

Appendix I – Model adaptation workflow

This appendix contains all the ICC parameter estimates for model adaptation based on baseline data from study 168 and study 169:

1 Intellectual Impairment in UPDRS: Cognitive Impairment in MDS-UPDRS:

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 2, 2 → 3, 3 → 4, 4 → 4

$$\begin{aligned} P(Y_{ij} = 0) &= P0 + P1*FR1 \\ P(Y_{ij} = 1) &= P2 + P1*(1 - FR1) \\ P(Y_{ij} = 2) &= P3 \\ P(Y_{ij} = 3) &= P4*FR4 \\ P(Y_{ij} = 4) &= P4*(1 - FR4) \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
1	> 1	0.80	1.4	$FR1 = 0.49$ $FR4 = 1$
	> 2		4.2	
	> 3		6.7	
	= 4		57	

2 Thought Disorder in UPDRS: Hallucinations and Psychosis in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 0, 2 → 1|2, 3 → 3, 4 → 4

$$\begin{aligned} P(Y_{ij} = 0) &= P0*FR0 \\ P(Y_{ij} = 1) &= P0*(1 - FR0) \\ P(Y_{ij} = 2) &= P1 + P2 \\ P(Y_{ij} = 3) &= P3 \\ P(Y_{ij} = 4) &= P4 \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
2	> 1	0.72	4.4	$FR0 = 0.84$
	> 2		8.3	
	> 3		58	
	= 4		108	

3 Depression in UPDRS: Depressed mood in MDS-UPDRS

Direct mapping

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
3	> 1	0.76	1.6
	> 2		4.0
	> 3		6.2
	= 4		56

4 Motivation and Initiative in UPDRS: Apathy in MDS – UPDRS

Direct mapping

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
4	> 1	1.1	1.7
	> 2		3.3
	> 3		5.5
	= 4		55

5 Speech in UPDRS: Speech in MDS-UPDRS

Direct Mapping

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
5	> 1	1.1	0.65
	> 2		2.1
	> 3		4.2
	= 4		54

6 Salivation in UPDRS: Saliva and Drooling in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 2, 2 → 3, 3 → 3, 4 → 4

$$\begin{aligned} P(Y_{ij} = 0) &= P0 + P1*FR1 \\ P(Y_{ij} = 1) &= P1*(1 - FR1) + P2 \\ P(Y_{ij} = 2) &= P3*FR3 \\ P(Y_{ij} = 3) &= P3*(1 - FR3) \\ P(Y_{ij} = 4) &= P4 \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
6	> 1	1.0	0.70	FR1 = 1
	> 2		1.7	FR3 = 0.76
	> 3		3.0	
	= 4		5.2	

7 Swallowing in UPDRS: Chewing and Swallowing in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 3, 2 → 3, 3 → 2, 4 → 4

$$\begin{aligned} P(Y_{ij} = 0) &= P0 + P1*FR1 \\ P(Y_{ij} = 1) &= P1*(1 - FR1) + P3*FR3 \\ P(Y_{ij} = 2) &= P3*(1 - FR3) \\ P(Y_{ij} = 3) &= P2 \\ P(Y_{ij} = 4) &= P4 \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
7	> 1	1.0	1.9	FR1 = 0.57
	> 2		4.8	FR3 = 0
	> 3		5.6	
	= 4		56	

8 Handwriting in UPDRS: Handwriting in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0→0, 1→1, 2→1, 3→2|3, 4→4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 * FR1 \\
 P(Y_{ij} = 2) &= P1 * (1 - FR1) \\
 P(Y_{ij} = 3) &= P2 + P3 \\
 P(Y_{ij} = 4) &= P4
 \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
8	> 1	0.90	-0.65	$FR1 = 0.64$
	> 2		1.5	
	> 3		3.4	
	= 4		5.7	

9 Cutting Food and Handling Utensils in UPDRS: Eating Tasks in MDS-UPDRS

Direct mapping mechanism

Item -j	Category	a_j	$b_{j,k}$
10	> 1	1.3	0.63
	> 2		2.8
	> 3		6.5
	= 4		8.5

10 Dressing in UPDRS: Dressing in MDS-UPDRS

Direct mapping mechanism

Item -j	Category	a_j	$b_{j,k}$
10	> 1	1.7	0.25
	> 2		2.2
	> 3		4.7
	= 4		6.6

11 Hygiene in UPDRS: Hygiene in MDS-UPDRS

Direct mapping mechanism

Item -j	Category	a_j	$b_{j,k}$
12	> 1	1.3	0.88
	> 2		4.5
	> 3		5.9
	= 4		56

12 Turning in Bed and Adjusting Clothes in UPDRS: Turning in Bed in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1, 2 → 2|3, 3 → 3|4, 4 → 4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 \\
 P(Y_{ij} = 2) &= P2 + P3*FR3 \\
 P(Y_{ij} = 3) &= P3*(1 - FR3) + P4*FR4 \\
 P(Y_{ij} = 4) &= P4*(1 - FR4)
 \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
12	> 1	1.5	0.78	FR3 = 0
	> 2		3.4	FR4 = 0
	> 3		5.6	
	= 4		7.5	

13 Falling in UPDRS

[In UPDRS only]

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
14	> 1	1.3	2.5
	> 2		4.2
	> 3		5.9
	= 4		56

14 Freezing When Walking in UPDRS: Freezing in MDS-UPDRS

*Unique parameterization: for probabilities of 2, 3, 4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 \\
 P(Y_{ij} = 2) &= NP2 \\
 P(Y_{ij} = 3) &= NP3 \\
 P(Y_{ij} = 4) &= NP4
 \end{aligned}$$

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
15	> 1	1.5	2.4
	> 2		3.8
	> 3		5.3
	= 4		7.1

15 Walking in UPDRS: Walking and Balance in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1, 2 → 1|2, 3 → 3|4, 4 → 4

$$\begin{aligned} P(Y_{ij} = 0) &= P0 \\ P(Y_{ij} = 1) &= P1 * FR1 \\ P(Y_{ij} = 2) &= P2 + P1 * (1 - FR1) \\ P(Y_{ij} = 3) &= P3 + P4 * FR4 \\ P(Y_{ij} = 4) &= P4 * (1 - FR4) \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
15	> 1	1.5	0.38	FR1 = 0.94
	> 2		3.0	FR4 = 1
	> 3		3.9	
	= 4		54	

16 Tremor in UPDRS: Tremor in MDS-UPDRS

Direct mapping mechanism

Item -j	Category	a_j	$b_{j,k}$
16	> 1	0.29	-6.2
	> 2		3.7
	> 3		11
	= 4		19

17 Sensory Complaints related to Parkinson's Disease in UPDRS: Pain and Other Sensations in MDS-UPDRS

Direct mapping mechanism

Item -j	Category	a_j	$b_{j,k}$
17	> 1	0.85	-0.11
	> 2		2.4
	> 3		3.9
	= 4		54

18 Speech (Motor Examination) in UPDRS: Speech (Motor Examination) in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0→0, 1→1, 2→2, 3→3|4, 4→4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 \\
 P(Y_{ij} = 2) &= P2 \\
 P(Y_{ij} = 3) &= P3 + P4 * FR4 \\
 P(Y_{ij} = 4) &= P4 * (1 - FR4)
 \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
19	> 1	1.1	0.040	FR4 = 0
	> 2		3.0	
	> 3		6.0	
	= 4		9.0	

19 Facial Expression in UPDRS: Facial Expression in MDS-UPDRS

Direct mapping mechanism

Item -j	Category	a_j	$b_{j,k}$
19	> 1	1.6	-1.6
	> 2		0.84
	> 3		3.0
	= 4		4.9

20 Tremor at Rest in UPDRS

Unique to UPDRS: As there is no parallelism to Rest Tremor Amplitude in MDS-UPDRS

(1) Face, Lips and Chin

Item - j	Category	a_j	$b_{j,k}$
20 (1)	> 1	0.42	5.2
	> 2		9.8
	> 3		17
	= 4		67

(2) Left Upper Extremity

Item - j	Category	a_j	$b_{j,k}$
20 (2)	> 1	0.72	-0.62
	> 2		1.5
	> 3		4.0
	= 4		9.2

(3) Right Upper Extremity

Item - j	Category	a_j	$b_{j,k}$
20 (3)	> 1	0.76	-0.49
	> 2		1.4
	> 3		3.7
	= 4		7.6

(4) Left Lower Extremity

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
20 (4)	> 1	0.80	1.3
	> 2		3.4
	> 3		6.2
	= 4		56

(5) Right Lower Extremity

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
20 (5)	> 1	0.90	1.1
	> 2		3.1
	> 3		5.8
	= 4		56

21 Action/Postural Tremor in UPDRS

Unique to UPDRS: As there is no parallelism to 'Postural Tremor' and 'Kinetic Tremor' in MDS-UPDRS

(1) Left Hand

Item - j	Category	a_j	$b_{j,k}$
21 (1)	> 1	0.77	0.12
	> 2		2.9
	> 3		5.4
	= 4		55

(2) Right Hand

Item - j	Category	a_j	$b_{j,k}$
21 (2)	> 1	0.84	0.31
	> 2		2.8
	> 3		4.9
	= 4		7.5

22 Rigidity in UPDRS: Rigidity in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0→0, 1→1, 2→2, 3→2, 4→3|4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 \\
 P(Y_{ij} = 2) &= P2 * FR2 \\
 P(Y_{ij} = 3) &= P2 * (1 - FR2) + P4 * FR4 \\
 P(Y_{ij} = 4) &= P3 + P4 * (1 - FR4)
 \end{aligned}$$

(1) Neck

Item -j	Category	a_j	$b_{j,k}$	FR
22 (1)	> 1	1.0	-0.023	FR2 = 0.84
	> 2		1.6	FR4 = 1
	> 3		4.6	
	= 4		7.9	

(2) Left Upper Extremity

Item -j	Category	a_j	$b_{j,k}$	FR
22 (2)	> 1	1.2	-2.0	FR2 = 1
	> 2		-0.14	FR4 = 0.95
	> 3		2.6	
	= 4		2.6	

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0→0, 1→1, 2→2, 3→2, 4→3|4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 \\
 P(Y_{ij} = 2) &= P2 * FR2 \\
 P(Y_{ij} = 3) &= P2 * (1 - FR2) + P4 * FR4 \\
 P(Y_{ij} = 4) &= P3 + P4 * (1 - FR4)
 \end{aligned}$$

(3) Right Upper Extremity

Item -j	Category	a_j	$b_{j,k}$	FR
22 (3)	> 1	1.2	-2.1	FR2 = 0.82
	> 2		-0.22	FR4 = 1
	> 3		2.8	
	= 4		6.1	

(4) Left Lower Extremity

Item -j	Category	a_j	$b_{j,k}$	FR
22 (4)	> 1	0.93	-0.73	FR2 = 1
	> 2		0.93	FR4 = 0.87
	> 3		3.6	
	= 4		3.6	

(5) Right Lower Extremity

Item -j	Category	a_j	$b_{j,k}$	FR
22 (5)	> 1	0.85	-0.70	FR2 = 0.79
	> 2		1.2	FR4 = 1
	> 3		4.4	
	= 4		9.4	

23 Finger Taps in UPDRS: Finger Taps in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1|2, 2 → 2|3, 3 → 3, 4 → 4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 + P2*FR2 \\
 P(Y_{ij} = 2) &= P2*(1 - FR2) + P3*FR3 \\
 P(Y_{ij} = 3) &= P3*(1 - FR3) \\
 P(Y_{ij} = 4) &= P4
 \end{aligned}$$

(1) Left Hand

Item -j	Category	a_j	$b_{j,k}$	FR
23 (1)	> 1	1.8	-2.1	FR2 = 0.20
	> 2		-0.39	FR3 = 0.45
	> 3		1.3	
	= 4		3.3	

(2) Right Hand

Item -j	Category	a_j	$b_{j,k}$	FR
23 (2)	> 1	1.8	-1.8	FR2 = 0.099
	> 2		0.013	FR3 = 0.41
	> 3		1.6	
	= 4		3.6	

24 Hand Movements in UPDRS: Hand Movements in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0→0, 1→1|2, 2→2|3, 3→3, 4→4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 + P2*FR2 \\
 P(Y_{ij} = 2) &= P2*(1 - FR2) + P3*FR3 \\
 P(Y_{ij} = 3) &= P3*(1 - FR3) \\
 P(Y_{ij} = 4) &= P4
 \end{aligned}$$

(1) Left Hand

Item -j	Category	a_j	$b_{j,k}$	FR
24 (1)	> 1	1.7	-1.7	FR2 = 0.23
	> 2		-0.034	FR3 = 0.52
	> 3		1.7	
	= 4		52	

(2) Right Hand

Item -j	Category	a_j	$b_{j,k}$	FR
24 (2)	> 1	1.9	-1.3	FR2 = 0.066
	> 2		0.45	FR3 = 0.55
	> 3		2.0	
	= 4		52	

25 Hand Pronation and Supination in UPDRS: Hand Pronation and Supination in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1|2, 2 → 2|3, 3 → 3, 4 → 4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 + P2 * FR2 \\
 P(Y_{ij} = 2) &= P2 * (1 - FR2) + P3 * FR3 \\
 P(Y_{ij} = 3) &= P3 * (1 - FR3) \\
 P(Y_{ij} = 4) &= P4
 \end{aligned}$$

(1) Left Hand

Item -j	Category	a_j	$b_{j,k}$	FR
25 (1)	> 1	1.7	-1.6	FR2 = 0.23
	> 2		0.052	FR3 = 0.44
	> 3		1.6	
	= 4		3.5	

(2) Right Hand

Item -j	Category	a_j	$b_{j,k}$	FR
25 (2)	> 1	1.6	-1.3	FR2 = 0.085
	> 2		0.53	FR3 = 0.28
	> 3		2.4	
	= 4		4.5	

26 Leg Agility in UPDRS: Leg Agility in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1|2, 2 → 2|3, 3 → 3, 4 → 4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 + P2*FR2 \\
 P(Y_{ij} = 2) &= P2*(1 - FR2) + P3*FR3 \\
 P(Y_{ij} = 3) &= P3*(1 - FR3) \\
 P(Y_{ij} = 4) &= P4
 \end{aligned}$$

(1) Left Leg

Item -j	Category	a_j	$b_{j,k}$	FR
26 (1)	> 1	1.3	-0.97	FR2 = 0
	> 2		0.92	FR3 = 0
	> 3		3.0	
	= 4		6.4	

(2) Right Leg

Item -j	Category	a_j	$b_{j,k}$	FR
26 (2)	> 1	1.0	-0.43	FR2 = 0
	> 2		2.1	FR3 = 0
	> 3		4.5	
	= 4		6.6	

27 Arising From Chair in UPDRS: Arising From Chair in MDS-UPDRS

Direct mapping mechanism:

Item -j	Category	a_j	$b_{j,k}$
27	> 1	1.1	1.9
	> 2		3.9
	> 3		5.3
	= 4		6.7

28 Posture in UPDRS: Posture in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1, 2 → 2|3, 3 → 4, 4 → 4

$$\begin{aligned}
 P(Y_{ij} = 0) &= P0 \\
 P(Y_{ij} = 1) &= P1 \\
 P(Y_{ij} = 2) &= P2 + P3 \\
 P(Y_{ij} = 3) &= P4 * FR4 \\
 P(Y_{ij} = 4) &= P4 * (1 - FR4)
 \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
28	> 1	1.3	-0.27	$FR4 = 0.92$
	> 2		2.1	
	> 3		4.2	
	= 4		6.6	

29 Gait in UPDRS: Gait in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1, 2 → 2, 3 → 3|4, 4 → 4

$$\begin{aligned} P(Y_{ij} = 0) &= P0 \\ P(Y_{ij} = 1) &= P1 \\ P(Y_{ij} = 2) &= P2 \\ P(Y_{ij} = 3) &= P3 + P4 * FR4 \\ P(Y_{ij} = 4) &= P4 * (1 - FR4) \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
29	> 1	0.92	-0.53	$FR4 = 0$
	> 2		3.5	
	> 3		6.0	
	= 4		8.4	

30 Postural Stability in UPDRS: Postural Stability in MDS-UPDRS

Indirect mapping mechanism: UPDRS → MDS-UPDRS

0 → 0, 1 → 1|2, 2 → 3, 3 → 4, 4 → 4

$$\begin{aligned} P(Y_{ij} = 0) &= P0 \\ P(Y_{ij} = 1) &= P1 + P2 \\ P(Y_{ij} = 2) &= P3 \\ P(Y_{ij} = 3) &= P4 * FR4 \\ P(Y_{ij} = 4) &= P4 * (1 - FR4) \end{aligned}$$

Item -j	Category	a_j	$b_{j,k}$	FR
29	> 1	0.80	3.2	$FR4 = 0.93$
	> 2		4.8	
	> 3		5.8	
	= 4		8.9	

31 Body Bradykinesia and Hypokinesia in UPDRS: Global Spontaneity of Movement in MDS-UPDRS

Direct mapping mechanism

Item - <i>j</i>	Category	<i>a_j</i>	<i>b_{j,k}</i>
32	> 1	1.8	-1.5
	> 2		0.41
	> 3		2.2
	= 4		5.8