ORIGINAL ARTICLE

The Comprehensive ICF core sets for spinal cord injury from the perspective of physical therapists: a worldwide validation study using the Delphi technique

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Objective: To validate the International Classification of Functioning, Disability and Health (ICF) Core Set for individuals with spinal cord injury (SCI) in the early post-acute and long-term context from the perspective of physical therapists.

Setting: International.

Methods: Physical therapists experienced in the treatment of SCI were asked about problems, resources and aspects of the environment treated by them, in a three-round electronic mail survey using the Delphi technique. Responses were linked to the ICF by two researches; κ -coefficient was calculated as statistical measure of agreement.

Results: In all, 81 experts from 27 countries named 3694 concepts. They were linked to 187 ICF categories for the early post-acute context. Three ICF categories from the component body function, five ICF categories from the component body structures and two ICF categories from the component activities and participation were not represented in the ICF Core Set for the early post-acute context. In all, 207 ICF categories were linked for the long-term context. Four ICF categories from the component body function, five ICF categories from the component body structures and two ICF categories from the component activities and participation were not represented in the ICF Core Set for the long-term context.

Conclusion: Physical therapists addressed a vast variety of problems that they take care of in their interventions in patients with SCI. The Comprehensive ICF Core Sets covered a high percentage of these problems. Further research is necessary on several responses not covered in the ICF.

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Introduction

Patients with spinal cord injury (SCI), experience abruptly and often permanently, personal, bio-psychological and socioeconomic consequences.¹ Decisions regarding medical care and rehabilitation can lead to tremendous annual and lifetime costs.² Thus, it is important to optimize health services including rehabilitation care to restore the functioning and health of the patients. Interdisciplinary communication and collaboration among health professionals are fundamental owing to the complexity of the problems involved in SCI.

A mutual basis for multidisciplinary collaboration is the International Classification of Functioning, Disability and Health (ICF), which represents a comprehensive and universally accepted framework for describing functioning, disability and health in persons with all kinds of health conditions including SCI.³ According to the ICF, the problems associated with a disease may concern body functions and body structures, as well as activities and participation in a person's life situation, which are then modified by contextual factors such as environmental and personal factors. The detailed hierarchical structure of the contents of the ICF is presented in Figure 1.

In order to facilitate the implementation of the ICF into the SCI rehabilitation process, 'ICF Core Sets' for individuals with SCI in the early post-acute⁴ and the long-term context⁵ have been developed. These ICF Core Sets include selections

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Figure 1 Structure of the ICF.

of ICF categories relevant to patients with SCI in the early post-acute context comprising 162 categories and in long-term context of care comprising 168 categories. Based on the work definition used during the development of ICF Core Sets for SCI, the post-acute context commences when multidisciplinary comprehensive rehabilitation starts and finalized with its completion. The subsequent phase is the long-term context.

The standard approach for the development of ICF Core Sets was based on the evidence from preparatory studies followed by a formal decision-making and consensus process, which is then followed by a validation phase. Key aspect of the validation is whether the problems addressed by health professionals involved in a multidisciplinary team are included in the ICF Core Sets for SCI. An essential group of professionals involved in the treatment of patients with SCI in all different health care contexts are physical therapists.⁶

The objective of this study is to validate the ICF Core Set for SCI in the early post-acute and long-term context from the perspective of physical therapists.

Methods

Study design

The study was conducted as a worldwide electronic-mail survey applying a three-round Delphi technique with invited physical therapists. The Delphi technique enabled experts to repeatedly access the group, explore the complex issue aiming to obtain consensus.⁷

Recruitment

Persons with specific training as physical therapist and experience in the field of SCI were eligible to participate in this study.

Initially, physical therapy associations, universities, model care units, hospitals and other institutions were identified by internet search and contacted worldwide. To identify

experts, author search was undertaken and personal recommendations were followed up. Experts were invited to recommend other physical therapists with expertise in SCI (snow-ball system). Possible participants received an information pack with study details and had to confirm their consent in order to be included in the study.

Delphi process

In the first Delphi round, the experts received an open-ended questionnaire. Physical therapists were asked to list problems, resources and aspects of the environment in treating patients with SCI, first for the early post-acute and second for the long-term context (Figure 2). Answers were tabulated and linked to the ICF (see below 'Linking'). In addition, experts completed questions on demographic characteristics and professional experience. In Delphi round two, experts had to decide whether to agree that the respective ICF categories represent patients' problems, patients' resources or aspects of environment treated by physical therapists in patients with SCI.

In order to maintain motivation of the participants, only a selection of the ICF categories from the second round were included in round three. A modified scree test was applied to identify ICF categories, which did not reach sufficient consensus.⁸ A graph was plotted containing the percentages of expert agreement (ordinate) for each ICF category (abscissa). The scree line was placed onto the downward slope, along the points to see where they approximately form a straight line. Points close to the scree line indicated an insufficient endorsement and were included into Delphi round three.

In Delphi round three, the ratings were tabulated with frequencies of answers from the previous round to inform about the decisions other experts made. Experts were requested to reconsider their answers. Within the Delphi process, experts were returning their responses within 3–5 weeks for each round.

Linking

Each response of the first Delphi round was linked according to the linking rules established⁹ to the most precise ICF category by two researchers. Each ICF category is coded with a prefix for the components body functions (b), body structures (s), activities and participation (d) and environmental factors (e) and a suffix of one to five digits (Figure 1). Disagreements were discussed with supervisors and a joint decision was made. According to the ICF definition, personal factors were coded as personal factors. Concepts that could not be assigned to ICF categories were coded as not covered.

Data analyses

Descriptive statistics characterize the sample and frequencies of ratings. κ -coefficient was calculated with bootstrapped confidence intervals to analyze the agreement between the two researchers linking the answers of the participants to the ICF.¹⁰

ICF categories, which reached an agreement of more than 75% among the participants in the final Delphi round, were

Figure 2 The Delphi survey.

considered for comparison with the Comprehensive ICF Core Set for SCI. As no universal agreement on the level of consensus exists, based on experiences from previous studies, this cutoff point was considered as appropriate consensus to be achieved.

Results

Recruitment

A database of experts in SCI worldwide was used. From the 254 experts out of this database, 21 physical therapists

agreed to participate. Additional 48 experts were suggested by this group and agreed to participate. In all, 146 associations were contacted and newsletters or emails were sent to their members. Out of 341 individually invited specialists, 22 agreed to participate. Of the 12 experts found by author search, two agreed. In all, 54 institutions were contacted, 12 experts were recruited. From the 105 recruited experts, 98 persons out of 27 countries were eligible for inclusion and agreed to participate in the Delphi survey. Table 1 details the attrition of participants between the Delphi rounds, demographics and professional experience.

Table 1 Demographics and professional experience of round 1 participants and attrition between the Delphi rounds

WHO-region, countries	Delphi rounds			Demographics		Current professional activity					Professional experience		Expertise in treatment of SCI		Knowledge of ICF		
	Round 1	Round 2	Round 3	Age, median (min-max)	Gender, female n (%)	Acute care	Inpatient care	Outpatient care	Home care	University	Other	Prof experience years Median (min-max)	Practical experience years Median (min-max)	Rate post-acute expertise ^a	Rate long-term expertise ^a	Rate knowledge ICF ^b	Rate use ICF ^c
All	n = 85	n = 81	n = 81	40.22 (26–61)	61 (71.8)	12 (14.2%)	57 (67.1%)	20 (23.5%)	9 (10.6%)	22 (25.9%)	6 (7.1%)	16.7 (2–37)	12.5 (1–36)	7.8 (2–10)	7.7 (1–10)	5.7 (0–10)	4.4 (0–10)
African region ^d	n = 10	n = 9	n = 9	41.7 (36–55)	9 (90)	0	8	0	0	3	0	19.2 (13–30)	14.6 (7–23)	8.2 (7–10)	7.6 (6–9)	6.8 (5–10)	5.6 (0–8)
Region of the Americas ^e	n = 20	n = 20	n = 20	39.7 (29–56)	16 (80)	0	15	3	1	5	0	15.1 (3–34)	12.0 (2–34)	7.8 (2–10)	6.9 (1–10)	4.1 (1–9)	2.9 (0–9)
Eastern Mediterranean region ^f	n = 3	n = 3	n = 3	35.7 (32–43)	2 (66.7)	0	2	2	1	1	0	11.3 (5–19)	9.7 (5–15)	7.7 (5–10)	8.3 (7–10)	6 (3–9)	5.7 (3–9)
European region ^g	n = 35	n = 33	n = 33	41.1 (27–61)	22 (62.9)	10	22	10	6	9	4	17.4 (2.5–37)	13.8 (1–36)	7.5 (2–10)	8.1 (5–10)	5.9 (0–10)	4.6 (0–8)
South East Asia region ^h	n = 4	n = 4	n = 4	29.3 (26–33)	1 (25)	1	3	1	0	1	1	5.3 (2–8)	2.8 (2–4)	7 (4–9)	8.5 (8–9)	6.3 (5–7)	3 (0–6)
Western Pacific region ⁱ	n = 13	n = 12	n = 12	42 (26–53)	11 (84.6)	1	7	5	1	3	1	20.2 (3–33)	11.9 (2–25)	8.5 (7–10)	7.9 (5–10)	6.7 (1–10)	5.7 (0–10)

Abbreviation: ICI, International Classification of Functioning, Disability and Health.

^a0 (no) and 10 (excellent).^b0 (never heard of the ICF) and 10 (enough knowledge to use the ICF as part of my professional work).^c0 (never used the ICF) and 10 (use the ICF as part of my professional work)^dSouth Africa,^eCanada and United States of America,^fIran, Kingdom of Saudi Arabia, Pakistan,^gDenmark, Finland, Germany, Israel, Italy, Lithuania, Malta, Spain, Sweden, Switzerland, The Netherlands, Turkey and United Kingdom,^hBangladesh, India and Nepal,ⁱAustralia, New Zealand, Taiwan-ROC, Singapore and Vietnam.

Delphi process

The Delphi survey was conducted from April to August 2009. The first-round questionnaire was returned by 86.7% of the participants, seven questionnaires were excluded because they were not completed and six questionnaires were not returned for unknown reasons. The second-round questionnaire was returned by 95.2% of the experts. According to the scree test, 102 categories for the early post-acute and 70 categories for the long-term context with inexplicit consensus among the second-round participants were included for round three. The response rate for the third round was 100%.

Linking

In Delphi round one, 3694 patients' problems, resources or aspects of environment treated by physical therapists in SCI were named for the early post-acute and long-term context. The answers were linked to 187 ICF categories for the early post-acute and 207 for the long-term context (Tables 2–5).

In all, 45 answers were linked to the personal factors; 34 concepts for the early post-acute and 26 answers were linked for the long-term context (Table 6). In all, 13 responses were found to be not covered by the ICF; 10 concepts for the early post-acute and six for the long-term context (Table 7).

The κ -statistics with bootstrapped confidence interval for the linking was for the early post-acute 0.77 (0.75–0.80) and for the long-term context 0.79 (0.76–0.82).

Representation of responses of physical therapist in the Comprehensive ICF Core Sets for SCI

In total, 187 ICF categories for the early post-acute context and 207 for the long-term context linked to the responses of participants reached an agreement of more than 75% in the final round and were considered for comparison with the current Comprehensive ICF Core Set for SCI.

From the component body functions, 60 categories are represented in the ICF Core Set for the early post-acute context and for the long-term context, 53 categories are

Table 2 ICF component body functions: percent agreement among participants in the final Delphi round

ICF code			ICF category title	Early post-acute context		Long-term context	
Second level	Third level	Fourth level		ICF Core Set SCI	Final round n = 81	ICF Core Set SCI	Final round n = 81
<i>b—Body functions</i>							
b126			Temperament and personality functions	X		X	
b130			Energy and drive functions	X		X	
	b1301		Motivation		85.9		80.0
b134			Sleep functions	X		X	44.3
b152			Emotional functions	X	76.5	X	80.0
	b1646		Problem solving		86.4		
	b1801		Body image		85.9		
b250			Taste function		11.1		
b255			Smell function		12.3		
b260			Proprioceptive function	X	93.8	X	92.2
b265			Touch function	X	88.9	X	85.1
b270			Sensory functions related to temperature and other stimuli	X	88.6	X	85.9
	b2700		Sensitivity to temperature		80.2		77.9
	b2702		Sensitivity to pressure		90.1		
b280			Sensation of pain		92.2		93.3
	b2800		Generalized pain	X			
	b2801		Pain in body part		93.6		98.7
		b28010	Pain in head and neck	X	90.9	X	88.3
		b28011	Pain in chest		86.8	X	81.1
		b28012	Pain in stomach or abdomen			X	
		b28013	Pain in back	X	91.3	X	
		b28014	Pain in upper limb	X	92.2	X	94.7
		b28015	Pain in lower limb	X	92.5	X	
		b28016	Pain in joints	X	87.3	X	93.7
	b2802		Pain in multiple body parts		88.8		
	b2803		Radiating pain in a dermatome	X		X	93.6
	b2804		Radiating pain in a segment or region	X		X	92.4
b310			Voice functions	X			33.3
b410			Heart functions	X	78.8		77.5
b415			Blood vessel functions	X	55.6		60.5
b420			Blood pressure functions		88.9	X	81.5
	b4200		Increased blood pressure	X			62.7
	b4201		Decreased blood pressure	X	86.3		81.3
	b4202		Maintenance of blood pressure	X			86.1
b430			Hematological system functions	X	22.2		30.8
b435			Immunological system functions		20.0		30.3
	b4352		Functions of lymphatic vessels		76.5		
b440			Respiration functions	X	97.5	X	93.5
	b4402		Depth of respiration				96.2

Table 2 Continued

ICF code			ICF category title	Early post-acute context		Long-term context	
Second level	Third level	Fourth level		ICF Core Set SCI	Final round n = 81	ICF Core Set SCI	Final round n = 81
b445			Respiratory muscle functions	X	100.0	X	96.1
b450			Additional respiratory functions	X	96.3		90.8
b455			Exercise tolerance functions	X	96.2	X	93.5
	b4550		General physical endurance		92.5		92.1
	b4551		Aerobic capacity		87.2		87.0
	b4552		Fatigability				85.7
b460			Sensations associated with cardiovascular and respiratory functions				50.0
b510			Ingestion functions	X			
b515			Digestive functions	X			26.0
b525			Defecation functions		48.1	X	40.5
	b5250		Elimination of feces	X			
	b5251		Fecal consistency	X			
	b5252		Frequency of defecation	X	40.7		
	b5253		Fecal continence	X			45.0
	b5254		Flatulence	X			
b530			Weight maintenance functions	X		X	78.2
	b5450		Water balance				33.3
b550			Thermoregulatory functions	X		X	
b610			Urinary excretory functions	X	17.5	X	28.0
	b6101		Collection of urine		17.7		32.4
b620			Urination functions		35.0		33.3
	b6200		Urination	X		X	
	b6201		Frequency of urination	X		X	
	b6202		Urinary continence	X		X	51.9
b630			Sensations associated with urinary functions	X	35.8		37.5
b640			Sexual functions	X	29.5	X	36.8
b660			Procreation functions			X	
	b6600		Functions related to fertility				26.3
b670			Sensations associated with genital and reproductive functions	X		X	
b710			Mobility of joint functions	X	95.0	X	97.4
	b7100		Mobility of a single joint		95.0		96.1
	b7101		Mobility of several joints		95.0		97.4
b715			Stability of joint functions	X	93.8	X	97.4
	b7151		Stability of several joints		95.1		
b720			Mobility of bone functions			X	
b730			Muscle power functions		96.3	X	94.9
	b7300		Power of isolated muscles and muscle groups	X	98.8		
	b7301		Power of muscles of one limb		96.3		97.5
	b7302		Power of muscles of one side of the body	X			
	b7303		Power of muscles in lower half of the body	X	97.5		94.9
	b7304		Power of muscles of all limbs	X	98.8		
	b7305		Power of muscles of the trunk	X	96.2		97.4
b735			Muscle tone functions		98.7	X	98.7
	b7350		Tone of isolated muscles and muscle groups		97.5		
	b7353		Tone of muscles of lower half of body	X	96.3		97.4
	b7354		Tone of muscles of all limbs	X			
	b7355		Tone of muscles of trunk	X			
b740			Muscle endurance functions	X	96.3	X	97.5
b750			Motor reflex functions	X	90.1	X	
b755			Involuntary movement reaction functions	X	88.8		90.8
b760			Control of voluntary movement functions	X	97.5	X	94.8
	b7600		Control of simple voluntary movements		98.8		
b765			Involuntary movement functions	X	87.7		
	b7650		Involuntary contractions of muscles				80.3
b770			Gait pattern functions	X	97.5	X	100.0
b780			Sensations related to muscles and movement functions	X	96.3	X	93.5
	b7801		Sensation of muscle spasm		87.7		86.9
b810			Protective functions of the skin	X	93.8	X	85.5
b820			Repair functions of the skin	X	83.8	X	77.4
b830			Other functions of the skin	X		X	62.0
b840			Sensation related to the skin	X		X	

Abbreviations: ICI, International Classification of Functioning, Disability and Health; SCI, spinal cord injury.

Note: Categories not represented in the ICF Core Set for SCI for the early post-acute context or the long-term context with an agreement by the experts of more than 75% are highlighted bold.

Table 3 ICF Component body structures: percent agreement among participants in the final Delphi round

ICF code			ICF category title	Early post-acute context		Long-term context	
Second level	Third level	Fourth level		ICF Core Set SCI	Final round n = 81	ICF Core Set SCI	Final round n = 81
<i>S—Body structures</i>							
s120			Spinal cord and related structures		84.6		83.3
		S12000	Cervical spinal cord	X	84.6	X	
		S12001	Thoracic spinal cord	X	84.6	X	
		S12002	Lumbosacral spinal cord	X	84.6	X	
		S12003	Cauda equina	X		X	
	s1201		Spinal nerves	X		X	
s430			Structure of respiratory system	X	88.5	X	
	s4300		Trachea		84.6		71.8
	s4301		Lungs		87.3		84.0
	s4303		Muscles of respiration		100.0		93.5
s610			Structure of urinary system	X		X	
s710			Structure of head and neck region	X	88.5		
	s7100		Bones of cranium		20.0		35.1
s720			Structure of shoulder region	X		X	92.4
	s7200		Bones of shoulder region				77.9
	s7201		Joints of shoulder region		96.3		
s730			Structure of upper extremity	X	93.5		92.2
	s7300		Structure of upper arm			X	
	s7301		Structure of forearm			X	
	s7302		Structure of hand			X	89.6
s740			Structure of pelvic region	X			
s750			Structure of lower extremity	X			
	s7500		Structure of thigh			X	
	s7501		Structure of lower leg			X	
	s7502		Structure of ankle and foot			X	
s760			Structure of trunk	X	94.9	X	94.8
	s7600		Structure of vertebral column		93.6		93.5
s770			Additional musculoskeletal structures related to movement		97.4		97.4
	s7700		Bones		82.1		78.2
	s7701		Joints		96.1		97.5
	s7702		Muscles		100.0		98.7
	s7703		Extra-articular ligaments, fasciae, extramuscular aponeuroses, retinacula, septa, bursae, unspecified		91.1		94.9
s810			Structure of areas of skin	X	93.4		90.9
	s8102		Skin of upper extremity			X	
	s8103		Skin of pelvic region			X	
	s8104		Skin of lower extremity			X	
	s8105		Skin of trunk and back			X	

Abbreviations: ICI, International Classification of Functioning, Disability and Health; SCI, spinal cord injury.

Note: Categories not represented in the ICF Core Set for SCI for the early post-acute context or the long-term context with an agreement by the experts of more than 75% are highlighted bold.

represented (Table 2). Few responses for the early post-acute context were linked to third level categories, for example, b4550 general physical endurance or b4551 aerobic capacity, and are represented in the ICF Core Set by the corresponding second level category b455 exercise tolerance function. For the long-term context, answers were linked to a third level category, for example, b2700 sensitivity to temperature is represented by a second level category such as b270 sensory functions related to temperature and other stimuli. For the early post-acute context, three categories were not represented in the ICF Core Set, namely b1646 problem solving, b1801 body image and b4352 functions of the lymphatic vessels. For the long-term context, four categories: b410 heart functions, b450 additional respiratory functions, b755

involuntary movement reaction functions and b7650 involuntary contractions of muscle, were not represented in the respective ICF Core Set.

From the component body structures, 15 categories for the early post-acute context and 11 categories for the long-term are included in the ICF Core Set (Table 3). Few third level categories are represented in the ICF Core Set by a second level category, for example, s4300 trachea, s4031 lungs and s4303 muscles of respiration are represented by s430 structure of the respiratory system. Suggested second level categories of the experts are represented in the ICF Core Set on the fourth level such as s120 spinal cord related structures. Five ICF categories for both the early post-acute and the long-term context are not included, namely s770

Table 4 ICF component activities and participation: percent agreement among participants in the final Delphi round

ICF code		ICF category title	Early post-acute context		Long-term context	
Second level	Third level		ICF Core Set SCI	Final round n = 81	ICF Core Set SCI	Final round n = 81
<i>d—Activities and participation</i>						
d155		Acquiring skills			X	89.9
d175		Solving problems		75.0		79.7
d230		Carrying out daily routine	X		X	77.5
d240		Handling stress and other psychological demands	X		X	57.0
	d2401	Handling stress		73.8		
d345		Writing messages			X	
d350		Conversation		29.1		
d355		Discussion		25.0		
d360		Using communication devices and techniques	X		X	44.9
d410		Changing basic body position		97.5		95.0
	d4100	Lying down	X	96.3	X	93.8
	d4102	Kneeling			X	
	d4103	Sitting	X	96.3	X	95.0
	d4104	Standing	X	96.3	X	100.0
	d4105	Bending	X		X	
	d4106	Shifting the body's center of gravity	X	97.5	X	98.8
d415		Maintaining a body position		96.3	X	97.5
	d4150	Maintaining a lying position		98.7		89.9
	d4153	Maintaining a sitting position	X	94.9		94.9
	d4154	Maintaining a standing position	X	94.9		100.0
d420		Transferring oneself	X	96.3	X	94.9
	d4200	Transferring oneself while sitting		97.5		94.9
	d4201	Transferring oneself while lying		94.9		92.2
d430		Lifting and carrying objects	X	93.8	X	93.7
	d4301	Carrying in the hands				92.4
	d4305	Putting down objects				94.9
d435		Moving objects with lower extremities	X			98.7
d440		Fine hand use		79.5		83.3
	d4400	Picking up	X		X	82.1
	d4401	Grasping	X	87.2	X	91.0
	d4402	Manipulating	X		X	84.4
	d4403	Releasing	X		X	84.6
d445		Hand and arm use		96.2		94.9
	d4450	Pulling	X		X	
	d4451	Pushing	X		X	89.6
	d4452	Reaching	X	94.9	X	93.6
	d4453	Turning or twisting the hands or arms	X		X	
	d4454	Throwing			X	
	d4455	Catching	X	96.3		
d450		Walking		91.3		98.7
	d4500	Walking short distances	X		X	100.0
	d4501	Walking long distances	X		X	100.0
	d4502	Walking on different surfaces	X	90.0	X	98.7
	d4503	Walking around obstacles	X	87.7	X	100.0
d455		Moving around	X		X	89.6
	d4550	Crawling		89.9		
	d4551	Climbing		79.5		96.2
	d4552	Running		86.1		92.4
	d4553	Jumping		84.6		87.3
	d4554	Swimming		78.2		92.3
d460		Moving around in different locations		83.1		93.6
	d4600	Moving around within home	X		X	
	d4601	Moving around within buildings other than home	X		X	87.5
	d4602	Moving around outside the home and other buildings	X		X	91.0
d465		Moving around using equipment	X	83.5	X	91.1
d470		Using transportation	X	81.5	X	78.8
	d4701	Using private motorized transportation				88.9
	d4702	Using public motorized transportation				91.4
d475		Driving	X	50.6	X	80.0
	d4750	Driving human-powered transportation				79.2
	d4751	Driving motorized vehicles		33.3		68.4
d510		Washing oneself	X	62.5	X	63.0
d520		Caring for body parts	X		X	
	d5200	Caring for skin		65.8		66.3

Table 4 Continued

ICF code		ICF category title	Early post-acute context		Long-term context	
Second level	Third level		ICF Core Set SCI	Final round n = 81	ICF Core Set SCI	Final round n = 81
d530		Toileting		48.1		48.1
	d5300	Regulating urination	X	60.0	X	56.3
	d5301	Regulating defecation	X	59.0	X	59.0
	d5302	Menstrual care	X		X	
d540		Dressing	X	73.8	X	73.4
d550		Eating	X	64.6	X	65.8
d560		Drinking	X		X	
d570		Looking after one's health	X	91.3	X	76.9
	d5700	Ensuring one's physical comfort				77.9
	d5701	Managing diet and fitness		88.9		96.3
	d5702	Maintaining one's health		88.8		77.0
d610		Acquiring a place to live	X		X	
d620		Acquisition of goods and services	X		X	
	d6200	Shopping				36.4
d630		Preparing meals	X	18.8	X	30.3
d640		Doing housework	X	22.2	X	42.3
d650		Caring for household objects			X	35.9
	d6504	Maintaining assistive devices		80.0		79.5
d660		Assisting others	X		X	
d710		Basic interpersonal interactions				38.2
d720		Complex interpersonal interactions			X	
d730		Relating with strangers		29.6		
d740		Formal relationships		38.3		
d750		Informal social relationships		32.9	X	35.4
d760		Family relationships	X	53.1	X	46.8
d770		Intimate relationships	X	28.8	X	37.5
	d7701	Spousal relationships				31.3
	d7702	Sexual relationships		21.5		35.0
d810		Informal education		18.5	X	
d820		School education		16.0	X	28.2
d825		Vocational training		12.8	X	35.4
d830		Higher education		21.5	X	26.6
d840		Apprenticeship (work preparation)		13.8	X	29.1
d845		Acquiring, keeping and terminating a job		15.4	X	32.5
	d8451	Maintaining a job		25.6		
d850		Remunerative employment	X	13.6	X	33.3
d855		Non-remunerative employment		22.8		32.9
d860		Basic economic transactions				20.5
d870		Economic self-sufficiency	X		X	
	d8700	Personal economic resources				24.1
d910		Community life		28.8	X	55.1
d920		Recreation and leisure	X	82.7	X	78.2
	d9201	Sports		84.6		81.6
	d9202	Arts and culture				43.8
	d9204	Hobbies		24.1		37.8
	d9205	Socializing		48.8		53.8
d930		Religion and spirituality	X			30.4
d940		Human rights			X	
d950		Political life and citizenship				26.9

Abbreviations: ICI, International Classification of Functioning, Disability and Health; SCI, spinal cord injury.

Note: Categories not represented in the ICF Core Set for SCI for the early post-acute context or the long-term context with an agreement by the experts of more than 75% are highlighted bold.

additional musculoskeletal structures related to movement, s7700 bones, s7701 joints and s7703 extra-articular ligaments, fasciae, extra muscular aponeuroses so on.

From the component activities and participation, 53 categories mentioned by experts in the early post-acute and 81 in the long-term context are represented in the ICF Core Set (Table 4). Some categories are represented on a different level of classification, for example, in the long-term

context, d455 moving around is represented by d4550 climbing, d4551 running, d4552 jumping and d4553 swimming. In some cases, third level categories in the ICF Core Set are represented on the second level, for example, d440 fine hand use was represented more detailed by pulling, pushing, reaching, catching, turning and twisting. Three ICF categories, d175 solving problems, d435 moving objects with lower extremities for the long-term context and d6504

Table 5 ICF component environmental factors: percent agreement among participants in the final Delphi round

ICF code		ICF category title	Early post-acute context		Long-term context	
Second level	Third Level		ICF Core Set SCI	Final round n = 81	ICF Core Set SCI	Final round n = 81
e—Environmental factors						
e110		Products or substances for personal consumption	X		X	
e115		Products and technology for personal use in daily living	X	90.1	X	91.4
	e1150	General products and technology for personal use in daily living		53.1		58.8
	e1151	Assistive products and technology for personal use in daily living		97.5		79.5
e120		Products and technology for personal indoor and outdoor mobility and transportation	X	78.2	X	79.2
	e1200	General products and technology for personal indoor and outdoor mobility and transportation				83.8
	e1201	Assistive products and technology for personal indoor and outdoor mobility and transportation		86.3		87.2
e125		Products and technology for communication	X	45.6	X	
	e1251	Assistive products and technology for communication		48.1		
e130		Products and technology for education	X		X	33.8
e135		Products and technology for employment	X		X	60.0
e140		Products and technology for culture, recreation and sport	X	82.5	X	78.7
	e1401	Assistive products and technology for culture, recreation and sport				77.3
e150		Design, construction and building products and technology of buildings for public use	X	44.9	X	50.0
	e1500	Design, construction and building products and technology for entering and exiting buildings for public use		42.0		
e155		Design, construction and building products and technology of buildings for private use	X	43.2	X	49.4
	e1551	Design, construction and building products and technology for gaining access to facilities in buildings for private use				43.8
e160		Products and technology of land development			X	32.4
	e1601	Products and technology of suburban land development		29.6		
	e1602	Products and technology of urban land development		24.7		36.8
e165		Assets	X		X	
	e1650	Financial assets				26.6
e210		Physical geography				27.8
	e2100	Land forms		17.3		
e230		Natural events		16.3		
e235		Human-caused events		19.0		
e310		Immediate family	X	82.7	X	84.0
e315		Extended family	X	67.9	X	66.7
e320		Friends	X	72.5	X	69.2
e325		Acquaintances, peers, colleagues, neighbors and community members	X		X	62.5
e330		People in positions of authority	X		X	
e340		Personal care providers and personal assistants	X	91.4	X	79.5
e350		Domesticated animals				35.8
e355		Health professionals	X	83.5	X	82.9
e360		Other professionals	X		X	
e410		Individual attitudes of immediate family members	X		X	77.9
e415		Individual attitudes of extended family members	X		X	
e420		Individual attitudes of friends	X		X	72.2
e425		Individual attitudes of acquaintances, peers, colleagues, neighbors and community members	X		X	
e440		Individual attitudes of personal care providers and personal assistants	X	79.0	X	
e450		Individual attitudes of health professionals	X	92.5	X	91.1
e455		Individual attitudes of health-related professionals			X	
e460		Societal attitudes	X	63.8	X	70.9
e465		Social norms, practices and ideologies		38.0	X	46.2
e510		Services, systems and policies for the production of consumer goods			X	
e515		Architecture and construction services, systems and policies	X		X	
e525		Housing services, systems and policies	X		X	
e530		Utilities services, systems and policies			X	
e535		Communication services, systems and policies			X	
e540		Transportation services, systems and policies	X	42.0	X	54.4
e550		Legal services, systems and policies			X	
e555		Associations and organizational services, systems and policies	X		X	
	e5550	Associations and organizational services				72.5
e560		Media services, systems and policies				34.6
e565		Economic services, systems and policies		16.0		28.9
	e5650	Economic services		17.5		
e570		Social security services, systems and policies	X		X	35.1
e575		General social support services, systems and policies	X		X	59.7

Table 5 Continued

ICF code		ICF category title	Early post-acute context		Long-term context	
Second level	Third Level		ICF Core Set SCI	Final round n = 81	ICF Core Set SCI	Final round n = 81
e580		Health services, systems and policies	X	81.3	X	89.9
	e5800	Health services				82.9
	e5801	Health systems		90.0		
	e5802	Health policies		83.1		
e585		Education and training services, systems and policies			X	
e590		Labor and employment services, systems and policies			X	
e595		Political services, systems and policies		18.7		

Abbreviations: ICI, International Classification of Functioning, Disability and Health; SCI, spinal cord injury.

maintaining assistive devices for the early post-acute context are not represented in the ICF Core Set.

From the component environmental factors, all ICF categories with an agreement >75% are represented in the ICF Core Set, namely 25 ICF categories from the early post-acute and 23 from the long-term context (Table 5).

In all, 25 responses for the early post-acute context and 21 for the long-term context were assigned to the not-yet developed ICF component personal factors and reached an agreement surpassing 75% (Table 6). In all, 13 responses, which reached an agreement >75% were not covered by the ICF (Table 7).

Discussion

We found that the categories of the current versions of the ICF Core Sets for SCI were largely representing what physical therapists agreed upon to take care of in their interventions. Some ICF categories regarding the body functions were not included in the ICF Core Set. For the early post-acute context, the experts mentioned b4352 functions of lymphatic vessels. There is evidence to support the expert opinion. Lymph drainage as a therapeutic intervention is aiming to reduce the volume of edema, as well as pain and increasing the range of motion and activating the regeneration of new lymphatic vessels in scarred tissue.¹¹

The experts agreed that b1801 body image is a problem they take care of. Physical impairments are resulting in a changed body, and strongly affect physical and social-psychological well being and performance.¹² Body composition may impact satisfaction with physical appearance for some women.¹³ First, sports therapy has the effect of increasing and developing a new body image and body scheme.¹² Second, for example, cognitive-behavioral-therapy is a tool to strengthen physical therapy.¹⁴ Physical therapists are increasingly offered cognitive-behavioral-therapy courses for improvement of patient care.¹⁵ It can be useful in physical therapy treatment units to help the patients to learn more effective ways to overcome the difficulties that contribute to their distress.¹⁴ This leads directly to the ICF category b1646 problem solving, which addresses the mental functions of identifying, analyzing and integrating incongruent information into a solution.

Effective problem solving reduces depressive behavior and psychosocial impairment and leads to assertiveness¹⁶ irrespective of the onset of injury. Related to this finding, the category of the component activity and participation d175 solving problems was supported by experts for the early post-acute and long-term context. It is used in the sense of finding solutions by identifying and analyzing issues.¹⁷

For the long-term context, experts agreed that b450 additional respiratory functions, b755 involuntary movement reaction functions and b7650 involuntary contractions of muscles are problems treated by physical therapists. Involuntary movement reactions are induced by the body position, balance or threatening stimuli affecting the whole body or large muscles. Involuntary contractions of muscles affect one muscle or muscle group and are not intentional.¹⁸

The category b410 Heart functions, was mentioned for the long-term context. In fact, abnormal heart rates and rhythms are commonly present after a spinal cord injury. People with SCI experience poor venous return and lower limb blood pooling, resulting from a lack of sympathetic tone and a reduced muscle pump in the lower extremity. Consequently, the increase of aerobic performance by increasing lower limb strength and cycle endurance performance or functional electric stimulation is a common intervention goal in rehabilitation.¹⁹ Physical therapists decide on the intensity and type of exercise they prescribe as part of a plan of care. Exercise is an important component of evidence-based treatment in physical therapy settings and is an essential component of improving health.²⁰

The ICF categories from the component body structures not represented in the ICF Core Set are identical for early post-acute and long-term context. The ICF categories s770 additional musculoskeletal structures related to movement, as well as detailed categories s7700 bones, s7701 joints, s7702 muscles and s7703 extra-articular ligaments, Fasciae and so on were identified by the experts to represent problems treated by physical therapists. The impact of musculoskeletal diseases on the overall function and well being of a person with SCI cannot be overstated.²¹

In our survey, a large number of personal factors were identified mainly related to health conditions or were related to age, coping or adapting to the new role. Personal factors are not classified in the ICF yet. There is consensus in the literature that personal factors are influential to the degree of

Table 6 ICF personal factors: percent agreement among participants in the final Delphi round

Concept	Early post- acute context	Long-term context
	Final round n = 81	Final round n = 81
Musculoskeletal trauma unrelated to the SCI	98.7	
Overuse of musculoskeletal systems		98.7
Overuse upper extremity and shoulder		97.5
Edema	97.5	96.2
Realistic goals	96.2	
Education, knowledge about the health condition and treatment	96.1	93.6
Motivation	96.1	94.7
Respiratory infections	94.9	
Joints inflammation		93.7
Independence	94.8	93.4
Pneumonia	93.7	
Adapting to a new physical and functional reality	93.6	93.6
Carpal tunnel problems		88.6
Ageing aspects		85.9
Loss of self esteem	89.7	
Concomitant injuries	89.6	
Coping strategies	86.8	84.0
Will and willingness	84.8	
Feel accepted and understood	83.3	
Patient—ability to instruct others	82.1	85.9
Pulmonary infection		82.1
Concomitant brain injury	81.8	
Fractures	80.8	82.1
Obesity	78.5	89.6
Changed role		77.3
Chest infection	82.1	88.6
Inflammation	91.3	
Heterotopic ossification	87.7	87.2
Syringomyelia		87.2
Osteoporosis	87.5	87.2
Deep vein thrombosis	85.0	
Depression	77.8	77.5
Psychological unrest	75.9	
Self determined agitation		73.4
Pulmonary edema	69.1	
Unstable behavior	68.8	
Pulmonary emboli	63.0	
Postural tachycardia syndrome	56.8	
Dementia	35.8	
Urinary tract infections	33.3	36.4
Tuberculosis	26.9	
Kidney infections	20.0	37.7
Illiteracy	20.0	
Bowel infections		34.6
Colostomy		33.3

Abbreviation: ICI, International Classification of Functioning, Disability and Health.

functioning, disability and well being.²² Thus, it could be useful to develop the ICF component, personal factors, to enable health professionals to comprehensively and systematically describe relevant aspects influencing a patient's functioning and health.

Regarding methodological strengths and limitations, the following aspects should be considered. The Delphi technique was an appropriate method for this study objective. With a total response rate of 82.7%, the criterion of a minimum 70% response rate was clearly exceeded.⁷ According

Table 7 ICF not covered - responses that could not be linked to the ICF category concept: percent agreement among participants in the final Delphi round

Concept	Early post- acute context	Long-term context
	Final round n = 81	Final round n = 81
Ensuring participation goals are addressed		96.0
Partner, family training/education/support	97.4	93.5
Caregiver, personal assistant training/education/support	94.9	91.0
Soft tissue	93.7	
Outcome of treatment/patient	93.6	
Equipment and resources available for family	91.1	
Knowledge, education of health professionals/PTs	91.1	
Research	89.9	
Secretion clearance	89.7	
Friends education/information	89.7	89.5
Handlings with therapeutic appliances		89.5
Increased burden of care	90.1	
Family constrains		88.8

Abbreviations: ICI, International Classification of Functioning, Disability and Health; PT, physical therapist.

to the κ -coefficient, there was substantial agreement of the two researchers who performed the linking process. This finding supports the reliability of the study.

However, a potential selection bias cannot be excluded. Random sampling was not possible as no database is available with sufficient number of the targeted population. There is evidence that the Delphi method rather employs experts in the area of interest.⁷ Furthermore, there are limitations in the external validity. Although physical therapists from all WHO world regions participated, there was an underrepresentation of South East Asia, and the Eastern Mediterranean region. It is possible that health services are not yet established for SCI. Language barriers might have been another reason, as the Delphi survey was conducted in English language only.

A majority of problems treated by physical therapists were covered by the Comprehensive ICF Core Sets for SCI. Few shortcomings concerning body functions, structures, activities and participation and personal factors were disclosed. However, this study supports that the Comprehensive ICF Core Sets in SCI are relevant to the clinical practice of physical therapists. The Comprehensive ICF Core Sets in SCI provide a useful basis for clinical practice to describe and classify functioning, health and disability with a common framework and language. Further results on the validity of the ICF Core Sets will be available from studies involving perspectives from occupational therapists, physicians, psychologists, nurses and social workers.

Conflict of interest

The authors declare no conflict of interest.

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