frontiers

SUPPLEMENTARY MATERIAL

Consensus-based Core Set of Outcome Measures for Clinical Motor Rehabilitation after Stroke - A Delphi Study

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1. Hierarchical ranking of outcome measures and agreed measurement time points

Table I: Rank list of upper extremity outcome measures

Outcome measure	Sum of ranks	Median rank	IQR
Body functions			
Fugl-Meyer Motor Assessment Upper Extremity Subscale	49.5	1	1
Fugl-Meyer Assessment Sensory Subscale	101.5	3	3
Motricity Index Upper Extremity Subscale	102	3	2.75
Grip & Pinch Dynamometry/ Handheld Dynamometry	108	3	1.75
(Modified) Ashworth Scale	129	4	1
Range of Motion	139	5	2
Activities			
Action Research Arm Test	82	1	3.5
Box and Block Test	122	3	3.75
Nine-Hole Peg Test	120	4	1.75
Wolf Motor Function Test	173	5.5	5
Motor Activity Log	188	6	4
Motor Assessment Scale for the Upper Extremity	200	6.5	2.75
ABILHAND	203.5	7	6
Accelerometers	206	7	4.75
Rivermead Motor Assessment Arm Section	214	8	3.5
Chedoke Arm Hand Activity Inventory	230.5	8.5	2.75
Frenchay Arm Test	232	9	3
Participation			
Outcome measures on the participation level were rated within the Activities of Daily Living/ stroke-specific section, see Table III			

Legend: ADL, Activities of Daily Living; IQR, Interquartile Range.

Table II: Rank list for lower extremity outcome measures

Outcome measure	Sum of ranks	Median rank	IQR
Body functions			
Fugl-Meyer Motor Assessment Lower Extremity Subscale	84	2	4.75
10-Meter Walk Test	81.5	2.5	2.75
Motricity Index Lower Extremity Subscale	113.5	4	3
6-Minute Walk Test	127.5	4.5	4
Fugl-Meyer Assessment Sensory Subscale	129	4.5	4.63
Rivermead Motor Assessment	130	5.5	3.88
Range of Motion	154.5	6	3
Composite Spasticity Scale	175	6.75	2.75
Myometer Muscle Strength Reading	173	7	2
Activities (FAC 0-5)			
Timed-up-and-Go	99	3	2
Functional Ambulation Categories	168.2	4	6.5
Berg Balance Scale	156.5	4.5	7
Five-Times Sit-to-Stand Test	266.6	9	7.88
Accelerometers, step activity monitors	264.8	9.5	7.15
Tinetti Falls Efficacy Scale	282.8	10	9.5
Rivermead Mobility Index	237.1	10.5	8.83
Functional Gait Assessment	272.2	11	6
Trunk Impairment Scale	273.7	11	8
Falls Efficacy Scale	303.8	11.1	6.75
Berg Balance Scale (3-Point Short Form)	280.3	12	8.5
Functional Reach Test	301.8	12.1	8.25
Balance Evaluation System Test	332.3	12.1	7
Rivermead Motor Assessment, Leg and Trunk Section	297.8	12.65	6.75
Mini Balance Evaluation System Test	310.7	13	8.75
Motor Assessment Scale Sitting Subscale	332.8	13.05	6
Four-Step Square Test	345.8	13.1	10
Fugl-Meyer Assessment Balance Subscale	322.8	13.75	6.5
Motor Assessment Scale for Lower Extremity	321.8	13.3	7.25
Step-Up Test	367.8	14	5.7
Postural Assessment Scale for Stroke Patients	389.8	15	5.38
Activities (FAC<3)			
Berg Balance Scale	45	2	1
Functional Ambulation Categories	56	2	3.25
Rivermead Mobility Index	76	4	2
Trunk Impairment Scale	78	4	3
Five-Times Sit-to-Stand Test	98	5	2
Motor Activity Scale	100	6	2
Postural Assessment Scale for Stroke	108	6	2.75
Participation			
Outcome measures on the participation level were rated within the ADL/ stroke-specific section			

Legend: ADL, Activities of Daily Living; FAC, Functional Ambulation Categories; IQR, Interquartile Range.

Table III: Rank list for Activities of Daily Living/ stroke-specific outcome measures

Outcome measure	Sum of ranks	Median rank	IQR
Body functions			
National Institutes of Health Stroke Scale	29	1	0
Visual Analogue Scale	58	2	0
Activities			
Functional Independence Measure	66.5	2	2
Barthel Index	71	2	2
Modified Rankin Scale	87.5	3	2
Modified Barthel Index	88.5	3	2
Lower Extremity Functional Scale	121.5	4.5	1
Participation			
Stroke Impact Scale	70	2	3
Stroke Impact Scale 16-Item Version	80.5	3	3.13
Stroke-Specific Quality of Life Scale	84.5	3	2
Caregiver Strain Index	101	3	2
European Quality of Life Scale	93	4	2

Legend: IQR, Interquartile Range.

2. Agreed measurements time points poststroke

Table IV: Agreement rates (%) for measurement time points for the upper and lower extremity sections by ICF-domain

Time poststroke ICF-domain	Day 2±1	Day 7	Week 2	Week 4	Week 6	Week 12	Month 6	Every 6th month
Body functions	**82.6**	**78.3**	**78.3**	**91.3**	40.9	**78.3**	**91.3**	**73.9**
Activities	26.1	**91.3**	**65.2**	**87.0**	47.8	**82.6**	**73.9**	**69.6**
Participation *	6.3	30.4	52.2	30.4	26.1	**65.2**	43.5	**73.9**

Legend: Agreed measurement time points with a cut-off level of >70±5% are bold; *, Participation domain is the same across sections; ICF, International Classification of Functioning, Disability and Health.

Table V: Agreement rates (%) for measurement time points for the Activities of Daily Living/ stroke-specific section by ICF-domain

Time poststroke ICF-domain	Day 2±1	Day 7	Week 2	Week 4	Week 6	Week 12	Month 6	Every 6th month
Body functions								
NIHSS	**69.7**	**75.0**	45.8	41.7	29.2	41.7	33.3	54.2
Activities								
BI	51.5	**76.0**	60.0	48.0	44.0	**76.0**	48.0	**72.0**
FIM	51.5	**69.2**	57.7	50.0	42.3	**76.9**	46.2	**69.2**
Participation *								
SIS	6.3	30.4	52.2	30.4	26.1	**65.2**	43.5	**73.9**

Legend: Agreement measurement time points with a cut-off level of >70±5% are bold; *, Participation domain is the same across sections; BI, Barthel Index; FIM, Functional Independence Measure; ICF, International Classification of Functioning, Disability and Health; NIHSS, National Institutes of Health Stroke Scale; SIS, Stroke Impact Scale.

3. Core set's outcome measures' details and clinimetric properties in stroke patients

Table VI: Details of the outcome measures for the upper extremity section

Outcome measure	Construct	Self-reported	Time (minutes)	Materials and costs	Validity (correlation coefficient, *r*)	Intra-rater/ Inter-rater reliability (ICC)	Responsiveness (MCID)
Body functions							
Fugl-Meyer Motor Assessment Upper Extremity Subscale[1,2]	Motor function	No	15	Reflex hammer, stopwatch, ball, cylinder, pen, paper-card ~30€	0.93 with ARAT[3,4] 0.92 with BBT[4] 0.86 with MI[4] 0.71 with GF[5] 0.58-0.68 with MAL[3]	0.95[2]/ 0.66-1.0[6]	Acute to subacute: 9-10 points[2,7] Chronic: 4.25 to 7.25 points[8]
Activities							
Action Research Arm Test[9,10]	Uni-manual dexterity	No	15	Test set ~600€	0.93 with FMMA-UE[3] 0.91 with SULCS[11] 0.81 with MI-UE[12] 0.79 with AMAT[13]	0.99[14]/ 0.98[12,15]	Acute to subacute: 12 points dominant[16] 17 points non-dominant[16] Chronic: 5.7 points[17]
Participation							
Stroke Impact Scale[18,19]	Health-related quality of life	Yes	5 *	Free	0.87 with BI[20] 0.81 with mRS[20] 0.48 with SF-36[20] *	No data/ 0.94[20] *	Chronic: 9.2 points[21] (Strength Subscale) 5.9 points[21] (ADL Subscale) 17.8 points[21] (Hand Function Subscale)

Legend: *, only for Hand Function Subscale; ADL, Activities of Daily Living; AMAT, Arm Motor Ability Test; ARAT, Action Research Arm Test; BBT, Box and Blocks Test; BI, Barthel Index; FIM, Functional Independence Measure; FMMA-UE, Fugl-Meyer Motor Assessment Upper Extremity Subscale; GF, Grip Force; ICC, Intraclass Correlation Coefficient; MAL, Motor Activity Log; MAS, Motor Assessment Scale; MCID, Minimal Clinically Important Difference; MI-UE, Motricity Index Upper Extremity Subscale; mRS, modified Rankin Scale; NHPT, Nine-Hole Peg Test; SF-36, Short Form-36; SULCS, Stroke Upper Limb Capacity Scale.

Table VII: Details of the outcome measures for the lower extremity section

Outcome measure	Construct	Self-reported	Time (minutes)	Materials and costs	Validity (correlation coefficient, *r*)	Intra-rater/ Inter-rater reliability (ICC)	Responsiveness (MCID)
Body functions							
Fugl-Meyer Motor Assessment Lower Extremity Subscale[1,2]	Motor function	No	10	Reflex hammer, stopwatch ~20€	0.61 with GS[22] 0.77-0.89 with BI[23] 0.47 with FIM[6]	0.99[23]/ 0.81-0.96[24]	Acute to subacute: No data Chronic: 6 points[25]
10-Meter Walk Test[26]	Comfortable gait speed (applicable for FAC ≥3)	No	5	Stopwatch ~5€	0.76 with BI[27] -0.68-(-0.83) with DGI[28] -0.66-(-0.81) with FGA[28] 0.63 with BBS[29] 0.35 with FRT[30]	0.87-0.99[30]/ 0.97-0.99[29–31]	Acute to subacute: 0.16 m/s[32] Chronic: No data
Activities							
Berg Balance Scale[33]	Static/ dynamic balance in sitting and standing	No	20	Chair, stopwatch, measure tape, stepper ~30€	0.90-0.92 with FMMA-BS[34] 0.92-0.95 with PASS[34] 0.82-0.91 with MAS[34]	0.97[34]/ 0.95-0.98[34,35]	Acute to subacute: 12.5 points[36] Chronic: No data
Timed-up-and-Go[37]	Mobility/ balance/ gait (applicable for FAC ≥3)	No	5	Chair, stopwatch ~10€	-0.86-(-0,91) with GS[31] 0.86-0.90 with SCT[31] 0.92 with 6MWT[31] -0.75 with CB&M[38] -0.70 with BBS[31]	0.96[31]/ 0.95[31]	Acute to subacute: No data Chronic: No data
Participation							
Stroke Impact Scale[19,39]	Health-related quality of life	Yes	5 *	Free	0.53-0.83 with FIM[39] 0.82-0.84 with BI[39] 0.58 with SF-36[39] *	No data/ 0.83-0.89[20]	Chronic: 5.9 points[21] (ADL Subscale) 4.5 points[21] (Mobility Subscale)

Legend: *, only for Mobility and ADL Subscales; 10MWT, 10-Meter Walk Test; 6MWT, 6-Minute Walk Test; ADL, Activities of Daily Living; BI, Barthel Index; BBS, Berg Balance Scale; CB&M, Community Balance and Mobility Scale; DGI, Dynamic Gait Index; FAC, Functional Ambulation Categories; FGA, Functional Gait Assessment; FIM, Functional Independence Measure; FMMA-BS, Fugl-Meyer Motor Assessment Balance Subscale; FRT, Functional Reach Test; GS, Gait Speed; ICC, Intraclass Correlation Coefficient; MCID, Minimal Clinically Important Difference; MAS, Motor Assessment Scale; m/s, meter per second; PASS, Postural Assessments Scale for Stroke; SCT, Stair Climbing Test; SF-36, Short Form-36.

Table VIII: Details of the outcome measures for the Activities of Daily Living/ stroke-specific section

Outcome measure	Construct	Self-reported	Time (minutes)	Materials and costs	Validity (correlation coefficient, *r*)	Intra-rater/ Inter-rater reliability (ICC)	Responsiveness (MCID)
Body functions							
National Institutes of Health Stroke Scale[40]	Neurological functions	No	10	Sheets with pictures and sentences Free	0.48-0.62 with DWI-MRI[41] 0.60-0.85 with mRS[42,43] -0.65 with BI[42,43] -0.86 with GCS[43]	0.93[44]/ 0.92-0.96[44,45]	No data
Activities							
Barthel Index[46]	Basic ADL	Yes No	5 20	Free	0.92-0.94 with FIM[15] 0.78-0.81 with FMMA[47] 0.89-0.91 with BBS[47] 0.59-0.66 with FAT[47]	No data/ 0.94[47]	Acute to subacute: 1.85 points (20-Point Version)[49] Chronic: No data
Functional Independence Measure[48]	Basic ADL/ cognition	No	30-45	1590€ annually[§]	0.92-0.94 with BI[15] 0.77 with STREAM[49] 0.61-0.69 with POMA[50]	No data/ 0.92-0.95[51]	Acute to subacute: 17 points (Motor Subscale)[52] 3 points (Cognitive Subscale)[52] 22 points (Total Scale)[52] Chronic: No data
Participation							
Stroke Impact Scale[18,19]	Health-related quality of life	Yes	20 *	Free	0.87 with BI[20] 0.81 with mRS[20] 0.61 with SF-36[20]	No data/ 0.48-0.94[20]	Acute to subacute: No data Chronic: 9.2 points (Strength Subscale)[21] 5.9 points (ADL Subscale)[21] 4.5 points (Mobility Subscale)[21] 17.8 points (Hand Function Subscale)[21]

Legend: *, time to administer complete scale; §, according to information given by *Uniform Data System of Medical Rehabilitation*; ADL, Activities of Daily Living; BI, Barthel Index; BBS, Berg Balance Scale; DWI-MRI, Diffusion-Weighted Magnetic Resonance Imaging; FIM, Functional Independence Measure; FMMA, Fugl-Meyer Assessment; GCS, Glasgow Coma Scale; ICC, Intraclass Correlation Coefficient; MCID, Minimal Clinically Important Difference; mRS, modified Rankin Scale; POMA, Tinetti Performance Oriented Mobility Assessment; SF-36, Short Form-36; STREAM, Stroke Rehabilitation Assessment Measurement.

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