

Supplementary Table 6: Case-Control Studies with Polysomnography involving patients diagnosed with Parkinson's Disease, Dementia with Lewy Bodies, Multiple System Atrophy and Progressive Supranuclear Palsy

Disorder	Author	Year	Cohort	Assessment	Outcome
Parkinson's Disease	Maria et al. ¹	2003	PD (15) HC (15)	Full night of PSG	9 PD patients met the criteria for OSA and 1 for CSA – all had reduced REM percentage sleep.
Parkinson's Disease	Sixel-Döring et al. ²	2016	PD (113) HC (102)	PSG	De novo baseline compared to a two year follow up showed patients with PD had increased RBD from 25% to 43%, whereas, HC had an increased from 2% to 4%, although this did not reach statistical significance
Parkinson's Disease	Ferri et al. ³	2012	PD (27) HC (19)	PSG	Patients had a reduced total sleep time and sleep efficiency, increased WASO, reduced N2 percentage, and increased RWA compared to controls
Parkinson's Disease	Christensen et al. ⁴	2014	PD+RBD (15) PD-RBD (15) iRBD (15) HC (15)	At least one night of PSG	Sleep spindles in PD+RBD were significantly lower than control groups in N2, N3
Parkinson's Disease	Christensen et al. ⁵	2015	PD (15) HC (15);	PSG	PD patients showed significantly different sleep spindles from controls, in terms of duration, amplitude, density and frequency
Parkinson's Disease	Bunner et al. ⁶	2002	de novo PD (9) HC (10)	PSG	There were no significant differences in the conventional sleep parameters between de novo patients with PD and controls. After medication was started N1 sleep and the number of awakenings increased significantly
Parkinson's Disease	Cai et al. ⁷	2019	PD (27) HC (20)	PSG	REM sleep latency, percentage REM, sleep efficiency, total sleep time and N3 was reduced in PD patients compared to controls
Parkinson's Disease	Apps et al. ⁸	1985	PD (12) HC (12)	PSG	Patients had more frequent wakes than controls and spent a longer time awake, this was associated with a shorter duration of REM sleep in PD. Six patients had REM sleep for less than one minute. Respiratory rate was greater in the control group during REM sleep
Parkinson's Disease	Cesari et al. ⁹	2018	PD-RBD (25) PD+RBD (29) HC (27), iRBD (29) PLMD (36)	PSG	PD+RBD had higher PLMS/h than controls. Both PD groups had significantly reduced sleep efficiency and increased REM sleep latency, reduced percentage N2 sleep, PD-RBD had increased N3 percentage and PD+RBD had reduced N3 sleep compared to controls
Parkinson's Disease	Palma et al. ¹⁰	2013	PD (33) HC (29);	One night of PSG	No differences in sleep parameters were noted between the two groups, there was also no differences in AHI and PLMS
Parkinson's Disease	Puligheddu et al. ¹¹	2014	PD (44) HC (18)	PSG	PD patients having drug therapy had reduced N2 sleep compared to controls, and PD patients taking therapy had reduced N3 sleep compared to PD patients without treatment
Parkinson's Disease	González-Naranjo et al. ¹²	2019	PD (77) HC (20)	PSG	Patients showed reduced N2, N3 and REM sleep stages compared to controls, and increased sleep wakefulness
Parkinson's Disease	Happe et al. ¹³	2004	PD (12) HC (10)	One night of PSG	There was no difference in sleep spindles in PD and controls
Parkinson's Disease	Wailke et al. ¹⁴	2011	PD (32) HC (16)	PSG	Compared to controls, patients with PD had decreased total sleep time, REM sleep and N3

Parkinson's Disease	Priano et al. ¹⁵	2019	PD (31) HC (34);	Two nights of PSG	PD patients showed significant increase in sleep onset latency, wake after sleep onset, increase N2 sleep, and a decrease in sleep efficiency and N3 sleep. PLM index was increased compared to controls
Parkinson's Disease	Wetter et al. ¹⁶	2001	de novo PD (17) HC (10)	PSG	There was no difference in sleep architecture and PLM between both groups
Parkinson's Disease	Amato et al. ¹⁷	2018	PD (36) HC (7);	One night of PSG and 7 nights of Actigraphy	6 PD patients had RBD/RWA. Sleep architecture correlated with disease duration, including total sleep time, sleep efficiency and slow wave sleep
Parkinson's Disease	Bolitho et al. ¹⁸	2014	PD (29); 13 unmedicated and 16 medicated HC (27);	Overnight PSG, 14 nights of Actigraphy	Sleep onset latency was lower in unmedicated PD compared to medicated and controls
Parkinson's Disease	Zhang et al. ¹⁹	2019	PD+RBD (12) iRBD (15) HC (23);	Overnight v-PSG, SCOPA-Sleep	PD+RBD patients had an increased in N1, decreased N2 and N3 percentage and higher PLMI than healthy controls
Parkinson's Disease	Wienecke et al. ²⁰	2012	Advanced PD (10) Early/drug naïve (5) HC (10);	PSG, ESS, questions relating to RBD and sleep paralysis	Advanced patients were significantly sleepier than controls and early PD patients on MSLT, sleep apnea and PLMS was not significantly different
Parkinson's Disease	Mariotti et al. ²¹	2015	PD+RBD (49) PD-RBD (36) HC (3)	Two consecutive nights of v-PSG, dream content was analysed, PSQI, ESS	No differences were seen in PSG scores, with the exception of atonia index which was elevated in PD+RBD
Parkinson's Disease	Rye et al. ²²	2000	PD (27) HC (13)	One night of PSG, MSLT	PD patients as a group were not sleepier than controls, MSLT on the first day were non-significant. But patients had considerable MSLT variability and sleepiness was common (30% ≤ min)
Parkinson's Disease	Placidi et al. ²³	2008	de novo PD (12) HC (12);	Two nights of PSG, ESS	PD patients had lower sleep efficiency, increased WASO compared to controls, but no other sleep macrostructure differences at baseline. After the introduction of medication, patients had a reduction in N3 sleep
Parkinson's Disease	Imbach et al. ²⁴	2016	PD (70) HC (64);	v-PSG, ESS	On PSG only arousal index was increased, ESS was also increased
Parkinson's Disease	Schroeder et al. ²⁵	2016	PD (81) HC (31)	PSG, PDSS, ESS, NMSQuest,	Only REM density was decreased in comparison to controls. No other PSG parameters were
Parkinson's Disease	Margis et al. ²⁶	2015	PD drug-naïve (8) HC (9)	PSG, PSQI, ESS, BDI	No differences in PSG sleep parameters, but elevated PSQI scores in PD patients compared to controls
Parkinson's Disease	Diederich et al. ²⁷	2005	PD (49) HC (49);	Retrospective one of night PSG analysis	43% of PD patients had SAS with 7 having severe SAS. PD patients had more deep sleep and nocturnal awakenings than controls
Parkinson's Disease	Gagnon et al. ²⁸	2002	PD (33) HC (16);	One night of PSG, structured clinical interview	PSG increased the sensitivity diagnosis of RBD. 33% of patients met the criteria of RBD and none of the controls met criteria. Patients with PD (58%) had more RWA than controls (6%) and nearly 2/3 of patients had EMG activity during at least 20% of total REM sleep

Parkinson's Disease	Sixel-Döring et al. ²⁹	2014	PD (158) – newly diagnosed and medication naïve HC (110);	Two nights of PSG, RBD defined by ICSD-2, RBDSQ	RBE was detected in 51% of PD patients and 15% of HC. RBD in 25% of all patients and 2% of controls
Parkinson's Disease	Gagnon et al. ³⁰	2004	PD+RBD (7) PD-RBD (8) HC (15)	PSG, ESS	No difference between groups were found in PSG variables
Parkinson's Disease	Arnaldi et al. ³¹	2016	PD+RBD (10) PD-RBD (10) iRBD (10) HC (10)	PSG, ESS	Both PD groups had worsened sleep efficiency and decreased total sleep time compared to controls. PD+RBD patients had lower percentage N3 than controls and higher sleepiness scores than controls. No difference in AHI, N1 and REM sleep were observed between groups
Parkinson's Disease	Zhong et al. ³²	2013	PD (12) HC (11)	Two nights of PSG, RBDSQ	No differences in PSG sleep parameters compared to controls. Five patients had self-reported RBD compared to no controls, four of these demonstrated RWA on PSG
Parkinson's Disease	Happe et al. ³³	2005	PD (17) HC (62); a	Two nights of PSG, PSQI, two weeks of a sleep log, SSA	PD patients showed reduced subjective sleep, quality of time awake, decreased sleep duration and reduced sleep efficiency compared to controls. Objective and subjective ratings were impaired in PD patients
Parkinson's Disease	El-Senousy et al. ³⁴	2012	PD (24) HC (10)	Overnight PSG, PDSS	Sleep disturbances correlated to disease duration and severity. PD patients had increased AHI, worse PDSS scores, increased sleep latency, reduced sleep efficiency, reduced REM sleep compared to controls
Parkinson's Disease	Diederich et al. ³⁵	2013	PD (33); early stages of disease HC (37);	One night of PSG, PDSS	Total sleep time, sleep efficiency, awakenings, PLM, arousal and apnea/hypopnea were similar in both groups. PD patients had reduced REM sleep. PDSS scores were lower in PD than control group
Parkinson's Disease	Yong et al. ³⁶	2011	PD (56) HC (68); a	Overnight PSG, MSLT, ESS	PD patients had shorter total sleep time, lower sleep efficiency and increased REM sleep latency compared to controls. ESS scores were higher in PD patients
Parkinson's Disease	Dhawan et al. ³⁷	2006	PD drug naïve (25) PD advanced (34) HC (131)	Overnight PSG (in those with abnormal ESS: 9), PDSS, ESS	Controls reported higher PDSS scores than both groups of patients. PSG revealed OSA in 7, PLMS in 5, RBD in 1
Parkinson's Disease	Buskova et al. ³⁸	2011	PD drug-naïve (20) HC (15);	Three nights of PSG, MSLT, ESS, PSQI, PDSS	PSQI scores were higher in PD compared to control. ESS did not differ between groups. ESS was abnormally high in one patient, short MSLT was found in 3 patients. PSG showed higher RWA percentage in patients (28%) compared to controls (3%)
Parkinson's Disease	Ferreira et al. ³⁹	2014	PD drug-naïve (23) HC (31);	PSG, PDSS, ESS	Drug naïve patients had lower PDSS scores than controls. Reduced N3 and REM sleep, and increased sleep latency and WASO were seen. Medication improved sleep efficiency and reduced sleep latency
Parkinson's Disease	Cochen De Cock et al. ⁴⁰	2010	PD (100 – 50 referred for sleepiness) HC (50);	One night of PSG, ESS	Sleep apnea was frequent in PD patients (27%) vs in-hospital controls (40%). PD patients had reduced total sleep time and increased WASO

Parkinson's Disease	Shpirer et al. ⁴¹	2006	PD (46) HC (30);	One night of PSG, MSLT, ESS, HAM-D	PD patients were sleepier than controls (higher ESS – 50% >10 score), had a shorter total sleep time and REM sleep, sleep efficiency was lower, and N2 was longer compared to controls. 26% vs 0% of PD patients vs controls had RBD
Parkinson's Disease	Loo et al. ⁴²	2008	PD (200) HC (200)	PSG in four PD patients with RLS, PSQI	RLS present in 0.5% of controls and 3% of PD patients (non-significant). PD patients had higher PSQI scores on all components than controls
Parkinson's Disease	Breen et al. ⁴³	2014	PD (30) HC (15)	Two nights of PSG, 14 nights of Actigraphy, ESS, PSQI, PDQ-39, PDSS, RBDQ-HK	Subjective complaints were present in almost half of newly diagnosed patients. PD patients had increased sleep latency, reduced sleep efficiency and reduced REM sleep
Dementia with Lewy Bodies	Hibi et al. ⁴⁴	2012	DLB (9) AD (12) HC (10)	Overnight PSG	RBD was significantly higher in DLB (44%) compared to AD and controls (0%), as well as higher mean PLMS indices (81.8) compared to controls (23)
Multiple System Atrophy	Cao et al. ⁴⁵	2018	MSA (40) HC (40)	PSG, PDQ-39, ESS, HAM-D, HAM-A	MSA had longer SOL, reduced TST and REM time, increased arousal and reduced sleep efficiency compared to controls. SBD was found in 65% of MSA patients compared to 20% in HC. Patients with SBD had more frequent occurrences of ESS, hypopneas, OSA, higher HAM-D scores compared to those without SBD
Multiple System Atrophy	Guo et al. ⁴⁶	2013	MSA (30) HC (20);	PSG	PSG revealed that 29 patients had altered sleep architecture alteration. Longer N1, shorter REM, decreased sleep efficiency and total sleep time. 21 had OSA. Total sleep time was negatively correlated to motor disability
Progressive Supranuclear Palsy	Montplaisir et al. ⁴⁷	1997	PSP (6) HC (6);	Overnight PSG, MSLT on 3 patients	Patients with PSP had shorter total sleep time, lower REM percentage, and lower sleep efficiency compared to controls. Sleep spindles were nearly absent in PSP patients. MSLT showed high inter-subject variability
Progressive Supranuclear Palsy	Walsh et al. ⁴⁸	2017	PSP (20) HC (16)	Overnight PSG, MSLT, SSS	PSP took longer to fall asleep and more WASO, reduced N2, N3 and REM sleep compared to controls. During MSLT PSP took longer to fall asleep and subjectively reported sleepier on SSS
Mixed Cohort	Wetter et al. ⁴⁹	2000	PD (10) MSA (10) HC (10)	Two nights of PSG	Lower total sleep time, sleep efficiency, and sleep period time in PD and MSA compared to controls. PLMS were higher in PD but not MSA. 5 PD and 7 MSA patients had abnormal REM features compared to no HC
Mixed Cohort	Li et al. ⁵⁰	2017	iRBD (22) MSA (21) PD (22) HC (21)	One night of PSG	MSA and PD patients had shorter total sleep time, worse sleep efficiency, longer REM latencies, more PLMS and spent less time in N2. MSA patients also had lower percentage of sleep N2, and greater AHI. Loss of RWA was found in all MSA patients. The duration of RBD was positively correlated with PLM in the MSA patient group
Mixed Cohort	Rekik et al. ⁵¹	2018	PD (45) MSA (45) HC (45);	Overnight PSG	Higher PLMI and RBD behaviour was more frequent in MSA patients compared to PD and HC. 62% of MSA patients had SBD

Mixed Cohort	Arnulf et al. ⁵²	2005	PSP (15) PD (15) HC (15)	Overnight PSG, MSLT, sleep interview	RWA and RBD were frequent in PSP and PD. PSP had longer WASO and twice as much sleep fragmentation and percentage of N1 sleep than PD and HC. Similar AHI, PLMI and mean daytime sleep latencies in PSP and HC
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