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RESEARCH PAPER

Functioning of stroke survivors – A validation of the ICF core set for stroke in Sweden

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Abstract

Purpose.   To validate the *body functions* and *activities and participation* part of the extended International Classification of Functioning, Disability, and Health (ICF) core set for stroke with a Swedish population in the first 3 months post-stroke.
Method.   At 6 weeks and at 3 months post-stroke, stroke survivors were evaluated by 59 ICF categories of body functions, 59 categories of activities and participation from the stroke ICF core set (extended version).
Results.   The study sample included 99 stroke survivors (54% women) with an average age of 72 years. Statistical significant problems were identified in 28 ICF categories of body functions and in 41 ICF categories of activities and participation at both time points, at 6 weeks and at 3 months. About 17 ICF categories were reported as problems in independent (i.e. modified Rankin Scale (mRS) ≤ 2) and about 34 categories in dependent (i.e. mRS > 2) stroke survivors.
Conclusions.   The results suggest a possible reduction of the stroke ICF core set from 59 to 28 categories of body functions and from 59 to 41 categories of activities and participation. Hence, feasibility of the core set for multiprofessional assessment increases and the core set might find more integration in clinical practice. The number of problems in mobility and self-care mainly distinguished between independent and dependent stroke survivors.

Keywords: *Stroke, functioning, ICF, activities and participation, body functions*

Introduction

Stroke is a leading cause of physical disability worldwide [1,2]. There is strong evidence for the effectiveness of comprehensive, multidisciplinary rehabilitation interventions in reducing stroke-related disability [3,4]. The efficiency of interprofessional care depends – to some extent – on successful communication of health information across disciplinary boundaries [5]. Incorporating a framework of health and disability, such as the International Classification of Functioning, Disability, and Health (ICF) [6], could optimize multidisciplinary rehabilitation efforts [7]. The ICF has been acknowledged as one possible way to facilitate not only interprofessional communication but also communication between health professionals and patients [8–12]. Furthermore, it has been identified as a possible common framework for consistently reporting functional status (based on a bio-psycho-social perspective) [13–15]. The ICF is, however, difficult to use in a clinical context, as it contains >1400 categories.

To improve clinical practicability, ICF core sets have been developed which represent a selection of ICF categories describing the prototypical spectrum of problems in the functioning of patients with specific health conditions [16]. On the basis of evidence gathered from preliminary studies, the core sets were developed in a formal decision-making and consensus-based process for the most burdensome health conditions, including stroke [17,18]. The core set for stroke (extended version) includes 59 categories of body functions, 11 categories of body structures, 59 categories of activities and participation and 37 categories of environmental factors, as used in other study [19]. Before this core set can be

used as a practical tool to guide clinical assessment, there is a need to investigate the degree to which it covers the significant problems of stroke survivors. Hence, the core set for stroke was tested in a cross-sectional international multicenter validation study [20]. Given the changing spectrum of problems with increasing time after stroke, however, the core set might also be validated in longitudinal studies. As the recovery process is seen mainly in the first 3 months [21–25], the present study was conducted to investigate differences between the relevance of the core set at two different time points during this period. In addition, the ability to identify independent and dependent stroke survivors was examined. As the primary outcomes of multiprofessional rehabilitation interventions are usually body functions and activities and participation [21,26,27], this study focuses on these two parts of the core set, and the environmental factors are described elsewhere [28].

The two specific aims were: (1) to investigate the frequencies of impairments and limitations of stroke survivors at 6 weeks and 3 months post-stroke reported in the ICF categories included in the core set for stroke (extended version); and (2) to examine the discriminative ability of the identified significant frequent ICF categories in distinguishing between independent and dependent stroke survivors.

Methods

Participants

This study included 99 stroke survivors from four stroke units at Sahlgrenska University Hospital, Göteborg. Patients were consecutively recruited from February to July 2006 with the inclusion criteria of a diagnosis of first-ever stroke (ICD-10 codes I60–I67), an age of at least 18 and an ability to give written informed consent (or consent given by next to kin). Stroke was clinically determined by specialists at the stroke units according to the World Health Organization (WHO) criteria [29] and confirmed by computed tomography (CT).

Variables and instruments

The impairments and limitations of stroke survivors were collected by means of the 59 ICF categories of the component *body functions* and the 59 categories of the component *activities and participation* from the Comprehensive ICF core set for stroke (extended version). In the extended version, the comprehensive ICF core set for stroke was amended with categories from the core set for patients with neurological

conditions in the acute hospital and in early post-acute rehabilitation facilities [17,30]. Thus, the core set can be said to be applicable not only in the chronic but also in the early post-stroke phases. All chapters of the body functions (included categories range from b110 to b810) and all chapters of activities and participation (categories range from d110 to d940) are represented by the 118 ICF categories. The qualifier scale proposed by the WHO was used to evaluate the extent of a person's difficulties in each ICF category [6]. The proposed scale has five response categories ranging from 0 to 4 (no/mild/moderate/severe/complete problem). In addition, there are the response options '8 – not specified' and '9 – not applicable'. The latter is used when a category is not applicable to a particular patient or situation. For example, if someone is retired, the category 'd850 remunerative employment' is not applicable. The response option '8 – not specified' is used when available information is not sufficient to quantify the severity of the problem and/or is ambiguous (e.g. in interviews with participants with cognitive problems). If the problem is associated with other health conditions than stroke, the option C (for co-morbidity) is selected.

The modified Rankin Scale (mRS) was used to assess global disability. The mRS is a commonly used scale (from '0 = no symptoms at all' to '6 = dead') to describe disability in stroke survivors [31]. The intra-reliability of mRS is good, with a κ above 0.80 [32].

Data collection procedures

A contact person (nurse/physiotherapist) working at each stroke unit informed the research assistant about new admissions on a weekly basis. Eligible stroke patients were seen for recruitment within the first week after admission at baseline. Patients were provided with a written description of the study and in the case of participation written informed consent was obtained. Demographic information, subtype, and side of stroke (both determined by a stroke specialist) were recorded. Participants were followed up at 6 weeks and at 3 months post-stroke either at home or in hospital. Information about participants' health status was gathered from semi-structured questions based on the ICF categories of body functions as well as the categories of activities and participation from the extended stroke core set. After the interview was completed (the duration varied between 30 min and 2 h depending on the participant's functioning), the ICF core set was filled in on the basis of the interviewer's observation and the patient's story (in one case supported by the complementing information from the next-of-kin).

Global stroke severity (mRS) was recorded at recruitment, at 6 weeks and at 3 months post-stroke by the interviewer. The interviews were conducted by the same research assistant, trained within the scope of the international WHO Collaboration Project to validate ICF Core Sets [20]. The study was approved by the Ethics Committee of Göteborg University.

Data analysis

As the aim of this study was to investigate the frequencies and not the extent of impairments and limitations, the degrees of the qualifier scale were dichotomized as follows: the qualifier 0 (no problem) was maintained, the qualifiers 1 to 4 were recoded to 1 (problem), the response option '8 – not specified' was treated as missing, whereas the response option '9 – not applicable' was recoded to 0 (no problem). Two subgroups at each time point were generated: independent stroke survivors were defined by scoring 2 or under on the mRS, and those scoring > 2 were defined as dependent stroke survivors. This was accepted as meaningful dichotomizing with a sensitivity of 85% and a specificity of 87% [33]. Univariate statistics were used to describe the sample characteristics and examine the frequencies of impairments and limitations. When the variables were not normally distributed (Kolmogorov-Smirnov test [34]), medians were reported. To investigate differences in the number of problems between independent and dependent stroke survivors, the U-test was used. All tests were carried out as two-sided at local α levels of 5%. Statistical analyses were performed with SPSS (Version 13.0).

Results

Study participants

The 99 participants (54% women) had a mean age of 72 years. Cerebral infarction was the main cause of diagnosed stroke (81%). At recruitment, 26 participants were classified as independent (i.e. mRS ≤ 2) and 73 as dependent (i.e. mRS > 2), at 6 weeks; 16 more participants were independent and at 3 months post-stroke a total of 49 participants were independent and 40 were dependent. About 17 ICF categories were reported as problems in independent and about 34 categories in dependent stroke survivors. The baseline characteristics and diagnoses are shown in Table I, stratified by independent/dependent stroke survivors; global disability and the number of problems of the study sample are shown in Table II.

Table I. Baseline characteristics of study participants.

	Grade of disability		
	ID (*n* = 26)	D (*n* = 73)	Total (*n* = 99)
Age, mean (± STD)	66 (±14.2)	78 (±9.5)	72 (±13.1)
Gender, *n* (%)			
Female	15 (58)	39 (53)	54 (54)
Male	11 (42)	34 (47)	45 (46)
Diagnose ICD 10, *n* (%)			
I61	2 (8)	9 (12)	11 (11)
I63	19 (73)	62 (85)	81 (81)
I64	1 (4)	1 (1)	2 (2)
Others (I670; I676)	4 (15)	–	4 (4)
Localization, *n* (%)			
Left	11 (42)	17 (23)	28 (28)
Right	7 (27)	22 (30)	29 (29)
Bilateral	1 (4)	3 (4)	4 (4)
Central	3 (12)	9 (12)	12 (12)
Unspecified	4 (15)	22 (30)	26 (26)

ID, independent (e.g. mRS ≤ 2); D, dependent (e.g. mRS > 2).

Table II. Global disability and number of problems of participants.

	6 weeks	3 months
	Median (25–75 percentiles)	Median (25–75 percentiles)
mRS		
Total	3 (1–4)	2 (1–3.5)
ID	1 (1–2)	1 (0–1.3)
D	3 (2–4)	3 (2–4)
Problems in body functions		
Total	13 (9–18)	13 (8–17)
ID	11 (8–13)	17 (15–21)
D	10 (8–13)	16.5 (13.25–22)
Problems in activities and participation		
Total	9 (8–17)	9 (3–16)
ID	6 (3–9)	6 (2.5–10)
D	16 (11–19)	18 (11.25–22.5)

ID, independent (e.g. mRS ≤ 2); D, dependent (e.g. mRS > 2); at 6 weeks classified independent *n* = 42 and dependent *n* = 47, at 3 months classified independent *n* = 49 and dependent *n* = 40; *n* = 89.

Problems in body functions

Overall, problems at 6 weeks as well as at 3 months were identified as significant (that happened if at least 10% of participants had problems in a specific ICF category) in 28 of the 59 ICF categories of body functions. There is no obvious difference in frequencies of impairments between the two time points. b130 energy and drive functions, b144 memory functions, b455 exercise tolerance functions, b730 muscle power, b740 muscle endurance functions, and b770 gait pattern functions were the commonest problems and were reported in more than two-thirds of stroke survivors. The impairments reported with the ICF categories of body functions and their

frequency at 6 weeks and at 3 months are presented in Table III.

Problems in activities and participation

A total of 41 of the 59 ICF categories of activities and participation was significantly reported (i.e. at least 10% of participants) as problems at 6 weeks as well as at 3 months. d630 preparing meals, d640 doing housework and d920 recreation and leisure were reported significantly more often at 3 months than at 6 weeks. The main problems according to frequencies and number of single problems were reported in the chapter d4 mobility. At least 50% of stroke survivors presented problems in d220 undertaking multiple tasks, d440 fine hand use, d450 walking, and d460 moving around in different locations at 6 weeks. At 3 months, these were still the main problems, plus d640 doing housework. The consequences reported for the ICF codes of activities and participation at the two different time points are shown in Table IV.

Independent and dependent stroke survivors

At 6 weeks, 42% of participants were independent and 47% dependent. At this time point, the independent differed significantly from the dependent stroke survivors in the numbers of problems in all chapters except in chapters b4 functions of the cardiovascular, hematological, immunological, and respiratory systems, d2 general tasks and demands, and d6 domestic life. The latter two were not significantly distinctive at 3 months. At this time

Table III. Problems in ICF terms of body functions 6 weeks and 3 months post-stroke.

ICF code	ICF category title	6 weeks (n = 89)		3 months (n = 89)	
		%	(CI 95)	%	(CI 95)
Chapter 1. Mental functions					
b126	Temperament and personality functions	17	(8–27)	22	(12–31)
b130	Energy and drive functions	72	(62–81)	65	(55–75)
b134	Sleep functions (c = 18%)	36	(26–46)	34	(24–44)
b140	Attention functions	11	(5–18)	11	(5–18)
b144	Memory functions	66	(56–76)	61	(50–71)
b160	Thought functions	12	(5–18)	7	(2–13)
b164	High-level cognitive functions	22	(11–32)	20	(9–31)
b172	Calculation functions	17	(3–31)	7	(−8 to 21)
b176	Mental functions of sequencing complex movements	11	(4–18)	6	(1–12)
Chapter 2. Sensory functions and pain					
b210	Seeing functions (c = 79%)	95	(90–99)	96	(91–100)
b235	Vestibular functions	34	(24–44)	30	(20–39)
b240	Sensations associated with hearing and vestibular function (c = 9%)	19	(11–28)	19	(11–28)
b260	Proprioceptive functions	29	(20–39)	30	(21–40)
b265	Touch functions	11	(5–18)	10	(4–16)
b280	Sensation of pain	23	(14–31)	35	(25–45)
Chapter 4. Functions of the cardiovascular, hematological, immunological and respiratory systems					
b410	Heart functions (c = 41%)	43	(33–54)	42	(31–52)
b420	Blood pressure functions (c = 55%)	81	(73–89)	76	(67–85)
b455	Exercise tolerance functions	94	(89–99)	94	(89–99)
Chapter 5. Functions of the digestive, metabolic and endocrine systems					
b525	Defecation functions	17	(9–25)	17	(9–25)
b530	Weight maintenance functions	26	(17–35)	19	(11–27)
b540	General metabolic functions (c = 15%)	26	(17–35)	32	(22–42)
Chapter 6. Genitourinary and reproductive functions					
b620	Urination functions (c = 5%)	20	(12–29)	16	(8–23)
Chapter 7. Neuromusculoskeletal and movement-related functions					
b730	Muscle power functions	71	(61–80)	61	(50–71)
b740	Muscle endurance functions	77	(68–86)	79	(70–87)
b750	Motor reflex functions	14	(6–21)	10	(4–16)
b755	Involuntary movement reaction functions	52	(41–62)	54	(43–65)
b760	Control of voluntary movement functions	48	(38–59)	44	(33–54)
b770	Gait pattern functions	73	(64–82)	75	(66–84)

c = co-morbidity.

Table IV. Problems in ICF terms of activities and participation 6 weeks and 3 months post-stroke.

ICF code	ICF category title	6 weeks ($n = 89$)		3 months ($n = 89$)	
		%	(CI 95)	%	(CI 95)
Chapter 1. Learning and applying knowledge					
d130	Copying	11	(2–19)	8	(−1 to 17)
d135	Rehearsing	22	(11–34)	11	(0–21)
d155	Acquiring skills	27	(17–37)	25	(16–35)
d160	Focusing attention	31	(21–41)	30	(20–40)
d166	Reading	40	(30–51)	34	(24–44)
d170	Writing	27	(18–37)	30	(20–39)
d172	Calculating	12	(4–20)	4	(−1 to 9)
d175	Solving problems	13	(6–21)	9	(2–15)
d177	Making decisions	17	(9–25)	14	(6–21)
Chapter 2. General tasks and demands					
d210	Undertaking a single task	27	(17–36)	32	(22–41)
d220	Undertaking multiple tasks	58	(48–69)	59	(48–69)
d230	Carrying out daily routine	24	(14–33)	27	(18–36)
d240	Handling stress and other psychological demands	23	(14–32)	21	(12–29)
Chapter 3. Communication					
d310	Communicating with – receiving – spoken messages	14	(6–21)	3	(0–7)
d315	Communicating with – receiving – nonverbal messages	17	(7–27)	6	(−2 to 14)
d325	Communicating with – receiving – written messages	24	(15–33)	9	(3–15)
d330	Speaking	15	(7–22)	12	(5–19)
d335	Producing nonverbal messages	18	(8–29)	9	(−1 to 18)
d345	Writing messages	29	(17–41)	23	(10–36)
d350	Conversation	16	(8–23)	12	(5–19)
d360	Using communication devices and techniques	18	(10–26)	18	(10–26)
Chapter 4. Mobility					
d410	Changing basic body position	36	(26–46)	37	(27–47)
d415	Maintaining a basic body position	23	(14–31)	36	(26–46)
d420	Transferring oneself	37	(27–47)	39	(29–50)
d430	Lifting and carrying objects	44	(33–54)	38	(28–48)
d440	Fine hand use	53	(42–63)	46	(36–57)
d445	Hand and arm use	37	(27–47)	38	(28–48)
d450	Walking	78	(71–88)	78	(69–86)
d460	Moving around in different locations	71	(61–80)	67	(57–77)
d465	Moving around using equipment	42	(31–52)	38	(28–48)
d470	Using transportation	11	(5–18)	10	(4–16)
Chapter 5. Self-care					
d510	Washing oneself	33	(23–43)	32	(22–41)
d520	Caring for body parts	39	(29–50)	33	(23–43)
d530	Toileting	25	(16–34)	25	(16–34)
d540	Dressing	35	(25–45)	33	(23–43)
d550	Eating	21	(13–30)	24	(15–33)
d570	Looking after one's health	9	(3–15)	10	(4–16)
Chapter 6. Domestic life					
d620	Acquisition of goods and services	26	(17–35)	36	(26–46)
d630	Preparing meals	25	(16–34)	30	(21–40)
d640	Doing housework	29	(20–39)	50	(39–61)
Chapter 9 Community, social and civic life					
d920	Recreation and leisure	19	(11–28)	39	(29–50)

point, 49% of participants were independent and 40% dependent. Overall, at both time points, d4 mobility (mean difference (M_{diff}) = 4.8), d5 self-care (M_{diff} = 2.9), and b7 neuromusculoskeletal and movement-related functions (M_{diff} = 2.6) followed by b6 genitourinary and reproductive functions (M_{diff} = 0.3) and d3 communication (M_{diff} = 1.6) were significant with $p < 0.000$. Table V shows the comparison of numbers of problems between

independent and dependent stroke survivors at 6 weeks and 3 months.

Discussion

This study showed that 28 of 59 ICF categories of body functions and 41 of 59 ICF categories of activities and participation were significantly identified as

Table V. Comparison of number of problems between independent and dependent stroke survivors.

ICF chapters	6 weeks				3 months			
	Mean	SD	Mean difference	p	Mean	SD	M_{diff}	p
Body functions								
Mental functions								
ID	2.0	1.39	−0.7	0.014	1.7	1.38	−0.9	0.002
D	2.7	1.54			2.6	1.46		
Sensory functions and pain								
ID	1.8	1.13	−0.6	0.010	1.9	1.08	−0.6	0.005
D	2.4	1.09			2.5	1.09		
Functions of the cardiovascular, hematological, immunological, and respiratory systems								
ID	1.9	0.78	−0.3	0.068	1.9	0.82	−0.5	0.008
D	2.2	0.70			2.4	0.62		
Functions of the digestive, metabolic, and endocrine systems								
ID	0.4	0.67	−0.4	0.046	0.4	0.71	−0.6	0.002
D	0.8	0.93			1.0	1.04		
Genitourinary and reproductive functions								
ID	0.0	0.15	−0.3	0.000	0.0	0.14	−0.3	0.000
D	0.4	0.49			0.3	0.47		
Neuromusculoskeletal and movement-related functions								
ID	2.0	1.75	−2.5	0.000	2.0	1.72	−2.6	0.000
D	4.5	1.3			4.7	1.03		
Activities and participation								
Learning and applying knowledge								
ID	1.2	1.34	−1.1	0.003	1.1	1.59	−0.7	0.007
D	2.3	1.74			1.9	1.57		
General tasks and demands								
ID	1.4	1.04	0.2	0.289	1.2	1.15	−0.3	0.233
D	1.2	1.00			1.5	1.01		
Communication								
ID	0.2	0.54	−2.1	0.000	0.2	0.86	−1.1	0.000
D	2.3	2.40			1.3	1.79		
Mobility								
ID	1.9	1.89	−4.5	0.000	2.0	1.85	−5.1	0.000
D	6.5	2.54			7.1	2.35		
Self-care								
ID	0.1	0.57	−2.8	0.000	0.2	0.67	−3.0	0.000
D	2.9	2.03			3.2	2.08		
Domestic life								
ID	0.7	1.13	−0.1	0.788	0.9	1.05	−0.5	0.061
D	0.9	1.25			1.4	1.22		
Community, social, and civic life								
ID	0.3	0.48	0.3	0.001	0.4	0.49	−0.01	0.907
D	0.1	0.25			0.4	0.50		

ID, independent stroke survivor (i.e. mRS ≤ 2); D, dependent stroke survivor (i.e. mRS > 2).

problems in a Swedish stroke population at 6 weeks and 3 months after stroke event. It was possible to distinguish between independent and dependent stroke survivors by the number of problems documented by these ICF categories. Chapters d4 mobility, d5 self-care, and b7 neuromusculoskeletal and movement-related functions followed by b6 genitourinary and reproductive functions and d3 communication showed the overall best discriminative ability.

In this study, the comprehensive core set for stroke (extended version) was validated by empirical data. Before discussion of the results and any generalization, the characteristics of the study sample should be closely considered. The study participants are Swedish residents and the results cannot be directly

generalized to other cultures and populations. The study sample represents an average stroke unit population with an average age of 72 years. As the data collection was based on an interview process which implies that stroke survivors were able to understand and answer questions in a coherent way, the present identified problems probably reflect the spectrum of problems for persons without severely impaired cognitive functions.

Problems in body functions

Although the core set was developed to define the typical spectrum of problems in functioning of stroke

survivors, only 28 of 59 ICF categories of body functions were empirically identified as substantial at 6 weeks and 3 months. Overall, the most frequently reported impairments were seen in chapter b7 neuromusculoskeletal and movement-related functions. These findings were supported by the literature, which describes those impairments as common outcome variables of clinical stroke trials [26,35,36]. In particular, there were five impairments with which more than two-thirds of stroke survivors were confronted. The first, b455 exercise tolerance functions, was the impairment which was reported in nearly all stroke survivors. As both this study and others have shown that problems with exercise tolerance functions are extremely common in stroke survivors [37,38], more attention might be paid to assessment of and intervention in aerobic exercise capacity. The following three categories, b740 muscle endurance functions, b770 gait pattern functions and b730 muscle power, were impaired in about three-quarters of participants. They are well-known problems often assessed in clinical stroke research [39]. Just as common as the neuromusculoskeletal impairments was the fifth, b130 energy and drive functions (which in ICF language mean mental functions in physiological and psychological mechanisms). This problem, often referred to in the literature as fatigue, has similar prevalence in other studies and has been identified as an important outcome for functioning of stroke survivors [40,41]. Moreover, the high number of single problems in chapter b1 mental functions indicates the complexity of global brain function and cognitive problems. Hence, rehabilitation interventions might focus more on this field with respect to its intricacy.

In terms of the 31 discarded categories, most of them are impairments associated with acute problems in the first week of admission or with severe stroke, for example b110 consciousness functions, b114 orientation functions, and b510 Ingestion functions. In addition, there are certain impairments which may be more frequent in very old persons, like b117 intellectual functions (including dementia), b230 hearing functions, b435 immunological system functions, and b440 respiration functions. As the mean age of the stroke survivors of this study was close to the average age of those who suffer a stroke (about 75 years [42–45]), and as stroke survivors primarily suffer mild to moderate stroke [46,47], as in the present study, it can be assumed that the 28 identified categories cover the spectrum of problems of the main group of stroke survivors.

In order to distinguish between independent and dependent stroke survivors, problems of the chapters b6 genitourinary and reproductive functions (i.e. b620 Urination functions) and b7 neuromusculoskeletal and movement-related functions could be assessed, as they were the most distinctive. Results in the literature support these findings [23,36,48].

Problems in activities and participation

Forty-one of the 59 ICF categories of activities and participation were identified as substantial reported problems of stroke survivors by the empirical data at 6 weeks and 3 months. The main problem, recognized through the high frequency and high number of single problems, was seen in chapter d7 mobility, which is in accordance with the literature [26,49–51]. Although limitations in chapter b8 self-care were also quite common in six different categories, problems in chapter d1 learning and applying knowledge and chapter d3 communication were less frequently stated but were seen in many single categories. Hence, problems in self-care were concrete whereas problems in learning and applying knowledge and communication appeared to be more diffuse and complex. In particular, the most frequently reported limitations comprised d450 walking, d460 moving around in different locations, d440 fine hand use, and d220 undertaking multiple tasks. Although rehabilitation interventions already focus on the first three problems [26,51–54], the last one is less often seen as a study outcome. There are studies, however, which differentiate between recovery and compensation, which means in this case stroke patients should avoid attempting multiple tasks and learn to do things step by step [55,56].

As regard the 18 discarded categories, they can be divided into two groups. Categories in the first group might not be as common as supposed, e.g. problems in d110 watching, d115 listening, and d120 other purposeful sensing. In the categories of chapter d7 interpersonal interactions and relationships, no frequent problems were reported. Rather, family and relationships were facilitators for stroke survivors [28]. Categories of the second group are mainly associated with younger stroke survivors, e.g. d845 acquiring, keeping and terminating a job and d850 remunerative employment. As in general the average age of stroke survivors is close to the age of the study sample, the 41 categories identified might comprise the spectrum of limitation of most of the stroke survivors.

Independent and dependent stroke survivors could be distinguished best by reported problems in chapters d3 communication, d4 mobility, and d5 self-care. There were no differences between limitations of independent and dependent stroke survivors in chapters d2 general tasks and demands and d6 domestic life.

Owing to the process of data collection (interview), our study has some points of weakness. First,

the received information could be biased: on one hand, by the interviewer's specific professional knowledge, as their role and educational background may lead them to adopt different points of view when asking questions. On the other hand, by the interviewer's personal judgment regarding the choice of qualifier. Therefore, for further research, more than one person doing the coding would be preferable. Another bias could arise from the subjective component of the ICF classification within activities and participation. More precisely, the objective equal deficits of two people can be reported differently. For example, a person accustomed to walking quickly is going to report moderate limitations if they are not able to walk as quickly as they were able to do prior to the stroke. Another, less active, person is going to report only mild limitations, although he/she cannot walk as fast as the first person. In order to overcome some of these problems the following steps were taken. First, all interviews were conducted by one person. Second, control questions were asked to evaluate the extent of a problem. Third, during the interview observations of the way participants acted were made. Fourth, for the data analysis, the qualifiers were dichotomized (no problem, problem). These factors can be hypothesized to have reduced the impact of the potential bias and thus increased the reliability of the findings. Moreover, our findings demonstrated no abnormality compared with findings in the literature.

Conclusion

The 28 ICF categories of body functions and the 41 ICF categories of activities and participation which we identified may represent a meaningful reduction of the extended version of the comprehensive core set for stroke to cover the spectrum of problems of most stroke survivors in Sweden. The practical feasibility of the core set is therefore increased and could become a helpful tool in clinical multiprofessional assessment. Consideration of problems in urinary incontinence, neuromusculoskeletal functions, communication, mobility, and self-care provides the most precise discrimination between independent and dependent stroke survivors. Although functional recovery mainly takes place during the first 3 months after stroke, the number of sustainable problems remains constant between 6 weeks and 3 months, i.e. the extent of the problems changes but the problems themselves seldom disappear. In future, a validation of the core set for young stroke survivors and diagnosis of severe stroke may be appropriate, as some of the discarded categories are apparently associated with these groups.

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