

Supplement A: MDS-UPDRS subscales

	Non-motor Items	3.3c	Rigidity– non-dominant side UE
1.1	Cognitive impairment	3.3d	Rigidity–dominant side LE
1.2	Hallucinations and psychosis	3.3e	Rigidity– non-dominant side LE
1.3	Depressed mood	3.4a	Finger tapping–dominant side
1.4	Anxious mood	3.4b	Finger tapping– non-dominant side
1.5	Apathy	3.5a	Hand movements–dominant side
1.6	Sleep problems	3.5b	Hand movements– non-dominant side
1.7	Daytime sleepiness	3.6a	Pronation- supination movements– hand dominant side
1.8		3.6b	Pronation- supination movements– hand non-dominant side
1.9	Pain and other sensations	3.7a	Toe tapping– dominant side
1.10	Urinary problems	3.7b	Toe tapping– non-dominant side
1.11	Constipation problems	3.8a	Leg agility– dominant side
1.12	Light headedness on standing	3.8b	Leg agility– non-dominant side
1.13	Fatigue	3.9	Arising from chair
	Motor Items	3.10	Gait
2.1	Speech	3.11	Freezing of gait
2.2	Saliva and drooling	3.12	Postural stability
2.3	Chewing and swallowing	3.13	Posture
2.4	Eating tasks	3.14	Global spontaneity of movement
2.5	Dressing		Tremor Items
2.6	Hygiene	2.10	Tremor
2.7	Handwriting	3.15a	Postural tremor dominant side
2.8	Doing hobbies and other activities	3.15b	Postural tremor non-dominant side
2.9	Turning in bed	3.16a	Kinetic tremor dominant side
2.11	Getting out of bed	3.16b	Kinetic tremor non-dominant side
2.12	Walking and balance	3.17a	Rest tremor amplitude dominant UE
2.13	Freezing	3.17b	Rest tremor amplitude non dominant UE
3.1	Speech	3.17c	Rest tremor amplitude–dominant side LE
3.2	Facial expression	3.17d	Rest tremor amplitude– non-dominant side LE
3.3a	Rigidity– Neck	3.17e	Rest tremor amplitude– Lip/jaw
3.3b	Rigidity– dominant side UE	3.18	Constancy of rest

Supplement B: Optimization algorithm

```

Optimized<-rep(0, 56)
for (i in 1:56){
  Optimized[add]<-1
  for (n in 1:56) {
    z<-Optimized
    z[n]<-1
    mu1<- y1*z
    mu2<- y2*z
    var1<- t(z)%*%Omega1%*%z
    var2<- t(z)%*%Omega2%*%z
    diff<- sum(mu1)-sum(mu2)
    sd<- sqrt(var1 + var2)
    Item[n, i]<- pnorm(0, mean=diff, sd=sd, lower.tail=F) }
  add<- which.max(Item[, i]) }

```

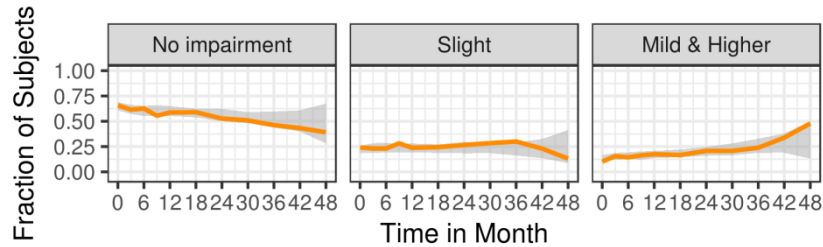
Table B.I: Optimized list of items per optimization scenario

Optimization scenario	Motor items	Non-motor items	Tremor Items
I	2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.11, 2.12, 2.13, 3.1, 3.2, 3.3a, 3.3b, 3.3c, 3.3d, 3.3e, 3.4a, 3.4b, 3.5a, 3.5b, 3.6a, 3.6b, 3.7a, 3.7b, 3.8a, 3.8b, 3.9, 3.10, 3.12, 3.13, 3.14	1.5, 1.13	2.10, 3.17a, 3.17b, 3.17d, 3.17e, 3.18
II	2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.11, 2.12, 2.13, 3.1, 3.2, 3.3a, 3.3b, 3.3c, 3.3d, 3.3e, 3.4a, 3.4b, 3.5a, 3.5b, 3.6a, 3.6b, 3.7a, 3.7b, 3.8a, 3.8b, 3.9, 3.10, 3.13, 3.14		3.17a, 3.18
III	2.4, 2.5, 2.6, 2.8, 2.9, 2.11, 2.12, 2.13, 3.1, 3.2, 3.3a, 3.3b, 3.3e, 3.4a, 3.4b, 3.5a, 3.5b, 3.6b, 3.7a, 3.7b, 3.8a, 3.8b, 3.9, 3.10, 3.14	1.13	2.10, 3.15a, 3.16b, 3.17a, 3.17b, 3.17c, 3.17d, 3.17e, 3.18

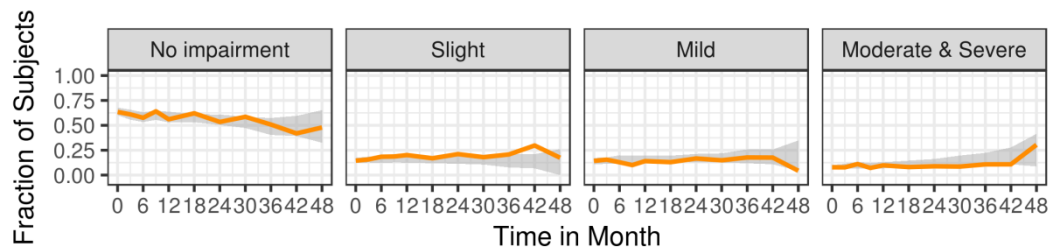
Supplement C: Item Level VPCs

Figure C.1: Motor items: fraction of the *de novo* PD patients assigned to a certain category as observed in the data (orange lines) and as predicted by the model (95% confidence interval in gray).

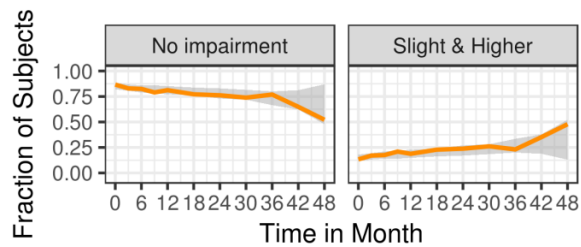
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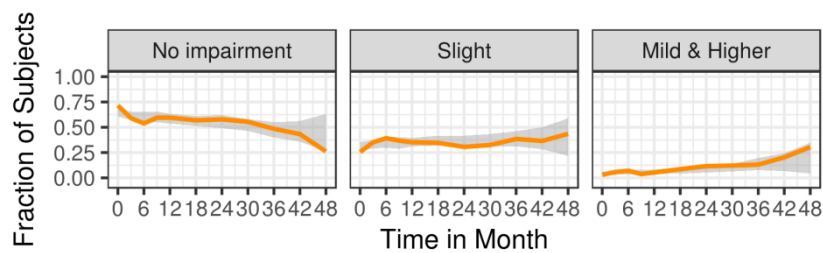
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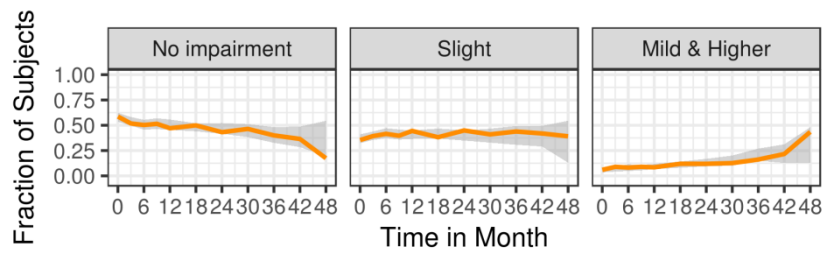
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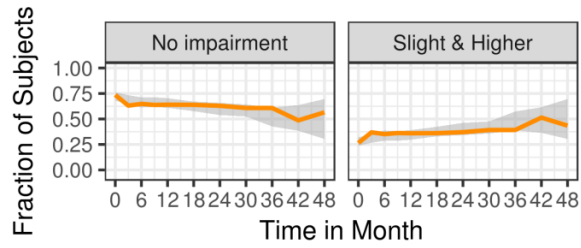
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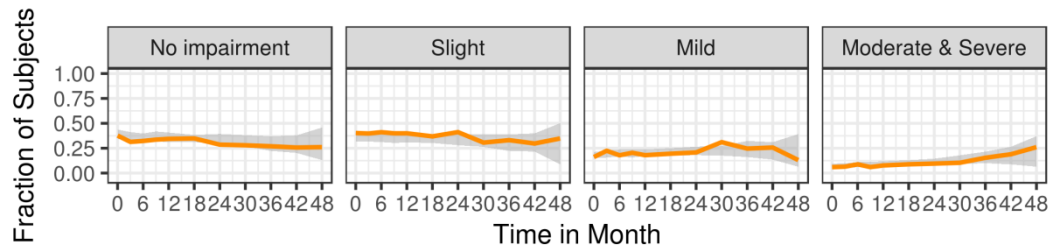
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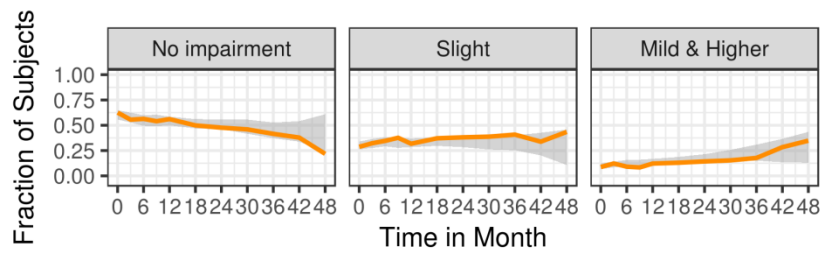
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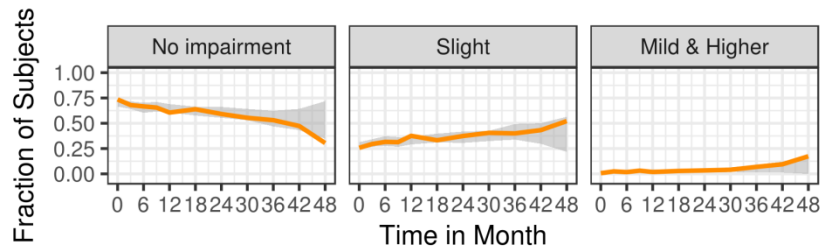
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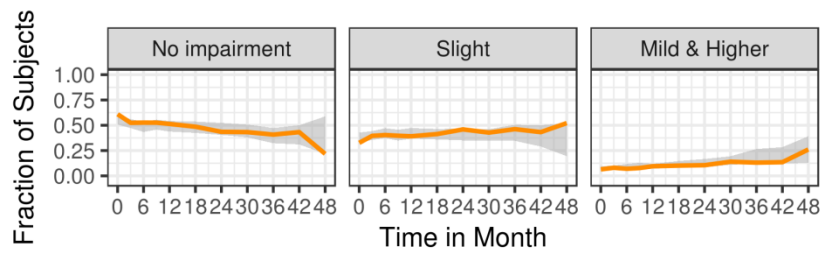
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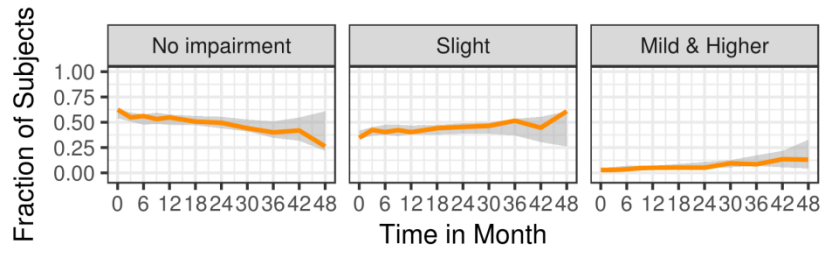
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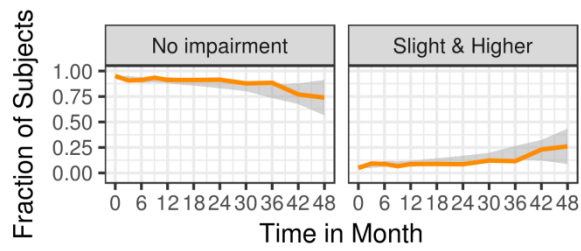
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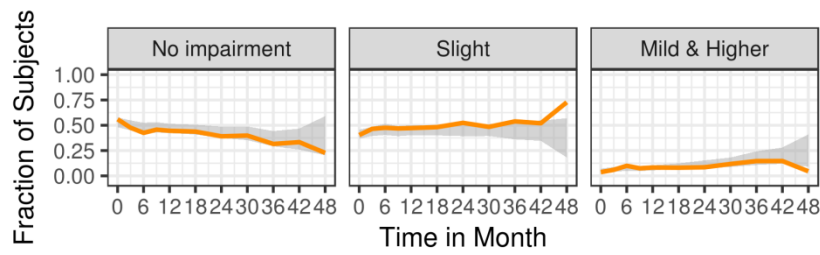
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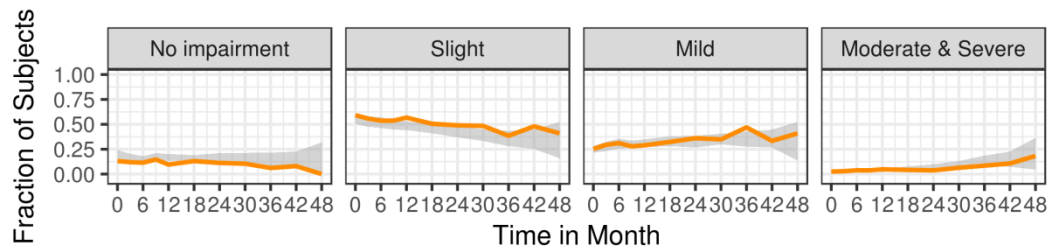
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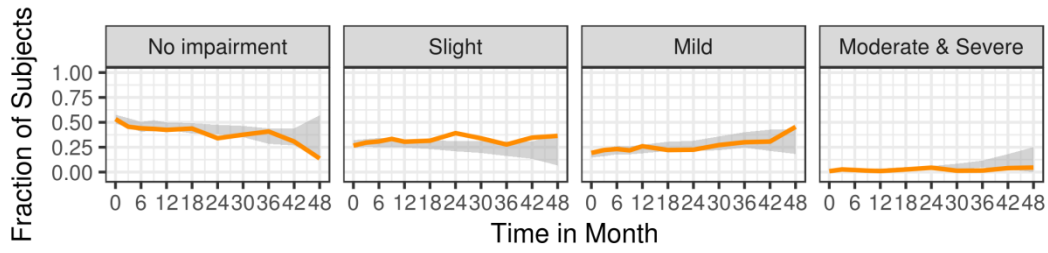
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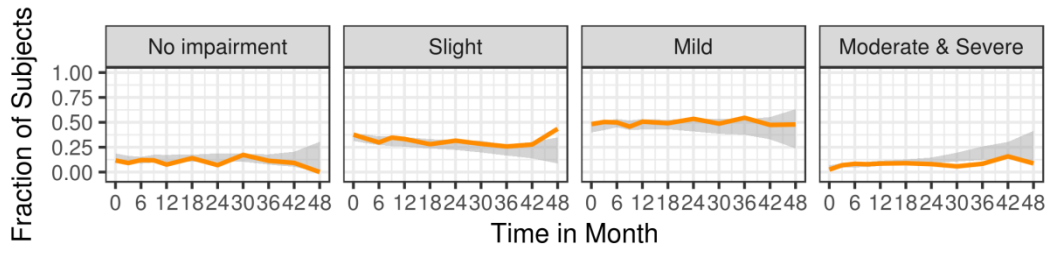
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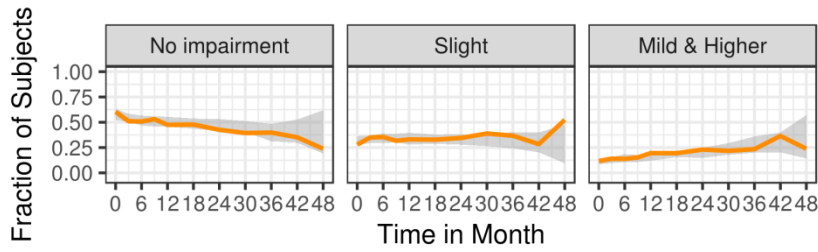
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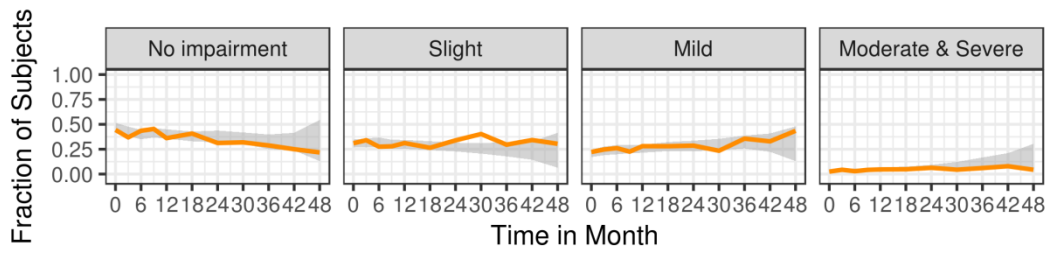
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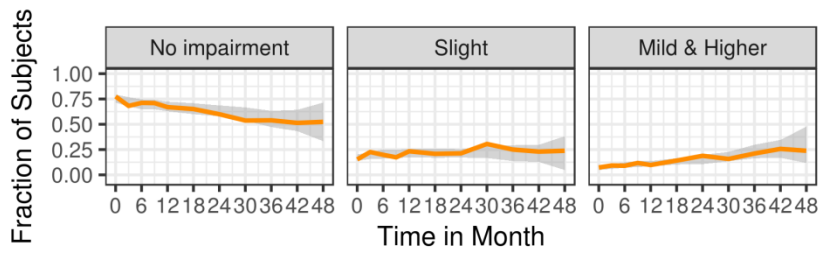
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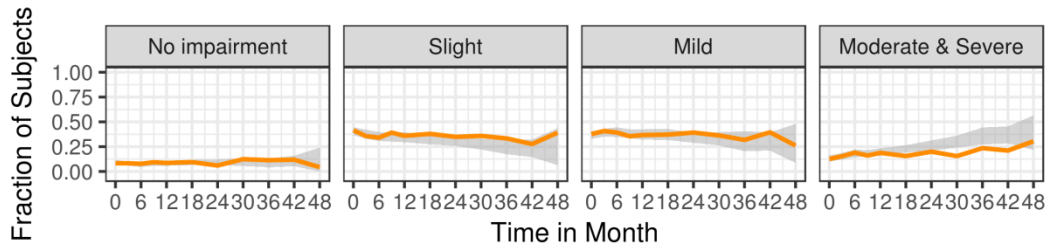
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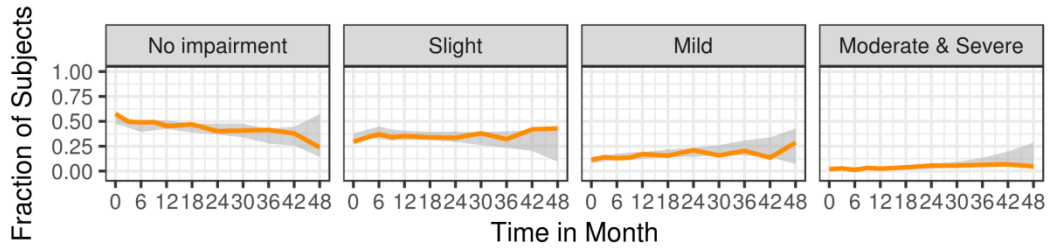
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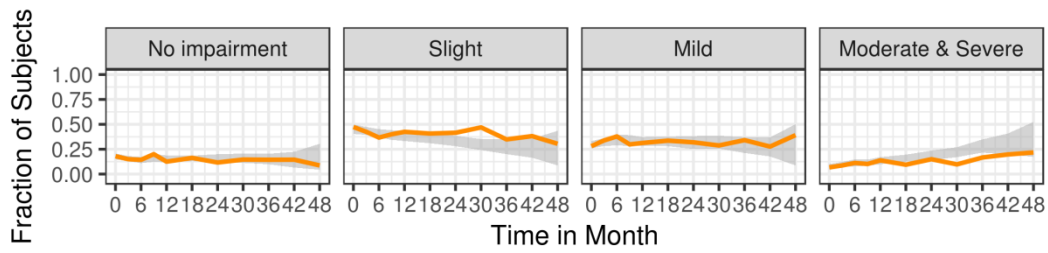
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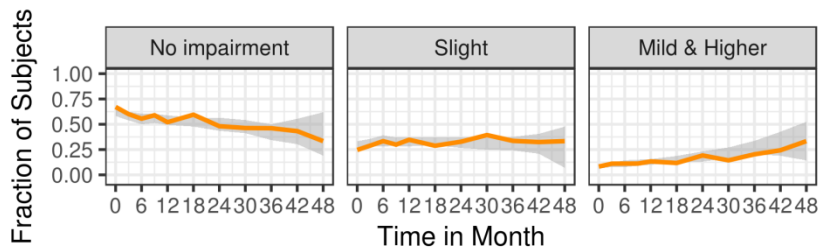
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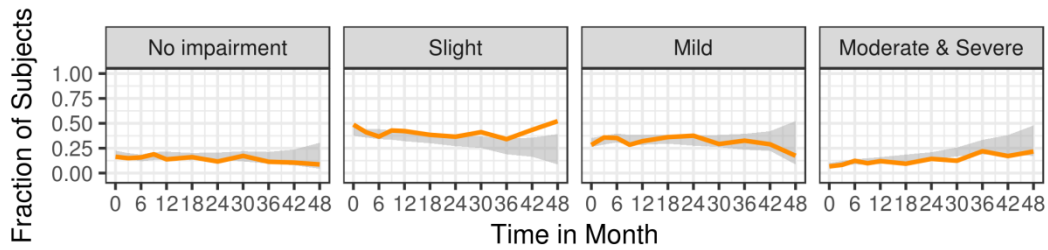
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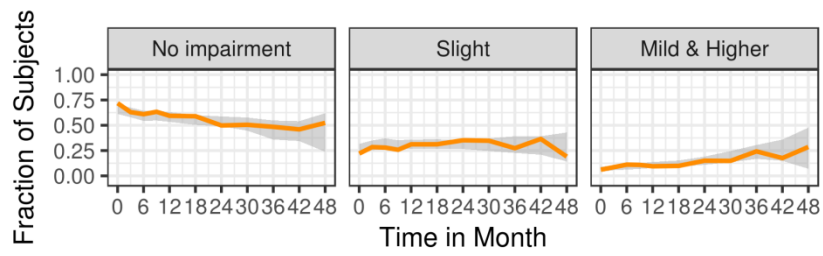
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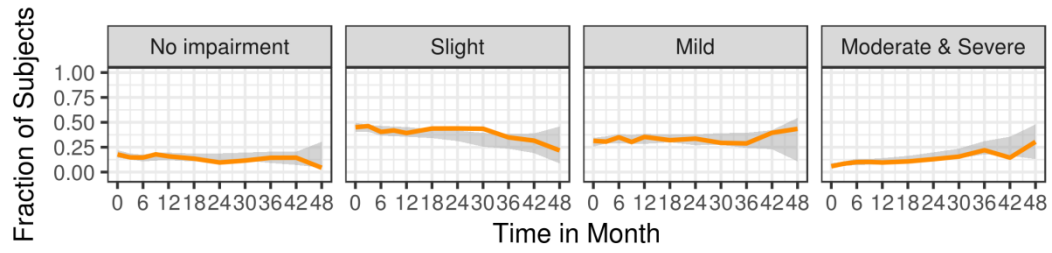
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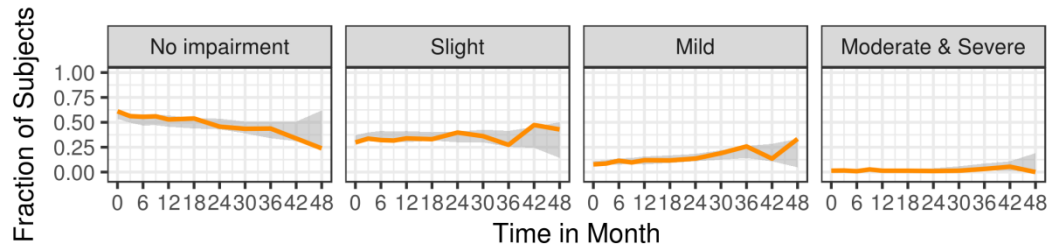
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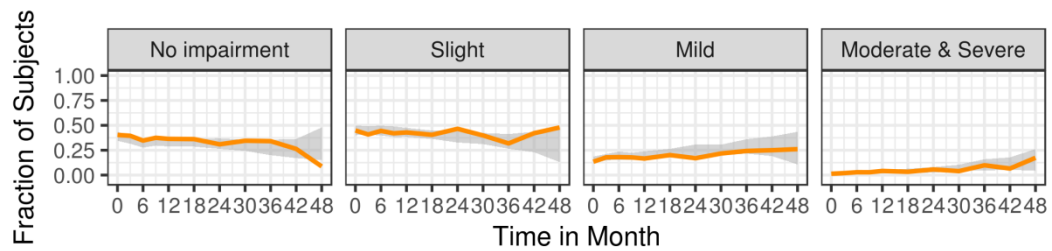
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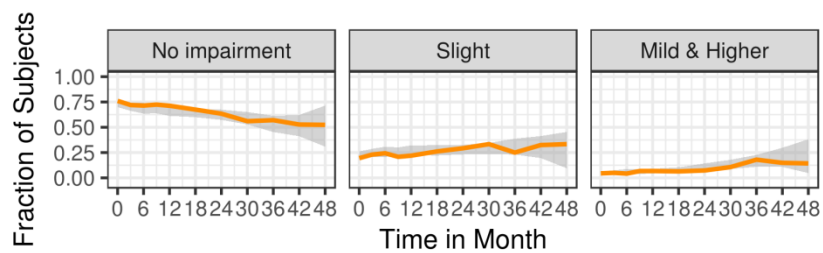
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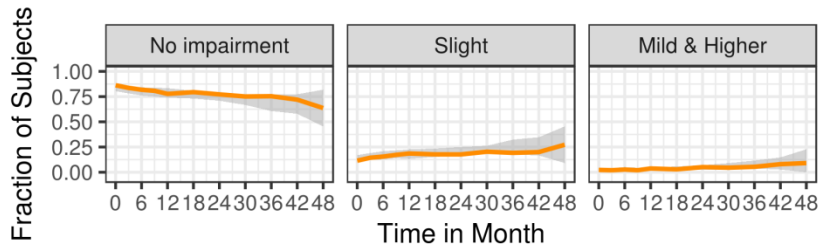
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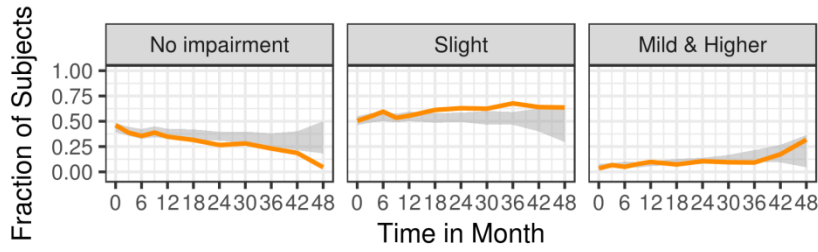
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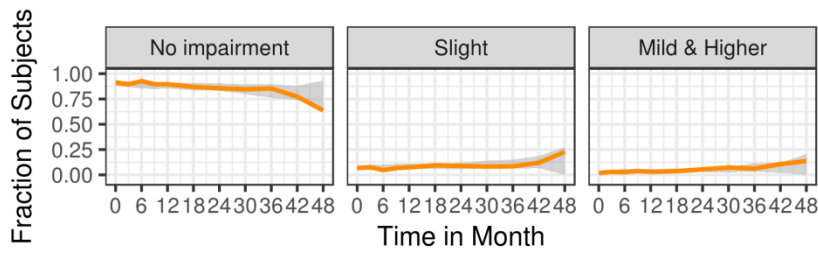
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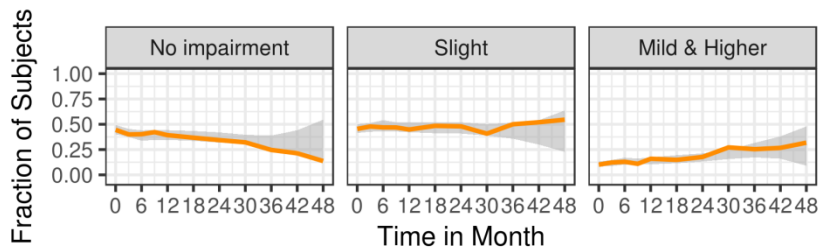
Item 3.10



Item 3.12



Item 3.13



Item 3.14

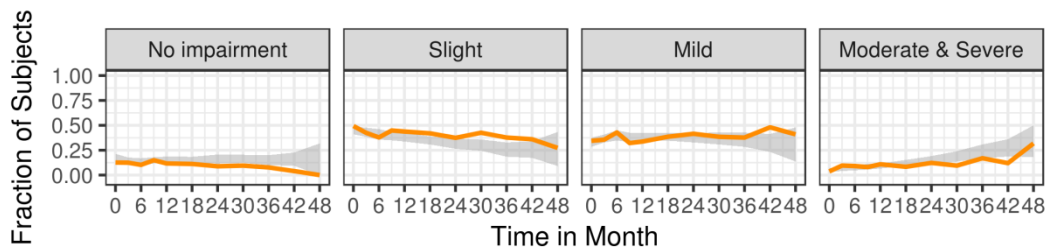
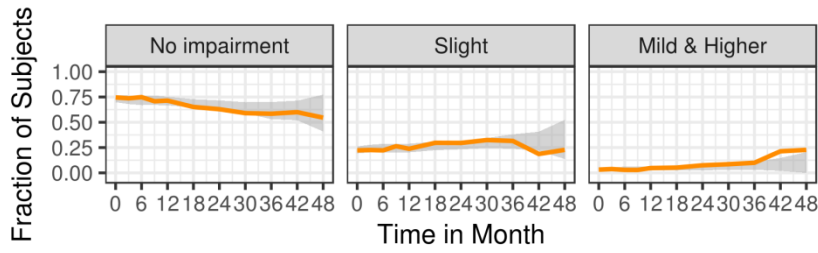
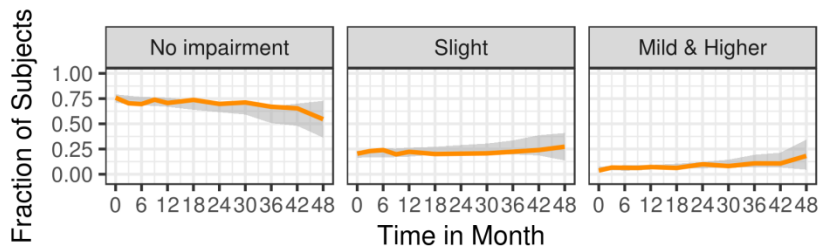


Figure C.2: Non-Motor items: fraction of the *de novo* PD patients assigned to a certain category as observed in the data (orange lines) and as predicted by the model (95% confidence interval in gray).

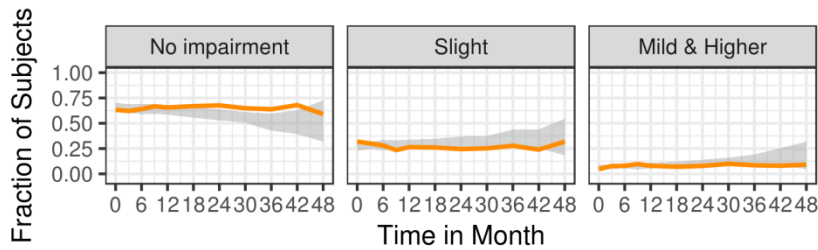
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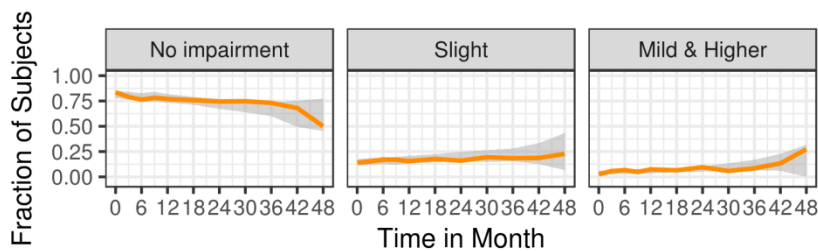
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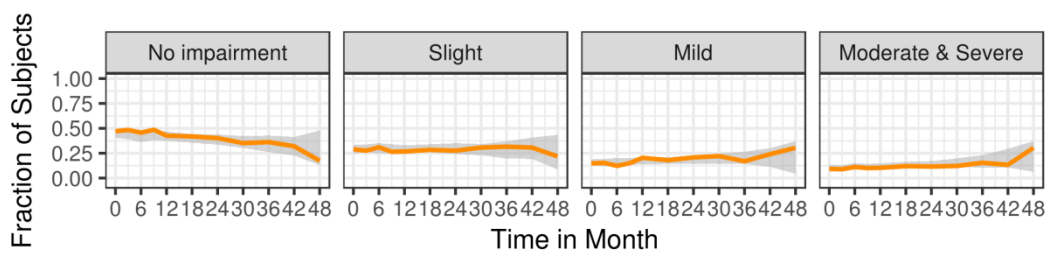
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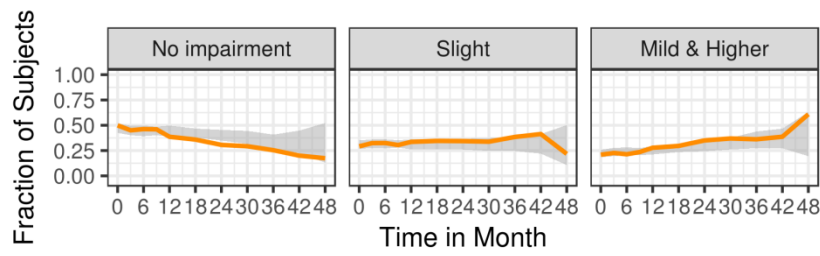
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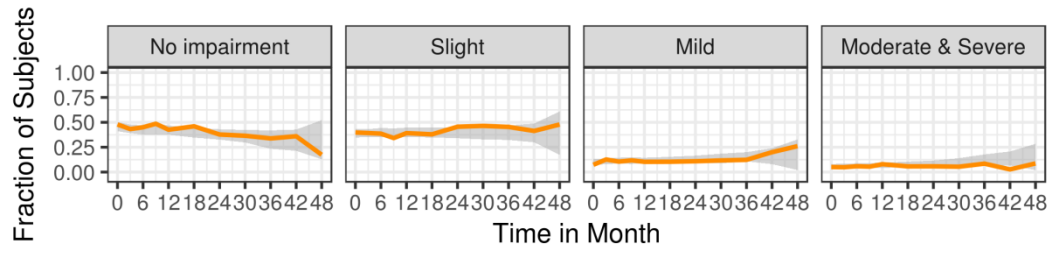
Item 1.7



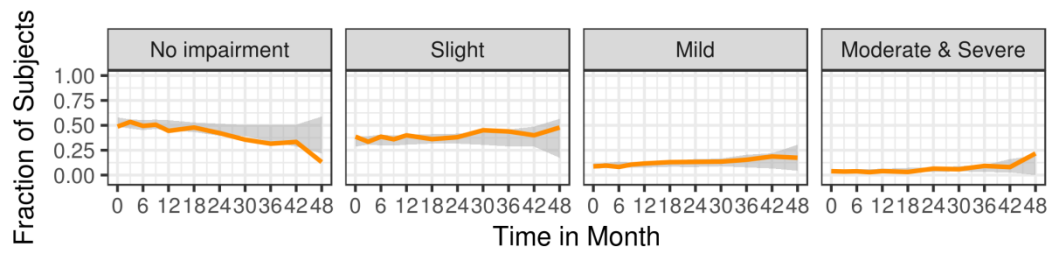
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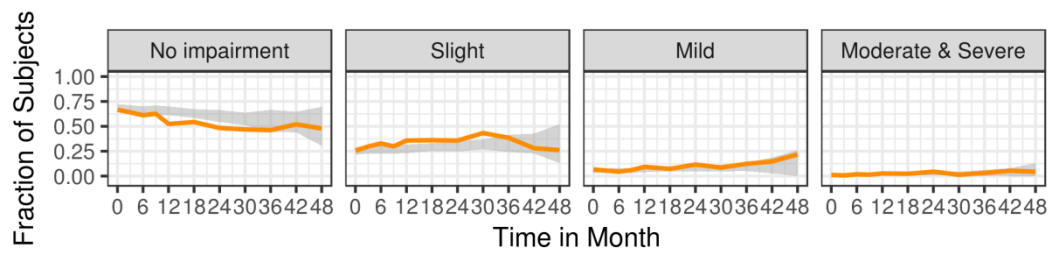
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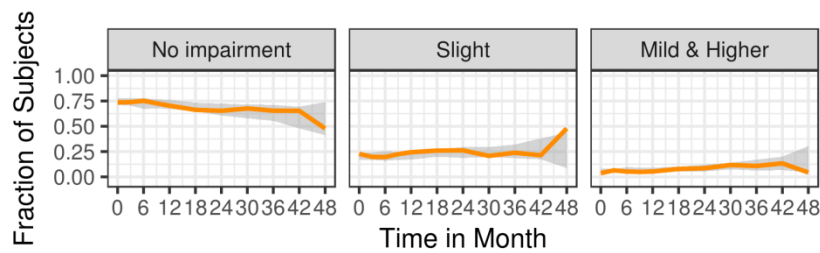
Item 1.10



Item 1.11



Item 1.12



Item 1.13

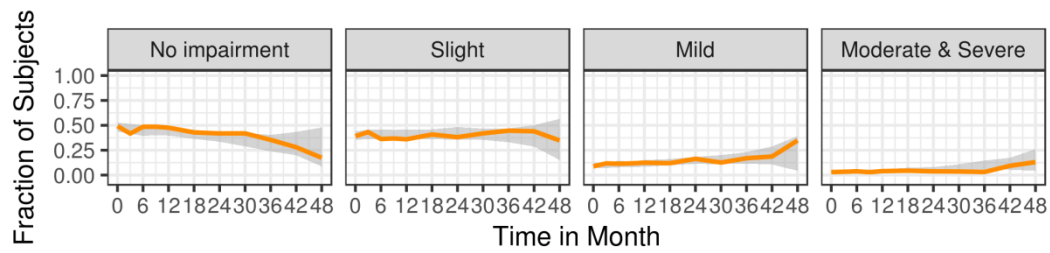
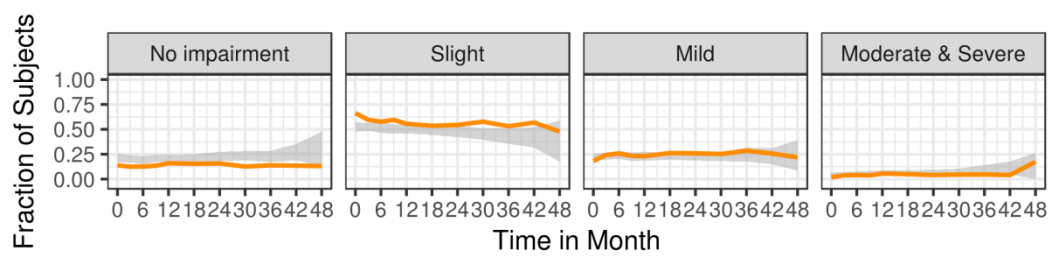
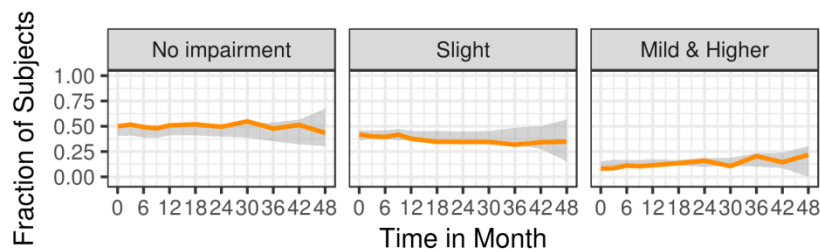


Figure C.3: Tremor items: fraction of the *de novo* PD patients assigned to a certain category as observed in the data (orange lines) and as predicted by the model (95% confidence interval in gray).

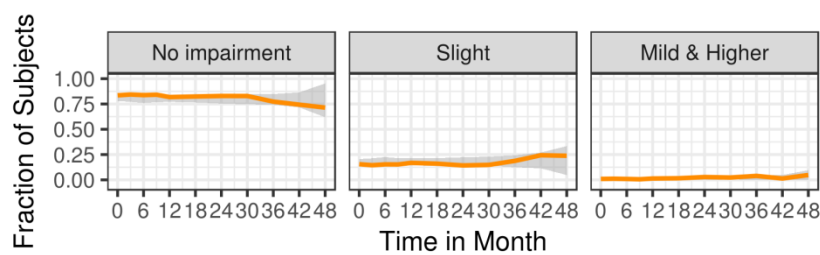
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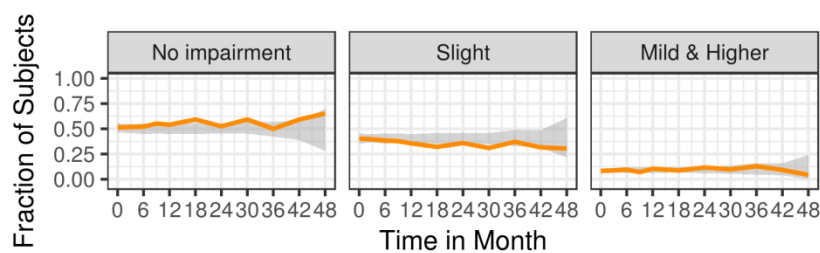
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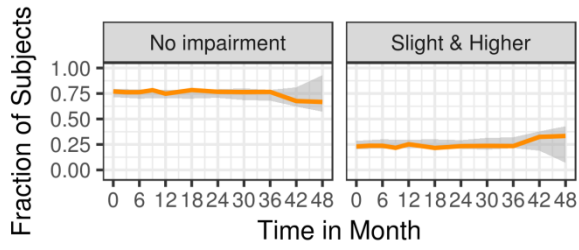
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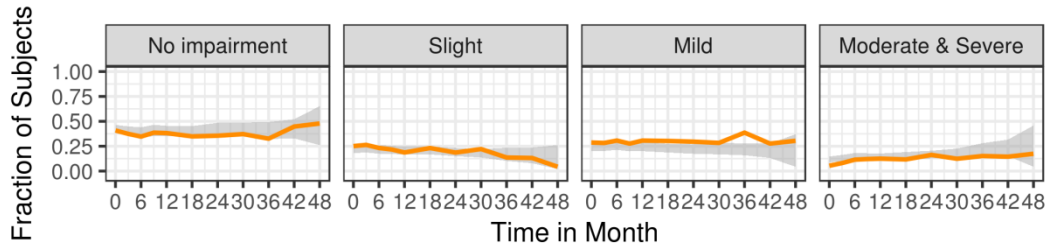
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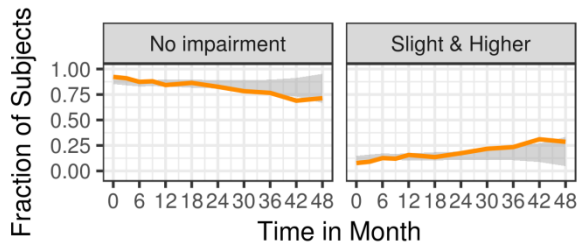
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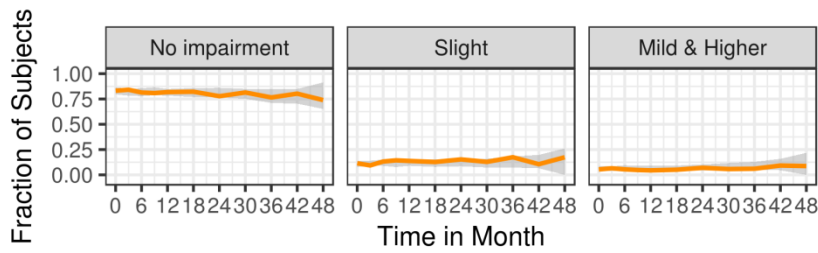
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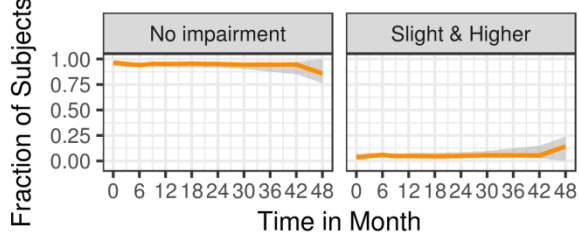
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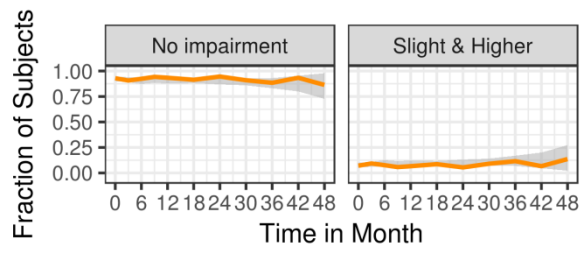
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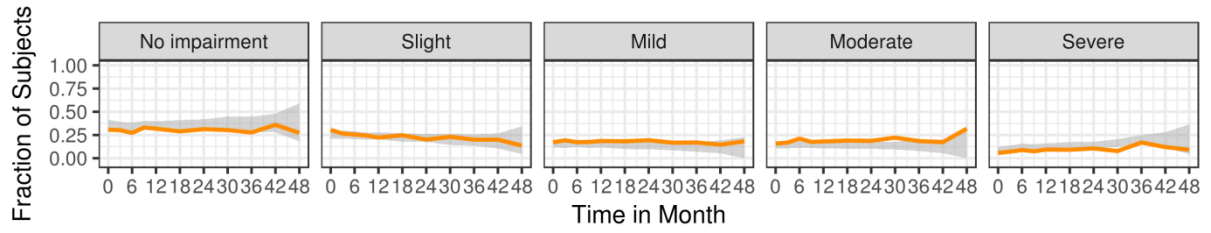
Item 3.17d



Item 3.17e



Item 3.18



Supplement D: Total Score Level VPCs

Figure D.1: Visual predictive Check of the final total MDS-UPDRS time course model for the MDS-UPDRS total score. The orange curves represent, the 2.5, Median, and 97.5 percentiles of the observations and the grey area the 95% confidence interval simulated from the model.

