

Validity of Preference-Weighted Scores: A Case Study of the International Classification of Functioning, Disability, & Health

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Background: Decision-makers largely draw their conclusions on the benefits and harms of healthcare treatments based on different clinical outcomes. It remains unclear whether measurable functions or improvement in function have an impact on assessable (patient) benefit and what therapy best meets the needs of patients. Indices such as the International Classification of Functioning, Disability and Health (ICF)[1] are commonly used to measure outcomes for decision making.

Objective: As with other instruments, equal weight is assigned to each item without distinguishing relevance. From the patient's perspective, the validity of the outcomes may be questioned. The aim is to examine the extent to which a preference-weighted assessment of core elements of the ICF differs from unweighted assessments currently used in clinical decision making (Figure 1).

Methods: Three BWS experiments are used to assess ICF dimensions in terms of body function/movement, neglect/perception and activities. Stroke patients and citizens are recruited. The ICF "tariff" is generated by converting the ICF generic percentage qualifiers for impairments into a unidimensional index. Doing so, the median of the percentages per level is determined and converted to a 0-1 scale. This acts as a "coefficient" per level for the ICF standards. Preference weights for levels within each dimension are determined on a scale of 0 to 1, with the most desirable level rated 1. An intraclass correlation coefficient (ICC) is used to determine if items (or subjects) can be rated reliably by different raters. In order to calculate the ICC, an Anova: Two-Factor Without Replication was fit. The ICC is a value between 0 and 1, where values below 0.5 indicate poor reliability, between 0.5 and 0.75 moderate reliability, between 0.75 and 0.9 good reliability.

Results: N=1112 participants (51% male) from the German general population were recruited through August/September 2022. There is evidence of divergent validity of preference-weighted and unweighted scores for the ICF based on the intraclass correlation coefficient. Unweighted scores in the dimensions of body function, activity, and perception differ considerably from the preference-weighted scores derived from BWS experiments in general, especially for the neglect scale. But even for the arm paresis there are discordances between both scales (e.g., ICC_movement: 0.864, ICC_neglect: 0.491).

What impact would these theoretical deviations have in the practice of decision making in rehabilitation?

Assuming three different health states as final goal of the rehabilitation it becomes obvious that the comparison of both scores/tariffs always results in a different weighting of the BWS score than the current state of practice of the ICF. Unweighted scores in the dimensions body function differ considerably from the preference-weighted scores derived from BWS experiments in general.

Conclusions: To our knowledge, this is the first study assessing the relative importance of several (sub-)chapters of the ICF against the background of decision-making for neurorehabilitation following stroke.

Body functions have effects on activities, and these effect on health-related quality of life. This raises the question how the value is measured and considered in decision-making? The results reveal that ICF body functions or activities are not equally weighted by those affected.

This fosters discussions on the differences of preference-weighted scores and simple additive models to develop a patient-centered classification of impairments and therapy goals.

Figure 1: Research Question: Scoring and weighting of ICF?

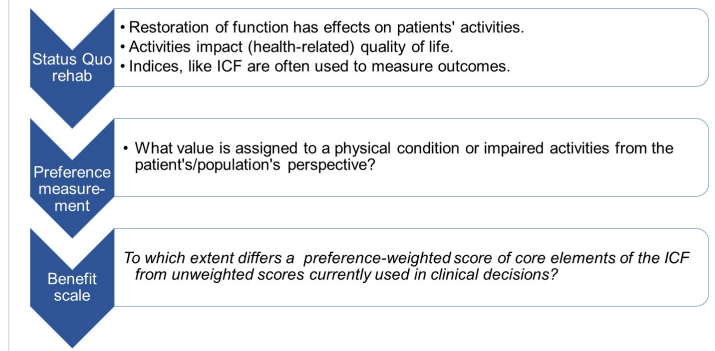


Figure 2: An ICF "tariff" vs. Preference-weighted scores?

ICF "tariff"		Armparesis			Neglect		
xxxx0 NO problem	0-4 %	Attributed Level	BURT BWS	BWS Scale 0-1	Attributed Level	Coefficients	BWS Scale 0-1
xxxx1 MILD problem	5-24 %	Mobility of joints: No problem	0.91	0.29	Visualspatial perception: No problem	0.915	0.14
xxxx2 MODERATE problem	25-49 %	Mobility of joints: Moderate problem	1.371	0.53	Visualspatial perception: Moderate problem	0.826	-1.14
xxxx3 SEVERE problem	50-95 %	Mobility of joints: No problem	2.589	1.00	Visualspatial perception: Complete problem	0.6811	1.50
xxxx4 COMPLETE problem	96-100 %	Stability of joints: Moderate problem	0.521	0.25	Orientation to time: No problem	0.919	1.00
		Stability of joints: Complete problem	1.210	0.49	Orientation to time: Moderate problem	0.9010	0.50
		Mobility of bones: No problem	2.651	1.00	Orientation to time: Complete problem	0.9630	-1.02
		Mobility of bones: Moderate problem	0.540	0.28	Orientation to place: No problem	0.9441	1.00
		Mobility of bones: Complete problem	1.061	0.54	Orientation to place: Moderate problem	-0.6611	-0.43
		Muscle power: No problem	1.953	1.00	Orientation to place: Complete problem	-0.0590	-0.57
		Muscle power: Moderate problem	0.482	0.34	Orientation to person: No problem	0.8916	1.00
		Muscle power: Complete problem	0.734	0.51	Orientation to person: Moderate problem	0.9094	0.11
		Muscle tone: No problem	1.432	1.00	Orientation to person: Complete problem	-0.0910	-1.11
		Muscle tone: Moderate problem	0.657	0.33	Orientation to self: No problem	0.9079	1.00
		Muscle tone: Complete problem	0.985	0.41	Orientation to self: Moderate problem	-0.0196	-0.10
		Muscle endurance: No problem	1.389	1.00	Orientation to self: Complete problem	0.1595	1.00
		Muscle endurance: Moderate problem	0.428	0.37	Orientation to others: No problem	0.9029	0.02
		Muscle endurance: Complete problem	0.513	0.52	Orientation to others: Moderate problem	0.0029	0.02
		Movement reaction: No problem	1.173	1.00	Orientation to others: Complete problem	-0.1344	-1.02
		Movement reaction: Moderate problem	0.654	0.31			
		Movement reaction: Complete problem	0.960	0.68			
		Voluntary movement: No problem	1.462	1.00			
		Voluntary movement: Moderate problem	0.258	0.28			
		Voluntary movement: Complete problem	1.604	0.62			
		Involuntary movement: No problem	2.500	1.00			
		Involuntary movement: Moderate problem	0.460	0.33			
		Involuntary movement: Complete problem	0.796	0.57			
		Gait pattern: No problem	1.468	1.00			
		Gait pattern: Moderate problem	0.677	0.30			
		Gait pattern: Complete problem	1.211	0.60			
		Sensations: No problem	2.275	1.00			
		Sensations: Moderate problem	0.570	0.27			
		Sensations: Complete problem	1.150	0.55			
		Reflex functions: No problem	2.108	1.00			
		Reflex functions: Moderate problem	0.380	0.30			
		Reflex functions: Complete problem	1.026	0.52			
		Reflex functions: Complete problem	1.961	1.00			

Figure 3: Reliability: intraclass correlation coefficient

Armparesis					Neglect				
Anova: Two-Factor Without Replication.					Anova: Two-Factor Without Replication.				
SUMMARY	Count	Sum	Average	Variance	SUMMARY	Count	Sum	Average	Variance
Scale BWS	36	22.1812	0.6161	0.0875	Scale DCE	18	3.0E-07	1.7E-08	7.1E-01
Scale ICF	36	16.7755	0.4660	0.1685	Scale ICF	18	8.3878	4.7E-01	1.7E-01

Source of Variation	Squared sum (SS)	df	MS	F	P-value	F crit
Rows	8.888	35	0.248	31.749	4.3259E-18	1.7571
Columns	0.406	1	0.406	51.907	2.0839E-08	4.1213
Error	0.274	35	0.008			
Total	9.368	71				

Source of Variation	Squared sum (SS)	df	MS	F	P-value	F crit
Rows	1.9543	17	0.11496	11.7036	4.0209	0.0032
Columns	1.9543	1	1.9543	11.9677	0.0039	4.4513
Error	2.9749	17	0.1750			
Total	16.8911	35				

ICC	Value
ICC	0.864
ICC	0.491

Figure 4: Weighting of different health states (armparesis)

Health state A	BWS score	ICF score
Stability of joints: No problem	0.25	0.02
Muscle power: Complete problem	1.00	1.00
Voluntary movement: Moderate problem	0.62	0.38
Gait pattern: Moderate problem	0.60	0.38
Sensations: Complete problem	1.00	1.00
Sum	3.47	2.78

Health state B	BWS score	ICF score
Mobility of joints: No problem	0.29	0.02
Mobility of bones: Moderate problem	0.54	0.38
Muscle endurance: Complete problem	1.00	1.00
Movement reaction: No problem	0.31	0.02
Involuntary movement: Moderate problem	0.57	0.38
Sum	2.71	1.80

Health state C	BWS score	ICF score
Mobility of joints: No problem	0.29	0.02
Muscle power: No problem	0.34	0.02
Muscle tone: No problem	0.33	0.02
Voluntary movement: No problem	0.28	0.02
Gait pattern: Complete problem	1.00	1.00
Sum	2.24	1.08

[1]: World Health Organization 2001. The International Classification of Functioning, Disability and Health (ICF). Geneva: WHO. <http://www.who.int/classifications/icf/en/>

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