 Hand and arm use	23–26, 39–40	CMDT
d449 Carrying, moving and handling objects, other specified and unspecified—dolley, trash barrel*	26	–
Chapter 6: Domestic life d640 Doing housework*	27, 39–40	–

ICF the international classification of functioning, disability and health, *SFS* spinal function sort, *FCE* functional capacity evaluation, *CMDT* Complete Minnesota Dexterity Test

Table 3 Number of unique ICF components and 3rd level categories of the SFS and FCE tests

ICF components/categories:	SFS	FCE					
		Grip	CMDT	Lift	Carry	Push	Pull
Body function, n (3rd level)	5(2)	1(1)	1(1)	2(2)	1(1)	1(1)	1(1)
Activities and participation, n (3rd level)	26(21)	3(3)	4(2)	4(3)	3(2)	2(2)	2(2)
Personal factors, n	0	0	1	0	0	0	0
Total numbers of ICF categories (3rd level)	31(23)	4(4)	5(3)	6(5)	4(3)	3(3)	3(3)

ICF: The International Classification of Functioning, Disability and Health

SFS: Spinal Function Sort

FCE: Functional Capacity Evaluation

CMDT: Complete Minnesota Dexterity Test

Table 4 ICF 3rd level categories within the *Body function* component of SFS and FCE tests by chapter. None of these categories are from the CSVR

ICF category	SFS item	FCE test
Body function		
Chapter 7: Neuromusculoskeletal and movement-related functions		
b7101 Mobility of several joints	21	Lifting
b7301 Power of muscles of one limb	–	Grip strength
b7306 Power of all muscles of the body	–	Lifting, Carrying, Pushing and Pulling
b7602 Coordination of voluntary movements	–	CMDT
b7608 Control of voluntary movement functions, other specified	25	–

ICF the international classification of functioning, disability and health, *SFS* spinal function sort, *FCE* functional capacity evaluation, *CMDT* Complete Minnesota Dexterity Test

Table 5 ICF 3rd level categories within the *Activities and Participation* component of SFS and FCE tests by chapter. None of these are from the CSVR

ICF CATEGORY	SFS	FCE
Activity and participation		
Chapter 4: Mobility		
d4101 Squatting	–	Lifting
d4103 Sitting	30, 32	–
d4105 Bending	27–28	Lifting
d4108 Changing basic body position, other specified	30, 32	–
d4153 Maintaining a sitting position	–	Grip strength
d4154 Maintaining a standing position	17, 49	CMDT
d4158 Maintaining a body position, other specified	–	Grip strength
d4300 Lifting	2, 9–11, 14, 16, 43–44, 47–48	–
d4301 Carrying in the hands	33–36	-
d4305 Putting down objects	1, 7–8, 12, 41–42, 45–46	–
d4308 Lifting and carrying, other specified	1–2, 5–16, 33–36, 41–48, 50	Lifting and carrying
d4450 Pulling	34, 31	Pulling
d4451 Pushing	3–4, 29	Pushing
d4452 Reaching	6, 50	CMDT
d4453 Turning or twisting the hands and arms	18–20, 22	–
d4458 Hands and arm use, other specified	17–25, 28–29, 31, 49	Grip strength
d4500 Walking short distances	–	Carrying, pulling and pushing
d4551 Climbing	37–38	
d4558 Moving around, other specified	37	–
Chapter 6: Domestic life		
d6208 Acquisition of goods and services, other specified	4	–
d6401 Cleaning cooking area and utensils	19	–
d6403 Using household appliances	3	–
d6408 Doing housework, other specified	27, 39–40	–
d6501 Maintaining dwelling and furnishings	17–18, 21–24, 49	–
d6505 Taking care of plants, indoors and outdoors	20	–

ICF the international classification of functioning, disability and health, *SFS* spinal function sort, *FCE* functional capacity evaluation, *CMDT* Complete Minnesota Dexterity Test

and chapter 6 (domestic life). Categories from chapter 4, found in both the SFS and the FCE tests, describe squatting, sitting, bending, changing body position, maintaining sitting, standing and body positions, lifting, carrying, putting down objects, pulling, pushing, reaching, turning or twisting the hands and arms, hand and arm use, walking, climbing and moving around.

Categories from chapter 6 were only found in the SFS and describe acquisition of goods and services, cleaning cooking area and utensils, using household appliances, doing housework, maintaining dwelling and furnishings and taking care of plants.

Including all unique 2nd and 3rd level categories for FCE tests and the SFS made a total of 39 unique ICF categories. Out of these 39 categories six (15,4%) were from the CSVR. All categories from the CSVR were from the components Body functions and Activities and Participation.

Linking agreement

The interrater agreement between raters ranged from 16.7 to 90.7%. The percent agreements presented in Table 6 are the averages calculated from all ICF categories for each test. The agreement was below 50% in carrying, pushing and pulling. The two primary raters were able to agree in the end on all linked items with differences, therefore there was no need to consult the third rater.

Discussion

The objective of this study was to link the SFS, lifting, carrying, pushing, pulling, grip strength and CMDT tests to the ICF, and to evaluate the extent to which the SFS and six FCE tests could be mapped to the CSVR categories. All of the meaningful concepts within the SFS and the six FCE tests could be linked to the ICF. Other functional capacity related tests [18, 34–38] had been linked to the ICF, but the tests selected for this study and commonly used during FCEs had not been linked previously. There are many tests available for evaluating functional capacity and work capacity [4, 26, 30] causing difficulties for health care professionals to select the adequate one. Linking functional related tests, such as in this study, to the ICF will enhance and improve the use of ICF as a common framework, improve documentation and improve the efficiency of comparing research information at the content level [19].

As a whole the SFS and the six FCE tests included items within the ICF components of Body functions and Activities and participation. The absence of the other components may be due to the fact that both the SFS and the six FCE tests are functional related tests. In linking the CMDT a main concept including using a persons' dominant hand received the only personal factor code. Knowledge of this feature is important, since it may affect disability and the outcome of various interventions [22]. In this study no environmental concepts (e) were identified. Environmental factors interact with both Body functions, Activities and Participation and therefore can have a very different effect on the same person depending on whether the environment has a limiting or favorable effect on the performance [22]. The SFS as a questionnaire and the six FCE tests as described are performed in a standardized clinical setting. Due to this fact it is important when evaluating a persons' functional or work ability to take into consideration, how the clinical setting or the professional may have affected the test results. Additional testing may also be necessary, such as, in the persons' work environment or by using work/job simulation.

The SFS and the six FCE tests could be linked to 39 unique 2nd and 3rd level categories out of which only six (15,4%) were from the CSVR (2nd level). If a suitable category was not found for the meaningful concept a more relevant category was chosen from the whole ICF. None of the items in the FCE tests were found suitable categories from the 2nd level Body functions and just four out of 18 2nd level categories from the Activities and Participation component. For the FCE tests the 3rd level categories, were from the chapter Neuromusculoskeletal and movement-related functions (for example; mobility of several joints, power of muscles of the body) under the Body function component and under the chapter Mobility (for example; squatting, bending, lifting, pushing) under the Activities and Participation component. For the SFS the 3rd level categories were from the chapter Neuromusculoskeletal and movement-related functions (for example; mobility of several joints) under the Body function component, under the chapter Mobility (for example; sitting, lifting, putting down objects, pulling) and under the chapter Domestic life (for example; acquisition of goods and services, other specified and taking care of plants) under the Activities and Participation component. Consensus was found between the raters on all their differences in linking.

The categories in the CSVR are all 2nd level categories. Within the CSVR, the function of both sitting down and squatting falls under the category 'changing basic

Table 6 Percentage of agreement of linking the SFS and FCE tests to the ICF

Questionnaire/test	Overall agreement (%)
SFS	90.7
Grip strength	66.8
CMDT	73.7
Lifting	50.0
Carrying	16.7
Pushing	40.0
Pulling	40.0

ICF the international classification of functioning, disability and health, *SFS* spinal function sort, *FCE* functional capacity evaluation, *CMDT* Complete Minnesota Dexterity Test

body position'. In describing functional capacity this level may not be specific enough, because there is a need in being able to differentiate between for example sitting and squatting. To be able to describe these functions more specific a 3rd level category is needed. Most of the items of the SFS and the chosen six FCE tests were linked to 3rd level categories because the categories in the CSVR were too general.

This study has some limitations owing to the linking procedure. The outcome of this study may have been affected by rater one who did not have previous experience using the ICF or with the linking process. The other aspect that may have affected the outcome of the linking process and at the end the wide range of percentage of agreement was that the perspectives used in the linking process varied slightly between the raters. One rater did the linking from a performance point of view and the other more from a functional point of view. One reason may be the fact that the content and/or the aim of SFS and the FCE related tests were not familiar to one of the raters. The main strength of this study is the novel findings of the biopsychosocial aspects of work-related functional capacity related to the SFS and FCE tests. Other strength is that, there was a 100% agreement of linking tests to the ICF between the two raters after discussion was made to resolve differences.

Further research is needed as to how well it is possible to describe tests used to evaluate functional capacity and especially tests used to evaluate work capacity using the CSVR. This study implies that the CSVR may be too general to describe, a majority of the tests linked in this study. This needs to still be confirmed with further validation studies. Research regarding ICF categories used to describe functional and work capacity related tests may help further develop a short list to describe work functioning and work capacity.

Conclusions

Linking tests to the ICF may help facilitate the development of a database of functional tests thereby helping researchers compare their data and health care professionals to choose the appropriate test. The CSVR include categories up to the 2nd level. Due to this fact it was, according to this study, possible to describe only six categories including vestibular functions, muscle power functions, writing, lifting and carrying objects, fine hand use and hand and arm use in the SFS and in the CMDT with this shortlist. ICF could be a useful instrument to describe work functioning and work capacity related test.

Appendix 1

Comprehensive ICF core set of vocational rehabilitation

ICF code	ICF category title
Activities and participation (40)	
d155	Acquiring skills
d160	Focusing attention
d163	Thinking
d166	Reading
d170	Writing
d172	Calculating
d175	Solving problems
d177	Making decisions
d210	Undertaking a single task
d220	Undertaking multiple tasks
d230	Carrying out daily routine
d240	Handling stress and other psychological demands
d310	Communicating with—receiving—spoken messages
d315	Communicating with—receiving—nonverbal messages
d350	Conversation
d360	Using communication devices and techniques
d410	Changing basic body position
d415	Maintaining a body position
d430	Lifting and carrying objects
d440	Fine hand use
d445	Hand and arm use
d445	Nand and arm use
d450	Walking
d455	Moving around
d465	Moving around using equipment
d470	Using transportation
d475	Driving
d530	Toileting
d540	Dressing
d570	Looking after one's health
d710	Basic interpersonal interactions
d720	Complex interpersonal interactions
d740	Formal relationships
d820	School education
d825	Vocational training
d830	Higher education
d840	Apprenticeship (work preparation)
d845	Acquiring, keeping and terminating a job
d850	Remunerative employment
d855	Non-remunerative employment

ICF code	ICF category title
d870	Economic self-sufficiency
Environmental factors (33)	
e11001	Drugs
e115	Products and technology for personal use in daily living
e120	Products and technology for personal index and outdoor mobility and transportation
e125	Products and technology for communication
e130	Products and technology or education
e135	Products and technology for employment
e150	Design, construction and building products and technology or buildings for public use
e155	Design, construction and building products and technology or buildings for public use
e225	Climate
e240	Light
e250	Sound
e260	Air quality
e310	Immediate family
e320	Friends
e325	Acquaintances, peers, colleagues, neighbours and community members
e330	People in positions of authority
e340	Personal care providers and Personal assistants
e355	Health professionals
e360	Other professionals
e430	Individual attitudes of people In positions of authority
e450	Individual attitudes of health professionals
e460	Societal attitudes
e465	Social norms, practices and ideologies
e525	Housing services, systems and policies
e535	Communications, services, systems and policies
e550	Legal services, systems and policies
e555	Assoastions and organisational services, systems and policies
e565	Economic services, systems and policies
e570	Social security services, systems and policies
e580	Health services, systems and policies
e585	Education and training services, systems and policies
e590	Labour and employment services, systems and policies
b210	Seeing functions
b230	Hearing functions
b235	Vestibular functions
b280	Sensation of pain
b455	Exercise tolerance functions b730 Muscle power functions
b730	Muscle power functions
b740	Muscle endurance functions b810 Protective functions of the skin
b810	Protective functions of the skin

References

1. ICF Research Branch. ICF core sets for vocational rehabilitation [internet]. [Place unknown]. ICF Research Branch 2013 [updated 2017; cited 2015 Aug 3]. Available from: https://www.icf-research-branch.org/images/ICF%20Core%20Sets%20Download/Comprehensive_ICF_Core_Set_for_Vocational_Rehabilitation.pdf.
2. Cieza A, Geyh S, Chatterji S, Kostanjsek N, Üstün B, Stucki G. ICF linking rules: an update based on lessons learned. J Rehabil Med. 2005;37(4):212–218.
3. Escorpizo R, Ekholm J, Gmünder H-P, Cieza A, Kostanjsek N, Stucki G. Developing a core set to describe functioning in vocational rehabilitation using the international classification of functioning, disability and health (ICF). J Occup Rehabil. 2010;20(4):502–511.
4. Matheson LN, Matheson ML, Grant J. Development of a measure of perceived functional ability. J Occup Rehabil. 1993;3(1):15–30.
5. Robinson RC, Kishino N, Matheson L, Woods S, Hoffman K, Unterberg J, et al. Improvement in postoperative and nonoperative spinal patients on a self-report measure of disability: the Spinal function sort (SFS). J Occup Rehabil. 2003;13(2):107–113.
6. Oesch PR, Hilfiker R, Kool JP, Bachmann S, Hagen KB. Perceived functional ability assessed with the spinal function sort: is it valid for European rehabilitation settings in patients with non-specific non-acute low back pain? Eur Spine J. 2010;19(9):1527–1533.
7. Trippolini, MA. Evaluation of functioning in workers with whiplash-associated disorders and back pain. Dissertation 2014, University of Groningen, The Netherlands.
8. Soer R, van der Schans CP, Groothoff JW, Geertzen JHB, Reneman M. Towards consensus in operational definitions in functional capacity evaluation: a Delphi survey. J Occup Rehabil. 2008;18(4):389–400.
9. Lakke SE, Wittink H, Geertzen JH, van der Schans CP, Reneman MF. Factors that affect functional capacity in patients with musculoskeletal pain: a Delphi study among scientists, clinicians and patients. Arch Phys Med Rehabil. 2012;93(3):446–457.
10. Soer R, Reneman MF, Frings-Dresen MH, Kuijer PP. Experts opinion on the use of normative data for functional capacity evaluation in occupational and rehabilitation medicine and disability claims. J Occup Rehabil. 2014;24(4):806–811.
11. Postema SG, Bongers RM, Reneman MF, van der Sluis CK. Functional capacity evaluation in upper limb reduction deficiency and

amputation: Development and pilot testing. J Occup Rehabil. 2017. https://doi.org/10.1007/s10926-017-9703-4.
12. Matheson L. The functional capacity evaluation. In: Andersson G, Demeter S, Smith G, editors. Disability evaluation. 2nd ed. Chicago, IL: Mosby Yearbook; 2003. p. 1–35.
13. Escorpizo R, Stucki G. Disaility evaluation, social security, and the international classification of functioning, disability and health: the time is now. (published correction appears in J Occup Environ Med. 2013 Sep;55(9):1110–2). J Occup Environ Med. 2013:55(6):644–651.
14. Lakke SE, Soer R, Geertzen JH, Wittink H, Douma RK, van der Schans CP, et al. Construct validity of functional capacity tests in healthy workers. BMC Musculoskelet Disord. 2013;14:180–192.
15. Deist B, Schneider S, Prodans R. Application and limitations of functional capacity evaluations in managing work-related musculoskeletal disorder risks/hazards. Position Paper. American Industrial Hygiene Association, AIHA 2015.
16. Wind H, Gouttebarge V, Kuijer PP, Sluiter JK, Frings-Dresen MH. Complementary value of functional capacity evaluation for physicians in assessing the physical work ability of workers with musculoskeletal disorders. Int Arch Occup Environ Health. 2009;82(4):435–443.
17. Trippolini MA, Dijkstra PU, Geertzen JH, Reneman MF. Measurement properties of the spinal function sort in patients with subacute whiplash-associated disorders. J Occup Rehabil. 2014;95(12):2357–2366.
18. Drummond AS, Sampaio RF, Mancini MC, Kirkwood RN, Stamm TA. Linking the disabilities of arm, shoulder, and hand to the international classification of functioning, disability, and health. J Hand Ther. 2007;20(4):337–343.
19. Rauch A, Escorpizo R, Riddle DL, Eriks-Hoogland I, Stucki G, Cieza A. Using a case report of a patient with spinal cord injury to illustrate the application of the international classification of functioning, disability and health during multidisciplinary patient management. Phys Ther. 2010;90(7):1039–1051.
20. Reneman MF, Soer R, Gross DP. Developing research on performance-based functional work assessment: Report on the first international functional capacity evaluation research meeting. J Occup Rehabil. 2013;23(4):513–515.
21. Cieza A, Fayed N, Bickenbach J, Prodinger B. Refinements of the ICF linking rules to strengthen their potential for establishing comparability and health information. Disabil Rehabil. 2016. https://doi.org/10.3109/09638288.2016.1145258.
22. World Health Organization. International classification of functioning, disability and health. Geneva: WHO; 2001.
23. World Health Organization (WHO). How to use the ICF: A practical manual for using the international classification of functioning, disability and health (ICF). Exposure draft for comment. WHO, Geneva, 2013.
24. Borloz S, Trippolini MA, Ballabeni P, Luthi F, Deriaz O. Cross-cultural adaptation, reliability, internal consistency and validation of the Spinal function sort (SFS) for French- and German-speaking patients with back complaints. J Occup Rehabil. 2012;22(3):387–393.
25. Desrosiers J, Rochette A, Herbert R, Bravo G. The Minnesota manual dexterity test: reliability, validity and reference values studies with healthy elderly people. Can J Occup Ther. 1997;64:270–276.
26. Mathiowetz V, Kashman N, Volland G, Weber K, Dowe M, Rogers S. Grip and pinch strength: normative data for adults. Arch Phys Med Rehabil. 1985;66(2):69–74.
27. Mathiowetz V. Comparison of Rolyan and Jamar dynamometers for measuring grip strength. Occup Ther Int. 2002;9(3):201–209.
28. Hollak N, Soer R, van der Woude LH, Reneman MF. Towards a comprehensive functional capacity evaluation for hand function. Appl Ergonimics. 2014;45(3):686–692.
29. Snook SH, Cirello VM. The design of manual handling tasks: revised tables of maximum acceptable weights and forces. Ergonomics. 1991;34(9):1197–1213.
30. Mayer TG, Barnes D, Kishino ND, Nicholas G, Gatchel RJ, Mayer HV. Progressive isonertial lifting evaluation: I. A standardized protocol and normative database. Spine. 1988;13(9):993–997.
31. Mayer TG, Barnes D, Nichols G, Kishino ND, Coval K, Piel B, et al. Progressive isoinertial lifting evaluation. II. A comparison with isokinetic lifting in a disabled chronic low-back pain industrial population. Spine. 1988;13(9):998–1002.
32. Cieza A. Linking health-status measurements to the international classification of functioning, disability and health. J Rehabil Med. 2002;34(5):205–210.
33. McHugh ML. Interrater reliability: the kappa statistic. Biochem Med. 2012;22(3):276–282.
34. Andelic N, Johansen JB, Bautz-Holter E, Mengshoel AM, Bakke E, Roe C. Linking self-determined functional problems of patients with neck pain to the international classification of functioning, disability, and health (ICF). Patient Prefer Adher. 2012;6:749–755.
35. Vincent JI, MacDermid JC, King GJ, Grewal R. Linking of the Patient rated elbow evaluation (PREE) and the American shoulder and elbow surgeons—elbow questionnaire (pASES-e) to the international classification of functioning disability and health (ICF) and hand core sets. J Hand Ther. 2015;28(1):61–67.
36. Nicol R, Robinson NM, Hopfe M, Newell D. Linking the Bournemouth Questionnaire for low back pain to the International Classification of functioning, disability and health. Disabil Rehabil. 2016;38(11):1089–1096.
37. Maritz R, Baptiste S, Darzins SW, Magasi S, Weleschuk C, Prodinger B. Linking occupational therapy models and assessments to the ICF to enable standardized documentation of functioning. Can J Occup Ther. 2018;85(4):330–341.
38. Osborne CL, Kauvar DS, Juengst SB. Linking the behavioral assessment screening tool to the international classification of functioning, disability, and health as a novel indicator of content validity. Disabil Rehabil. 2019. https://doi.org/10.1080/09638288.2018.1539128.