

Supplementary Material

Agreement of the national Rehabilitation Routing Scale with the Gross Motor Function Measure and the Barthel Index as measures of change in children admitted to a national rehabilitation centre

Contents: Supplementary Tables S1-S6; Supplementary Figures S1-S3.

GMFM = Gross Motor Function Measure; SRM = standardized response mean (mean change divided by the standard deviation of change). Positive change means improvement for every scale. Confidence intervals are percentile bootstrap intervals (2,000 resamples, seed 2025).

Supplementary Table S1. Availability of change scores by diagnosis, age group and sex

Scale	Variable	Level	n in level	n with change score	% with change score	p (chi-square, whole variable)
SHM	Diagnosis	ASD	36	36	100.0	0.594
SHM	Diagnosis	Cerebral palsy	121	116	95.9	0.594
SHM	Diagnosis	Down syndrome	18	18	100.0	0.594
SHM	Diagnosis	Other	37	36	97.3	0.594
SHM	Diagnosis	Other neurological	27	26	96.3	0.594
SHM	Diagnosis	Speech/language delay	79	74	93.7	0.594
SHM	Age group (years)	0-3	56	54	96.4	0.671
SHM	Age group (years)	12+	57	56	98.2	0.671
SHM	Age group (years)	3-7	135	128	94.8	0.671
SHM	Age group (years)	7-12	70	68	97.1	0.671
GMFM	Diagnosis	ASD	36	10	27.8	<0.001
GMFM	Diagnosis	Cerebral palsy	121	118	97.5	<0.001
GMFM	Diagnosis	Down syndrome	18	17	94.4	<0.001

GMFM	Diagnosis	Other	37	30	81.1	<0.001
GMFM	Diagnosis	Other neurological	27	26	96.3	<0.001
GMFM	Diagnosis	Speech/language delay	79	14	17.7	<0.001
GMFM	Age group (years)	0-3	56	52	92.9	<0.001
GMFM	Age group (years)	12+	57	54	94.7	<0.001
GMFM	Age group (years)	3-7	135	56	41.5	<0.001
GMFM	Age group (years)	7-12	70	53	75.7	<0.001
Barthel Index	Diagnosis	ASD	36	11	30.6	<0.001
Barthel Index	Diagnosis	Cerebral palsy	121	45	37.2	<0.001
Barthel Index	Diagnosis	Down syndrome	18	10	55.6	<0.001
Barthel Index	Diagnosis	Other	37	19	51.4	<0.001
Barthel Index	Diagnosis	Other neurological	27	11	40.7	<0.001
Barthel Index	Diagnosis	Speech/language delay	79	54	68.4	<0.001
Barthel Index	Age group (years)	0-3	56	55	98.2	<0.001
Barthel Index	Age group (years)	12+	57	0	0.0	<0.001
Barthel Index	Age group (years)	3-7	135	95	70.4	<0.001
Barthel Index	Age group (years)	7-12	70	0	0.0	<0.001

Chi-square test of whether availability differs across the levels of the variable (one p value per variable).

Supplementary Table S2. Magnitude of change by diagnosis group, age group and in the children with all three scales

Scale	Group	n	Mean change	SD of change	Effect size	SRM (95% CI)	% improved	% unchanged	% worse
SHM	Cerebral palsy	116	0.18	0.14	0.46	1.34 (1.17 to 1.54)	84.5	15.5	0.0
GMFM	Cerebral palsy	118	3.02	2.93	0.10	1.03 (0.80 to 1.33)	89.0	0.8	10.2
Barthel Index	Cerebral palsy	45	7.62	5.32	0.35	1.43 (1.14 to 2.11)	93.3	6.7	0.0
SHM	Other diagnoses	190	0.18	0.12	0.46	1.47 (1.29 to 1.70)	90.0	10.0	0.0
GMFM	Other diagnoses	97	3.93	3.67	0.13	1.07 (0.86 to 1.43)	94.8	0.0	5.2
Barthel Index	Other diagnoses	105	9.82	5.71	0.46	1.72 (1.52 to 2.01)	97.1	2.9	0.0
SHM	Age 0-3	54	0.19	0.13	0.48	1.42 (1.21 to 1.75)	88.9	11.1	0.0
GMFM	Age 0-3	52	4.40	2.89	0.15	1.52 (1.35 to 1.80)	98.1	1.9	0.0
Barthel Index	Age 0-3	55	7.64	3.45	0.35	2.21 (1.83 to 2.83)	98.2	1.8	0.0
SHM	Age 3-7	128	0.19	0.13	0.49	1.51 (1.29 to 1.84)	92.2	7.8	0.0
GMFM	Age 3-7	56	4.89	3.91	0.17	1.25 (0.96 to 1.98)	98.2	0.0	1.8
Barthel Index	Age 3-7	95	10.04	6.47	0.47	1.55 (1.37 to 1.82)	94.7	5.3	0.0
SHM	Age 7-12	68	0.21	0.12	0.53	1.69 (1.45 to 1.93)	98.5	1.5	0.0

2.04)

GMFM	Age 7-12	53	2.81	1.94	0.10	1.45 (1.23 to 1.81)	98.1	0.0	1.9
SHM	Age 12+	56	0.11	0.11	0.29	1.07 (0.85 to 1.37)	64.3	35.7	0.0
GMFM	Age 12+	54	1.57	3.07	0.05	0.51 (0.23 to 0.88)	72.2	0.0	27.8
SHM	Same children (set 3)	86	0.20	0.12	0.52	1.66 (1.44 to 1.96)	91.9	8.1	0.0
GMFM	Same children (set 3)	86	4.99	3.62	0.17	1.38 (1.11 to 1.90)	98.8	0.0	1.2
Barthel Index	Same children (set 3)	86	7.59	3.84	0.35	1.98 (1.65 to 2.53)	96.5	3.5	0.0

Effect size = mean change divided by the standard deviation of the admission score in the full cohort.

Supplementary Table S3. Floor and ceiling effects and resolution of the Routing Scale

Scale	Time point	n	% at or below floor cut-off	% at or above ceiling cut-off	Floor cut-off	Ceiling cut-off
GMFM	admission	218	11.0	4.6	<=10	>=90
GMFM	discharge	217	8.8	9.2	<=10	>=90
Barthel Index	admission	154	5.2	5.2	<=20	>=90
Barthel Index	discharge	150	1.3	16.0	<=20	>=90

Routing Scale change: n=306, 36 distinct values, 12.1% with exactly zero change.

Supplementary Table S4. Children included in and excluded from each analysis set

Analysis set	n in	n out	Median age in	Median age out	p (age)	% cerebral palsy in	% cerebral palsy out	Median admission Routing Scale in	Median admission Routing Scale out	p (Routing Scale)
Set 1 (SHM+GMFM)	208	110	7.0	5.2	0.008	54.3	7.3	2.55	2.50	0.192
Set 2 (SHM+Barthel)	143	175	3.6	9.5	<0.001	28.7	45.7	2.70	2.30	<0.001
Set 3 (all three)	86	232	2.6	7.6	<0.001	47.7	34.5	2.80	2.40	<0.001

p values from Mann-Whitney (age, Routing Scale) comparisons of included with excluded children.

Supplementary Table S5. Cross-tabulation of tertiles of change for each pair of scales

Pair	Row tertile	Lowest third	Middle third	Highest third	Total
Routing Scale change (rows) vs GMFM change (columns)	Lowest third	31	26	22	79
	Middle third	18	16	26	60
	Highest third	38	13	18	69
Routing Scale change (rows) vs Barthel change (columns)	Lowest third	22	14	12	48
	Middle third	23	21	9	53
	Highest third	20	19	3	42
GMFM change (rows) vs Barthel change (columns)	Lowest third	27	8	4	39

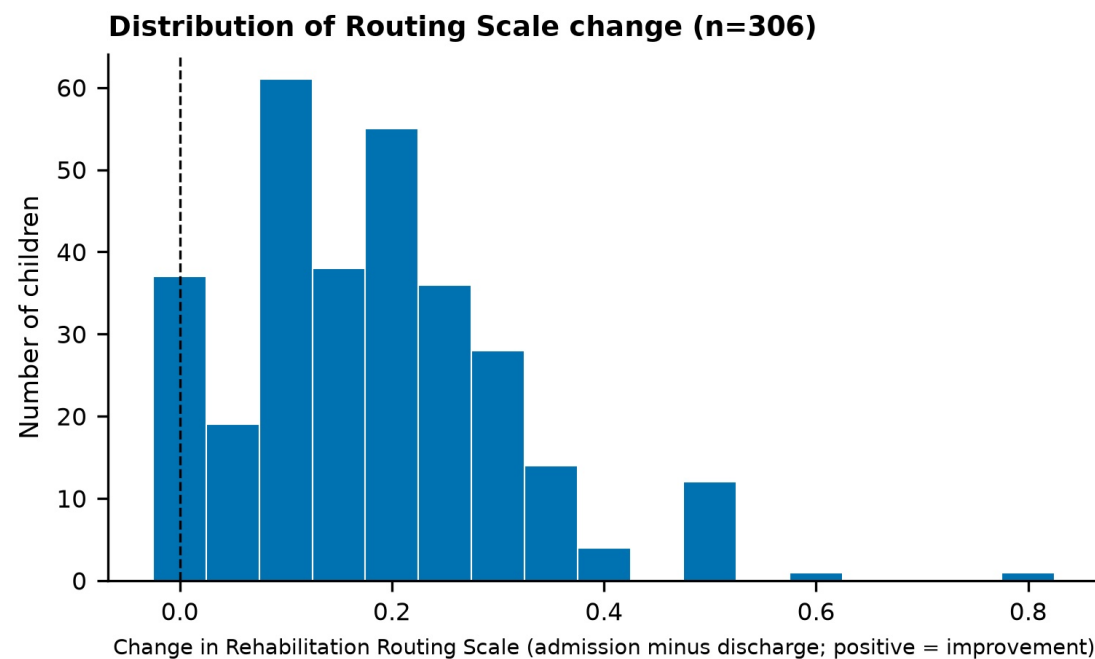
Middle third	13	8	2	23
Highest third	8	18	2	28

SHM vs GMFM: n=208, weighted kappa -0.06 (-0.17 to 0.04), same tertile 31.2%, opposite ends 28.8%; SHM vs Barthel: n=143, weighted kappa -0.06 (-0.17 to 0.05), same tertile 32.2%, opposite ends 22.4%; GMFM vs Barthel: n=90, weighted kappa 0.15 (0.01 to 0.28), same tertile 41.1%, opposite ends 13.3%

Supplementary Table S6. Sensitivity analyses of the correlation between changes

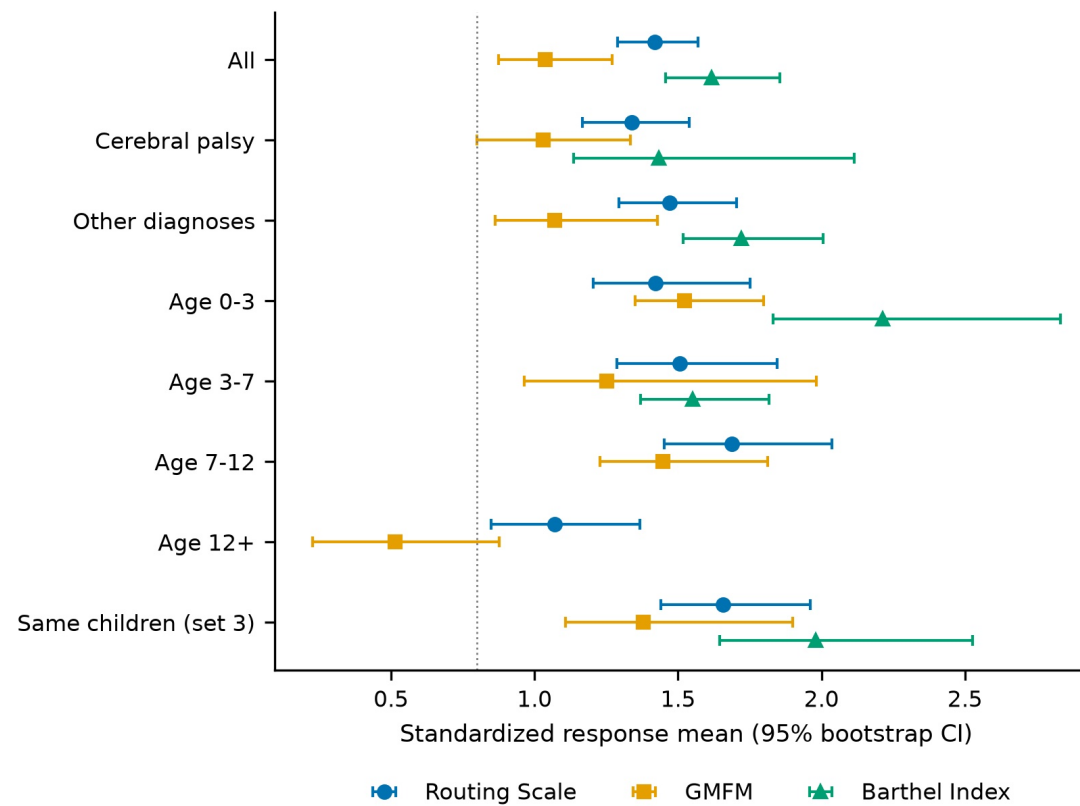
Analysis	Pair	n	Spearman rho (95% CI)	Kendall tau
Primary	SHM vs GMFM	208	0.04 (-0.10 to 0.17)	0.03
Primary	SHM vs Barthel	143	-0.05 (-0.21 to 0.11)	-0.04
Primary	GMFM vs Barthel	90	0.29 (0.07 to 0.48)	0.24
Cerebral palsy only	SHM vs GMFM	113	0.09 (-0.11 to 0.28)	0.07
Cerebral palsy only	SHM vs Barthel	41	0.17 (-0.10 to 0.45)	0.13
Cerebral palsy only	GMFM vs Barthel	45	0.22 (-0.09 to 0.50)	0.18
Other diagnoses	SHM vs GMFM	95	-0.02 (-0.21 to 0.17)	-0.02
Other diagnoses	SHM vs Barthel	102	-0.12 (-0.31 to 0.07)	-0.09
Other diagnoses	GMFM vs Barthel	45	0.35 (0.03 to 0.64)	0.30
Excluding repeat admissions	SHM vs GMFM	119	0.01 (-0.18 to 0.18)	0.01
Excluding repeat admissions	SHM vs Barthel	105	-0.11 (-0.30 to 0.08)	-0.09
Excluding repeat admissions	GMFM vs Barthel	60	0.39 (0.14 to 0.61)	0.32
Set 3 (all three scales)	SHM vs GMFM	86	-0.09 (-0.30 to 0.13)	-0.06
Set 3 (all three scales)	SHM vs Barthel	86	0.17 (-0.02 to 0.35)	0.13
Set 3 (all three scales)	GMFM vs Barthel	86	0.30 (0.06 to 0.50)	0.25

Including 2 implausible GMFM falls	SHM vs GMFM	210	0.06 (-0.08 to 0.20)	0.04
Including 2 implausible GMFM falls	SHM vs Barthel	143	-0.05 (-0.21 to 0.12)	-0.04
Including 2 implausible GMFM falls	GMFM vs Barthel	91	0.31 (0.11 to 0.51)	0.26
SHM recorded ratio instead of difference	SHM vs GMFM	212	-0.01 (-0.15 to 0.13)	-0.01
SHM recorded ratio instead of difference	SHM vs Barthel	144	-0.04 (-0.19 to 0.12)	-0.03
SHM recorded ratio instead of difference	GMFM vs Barthel	90	0.29 (0.09 to 0.49)	0.24
Age 0-3	SHM vs GMFM	50	-0.10 (-0.37 to 0.19)	-0.06
Age 0-3	SHM vs Barthel	53	0.27 (0.01 to 0.51)	0.22
Age 0-3	GMFM vs Barthel	51	0.30 (-0.00 to 0.57)	0.26
Age 3-7	SHM vs GMFM	54	-0.22 (-0.49 to 0.06)	-0.17
Age 3-7	SHM vs Barthel	90	-0.23 (-0.42 to -0.02)	-0.17
Age 3-7	GMFM vs Barthel	39	0.26 (-0.06 to 0.56)	0.22
Age 7-12	SHM vs GMFM	51	0.21 (-0.07 to 0.46)	0.16
Age 12+	SHM vs GMFM	53	0.01 (-0.28 to 0.29)	-0.01



Supplementary Figure S1. Distribution of Routing Scale change.

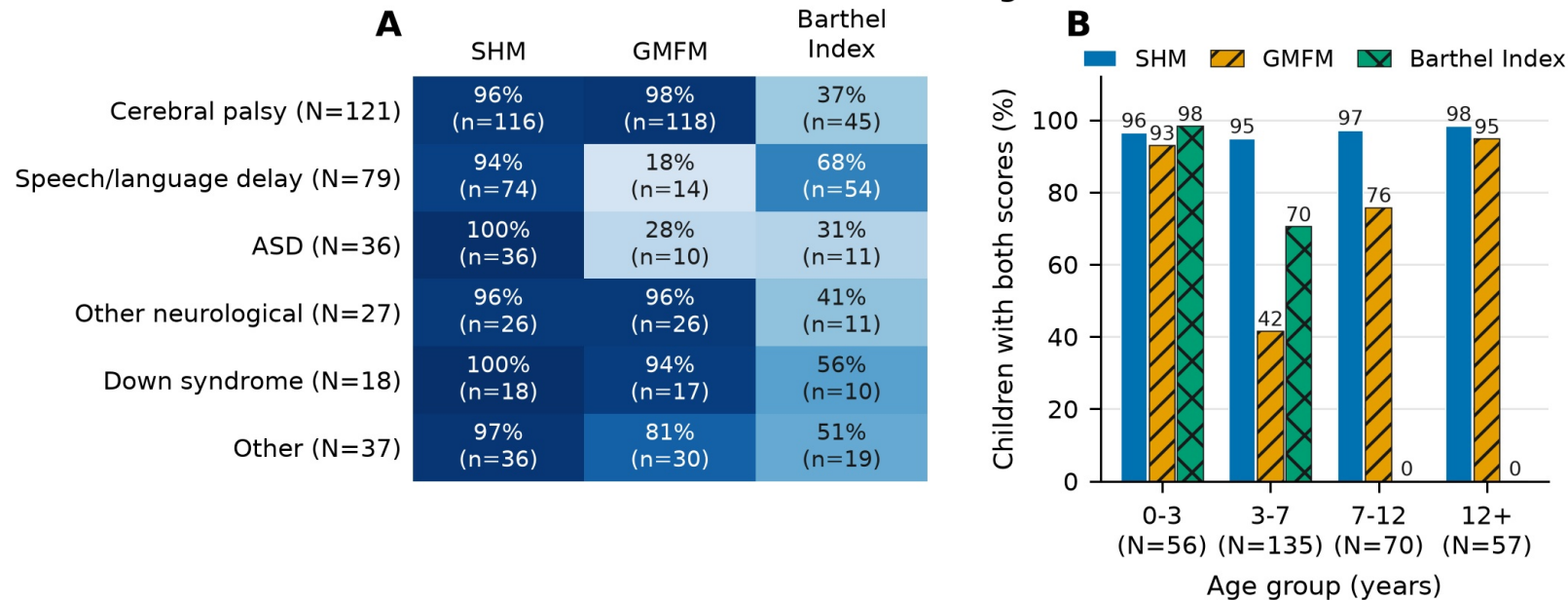
Histogram of admission minus discharge Routing Scale score. The dashed line marks no change; values to the right indicate improvement.



Supplementary Figure S2. Standardized response mean by subgroup.

Points are standardized response means with 95% bootstrap confidence intervals for each scale. The dotted line marks 0.8, a conventional threshold for large responsiveness.

Children with admission and discharge scores



Supplementary Figure S3. Availability of paired admission and discharge scores.

(A) Percentage of children in each diagnostic group with both admission and discharge scores on each instrument; counts in brackets. (B) The same by age group. No child aged 7 years or older had a Barthel Index. SHM, Rehabilitation Routing Scale; GMFM, Gross Motor Function Measure.

RECORD checklist

Agreement of a National Routing Scale with Validated Measures of Change in Pediatric Rehabilitation (EHDI-50031-2026). The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statement extends the STROBE checklist (Benchimol et al., PLoS Med 2015;12:e1001885). The STROBE items are reported as described in the manuscript. Section names refer to the manuscript.

RECORD item	Recommendation	Where it is reported (manuscript section)
1.1	The type of data used should be named in the title	Abstract, Methods ("anonymized discharge records"); Keywords ("Routinely Collected

	or abstract.	Health Data").
1.2	If applicable, the geographic region and time frame of the study should be reported in the title or abstract.	Abstract (Kazakhstan; national pediatric rehabilitation center; August to September 2025). Methods, Study design and setting (1 August to 30 September 2025).
1.3	If linkage between databases was done, this should be stated in the title or abstract.	Not applicable. No linkage between databases was done.
6.1	Methods of study population selection (such as codes or algorithms used to identify subjects).	Methods, Study design and setting and Data source and preparation: all consecutive inpatient admissions in the period were included, with no selection codes or algorithms; duplicate files for the same admission were consolidated, leaving 318 unique admissions. Analysis sets were defined only by availability of paired scores (Methods, Analysis sets; Figure 1).
6.2	Any validation studies of the codes or algorithms used to select the population should be referenced.	Not applicable. No codes or algorithms were used to select the population.
6.3	If the study involved linkage of databases, consider a flow diagram or other graphical display.	Not applicable (no linkage). Participant flow is shown in Figure 1.
7.1	A complete list of codes and algorithms used to classify exposures, outcomes, confounders and effect modifiers should be provided.	Methods, Instruments and change scores (definition of change on each instrument, improvement thresholds, the Routing Scale ratio and its source in Order No. 65). Methods, Data source and preparation (values read from the summaries by a rule-based parser; diagnosis groups assigned from the ICD-10 code of the main diagnosis). Table 1 (diagnosis and age groups).
12.1	Authors should describe the extent to which the investigators had access to the database population used to create the study population.	Methods, Data source and preparation: anonymized discharge summaries were provided for every admission.
12.2	Authors should provide information on the data cleaning methods used in the study.	Methods, Data source and preparation: screening of extracted values against plausible ranges; manual check of about half of the summaries against the source documents; reconciliation of the two independent extractions, with the agreement rates reported; consolidation of duplicate files. Methods: two implausible Gross Motor Function Measure changes set aside (retained in a sensitivity analysis).
12.3	State whether the study included person-level, institutional-level or other data linkage across two	Not applicable. No linkage to other databases was done; the two extractions of the same

	or more databases, and describe the methods of linkage and its quality.	discharge summaries were matched by the summary number.
13.1	Describe in detail the selection of the persons included in the study (that is, study population selection), including filtering based on data quality, data availability and linkage.	Results, Cohort and availability of scores, and Figure 1 (318 admissions and the number contributing to each analysis, with reasons for exclusion).
19.1	Discuss the implications of using data that were not created or collected to answer the specific research question(s), including misclassification, unmeasured confounding, missing data and changing eligibility over time.	Discussion, Strengths and limitations (routinely recorded scores, extraction error that cannot be excluded, conventional thresholds, no test-retest data, no external anchor, a single center).
22.1	Authors should provide information on how to access any supplemental information such as the study protocol, raw data or programming code.	Data and code availability (de-identified data on request to the corresponding author, subject to ethics committee and center approval; code on request). Supplementary Material (Tables S1 to S6; Figures S1 to S3).