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SPECIAL REPORT

LINKING HEALTH-STATUS MEASUREMENTS TO THE INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH

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With the approval of the International Classification of Functioning, Disability and Health by the World Health Assembly in May 2001, the concurrent use of both health-status measures and the International Classification of Functioning, Disability and Health is expected. It is therefore important to understand the relationship between these two concepts. The objective of this paper is to provide a systematic and standardized approach when linking health-status measures to the International Classification of Functioning, Disability and Health. The specific aims are to develop rules, to test their reliability and to illustrate these rules with examples. Ten linking rules and an example of their use are presented in this paper. The percentage agreement between two health professionals for 8 health-status instruments tested is also presented. A high level of agreement between the health professionals reflects that the linking rules established in this study allow the sound linking of items from health-status measures to the International Classification of Functioning, Disability and Health.

Key words: ICF, health-status measures, linking rules.

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INTRODUCTION

Evidence-based medicine, clinical quality management and randomized controlled trials, to name only a few current concepts in modern medicine, rely on the sound measurement of health. There are many ways to measure health: valuation methods, health-status measurements and classifications.

Health-status measures describe health and classifications categorize health. Based on the descriptions of health states, valuation methods, such as "standard gamble", utility, and "willingness to pay" attempt to assess the value of that an individual places on these health states. Each approach has its strengths and weaknesses and may or may not be appropriate to examine patients or evaluating clinical interventions. Though explicit valuation techniques are not routinely employed in clinical assessments, the overall impact experienced by subjects is influenced by the value they attach to their health condition. Instead, health-status measures and classifications are potentially useful in clinical practice. Both approaches have evolved separately and have rarely been combined (1).

The many health-status measures developed over the last 20 years are now widely used in research and, increasingly, in clinical practice (2, 3). For example, in rehabilitation, health-status measures are used for the assessment of patients' problems, intervention management and outcome evaluation.

The approval of the International Classification of Functioning, Disability and Health (ICF) (formerly the International Classification of Impairment, Disability and Handicap or ICIDH-1) by the World Health Assembly in May 2001, inaugurated the use of this classification to describe functional states associated with health conditions. The ICF is intended for use in multiple sectors, including health, education, insurance, labour, health and disability policy and statistics. In the clinical context, it is intended for use in assessment of needs, matching interventions to specific health states, rehabilitation and outcome evaluation (1).

The ICF has two parts, each containing two separate components. Part 1 covers Functioning and Disability and includes the components: 1. Body Functions (b) and Structure (s) and 2. Activities and Participation (d).

Part 2 covers Contextual Factors and includes the components: 1. Environmental Factors (e) and 2. Personal Factors.

In the ICF classification, the letters b, s, d and e, which refer to the component of the classification are followed by a numeric code that starts with the chapter number (a single digit) followed by the second level (two digits) and the third and fourth level

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Table I. *Linking rules with examples*

Number	Rule	Example
1	Before one links health-status measures to the ICF categories, one should have acquired good knowledge of the conceptual and taxonomical fundaments of the ICF, as well as of the chapters, domains and categories of the detailed classification, including definitions.	
2	Each item of a health-status measure should be linked to the most precise ICF category.	Item C4 of the *West Haven-Yale Multidimensional Pain Inventory* "Play card and other games" is linked to d2200 "Play" and not to d920 "Recreation and Leisure".
3	If a single item encompasses different constructs, the information in each construct should be linked.	In Item 4 of the *Oswestry Low Back Pain Disability Questionnaire* "Pain doesn't prevent me from walking any distance" *pain* as well as *walking any distance* will be linked.
4	All constructs of the item to be linked have to be highlighted (e.g. bold).	Item 8 of the *Million Visual Analogue Scale* "Does your pain interfere with your ability to *stand still*?
5	The response options of an item are linked if they refer to additional constructs.	Item 3 of the *Backill Measure*: "Walking" • I am able to *walk any distance*. • Discomfort prevents me from *walking more than 1 mile.* • Discomfort prevents me from *walking more than* $\frac{1}{2}$ *mile.* • Discomfort prevents me from *walking more than* $\frac{1}{4}$ *mile.* • I *walk only a limited distance* or *use a cane, crutches, or a walker*. • I am *in bed most of the time* or I *use a wheelchair*.
6	If the content of an item is not explicitly named in the corresponding ICF category, then the "other specified" option at the third and fourth coding level of the ICF classification is linked. The additional information not covered by the ICF classification is documented. Two special cases are to be distinguished within this rule:	Item 17 of the *Stait-Trait Anxiety Inventory (STAI)* "I am *worried*" is linked to b1528 "Emotional functions, other specified" and the additional information "worried" is documented.
	a) When the 'other specified' option in the two level classification is not available, then the 'other specified and unspecified' option is linked. The additional information not covered by the ICF will be documented.	Item 6 of *the Functional Abilities Confidence Scale* (FACS) "We would like to know how *confident* you are that you can *get in and out of the car or bus*" is linked to d469 "Walking and moving around, other specified and unspecified. "Get in and out of the car" and "Get in and out of the bus" is additionally documented.
	b) When the content of an item is not explicitly named in the corresponding ICF category, but at the same time is included in the ICF-category, then the item is linked to this ICF category and the additional information not explicitly named by the ICF is documented.	Item 5.1 of the *Aberdeen Low Back Pain Scale* "In your right leg do you have *pain* in the *foot/ankle*" is linked to b28015 "Pain in a lower limb" and the information "in a lower limb" is documented.
7	If the content of an item is more general than the corresponding ICF category, then the code of the higher level is linked.	Item 14 of the *Dallas Pain Questionnaire* "How much do you think your *pain* has changed your *relationship with others*" is linked to d7 "Interpersonal interactions and relationships".
8	If the content of an item is more general than any ICF category but otherwise the item specifies by examples partial aspects of the concept contained in one or more ICF categories, then the "unspecified" option of the ICF classification is linked (Code 99 for the second coding level, Code 9 for third and fourth coding levels). A statement or part of an item will be considered an example when it is introduced with "e.g.", appears between parenthesizes, is introduced with "for example", or with "such as".	Item 2 of the *Dallas Pain Questionnaire* – 16 "How much pain interfere with your *personal care* (*getting out of bed, teeth brushing, dressing etc?*" is linked to b280 "Sensation of pain" d599 "self care, unspecified" and d499 "Mobility, unspecified"
9	If the information provided by the item is not sufficient for making a decision about which ICF category the item should be linked to, this item is assigned *nd* (not definable).	Item 1 of the *Brief Psychiatric Rating Scale* "Degree of concern over present bodily health"
10	If an item is not contained in the ICF classification, then this item is assigned *nc* (not covered by ICF).	Item 3 of the *Beck Depression Inventory* "I do not feel like a failure"

(one digit each) (4). For example in the Body Functions classification there are these codes:

- b2 Sensory functions and pain
- b280 Sensation of pain
- b2801 Pain in body part
- b28013 Pain in back

The ICF will probably be used both in research and clinical studies. Accordingly, we may expect the concurrent use of both health-status measures and the ICF. It is therefore important to understand the relationship between these two concepts. For practical reasons, it would be useful if specific domains of health-status measures could be systematically linked to corresponding categories of the ICF.

The objective of this paper is to provide a systematic and standardized approach when linking health-status measures to the ICF. The specific aims are to develop rules, to test their reliability with health professionals trained in applying the ICF and to illustrate these rules with examples.

METHODS

The linking rules have been developed by a group of experts in quality-of-life measurement and ICF. The experts comprise three psychologists, a psychometrician, a clinician and a health-services researcher. All have worked extensively with the ICF and give seminars on the subject.

The rules were developed in a dynamic process in which approximately 300 items from 20 generic and condition-specific health-status instruments were linked. The first version of the linking rules contained 6 different rules. The number of rules was gradually increased. Whenever the existing rules did not enable items of health-status measures to be linked to the ICF in a specific and precise manner, a new rule was created and/or the existing rules were reworded. At the end of the development process, 10 rules were available. Each rule is clarified on the basis of one example (Table I).

The linking rules were then tested in the following 4 generic and 4 specific health-status instruments: Short Form 36 (5), Sickness Impact Profile (6), EQ-5D (7), the WHODAS II (8), Pain Disability Index (9), Lumbar Spine-Baseline (10), Self-Rating Depression Scale (11) and Hamilton Depression Scale (12).

These instruments were linked independently by two health professionals who had been trained in applying the ICF as well as in the linking rules.

During the health professionals' training, each linking rule was presented together with 2 examples. To practice each rule two previously selected items were linked by the trainees. Problems and disagreements between the trainees were discussed. The training session lasted 3 hours.

The percentage agreement between the health professionals in each of the instruments tested has been calculated. The different ICF levels have thereby been taken into account.

RESULTS

Table II illustrates the results of the linking process on the basis of one example. The ICF categories linked to the items of the SF-36 are presented in this manner.

One item can be linked to one or more ICF codes depending on the number of concepts contained in that item. Thus, in the SF-36 36 items, but at the same time 51 concepts, are linked.

Eleven of the 51 items have been linked to *nd* (not definable). This is due to the fact that all these 11 items refer to health in general. Thus, no decision can be made about which ICF category should be selected to link these items. One could even say that items like the first question in the SF-36, "In general, would you say your health is: excellent, very good, good, fair, poor?" could be linked to the whole ICF classification, since it refers to all health aspects, but at the same time to no specific one.

As seen in Table II, in the first half of the SF-36, items are linked to ICF categories within the component "Activities and Participation". Chapter 4 "Mobility" in particular, but also Chapter 2 "General Tasks and Demands", Chapter 5 "Self Care", Chapter 8 "Major Life Areas" and Chapter 9 "Community, Social and Civil Life" are represented in the SF-36.

In the second half of the SF-36, items correspond to ICF categories within the component "Body Functions". "Mental Functions" were thereby linked 12 times. Nine of these "Mental Functions" belong to the category b152 "Emotional Functions". The ICF category b1522 "Range of Motion" appears 8 times. The category b1300 "Energy Level" was linked to 3 different items and the category b280 "Sensation of Pain" was linked to 2 different items.

Table III shows the agreement reached (%) by the 2 different trainees on all 8 linked health-status measures at all different ICF levels. The agreement between trainees at the chapter and lower levels is calculated only when agreement has been reached at the previous level. For that reason, a higher consensus can be reached at the lower than at the higher levels.

An especially strong consensus was reached at all different levels of the ICF on the WHODAS II questionnaire, as well as on the SF-36. In the WHODAS II questionnaire, consensus ranged from 98.1% at the component level to 89.5% at the 3rd ICF classification level. In the SF-36, at the component level, the trainees' level of agreement about the concepts linked was 96.1%, at the chapter level 97.5 %, at the second level 100 % and at the third level of the ICF classification 80.0%.

The EQ-5D and the Pain Disability Index show the lowest agreement at the third level of the ICF classification, at 50% and 83.3%, respectively. The Lumbar Spine Questionnaire is the only questionnaire with items linked to ICF categories at the fourth ICF level. The agreement between trainees at that level was 100%. It has to be taken into account that only 4 linked concepts were considered to calculate this percentage.

The Sickness Impact Profile is the instrument with the highest number of items (136) and linked concepts (158). The agreement between trainees was 82.4% at the first level and

Table II. *Linked SF-36*

Item	Component	Chapter 1st level	2nd level	3rd level	4th level	Additional information
1. In general, would you say your *health* is: (excellent, very good, good, fair, poor)	nd					
2. Compared to one week ago, how would you *rate* your *health* in general now?	nd					
3. Does your *health* now limit you in these activities?	nd					
a) *vigorous activities*, such as	nd					
running,	d	4	55	9		
lifting heavy objects,	d	4	30	9		
participating in strenuous sports	d	9	20	9		
b) *moderate* activities, such as,	nd					
moving a table	d	4	45	9		
pushing a vacuum cleaner	d	4	45	9		
bowling or	d	9	20	9		
playing golf	d	9	20	9		
c) *lifting or carrying groceries*	d	4	30	1		groceries
d) *climbing several flights of stairs*	d	4	55	1		several flights of stairs
e) *climbing one flight of stairs*	d	4	55	1		one flight of stairs
f) *bending*, or	d	4	10	5		
kneeling	d	4	10	2		
stooping	d	4	10	5		stooping
g) *walking more than 1 mile*	d	4	50	1		more than 1 mile
h) *walking several blocks*	d	4	50	1		several blocks
i) *walking one block*	d	4	50	0		one block
j) *bathing* or	d	5	10	1		
dressing yourself	d	5	40			
4. During the past week, have you had any of the following problems with your *work* or	d	8	59			
daily activities as a result	d	2	30			
of your *physical health*?	nd					
5. During the past week, have you had any of the following problems with your *work* or	d	8	59			
regular *daily activities* as a result of any	d	2	30			
emotional problems (such as feeling depressed or anxious)?	b	1	52	9		
6. Has your physical health or	nd					
emotional problems interfered with your	b	1	52	9		
social activities with family, friends, neighbors, or groups?	d	9	20	5		
7. How much *bodily pain* have you had during the past week?	b	2	80			
8. How much did *pain* interfere with your normal	b	2	80			
work (including both *work outside the home*	d	8	59			
and *housework*) ?	d	6	49			
9. *These questions are about how you feel and how things have been with you during the past week. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past week:*						
a) Did you *feel full of pep*?	b	1	52	2		feel full of pep
b) Have you been a *very nervous* person?	b	1	52	2		nervous
c) Have you *felt so down in the dumps nothing could cheer you up*?	b	1	52	2		down in the dumps nothing could cheer you up
d) Have you *felt calm and peaceful*?	b	1	52	2		calm and peaceful
e) Did you have a *lot of energy*?	b	1	30	0		
f) Have you *felt downhearted and blue*?	b	1	52	2		downhearted and blue
g) Did you *feel worn out*?	b	1	30	0		
h) Have you been a *happy* person?	b	1	52	2		happy
i) Did you *feel tired*?	b	1	30	0		tired
10. How much of the time has your *physical health* or	nd					
emotional problems interfered with	b	1	52	9		
your *social activities* (like visiting with friends, relatives, etc.)?	d	9	20	5		
k) *How true or false is each of the following statements for you?*						
a) I seem to *get sick a little easier* than other people.	nd					
b) I am as *healthy* as anybody I know.	nd					
c) I expect my *health to get worse.*	nd					
d) My *health is excellent.*	nd					

Table III. *Percentage agreement between trainees*

	% Agreement					
Health-status measure	Number of concept linked	Component	Chapter 1st level	2nd level	3rd level	4th level
WHODAS II	54	98.1	97.4	97.4	89.5	
Short Form-36	51	96.1	97.5	100	80.0	
EQ-5D	16	93.8	100	83.3	50.0	
Pain Disability Index	14	92.9	100	92.3	62.5	
Lumbar Spine-Baseline	103	90.3	88.5	93.5	75.5	100
Hamilton Depression Scale	58	86.2	95.0	92.1	96.9	
Sickness Impact Profile	153	82.4	98.4	89.2	86.9	
Self-Rating Depression Scale	20	75.0	100	93.3	66.7	
Overall Agreement	469	89.2	96	91.4	74.9	83.4

Table IV. *Examples of items linked to Environmental Factors (e) as well as to Body Structures (s) of the ICF classification*

	Component	Chapter 1st level	2nd level	3rd level	Additional information
The Sickness Impact Profile (SIP)					
I do not move into or out of bed or chair by myself but I am	d	4	98		move into or out of bed or chair
moved by a person	e	3	99		
or mechanical aid.	e	1	20	1	mechanical aid
Disease Activity Score 4 (DAS 4) (15)					
Swollen joints	s	7	70	1	

increased at the lower levels of the classification. The agreement between trainees also increased at the lower levels in the Hamilton Depression Scale.

The lowest agreement at the component level was achieved in the Self-Rating Depression Scale. In this questionnaire, agreement between the trainees was reached at the component level in 75% of cases. At the first level, the agreement rose to 100% and fell to 66.7% at the third level.

DISCUSSION

The approval of the new ICF in May 2001 marked an exciting step for clinicians and health professionals involved in the care of patients with disabilities (13, 14).

The success of the classification will depend on several factors; among the most important of which is the linking of the ICF to health-status measures currently used by clinicians and researchers.

In this paper we have reported percentage agreement as a measure of agreement. Kappa statistics and other measures of degree of agreement that are chance corrected will be reported separately.

As reflected by the high agreement between the two trainees in all questionnaires studied, the linking rules established in this study will allow the sound linking of items from health-status measures to the ICF. However, based on the development of the linkage rules, it became clear that it is not at all simple and straightforward to link specific items to the ICF. A prerequisite to linkage is an extensive study of the ICF.

When linking the ICF, one may encounter specific difficulties, one of the most important of which may be linking items that ask about one's health in general. To overcome this difficulty, the code *nd* (not definable) was chosen. Nevertheless, *nd* can be linked in many other cases, for example, when an item refers to a general concept and no ICF category can be precisely chosen. The code *nd-gh* may be added in the future to enable the linking of items enquiring about the health of patients in general.

The code *nc* (not covered by the ICF) denotes a limitation similar to that of the code *nd do*, that is *nc* can refer to many different concepts, including personal factors. In the future, the code *pf* (personal factors) should be added for documentation of personal factors contained in the different health-status measures. Since personal factors are still not classified in the ICF classification, this information could be useful for its further development. By using the code *pf*, the code *nc* could be applied in a more specific way.

The highest level of agreement was found in general health-status measures, such as the WHODAS II and the SF-36.

Since the WHODAS II questionnaire was developed on the basis of the ICF classification, it is obvious why this health-status measure shows the highest agreement between trainees. It seemed apparent to both of them which ICF-categories have to be linked to the constructs of this instrument.

In the SF-36, the strong consensus between trainees is probably due to the fact that this health-status measure assesses

the functional aspects of the construct "Health-Related Quality of Life" (HRQoL) on the basis of concrete activities, as well as on the basis of a pre-determined number of body functions. Both activities and body functions are components of the ICF classification.

No item in the SF-36 has been linked to the component *Body Structures* or to the component *Environmental Factors* of the ICF classification. Nevertheless, when the concepts contained in an item refer to one of these two components, the linking rules can be applied. Table IV shows an example of 2 concepts of an item linked to the component *Environmental Factors* (e), as well as an example of an item linked to the component *Body Structures*.

The results of the linking process reflect the scale structure of a questionnaire, as is clearly shown in the linking results of the SF-36. The subscale "physical functioning" of the SF-36 is almost entirely linked to categories within the ICF component *d* (Activities and Participations) and the subscale "Mental Health" to ICF categories within the ICF component *b* (Body Functions) of the classification. Thus, linking the existing health-status measures to the ICF will enable both the relationship between these health-status measures and the ICF, and the relationship among the different health-status measures to be clarified.

Since the ICF classification is the basis of the linking process and provides a common language for clinical practice, teaching and research, it will probably become the cardinal reference for existing health-status measures, as well as for health-status measures to be developed in the future.

The work ahead of us is considerable, but worthwhile. The linking rules established in this study will allow researchers to link health-status measures to the ICF.

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REFERENCES

1. Stucki G, Cieza A, Ewert T, Kostanjsek N, Chatterji S, Üstün TB. Application of the International Classification of Functioning, Disability and Health (ICF in clinical Practice. Disabil Rehabil 2002; 24: 281–282.
2. Stucki G, Liang MH, Phillips C, Katz JN. The Short Form-36 is preferable to the SIP as a generic health-status measure in patients undergoing elective total hip arthroplasty. Arthritis Care Research 1995; 8: 174–481.
3. Stucki G, Liang MH, Stucki S, Katz JN, Lew RA. Application of statistical graphics to facilitate selection of health-status measures for clinical practice and evaluative research. Clin Rheumatol 1999; 18: 101–105.
4. International Classification of Functioning Disability and Health: ICF. Geneva: World Health Organization, 2001.
5. Ware JE, Sherbourne CD. The MOS 36-item Schort Form Health Survey (SF-36): I. Conceptual framework and item selection. Med Care 1992; 30: 473–483.
6. Bergner M, Bobbitt RA, Carter WA, Gilson BS. The Sickness Impact Profile: Development and final revision of a health-status measure. Med Care 1981; 19: 787–805.
7. The EuroQol Group: EuroQol – a new facility for the measurement of health-related quality of life. Health Policy 1990; 16: 199–208.
8. WHO Mental Health Bulletin: A newsletter on noncommunicable diseases and mental health, WHO Mental Health Bulletin 2000, 6.
9. Tait RC, Pollard CA, Margolis RB, Duckro PN, Krause SJ. The Pain Disability Index: psychometric and validity data. Arch Phys Med Rehabil 1987; 6: 438–441.
10. Hunsaker FG, Cioffi DA, Amadio PC, Wright JG, Caughlin B. The American Academy of Orthopaedic Surgeons Outcomes Instrumens. Normative values from general population. J Bone Joint Surg 2002; 84: 208–215.
11. Zung WWK. A self-rating depression scale. Arch Gen Psych 1965; 12: 63–70.
12. Hamilton, M. Development of a rating scale for primary depressive illness. British J Soc Clini Psych 1967; 6: 278–296.
13. Grimby G, Smedby B. ICF approved as the successor of ICIDH. J Rehabil Med 2001; 33: 193–194.
14. Stucki G, Ewert T, Cieza A. Value and application of the ICF in rehabilitation medicine. Disabil Rehabil 2002; 24: 281–282.
15. van der Heijde DM, van 't Hof MA, van Riel PL, Theunisse LA, Lubberts EW, van Leeuwen MA, van Rijswijk MH, van de Putte LB. Judging disease activity in clinical practice in rheumatoid arthritis: first step in the development of a disease activity score. Ann Rheum Dis 1990 Nov; 49(11): 916–920.