Non-motor symptoms impact on different domains of supervised and unsupervised mobility in Parkinson disease.

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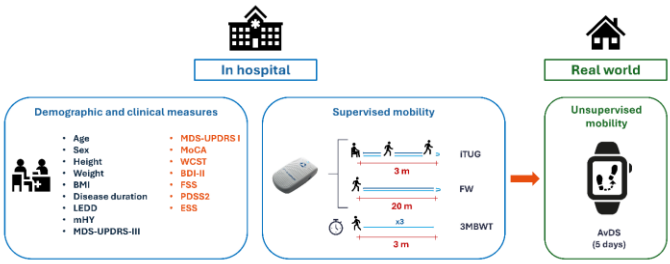
Objective

Non-motor symptoms (NMS) and mobility impairments are frequent manifestations in people with Parkinson's disease (PwPD) [1,2]. However, the impact of NMS on different types and domains of supervised and unsupervised mobility has not been elucidated.

Methods

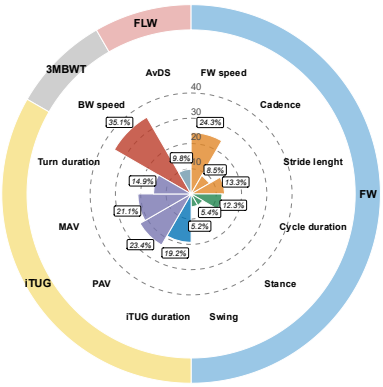
A total of 113 ambulating PwPD without dementia were enrolled. Participants performed three supervised mobility tests while wearing a lower-back-mounted inertial sensor (BTS G-WALK): a 20-meter forward walking (FW) task, an instrumented Timed-Up-and-Go (iTUG), a 3-meter backward walking test (3MBWT). FW, turning and BW parameters were collected. For free-living waling (FLW), average daily steps (avDS) were recorded at home through a Garmin Vivosmart 4 smartwatch for 5 consecutive days [3]. Data regarding NMS were measured through the MDS Unified Parkinson Disease Rating Scale (MDS-UPDRS) part I, the Parkinson Disease Sleep Scale (PDSS-2), the Epworth Sleepiness Scale (ESS), the Fatigue Severity Scale (FSS), the Beck depression Inventory (BDI-II), the Montreal Cognitive Assessment (MoCA) and the Word-Color Stroop Test (WCST). To quantify the proportion of variance in mobility variables explained by NMS, separate robust multivariate linear models (RLM) with bidirectional stepwise variable selection were built.



PwPD (N=113)	
Age	68.8 (8.6)
Sex (F)	36 (32%)
Height	172 (9)
Weight	76.1 (13.1)
BMI	25.7 (3.4)
Disease duration	5.9 (3.9)
LEDD	523 (273)
mHY	2 (2-2.5)
MDS-UPDRS part III	25 (21-32)
MDS-UPDRS part I	6 (4-9)
PDSS-2	9 (6-14)
ESS	6 (4-7)
FSS	3.32 (1.68)
BDI-II	7 (4-10)
MoCA	26 (25-28)
WCST (s)	40.3 (16.5)
AvDS (steps/day)	5800 (2978)
FW speed (m/s)	1.19 (0.22)
Cadence (steps/min)	112.3 (8.2)
Stride length% (%height)	74.3 (10.9)
Stance (%cycle)	61.1 (2.2)
Swing (%cycle)	38.9 (2.2)
Cycle duration (s)	1.09 (0.08)
iTUG duration (s)	11.8 (3.8)
Turn duration (s)	2.66 (0.96)
MAV (°/s)	71.0 (17.8)
PAV (°/s)	141.3 (40.6)
BW speed (m/s)	0.60 (0.22)

Results

For pace, NMS explained 24.3%, 8.5% and 13.3% of variance of FW speed, cadence and stride length, respectively. WSCT and BDI-II were significant predictors of FW speed and stride length. Only FSS was a significant predictor of cadence. For rhythm, NMS explained 12.3%, 5.4% and 5.2% of variance of cycle duration, stance and swing duration, respectively. FSS was the only significant predictor for all parameters. For iTUG duration, NMS explained 19.2% of variance. WSCT and BDI-II were significant predictors. Regarding turning, NMS explained 23.4%, 21.1% and 14.9% of mean (MAV) and peak angular velocities (PAV) and turn duration, respectively. PDSS-2 and WCST were significant predictors for turn duration; PDSS-2, WCST and BDI-II for MAV; FSS, BDI-II and WCST for PAV. For 3MBWT, NMS explained 35.1% of BW speed. FSS and WCST were significant predictors. Finally, NMS explained 9.8% of AvDS. FSS, BDI-II and WCST were significant predictors.



Discussion

NMS explained a variable portion of mobility parameters variance with BW being the most impacted followed by turning. This could be linked to the higher complexity of these tasks. Executive dysfunction, depression and fatigue were the most impactful predictors. Notably, sleep problems showed an impact only on turning.

Outcome	AdjR² (%)	p-value	Sign. predictors
AvDS (steps/day)	9.8	< 0.001	FSS, WCST, BDI-II
FW speed (m/s)	24.3	< 0.001	WCST, BDI-II
Cadence (steps/min)	8.5	0.019	FSS
Stride length% (%height)	13.3	< 0.001	WCST, BDI-II
Stance (%cycle)	5.4	0.002	FSS
Swing (%cycle)	5.2	0.002	FSS
Cycle duration (s)	12.3	0.003	FSS
iTUG duration (s)	19.2	< 0.001	WCST, BDI-II
Turn duration (s)	14.9	< 0.001	PDSS-2, WCST
MAV (°/s)	21.1	< 0.001	PDSS-2, WCST, BDI-II
PAV (°/s)	23.4	< 0.001	FSS, WCST, BDI-II
BW speed (m/s)	35.1	< 0.001	FSS, WCST

Conclusions

Our results suggest that NMS have different impact on mobility depending on the task and the setting. This support the implementation of protocols including different mobility tasks and in both supervised and unsupervised setting to comprehensively assess PwPD.

References

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