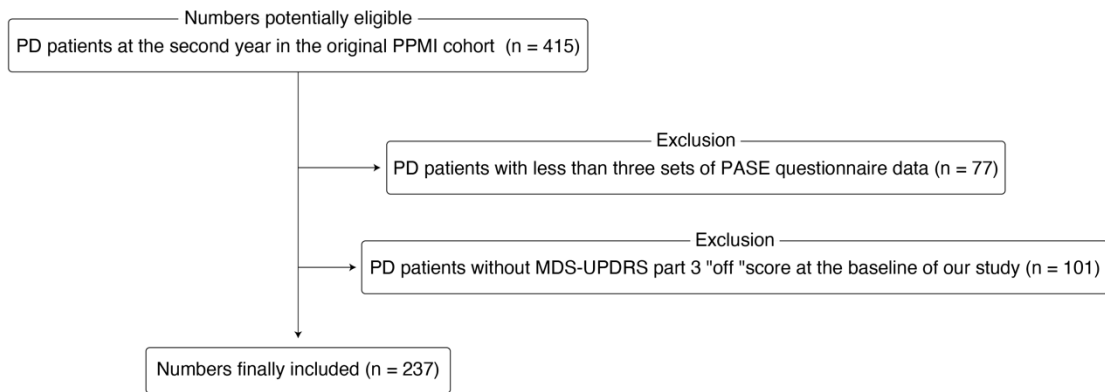


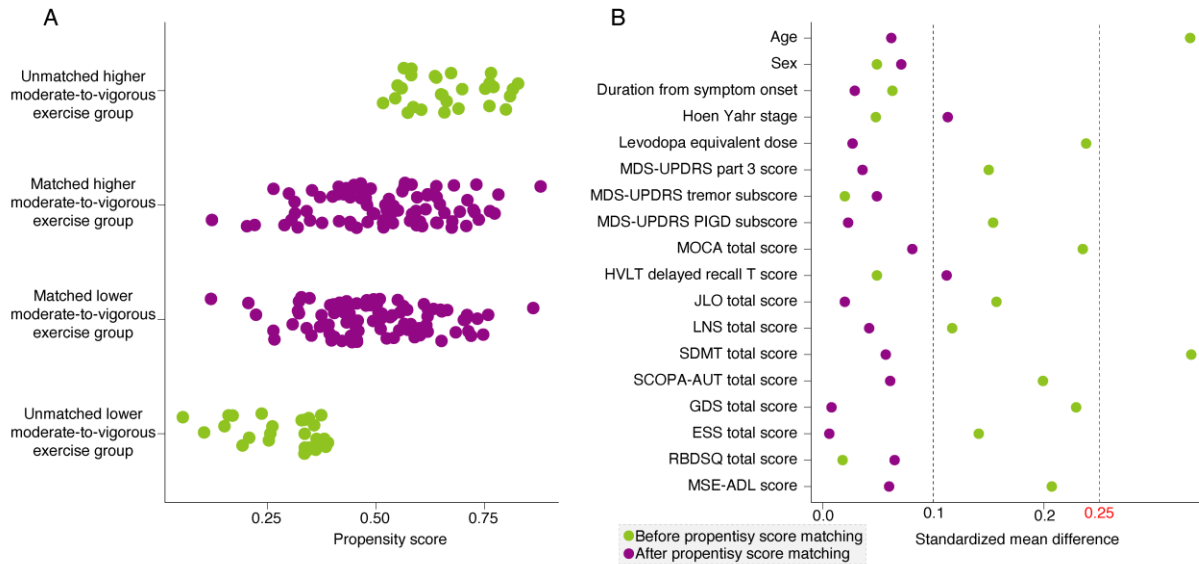
## Supplementary figure titles and legends

### eFigure 1. Study flowchart



Abbreviations: PPMI, Parkinson's Progression Markers Initiative; PD, Parkinson's disease; PASE, Physical Activity Scale for the Elderly; MDS-UPDRS, Movement Disorders Society-sponsored revision of the Unified Parkinson's disease rating scale.

**eFigure 2. Distribution of propensity scores and balance measures after propensity score matching for moderate-to-vigorous exercise levels**

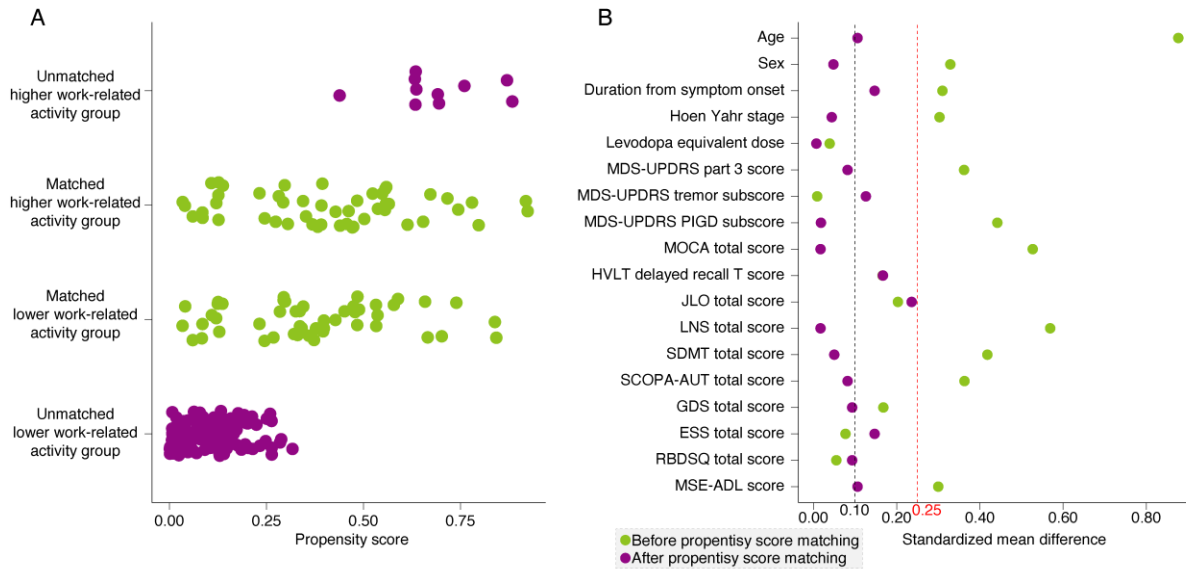


At first, Parkinson’s disease (PD) patients were dichotomized using the median of the average moderate-to-vigorous exercise levels. After propensity score matching, higher and lower regular moderate-to-vigorous exercise groups both consisted of 89 PD patients (A) and were matched such that standardized mean differences between all background factors fell well within a modest cut-off of 0.25 (B).

Abbreviations: MDS-UPDRS, Movement Disorders Society-sponsored revision of the Unified Parkinson's disease rating scale; PIGD, Postural Instability and Gait Disturbance; MOCA, Montreal Cognitive Assessment; HVLT-R, Hopkins Verbal Learning Test-Revised; JLO, Judgment of Line Orientation; LNS, Letter-Number Sequencing; SDMT, Symbol Digit Modalities Test; SCOPA-AUT, Scales for Outcomes in Parkinson’s Disease-Autonomic; GDS, Geriatric Depression Scale; ESS, Epworth Sleepiness Scale; RBDSQ, REM sleep Behavior Disorder Screening Questionnaire; MSE-ADL, Modified Schwab & England Activities of Daily Living scale.

**eFigure 3. Distribution of propensity scores and balance measures after propensity score matching for work-related activity**

**levels**



At first, Parkinson’s disease (PD) patients were dichotomized using the 75th percentile value of the average Physical Activity Scale for the Elderly work score. After propensity score matching, higher and lower regular physical activity groups both consisted of 50 PD patients (A) and were matched such that standardized mean differences between all background factors fell within a modest cut-off of 0.25 (B).

Abbreviations: MDS-UPDRS, Movement Disorders Society-sponsored revision of the Unified Parkinson's disease rating scale; PIGD, Postural Instability and Gait Disturbance; MOCA, Montreal Cognitive Assessment; HVLT-R, Hopkins Verbal Learning Test-Revised; JLO, Judgment of Line Orientation; LNS, Letter-Number Sequencing; SDMT, Symbol Digit Modalities Test; SCOPA-AUT, Scales for Outcomes in Parkinson’s Disease-Autonomic; GDS, Geriatric Depression Scale; ESS, Epworth Sleepiness Scale; RBDSQ, REM sleep Behavior Disorder Screening Questionnaire; MSE-ADL, Modified Schwab & England Activities of Daily Living scale.

Supplementary TABLES

**eTable 1. Baseline characteristics for Parkinson's disease (PD) patients with 5 years or less of follow-up or 6 years of follow-up**

	Follow up for 5 years or less, N = 119 <sup>1</sup>	Follow up for 6 years, N = 118 <sup>1</sup>	P value <sup>2</sup>
Baseline dates	2014/06/30 (2014/02/28–2014/12/16)	2013/07/31 (2013/05/31–2013/11/30)	<0.001*
Age (years)	64.0 (56.0, 72.0)	63.0 (56.0, 69.0)	0.22
Sex, Female	40 (34%)	33 (28%)	0.35
Disease duration (years)	4.0 (3.0, 5.0)	3.0 (2.0, 4.0)	0.025
Hoehn-Yahr stage	2.0 (1.5, 2.0)	2.0 (1.0, 2.0)	0.42
Levodopa equivalent dose (mg)	100.0 (0.0, 300.0)	100.0 (0.0, 236.2)	0.54
PASE leisure score	48.1 (18.4, 107.6)	50.4 (17.8, 77.0)	0.49
PASE household score	85.0 (50.0, 121.0)	86.0 (51.2, 116.0)	0.73
PASE work score	0.0 (0.0, 24.0)	0.0 (0.0, 60.0)	0.92
PASE total score	183.1 (110.4, 257.2)	162.6 (111.5, 249.4)	0.81
PASE score of moderate-to-vigorous exercise	0.2 (0.0, 0.8)	0.1 (0.0, 0.8)	0.89
AAN quality metrics, meet (%)	53 (45%)	52 (44%)	0.94
Off MDS-UPDRS part3 score	25.0 (18.0, 34.0)	26.0 (19.0, 33.8)	0.89
Off MDS-UPDRS tremor subscore	5.0 (2.5, 9.0)	7.0 (4.0, 10.0)	0.035
Off MDS-UPDRS PIGD subscore	1.0 (1.0, 2.0)	1.0 (1.0, 2.0)	0.65
MOCA total score	27.0 (24.0, 29.0)	27.0 (25.0, 28.0)	0.92
HVLT-R delayed recall T score	44.0 (36.0, 53.0)	47.0 (38.0, 55.0)	0.11
JLO total score	26.0 (22.0, 28.0)	28.0 (24.0, 28.0)	0.20
Missing (number)	1	0	
LNS total score	11.0 (9.0, 12.0)	11.0 (9.0, 12.0)	0.71
SDMT total score	42.0 (35.0, 48.0)	42.0 (35.0, 48.0)	0.95
SCOPA-AUT total score	13.0 (7.0, 19.8)	13.0 (9.0, 20.0)	0.67
Missing (number)	1	0	
GDS-15 total score	5.0 (5.0, 6.0)	5.0 (5.0, 6.0)	0.53
Missing (number)	1	0	
ESS total score	6.0 (4.0, 10.0)	5.5 (4.0, 7.0)	0.24
RBDSQ total score	5.0 (3.0, 7.0)	5.0 (3.0, 7.0)	0.88
MSE-ADL score	90.0 (86.2, 95.0)	90.0 (81.2, 90.0)	0.10
Missing (number)	1	0	

<sup>1</sup>Data are expressed as median (interquartile range) or number (percentage). <sup>2</sup>P values were obtained by Wilcoxon rank sum test or Pearson's Chi-squared test, as appropriate. Since there were 25 comparison items, the value of 0.05 divided by 25 was used to determine statistical significance, and statistically significant items were marked with asterisks.

Abbreviations: Physical Activity Scale for Elderly; AAN, American Academy of Neurology; MDS-UPDRS, Movement Disorders Society-sponsored revision of the Unified Parkinson's disease rating scale; PIGD, Postural Instability and Gait Disturbance; MOCA, Montreal Cognitive Assessment; HVLT-R, Hopkins Verbal Learning Test-Revised; JLO, Judgment of Line Orientation; LNS, Letter-Number Sequencing; SDMT, Symbol Digit Modalities Test; SCOPA-AUT, Scales for Outcomes in Parkinson's Disease-Autonomic; GDS-15, 15-items version of Geriatric Depression Scale; ESS, Epworth Sleepiness Scale; RBDSQ, REM sleep Behavior Disorder Screening Questionnaire; MSE-ADL, Modified Schwab & England Activities of Daily Living scale.

**eTable 2. Sensitivity analyses using the multiple imputation methods**

	Estimates	Original Bootstrap 95%CI, low	Bootstrap 95%CI, high	Estimates <sup>1</sup>	Multiple imputation method Bootstrap 95%CI, low <sup>1</sup>	Bootstrap 95%CI, high <sup>1</sup>
<b>vs. PASE total score</b>						
Off MDS-UPDRS part3 score	-0.018	-0.056	0.016	-0.025 (-0.026, -0.024)	-0.062 (-0.063, -0.061)	0.012 (0.010, 0.013)
Off MDS-UPDRS tremor subscore	-0.009	-0.045	0.026	-0.011 (-0.013, -0.010)	-0.050 (-0.051, -0.048)	0.027 (0.026, 0.029)
Off MDS-UPDRS PIGD subscore	-0.095	-0.135	-0.059	-0.098 (-0.099, -0.097)	-0.136 (-0.137, -0.135)	-0.061 (-0.062, -0.060)
MOCA total score	0.044	0.012	0.077	0.046 (0.045, 0.046)	0.012 (0.012, 0.013)	0.079 (0.078, 0.079)
HVLT-R delayed recall T score	-0.006	-0.046	0.030	-0.005 (-0.006, -0.005)	-0.044 (-0.045, -0.044)	0.034 (0.033, 0.034)
JLO total score	0.032	-0.003	0.070	0.031 (0.030, 0.031)	-0.007 (-0.007, -0.006)	0.067 (0.067, 0.068)
LNS total score	0.044	0.014	0.076	0.045 (0.044, 0.045)	0.013 (0.013, 0.013)	0.077 (0.076, 0.077)
SDMT total score	0.052	0.025	0.080	0.050 (0.050, 0.050)	0.022 (0.022, 0.023)	0.078 (0.077, 0.078)
SCOPA-AUT total score	-0.020	-0.049	0.012	-0.019 (-0.019, -0.019)	-0.050 (-0.051, -0.050)	0.012 (0.012, 0.013)
GDS-15 total score	-0.023	-0.070	0.017	-0.023 (-0.023, -0.023)	-0.066 (-0.067, -0.066)	0.021 (0.020, 0.021)
ESS total score	-0.009	-0.042	0.026	-0.008 (-0.009, -0.008)	-0.042 (-0.042, -0.042)	0.025 (0.025, 0.025)
RBDSQ total score	-0.015	-0.049	0.021	-0.015 (-0.015, -0.015)	-0.048 (-0.048, -0.047)	0.018 (0.018, 0.018)
MSE-ADL score	0.077	0.042	0.115	0.077 (0.077, 0.077)	0.039 (0.039, 0.039)	0.114 (0.114, 0.115)
<b>vs. PASE leisure score</b>						
Off MDS-UPDRS part3 score	-0.017	-0.051	0.018	-0.022 (-0.023, -0.021)	-0.059 (-0.060, -0.058)	0.015 (0.014, 0.017)
Off MDS-UPDRS tremor subscore	0.002	-0.032	0.029	0.000 (-0.002, 0.001)	-0.039 (-0.040, -0.037)	0.038 (0.037, 0.040)
Off MDS-UPDRS PIGD subscore	-0.073	-0.112	-0.037	-0.071 (-0.072, -0.070)	-0.109 (-0.110, -0.108)	-0.033 (-0.034, -0.032)
MOCA total score	0.042	0.009	0.075	0.042 (0.041, 0.042)	0.009 (0.008, 0.009)	0.075 (0.075, 0.076)
HVLT-R delayed recall T score	-0.026	-0.066	0.020	-0.023 (-0.024, -0.023)	-0.063 (-0.063, -0.062)	0.016 (0.016, 0.017)
JLO total score	0.028	-0.010	0.063	0.027 (0.026, 0.027)	-0.010 (-0.011, -0.010)	0.064 (0.063, 0.065)
LNS total score	0.036	0.002	0.068	0.037 (0.036, 0.037)	0.005 (0.005, 0.006)	0.069 (0.068, 0.069)
SDMT total score	0.006	-0.021	0.035	0.003 (0.003, 0.004)	-0.025 (-0.025, -0.024)	0.032 (0.031, 0.032)
SCOPA-AUT total score	-0.014	-0.043	0.017	-0.014 (-0.014, -0.013)	-0.045 (-0.045, -0.045)	0.018 (0.018, 0.018)
GDS-15 total score	-0.027	-0.073	0.020	-0.027 (-0.027, -0.027)	-0.071 (-0.071, -0.071)	0.017 (0.016, 0.017)
ESS total score	-0.033	-0.067	0.001	-0.033 (-0.033, -0.033)	-0.066 (-0.067, -0.066)	0.001 (0.000, 0.001)
RBDSQ total score	0.006	-0.030	0.038	0.006 (0.006, 0.006)	-0.028 (-0.028, -0.027)	0.039 (0.038, 0.039)
MSE-ADL score	0.040	0.005	0.079	0.040 (0.040, 0.040)	0.002 (0.002, 0.003)	0.078 (0.078, 0.079)
<b>vs. PASE household score</b>						
Off MDS-UPDRS part3 score	-0.019	-0.052	0.015	-0.020 (-0.022, -0.019)	-0.057 (-0.059, -0.056)	0.016 (0.014, 0.017)
Off MDS-UPDRS tremor subscore	-0.006	-0.043	0.030	-0.003 (-0.005, -0.001)	-0.041 (-0.043, -0.039)	0.035 (0.033, 0.037)
Off MDS-UPDRS PIGD subscore	-0.078	-0.113	-0.041	-0.080 (-0.082, -0.079)	-0.117 (-0.119, -0.116)	-0.044 (-0.045, -0.042)
MOCA total score	0.029	0.006	0.061	0.032 (0.032, 0.033)	-0.001 (-0.001, -0.001)	0.065 (0.064, 0.065)
HVLT-R delayed recall T score	0.016	-0.019	0.052	0.019 (0.019, 0.020)	-0.019 (-0.020, -0.019)	0.058 (0.057, 0.058)
JLO total score	0.014	-0.023	0.051	0.014 (0.014, 0.015)	-0.022 (-0.023, -0.022)	0.050 (0.050, 0.051)
LNS total score	0.050	0.017	0.080	0.052 (0.051, 0.052)	0.021 (0.020, 0.021)	0.083 (0.082, 0.083)
SDMT total score	0.039	0.012	0.070	0.039 (0.039, 0.040)	0.012 (0.011, 0.012)	0.067 (0.067, 0.067)
SCOPA-AUT total score	-0.026	-0.059	0.068	-0.026 (-0.026, -0.026)	-0.056 (-0.057, -0.056)	0.005 (0.005, 0.006)
GDS-15 total score	0.005	-0.040	0.049	0.005 (0.004, 0.005)	-0.038 (-0.038, -0.037)	0.048 (0.047, 0.048)
ESS total score	-0.007	-0.040	0.024	-0.007 (-0.007, -0.007)	-0.040 (-0.040, -0.040)	0.026 (0.026, 0.026)
RBDSQ total score	0.002	-0.030	0.035	0.002 (0.002, 0.002)	-0.030 (-0.030, -0.030)	0.034 (0.034, 0.035)
MSE-ADL score	0.088	0.050	0.123	0.087 (0.087, 0.087)	0.051 (0.050, 0.051)	0.124 (0.124, 0.124)
<b>vs. PASE work score</b>						
Off MDS-UPDRS part3 score	-0.002	-0.040	0.033	-0.008 (-0.009, -0.007)	-0.045 (-0.046, -0.044)	0.029 (0.028, 0.030)
Off MDS-UPDRS tremor subscore	-0.016	-0.051	0.022	-0.021 (-0.022, -0.020)	-0.059 (-0.060, -0.058)	0.018 (0.017, 0.019)
Off MDS-UPDRS PIGD subscore	-0.046	-0.084	-0.008	-0.049 (-0.051, -0.048)	-0.087 (-0.088, -0.086)	-0.011 (-0.012, -0.010)
MOCA total score	0.018	-0.014	0.052	0.018 (0.017, 0.018)	-0.015 (-0.016, -0.015)	0.051 (0.050, 0.051)
HVLT-R delayed recall T score	-0.001	-0.038	0.039	-0.002 (-0.003, -0.002)	-0.042 (-0.041, -0.042)	0.036 (0.036, 0.037)
JLO total score	0.023	-0.017	0.059	0.020 (0.020, 0.021)	-0.017 (-0.017, -0.016)	0.057 (0.057, 0.058)
LNS total score	0.006	-0.025	0.039	0.004 (0.004, 0.005)	-0.027 (-0.028, -0.027)	0.036 (0.036, 0.037)
SDMT total score	0.066	0.037	0.093	0.064 (0.064, 0.064)	0.036 (0.036, 0.037)	0.092 (0.091, 0.092)
SCOPA-AUT total score	-0.000	-0.033	0.031	-0.000 (-0.000, 0.000)	-0.031 (-0.032, -0.031)	0.031 (0.031, 0.032)
GDS-15 total score	-0.020	-0.064	0.029	-0.020 (-0.021, -0.020)	-0.064 (-0.064, -0.063)	0.023 (0.023, 0.024)
ESS total score	0.026	-0.006	0.060	0.026 (0.026, 0.027)	-0.007 (-0.007, -0.006)	0.060 (0.059, 0.060)
RBDSQ total score	-0.040	-0.070	-0.007	-0.039 (-0.039, -0.039)	-0.072 (-0.072, -0.072)	-0.007 (-0.007, -0.006)
MSE-ADL score	0.034	-0.003	0.072	0.034 (0.034, 0.034)	-0.004 (-0.004, -0.003)	0.072 (0.072, 0.072)
<b>vs. Moderate-to-vigorous exercise</b>						
Off MDS-UPDRS part3 score	-0.009	-0.049	0.029	-0.011 (-0.013, -0.010)	-0.0590 (-0.052, -0.048)	0.027 (0.025, 0.029)
Off MDS-UPDRS tremor subscore	-0.003	-0.043	0.031	-0.009 (-0.011, -0.007)	-0.049 (-0.051, -0.047)	0.031 (0.029, 0.034)
Off MDS-UPDRS PIGD subscore	-0.088	-0.129	-0.048	-0.077 (-0.079, -0.075)	-0.116 (-0.118, -0.114)	-0.038 (-0.039, -0.036)
MOCA total score	0.051	0.015	0.086	0.047 (0.046, 0.047)	0.012 (0.011, 0.013)	0.081 (0.080, 0.082)
HVLT-R delayed recall T score	-0.025	-0.066	0.016	-0.023 (-0.024, -0.022)	-0.064 (-0.065, -0.063)	0.017 (0.016, 0.018)
JLO total score	0.046	0.009	0.085	0.043 (0.042, 0.044)	0.005 (0.004, 0.006)	0.082 (0.080, 0.083)
LNS total score	0.043	0.008	0.078	0.042 (0.041, 0.043)	0.009 (0.008, 0.010)	0.075 (0.074, 0.076)
SDMT total score	0.014	-0.016	0.045	0.011 (0.010, 0.011)	-0.019 (-0.020, -0.018)	0.040 (0.039, 0.040)
SCOPA-AUT total score	-0.004	-0.036	0.032	-0.004 (-0.004, -0.003)	-0.036 (-0.036, -0.036)	0.029 (0.029, 0.029)
GDS-15 total score	-0.010	-0.054	0.035	-0.010 (-0.010, -0.009)	-0.055 (-0.055, -0.054)	0.035 (0.035, 0.036)
ESS total score	-0.032	-0.066	0.003	-0.034 (-0.034, -0.033)	-0.068 (-0.069, -0.068)	0.001 (0.001, 0.002)
RBDSQ total score	-0.006	-0.041	0.027	-0.007 (-0.007, -0.007)	-0.041 (-0.041, -0.041)	0.027 (0.027, 0.027)
MSE-ADL score	0.051	0.012	0.087	0.052 (0.051, 0.052)	0.013 (0.012, 0.013)	0.091 (0.091, 0.092)

<sup>1</sup>Data are expressed as mean (95% CIs).

Abbreviations: CI, Confidence Interval; Physical Activity Scale for Elderly; AAN, American Academy of Neurology; MDS-UPDRS, Movement Disorders Society-sponsored revision of the Unified Parkinson's disease rating scale; PIGD, Postural Instability and Gait Disturbance; MOCA, Montreal Cognitive Assessment; HVLT-R, Hopkins Verbal Learning Test-Revised; JLO, Judgment of Line Orientation; LNS, Letter-Number Sequencing; SDMT, Symbol Digit Modalities Test; SCOPA-AUT, Scales for Outcomes in Parkinson's Disease-Autonomic; GDS-15, 15-items version of Geriatric Depression Scale; ESS, Epworth Sleepiness Scale; RBDSQ, REM sleep Behavior Disorder Screening Questionnaire; MSE-ADL, Modified Schwab & England Activities of Daily Living scale.