EUROPEAN JOURNAL OF PHYSICAL AND REHABILITATION MEDICINE

MEDITERRANEAN JOURNAL OF PHYSICAL AND REHABILITATION MEDICINE

formerly

EUROPA MEDICOPHYSICA

Chief Editor: Stefano NEGRINI

VOLUME 54 - No. 1 - FEBRUARY 2018

Official Journal of

Italian Society of Physical and Rehabilitation Medicine (SIMFER)

European Society of Physical and Rehabilitation Medicine (ESPRM)

European Union of Medical Specialists - Physical and Rehabilitation Medicine Section (UEMS - PRM)

In association with

International Society of Physical and Rehabilitation Medicine (ISPRM)

PUBBLICAZIONE PERIODICA BIMESTRALE - POSTE ITALIANE S.P.A. - SPED. IN A.P.D.L. 353/2003 (CONV. IN L. 27/02/2004 N° 46) ART. 1, COMMA 1, DCB/CN - ISSN 1973-9087 TAXE PERÇUE

EDIZIONI MINERVA MEDICA

© 2017 EDIZIONI MINERVA MEDICA
Online version at http://www.minervamedica.it

European Journal of Physical and Rehabilitation Medicine 2018 February;54(1):110-7
DOI: 10.23736/S1973-9087.17.04784-0

SPECIAL ARTICLE

Standardized reporting of functioning information on ICF-based common metrics

Birgit PRODINGER [1, 2, 3] *, Alan TENNANT [1, 2], Gerold STUCKI [1, 2, 3]

[1]Department of Health Sciences and Health Policy, Faculty of Humanities and Social Sciences, University of Lucerne, Lucerne, Switzerland; [2]Swiss Paraplegic Research (SPF), Nottwil, Switzerland; [3]ICF Research Branch, a Cooperation Partner within the WHO Collaborating Center for the Family of International Classifications in Germany (at DIMDI), Nottwil, Switzerland

*Corresponding author: Birgit Prodinger, Swiss Paraplegic Research (SPF), Guido A. Zäch Strasse 4, 6207, Nottwil, Switzerland.
Email: birgit.prodinger@paraplegie.ch

ABSTRACT

BACKGROUND: In clinical practice and research a variety of clinical data collection tools are used to collect information on people's functioning for clinical practice and research and national health information systems. Reporting on ICF-based common metrics enables standardized documentation of functioning information in national health information systems. The objective of this methodological note on applying the ICF in rehabilitation is to demonstrate how to report functioning information collected with a data collection tool on ICF-based common metrics. We first specify the requirements for the standardized reporting of functioning information. Secondly, we introduce the methods needed for transforming functioning data to ICF-based common metrics. Finally, we provide an example.

METHODS: The requirements for standardized reporting are as follows: 1) having a common conceptual framework to enable content comparability between any health information; and 2) a measurement framework so that scores between two or more clinical data collection tools can be directly compared. The methods needed to achieve these requirements are the ICF Linking Rules and the Rasch measurement model. Using data collected incorporating the 36-item Short Form Health Survey (SF-36), the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0), and the Stroke Impact Scale 3.0 (SIS 3.0), the application of the standardized reporting based on common metrics is demonstrated.

RESULTS: A subset of items from the three tools linked to common chapters of the ICF (d4 Mobility, d5 Self-care and d6 Domestic life), were entered as "super items" into the Rasch model. Good fit was achieved with no residual local dependency and a unidimensional metric. A transformation table allows for comparison between scales, and between a scale and the reporting common metric.

CONCLUSIONS: Being able to report functioning information collected with commonly used clinical data collection tools with ICF-based common metrics enables clinicians and researchers to continue using their tools while still being able to compare and aggregate the information within and across tools.

(*Cite this article as:* Prodinger B, Tennant A, Stucki G. Standardized reporting of functioning information on ICF-based common metrics. Eur J Phys Rehabil Med 2018;54:110-7. DOI: 10.23736/S1973-9087.17.04784-0)

Key words: International Classification of Functioning, Disability and Health - Rehabilitation - Delivery of health care.

Functioning is the third health indicator in the health system and the key indicator for rehabilitation.[1] Functioning information is essential at all levels of the health system — clinical care, service provision, management and policy. To scale up rehabilitation in health systems worldwide it is essential to integrate functioning information in national health information systems.[2, 3] A prerequisite for the integration of functioning information into national health information systems is its standardized documentation using the International Classification of Functioning, Disability and Health (ICF). For this, users can rely on four steps: what ICF categories to document, what perspective to use — *e.g.* capacity or performance, what data collection tool to use, and, what metric to use for reporting. For the last step ICF-based common metrics with interval scale properties are recommended.[4]

The objective of this forth metholodological note on

applying the ICF in rehabilitation [5] is to demonstrate how to report functioning data collected with any data collection tool on ICF-based common metrics. Our specific aims are to first specify the requirements for the standardized reporting of functioning information. Secondly, we introduce the methods needed for transforming existing data to ICF-based common metrics. Finally, we provide an example on how to concretely transform functioning data into ICF-based common metrics.

Requirements for the standardized reporting of functioning information with the ICF

For the standardized reporting of health information based on the ICF two requirements need to be achieved: concept equivalence and score equivalence.[6] These two steps allow for the construction of ICF-based common metrics and the reporting of functioning data on these metrics.

Concept equivalence

The basic question is "do the items of the various tools measure the same domain?" The ICF provides a frame of reference to answer this question. The ICF offers a comprehensive description of features of a person's biological health, impairments of body functions and the lived experience of health in terms of the activities, simple to complex, that a person performs — that is, how the health condition plays out in the person's everyday life.[7]

Score equivalence

The basic question here is "has a score of *e.g.* 20, the same meaning regardless of which data collection tool is used?" This requires that all of the tools that are used are standardized on a common metric, *e.g.* ranging from 0 to 100, and scored in the same direction, *e.g.* a low score indicating extreme problems in functioning, a high score indicating little or no problems in functioning, or *vice versa*.

Concept and score equivalence are prerequisites for creating common metrics for single ICF categories or sets of ICF categories. Such metrics are created by mapping data from a range of data collection tools onto the ICF using established quantiative and qualitative linkage rules [4] and by specifying two anchor points at 0 (no problem) and 100 (complete problem).[6] An example is the reporting of functioning information in the Swiss Spinal Cord Injury Cohort Study (SwiSCI).[8]

Methods needed for transforming functioning data into ICF-based common metrics

A systematic approach is needed to transform functioning data into a format so that the requirements of concept and score equivalence are met.

To achieve concept equivalence, the ICF Linking Rules should be used. The ICF Linking Rules are an established method to identify the key concepts contained in any source of information, such as a data collection tool, and link it to the corresponding ICF category.[9-11] By linking the data collection tools used in a particular setting to the ICF, their similarities and differences in content covered can be identified.

To achieve score equivalence, a measurement framework is needed that fulfils the requirement of a raw score as a sufficient statistic, in that it contains all the information required to assess functioning on a given category.[12] The Rasch measurement model serves this purpose, since the instrument-equating approach within the Rasch measurement framework equates the two instruments in terms of their total scores.[13] This approach implies that only the total score needs to be known to gain a score on the common metric underpinning the standardized reporting based on ICF-based common metrics, a form of "scale banking."

Example of reporting functioning data on ICF-based common metrics

In the following paragraphs we illustrate how to report functioning data collected with a data collection tool on ICF-based common metrics.

Study design and participants

We conducted a secondary analysis of data collected previously during the validation of the ICF Core Set for stroke.[14] This data set contains data collected in Ger-

ICF Code & Label		SF-36	WHODAS 2.0	SIS
d4	**Mobility**	3. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much? a) vigorous activities, such as running, participating in strenuous sports, lifting heavy objects. b) moderate activities, such as, moving a table, pushing a vacuum cleaner, bowling or playing golf. c) lifting or carrying groceries d) climbing several flights of stairs e) climbing one flight of stairs f) bending, stooping or kneeling g) walking more than 1 mile h) walking several blocks i) walking one block j) bathing or dressing yourself	Getting around In the last 30 days, how much difficulty did you have in: D2.1 Standing for long periods such as 30 minutes? D2.2 Standing up from sitting down? D2.3 Moving around inside your home? D2.4 Getting out of your home? D2.5 Walking a long distance such as a kilometer (or equivalent)?	The following items ask about activities you might do during a typical day. 5. In the past 2 weeks, how difficult was it to… a. Cut your food with a knife and fork? b. Dress the top part (waist up) of your body? c. Bathe yourself? d. Clip your toenails? e. Get to the toilet on time? f. Control your bladder (not have an accident)? g. Control your bowels (not have an accident)? h. Do light household tasks/chores (e.g. dust, make a bed, take out garbage, do the dishes)? i. Go shopping? j. Do heavy household chores (e.g. vacuum, laundry or yard work)? The following questions are about your ability to be mobile, at home and in the community. 6. In the past 2 weeks, how difficult was it to… a. Sit without losing your balance? b. Stand without losing your balance? c. Walk without losing your balance? d. Move from a bed to a chair? e. Walk one block? f. Walk fast? g. Climb one flight of stairs? h. Climb several flights of stairs? i. Get in and out of a car? The following questions are about your ability to use your hand that was most affected by your stroke. 7. In the past 2 weeks, how difficult was it to use your hand that was most affected by your stroke to… a. Carry heavy objects (e.g. bag of groceries)? b. Turn a doorknob? c. Open a can or jar? d. Tie a shoe lace? e. Pick up a dime?
d410	Changing basic body position			
d415	Maintaining basic body position			
d420	Transferring oneself			
d430	Lifting and carrying objects			
d435	Moving objects with lower extremities			
d440	Fine hand use			
d445	Hand and arm use			
d450	Walking			
d455	Moving around			
d460	Moving around in different locations			
d465	Moving around using equipment			
d470	Using transportation			
d475	Driving			
d5	**Self-care**		Self care In the last 30 days, how much difficulty did you have in: D3.1 Washing your whole body? D3.2 Getting dressed? D3.3 Eating? D3.4 Staying by yourself for a few days?	
d510	Washing oneself			
d520	Caring for body parts			
d530	Toileting			
d540	Dressing			
d550	Eating			
d560	Drinking			
d570	Looking after one's health			
d6	**Domestic life**		Life activities In the last 30 days, how much difficulty did you have in: D5.1 Taking care of your household responsibilities? D5.2 Doing most important household tasks well? D5.3 Getting all the household work done that you need to do? D5.4 Getting your household work done as quickly as needed?	
d610	Acquiring a place to live			
d620	Acquisition of goods and services			
d630	Preparing meals			
d640	Doing housework			
d650	Caring for household objects			
d660	Assisting others			

Figure 1.—Linking of relevant sub-scales and item blocks of SF-36, WHODAS 2.0 and SIS 3.0 to the ICF.

many, Italy and Sweden. Sixty-one percent were male and the mean age 64 years.

Outcome measures

Three outcome measures were included in this data set:

— the Short Form (36) Health Survey (SF-36), a patient reported tool commonly used in the general population and in people with any health condition;[15]

— the World Health Organization Disability Schedule 2.0 (WHODAS 2.0), a patient-reported tool commonly used in people with any health condition;[16]

— the Stroke Impact Scale 3.0 (SIS 3.0), a stroke-specific scale.[17]

The tools were administered in all three countries, with the exception of the WHODAS 2.0 which was used to collect data only in Germany and Italy.

Concept equivalence

All three instruments were linked to the ICF to identify items that map onto a common domain. As shown in Figure 1, the physical functioning sub-scale of the SF-36, item block D2 Mobility, D3 Self-care and D5 Life activities of the WHODAS 2.0, and item block 5 Daily activities, 6 Mobility and 7 Hand function of the SIS 3.0 were linked to the ICF chapters d4 Mobility, d5 Self-care and d6 Domestic life.* These three ICF chapters constitute classical Activities of Daily Living (ADLs) and can be referred to in total, following Badley's [18] nomenclature, as physical tasks.

Scale equivalence

The instrument equating approach using the Rasch model [13] was applied to create a common metric for the domain of "physical tasks," incorporating the items linked to the ICF chapters of d4 Mobility, d5 Self-care, and d6 Domestic life. In this fashion the raw score range of the item set derived from the Stroke Impact Scale was 0-96; the SF-36 PF was 0-20, and the WHODAS 2.0 set of 13 relevant items was 0-52, making a total raw score across all three tools, reflecting a Physical Tasks metric, of 168. These scale-based scores were then fit to the Rasch model as three "super items" or testlets. The assumptions of the Rasch

* A detailed linking of all items of the three tools, as well as the assignment of an ICF code to each item can be requested by the authors.

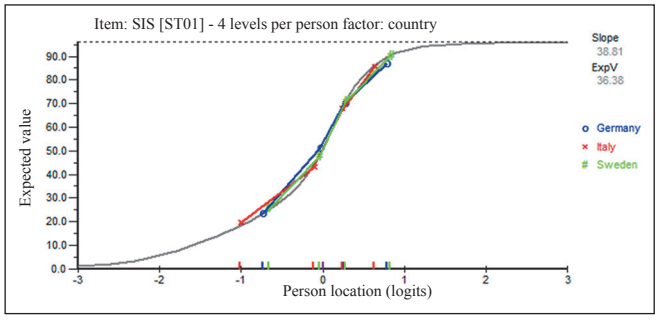

Figure 2.—Differential Item Functioning for the Stroke Impact Scale by Country.

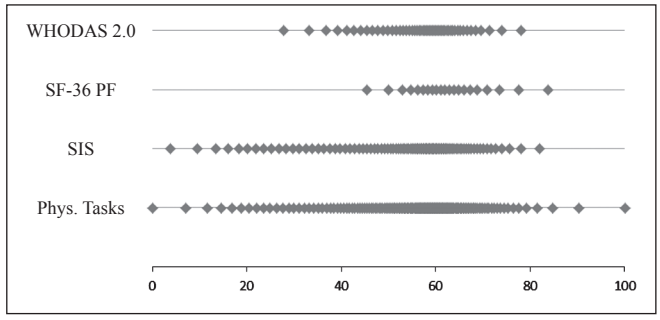

Figure 3.—Operational ranges of the three scale sets against the Physical Tasks Reference Metric.

model, including local dependency, unidimensionality, and invariance were tested. Fit to the model was good, with a χ^2 value of 31.4 (df 27, P=0.255). The *t*-test for unidimensionality showed that just 4.0% of estimates taken from two independent items sets (in this case the SIS compared with the rest). The instrument equating approach takes into account any local dependency within item sets. Invariance across age (younger and older people split at the mean), gender (male and female) and country (Germany, Italy and Sweden) was tested. There was no DIF by age or gender, but some DIF on the SIS by country, which varied across the continuum of Physical Tasks. However, at no point on the continuum did this differ by more than 0.34 logits. No action was therefore needed given overall fit to the model. A graphical view of the DIF on the SIS is shown in Figure 2. The RUMM2030 software was applied in this study.[19]

The operational ranges of the three scales, along with the Physical Tasks logit metric is shown in Figure 3. A high positive score represents little or no problem in physical tasks (the WHODAS 2.0 items were swopped to this orientation), whereas a high negative score represents extreme problems. The Stroke Impact Scale is shown to have the greatest range, and almost reaches the upper levels of functioning which is usually occupied by the SF36-PF_ Item 10 (*i.e.* "no problem" in vigorous activities). It also reaches much lower levels of functioning than the other two scales.

The transformation table of scale-specific raw score, including the overall Physical Tasks, to the Rasch interval scale logit metric is given in Table I. For example, a SF-36 PF score of 10 is equivalent to a raw score of 116 on the Physical Tasks metric, of 71 on the 24 item SIS, and 37 on the WHODAS 2.0 set of items, taking the nearest logit value available.

Results of the example

The common Physical Tasks metric so derived encompasses the ICF chapters d4 Mobility, d5 Self-care and d6 Domestic life. This seemed sensible in the context of traditional scales which addressed ADLs and IADLs. Nevertheless, metrics could be developed which addressed just a chapter level, or even category levels, particularly for some impairments of body function. The level of aggregation could vary by the focus of the clinical service and, in principal, a hierarchical structure could be developed which has metrics clustered within a higher order construct such as physical tasks.

Discussion

In this methodological note we have outlined how to report functioning information on ICF-based common metrics so that the requirements of concept equivalence and score equivalence are met. The ICF Linking Rules and Rasch measurement model are the methods most suited for this purpose. Once the data meets the requirements detailed in this paper, including fit to the expectation of the Rasch model, the transformation table makes it possible to directly compare scores derived from commonly used tools irrespective of whether the scale is generic or health condition specific. This ability to directly compare scale scores comes from the sufficiency of the raw score inherent to the Rasch model.[13]

TABLE I.—*Raw score to metric transformations and scale equivalence.*

Physical Tasks			SIS			SF-36 PF			WHODAS 2.0		
Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric
0	-3.105	0	0	-2.899	4	0	-0.636	45	0	-1.599	28
1	-2.723	7	1	-2.593	9	1	-0.391	50	1	-1.307	33
2	-2.476	12	2	-2.38	13	2	-0.234	53	2	-1.11	37
3	-2.315	15	3	-2.231	16	3	-0.132	55	3	-0.978	39
4	-2.192	17	4	-2.112	18	4	-0.056	56	4	-0.874	41
5	-2.087	19	5	-2.009	20	5	0.009	57	5	-0.787	43
6	-1.995	20	6	-1.915	22	6	0.065	58	6	-0.709	44
7	-1.91	22	7	-1.825	24	7	0.115	59	7	-0.638	45
8	-1.83	23	8	-1.738	25	8	0.162	60	8	-0.573	47
9	-1.753	25	9	-1.654	27	9	0.212	61	9	-0.511	48
10	-1.68	26	10	-1.572	28	10	0.259	62	10	-0.454	49
11	-1.609	28	11	-1.493	30	11	0.309	63	11	-0.4	50
12	-1.531	29	12	-1.415	31	12	0.358	64	12	-0.35	51
13	-1.477	30	13	-1.341	32	13	0.414	65	13	-0.304	52
14	-1.415	31	14	-1.269	34	14	0.477	66	14	-0.26	52
15	-1.356	32	15	-1.199	35	15	0.547	67	15	-0.221	53
16	-1.3	33	16	-1.132	36	16	0.632	69	16	-0.184	54
17	-1.247	34	17	-1.068	38	17	0.739	71	17	-0.151	54
18	-1.197	35	18	-1.006	39	18	0.881	73	18	-0.12	55
19	-1.149	36	19	-0.947	40	19	1.102	77	19	-0.092	55
20	-1.103	37	20	-0.889	41	20	1.441	84	20	-0.065	56
21	-1.06	38	21	-0.835	42				21	-0.041	56
22	-1.019	38	22	-0.782	43				22	-0.017	57
23	-0.98	39	23	-0.732	44				23	0.004	57
24	-0.942	40	24	-0.684	45				24	0.025	58
25	-0.907	40	25	-0.638	45				25	0.044	58
26	-0.872	41	26	-0.594	46				26	0.063	58
27	-0.839	42	27	-0.552	47				27	0.081	59
28	-0.807	42	28	-0.511	48				28	0.099	59
29	-0.777	43	29	-0.473	48				29	0.116	59
30	-0.747	43	30	-0.437	49				30	0.134	60
31	-0.719	44	31	-0.402	50				31	0.152	60
32	-0.692	44	32	-0.369	50				32	0.168	60
33	-0.665	45	33	-0.337	51				33	0.186	61
34	-0.639	45	34	-0.307	52				34	0.204	61
35	-0.614	46	35	-0.279	52				35	0.221	61
36	-0.59	46	36	-0.252	53				36	0.24	62
37	-0.566	47	37	-0.227	53				37	0.259	62
38	-0.544	47	38	-0.203	53				38	0.281	62
39	-0.521	48	39	-0.18	54				39	0.301	63
40	-0.5	48	40	-0.159	54				40	0.324	63
41	-0.479	48	41	-0.138	55				41	0.348	64
42	-0.459	49	42	-0.119	55				42	0.375	64
43	-0.439	49	43	-0.101	55				43	0.404	65
44	-0.42	49	44	-0.084	56				44	0.435	65
45	-0.402	50	45	-0.067	56				45	0.469	66
46	-0.384	50	46	-0.051	56				46	0.509	67
47	-0.366	50	47	-0.036	57				47	0.554	67
48	-0.349	51	48	-0.022	57				48	0.609	68
49	-0.333	51	49	-0.008	57				49	0.676	70
50	-0.317	51	50	0.006	57				50	0.767	71
51	-0.301	52	51	0.018	58				51	0.91	74
52	-0.286	52	52	0.031	58				52	1.135	78
53	-0.271	52	53	0.043	58						
54	-0.257	52	54	0.054	58						
55	-0.243	53	55	0.067	58						
56	-0.23	53	56	0.079	59						

(*To be continued*)

TABLE I.—*Raw score to metric transformations and scale equivalence (continues).*

Physical Tasks			SIS			SF-36 PF			WHODAS 2.0		
Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric
57	-0.217	53	57	0.09	59						
58	-0.204	53	58	0.102	59						
59	-0.192	54	59	0.113	59						
60	-0.18	54	60	0.124	59						
61	-0.168	54	61	0.135	60						
62	-0.157	54	62	0.147	60						
63	-0.145	55	63	0.159	60						
64	-0.135	55	64	0.17	60						
65	-0.124	55	65	0.182	61						
66	-0.114	55	66	0.195	61						
67	-0.104	55	67	0.207	61						
68	-0.094	55	68	0.22	61						
69	-0.085	56	69	0.234	61						
70	-0.076	56	70	0.248	62						
71	-0.067	56	71	0.262	62						
72	-0.058	56	72	0.277	62						
73	-0.049	56	73	0.293	63						
74	-0.041	56	74	0.31	63						
75	-0.032	57	75	0.327	63						
76	-0.024	57	76	0.345	64						
77	-0.016	57	77	0.364	64						
78	-0.008	57	78	0.385	64						
79	-0.001	57	79	0.406	65						
80	0.007	57	80	0.429	65						
81	0.014	57	81	0.453	66						
82	0.021	58	82	0.477	66						
83	0.029	58	83	0.504	66						
84	0.036	58	84	0.532	67						
85	0.043	58	85	0.561	68						
86	0.05	58	86	0.592	68						
87	0.057	58	87	0.625	69						
88	0.064	58	88	0.659	69						
89	0.071	58	89	0.698	70						
90	0.078	59	90	0.739	71						
91	0.084	59	91	0.786	72						
92	0.091	59	92	0.842	73						
93	0.097	59	93	0.909	74						
94	0.104	59	94	0.997	76						
95	0.111	59	95	1.133	78						
96	0.117	59	96	1.342	82						
97	0.124	59									
98	0.13	60									
99	0.137	60									
100	0.143	60									
101	0.15	60									
102	0.157	60									
103	0.163	60									
104	0.17	60									
105	0.177	60									
106	0.184	61									
107	0.191	61									
108	0.198	61									
109	0.204	61									
110	0.211	61									
111	0.218	61									
112	0.225	61									

(*To be continued*)

TABLE I.—*Raw score to metric transformations and scale equivalence (continues).*

Physical Tasks			SIS			SF-36 PF			WHODAS 2.0		
Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric	Raw score	Logit scale	Ref. metric
113	0.232	61									
114	0.24	62									
115	0.247	62									
116	0.255	62									
117	0.263	62									
118	0.27	62									
119	0.278	62									
120	0.286	62									
121	0.295	63									
122	0.303	63									
123	0.311	63									
124	0.32	63									
125	0.329	63									
126	0.338	63									
127	0.347	64									
128	0.357	64									
129	0.366	64									
130	0.376	64									
131	0.386	64									
132	0.397	64									
133	0.407	65									
134	0.419	65									
135	0.43	65									
136	0.441	65									
137	0.453	66									
138	0.466	66									
139	0.478	66									
140	0.491	66									
141	0.505	66									
142	0.519	67									
143	0.533	67									
144	0.548	67									
145	0.563	68									
146	0.58	68									
147	0.596	68									
148	0.614	68									
149	0.632	69									
150	0.651	69									
151	0.671	70									
152	0.692	70									
153	0.715	70									
154	0.739	71									
155	0.765	71									
156	0.792	72									
157	0.823	72									
158	0.856	73									
159	0.893	74									
160	0.935	74									
161	0.984	75									
162	1.041	76									
163	1.11	78									
164	1.198	79									
165	1.317	81									
166	1.493	85									
167	1.798	90									
168	2.326	100									

Conclusions

The standardized reporting of functioning data using ICF-based common metrics is advantageous as it allows clinicians and researchers to continue using their existing data collection tools while at the same time being able to report in a standardized manner. Thus, comparability with historical data is not at risk. Modern computer systems, including tablets, could undertake this transformation routinely. Since the approach outlined in this methodological note allows for the integration, not only of clinical data collection tools, but also registries and surveys, the resulting metrics are very promising to inform a national health information systems across all levels of the health system.[2] Furthermore, given that the metrics are ICF-based, the national health information systems can meet requirements of international standards for national eHealth models, namely to ensure that comparable health information is available in a timely and understandable manner so to inform sound decision-making,[20] and quality management in health care services.[21]

References

1. Stucki G, Bickenbach J. Functioning: the third health indicator in the health system and the key indicator for rehabilitation. Eur J Phys Rehabil Med 2017;53:134-8.
2. Stucki G, Bickenbach J, Melvin J. Strengthening Rehabilitation in Health Systems Worldwide by Integrating Information on Functioning in National Health Information Systems. Am J Phys Med Rehabil 2017;96:677-81.
3. World Health Organization. Health information systems and rehabilitation. Rehabilitation 2030: A Call for Action [Internet]. Available from: http://www.who.int/disabilities/care/HISandRehabilitation.pdf?ua=1 [cited 2017, March 14].
4. Stucki G, Prodinger B, Bickenbach J. Four steps to follow when documenting functioning with the International Classification of Functioning, Disability and Health (ICF). Eur J Phys Rehabil Med 2017;53:144-9.
5. Stucki G, Bickenbach J, Negrini S. Methodological notes on applying the International Classification of functioning, disability and health (ICF) in rehabilitation. Eur J Phys Rehabil Med 2017;53:132-3.
6. Prodinger B, Tennant A, Stucki G, Cieza A, Üstün TB. Harmonizing routinely collected health information for strengthening quality management in health systems: requirements and practice. J Health Serv Res Policy 2016;21:223-28.
7. World Health Organization. International Classification of Functioning, Disability and Health. Geneva: WHO; 2001.
8. Prodinger B, Ballert C, Brach M, Brinkhof MW, Cieza A, Hug K, *et al.* SwiSCI Study Group. Toward standardized reporting for a cohort study on functioning: The Swiss Spinal Cord Injury Cohort Study (SwiSCI). J Rehabil Med 2016;48:189-96.
9. Cieza A, Brockow T, Ewert T, Amman E, Kollerits B, Chatterji S, *et al.* Linking health-status measurements to the international classification of functioning, disability and health. J Rehabil Med 2002;34:205-10.
10. Cieza A, Fayed N, Bickenbach J, Prodinger B. Refinements to the ICF Linking Rules to strenghten their potential for establishing comparability of health information. Disabil Rehabil 2016;1-10.
11. 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;37:212-8.
12. Andrich D. Rasch models for measurement. Sage University Paper Series on Quantitative Applications in the Social Sciences series no 07-068 Newbury Park, CA: Sage Publications; 1988.
13. Andrich D. The Polytomous Rasch Model and the Equating of Two Instruments. In: Christensen KB, Kreiner S, Mesbah M, editors. Rasch Models in Health. London, UK: ILSTE Ltd; 2013.
14. Geyh S, Cieza A, Schouten J, Dickson H, Frommelt P, Omar Z, *et al.* ICF Core Sets for stroke. J Rehabil Med 2004;44:135-41.
15. Ware Jr JE. SF-36 Health Survey Update. Spine 2000;25:3130-9.
16. World Health Organization. WHO Disability Assessment Schedule 2.0 (WHODAS2.0). Geneva: WHO; 2013 [Internet]. Available from: http://www.who.int/classifications/icf/whodasii/en/index.html [cited 2017, Mar 14].
17. Duncan PW, Wallace D, Studenski S, Lai SM, Johnson D. Conceptualization of a new stroke-specific outcome measure: the stroke impact scale. Top Stroke Rehabil 2001;8:19-33.
18. Badley EM. Enhancing the conceptual clarity of the activity and participation components of the International Classification of Functioning, Disability, and Health. Soc Sci Med 2008;66:2335-45.
19. Andrich D, Sheridan B, Luo G. Rasch models for measurement: RUMM2030. Perth, Western Australia: RUMM Laboratory Pty Ltd; 2010.
20. ISO. Health informatics - Capacity-based eHealth architecture roadmap. Part 1: Overview of national eHealth initiatives PD ISO/TR 14639-1:2012. UK: International Standard Organisation; 2012.
21. BSI. Health care services - Quality management systems. Requirements based on EN ISO 9001:2008. UK: The British Standards Institution (BSI); 2012.

Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Acknowledgments.—The authors would like to thank Cristiana Baffone, Prof. Jerome Bickenbach and Susanne Stucki for the critical comments and the support during the preparation of the manuscript.

Article first published online: May 23, 2017. - Manuscript accepted: May 23, 2017. - Manuscript received: April 13, 2017.

This document is protected by international copyright laws. No additional reproduction is authorized. It is permitted for personal use to download and save only one file and print only one copy of this Article. It is not permitted to make additional copies (either sporadically or systematically, either printed or electronic) of the Article for any purpose. It is not permitted to distribute the electronic copy of the article through online internet and/or intranet file sharing systems, electronic mailing or any other means which may allow access to the Article. The use of all or any part of the Article for any Commercial Use is not permitted. The creation of derivative works from the Article is not permitted. The production of reprints for personal or commercial use is not permitted. It is not permitted to remove, cover, overlay, obscure, block, or change any copyright notices or terms of use which the Publisher may post on the Article. It is not permitted to frame or use framing techniques to enclose any trademark, logo, or other proprietary information of the Publisher.