Supplementary Table 1. Baseline characteristics of included studies

Study (Author, year)	Sample Size (n)	Baseline PDQ Score (mean ± SD)	Months of Follow-Up	Follow-up PDQ Score (mean ± SD)	Mean Age at Surgery (years)	Disease Duration at Surgery (years)	Gender (% Male)
Acera 2019	40	38.1 ± 13	12 60	27.4 ± 14.6 36.7 ± 15.4	62.2	14.1	64
Bjerkness 2020	53	27 ± 12	12	20 ± 15	62	11	75
Bjerkness 2022	46	26 ± 11.9	60	27.3 ± 15.2	63	12	72
Boussac 2021	303	31.3 ± 11.4	12	26.8 ± 13.5	60	10.1	67.3
Chan 2016	18	47.1 ± 10.9	12 24	32.1 ± 11.4 28.3 ± 11.6	55	13	68
Chen asleep 2023 Chen awake 2023	25 21	29.2 ± 12.1 29.4 ± 11.7	12 12	21.8 ± 14.3 21.1 ± 12.2	57.3 53.8	10.3 9.0	68 71
Chircop 2018	24	37.5 ± 14.7	12	17.9 ± 9.5	60.2	8.8	62
Dafsari 2018	65	33.3 ± 17.4*	24	30.6 ± 18.5*	62.3	10.9	75
Drapier 2005	27	44.1 ± 10.9	12	34.8 ± 12.3	60.8	14.6	70
Erdem 2023	22	42.3 ± 22	12	27.1 ± 22	57.3	11	63.6
Follett 2010	147	46.9 ± 12.6	24	42.7 ± 15.6	61.9	11.1	79
Georgiev 2021	28	53.4 ± 4.5	12 24 36	39.0 ± 3.6 40.2 ± 2.9 46.14 ± 4.1	64.4	8.5	61
Hong 2024	27	28.9 ± 9.2	24	17.6 ± 3.7	48.4	8.9	67
Houeto 2006	20	43.1 ± 13.1	24	30.9 ± 13	54.9	10.9	75
Jiang 2015	10	32.4 ± 14.1	12 36 60	19.8 ± 8.5 13.5 ± 10.5 26.1 ± 9.7	59.4	9.3	60
Jiang 2023	53	36.73 ± 16.86	12 60	27.29 ± 16.51 38.8 ± 21.19	58.89	9.45	45
Jost 2021	73	32.8 ± 16.8*	36	31.1 ± 20.2*	62	10.3	59
Jost 2024	61 57	31.8 ± 14.5* 31.8 ± 14.5*	12 60	23.4 ± 14.6* 37.1 ± 17.0*	62.6	10.4	60
Krause 2022	46	39 ± 15	12	28.8 ±18	51	12.9	59
Lewis 2014	28	36.3 ± 13.76	12	30.84 ±14.07	61.18	12.43	61
Lezcano 2016	64 54	41.1 ± 14.1 41.1 ± 14.1	12 60	26.1 ± 14.1 37.5 ± 16.5	61.3 61.1	13.2 13	61 57

Li 2020	16	52.49 ± 17.93	12	24.72 ± 9.83	60.25	10.38	50
Lin 2021	40	63.20 ± 26.43	12	45.20 ± 29.74	61.3	9.98	57
Liu 2019	45	39.05 ± 14.23	12	31.45 ± 17.75	61.8	11.9	47
Liu 2021	47 23	34.00 ± 2.64	12 36	23.45 ± 2.45 31.68 ± 3.44	65.3	11.9	n.r.
Lu 2020	87	58 ± 1.92	12	34.74 ± 5	62	n.r.	70
Lu_LA 2022 Lu_GA 2022	81 76	64 ± 9.6 64.7 ± 7.8	12 24 12 24	40.6 ± 5.7 48.0 ± 5.1 42.4 ± 9.1 48.7 ± 7.8	63.7 62.8	9.5 9.3	60 60
Luo 2023	12	33.0 ± 10.3	12	20.9 ± 14.1	61.3	11.3	50
Lyons 2005	59	41.7 ± 11.8	12	28.2 ± 13.6	59.5	11.9	75
Mameli 2022	20	40.15 ± 14.80*	12	30.73 ± 17.88*	57.6	10.95	40
Moran 2020	137	37.59 ± 21.15	12	29.98 ± 23.31	60	11	n.r.
Nazzaro 2011	24	32.4 ± 14.2	12	17.2 ± 9.6	64.2	10.6	67
Pintér direc. 2022 Pintér omni. 2022	52 57	28.4 ± 15 24.5 ± 12.2	12 12	17.3 ± 10.8 18.9 ± 13.9	60.3 59.7	9.7 10.3	63 65
Schuepbach 2013	110	30.1 ± 14.68	24	22 ± 12.59	52.9	7.3	76
Sobstyl 2014	16 14	35.4 ± 6.6 35.8 ± 6.9	12 24	24.7 ± 4.2 26.0 ± 3.9	63.5	n.r.	69
Soulas 2011	35	49.89 ± 11.06	12	39.12 ± 16.09	62.02	14.49	n.r.
Tykocki 2012	74	64.95 ± 30.09	12 24	39.51 ± 17.54 43.15 ± 20.54	55.6	12.3	51
Vats young 2019 Vats old 2019	20 20	24.55 ± 2.14 22.82 ± 3.33	12 24 12 24	19.59 ± 2.32 17.54 ± 2.51 19.90 ± 1.95 18.16 ± 1.84	51.95 68.75	n.r.	75
Vinke 2022	29	46.9 ± 21.5	12	39.2 ± 20.8	62	9	83
Weaver 2012	66 62	48.1 ± 13.2	24 36	39.5 ± 15.3 44 ± 15.1	60.7	11.3	80
Williams 2010	183	37.5 ± 14.6	12	32.5 ± 15.8	59	11.5	68
Yamamoto 2016	31 12 7	33.63 ± 2.70 33.63 ± 2.70 33.63 ± 2.70	12 36 60	28.29 ± 2.72 28.08 ± 5.61 42.05 ± 7.77	66.7	11.6	n.r.

* PDQ8 was used to measure quality of life.
n.r., not reported; PDQ, Parkinson's Disease Questionnaire.

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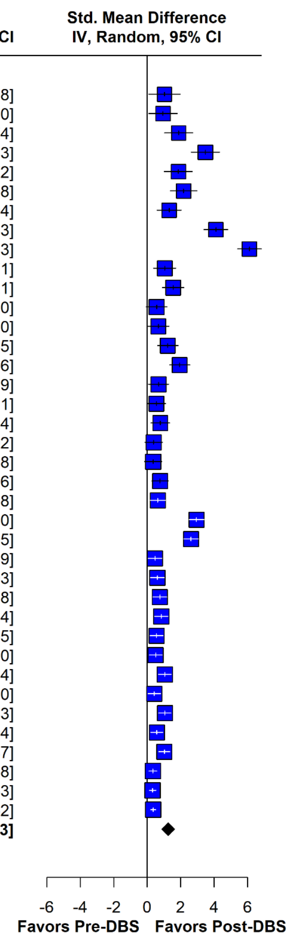
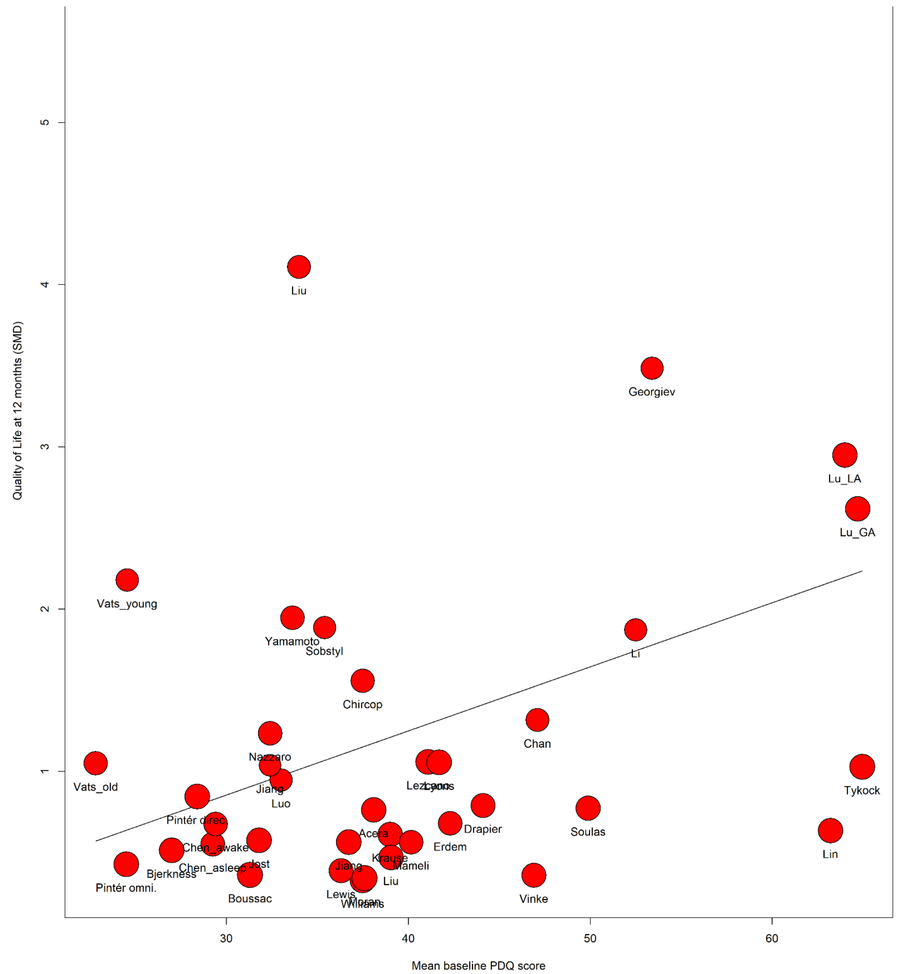
Supplementary Figure 1. Forest plot of the follow-up period of 12 months showing the SMD and the weights for the random effects analysis of each study. DBS, deep brain stimulation; SMD, standardized mean difference.

Study	Pre-DBS Mean	Pre-DBS SD	Pre-DBS Total	Post-DBS Mean	Post-DBS SD	Post-DBS Total	Weight	SMD	95% CI
12 months follow-up									
Jiang, 2015	32.40	14.10	10	19.80	8.50	10	2.4%	1.04	[0.09; 1.98]
Luo, 2023	33.00	10.30	12	20.90	14.10	12	2.4%	0.95	[0.09; 1.80]
Sobstyl, 2014	35.40	6.60	16	24.70	4.20	16	2.4%	1.89	[1.04; 2.74]
Georgiev, 2021	53.40	4.50	28	39.00	3.60	28	2.5%	3.48	[2.64; 4.33]
Li, 2020	52.49	17.93	16	24.72	9.83	16	2.5%	1.87	[1.02; 2.72]
Vats_young, 2019	24.55	2.14	20	19.59	2.32	20	2.5%	2.18	[1.38; 2.98]
Chan, 2016	47.10	10.90	18	32.10	11.40	18	2.5%	1.32	[0.59; 2.04]
Liu, 2021	34.00	2.64	47	23.45	2.45	47	2.5%	4.11	[3.39; 4.83]
Lu, 2020	58.00	1.92	87	34.74	5.00	87	2.5%	6.11	[5.40; 6.83]
Vats_old, 2019	22.82	3.33	20	19.90	1.95	20	2.6%	1.05	[0.38; 1.71]
Chircop, 2018	37.50	14.70	24	17.90	9.50	24	2.6%	1.56	[0.91; 2.21]
Mameli, 2022	40.15	14.80	20	30.73	17.88	20	2.6%	0.56	[-0.07; 1.20]
Chen_awake, 2023	29.40	11.70	21	21.17	12.21	21	2.6%	0.68	[0.05; 1.30]
Nazzaro, 2011	32.40	14.20	24	17.20	9.60	24	2.6%	1.23	[0.61; 1.85]
Yamamoto, 2016	33.63	2.70	31	28.29	2.72	31	2.6%	1.95	[1.34; 2.56]
Erdem, 2023	42.30	22.00	22	27.10	22.00	22	2.6%	0.68	[0.07; 1.29]
Chen_asleep, 2023	29.26	12.07	25	21.86	14.35	25	2.6%	0.55	[-0.02; 1.11]
Drapier, 2005	44.10	10.90	27	34.80	12.30	27	2.6%	0.79	[0.23; 1.34]
Lewis, 2014	36.30	13.76	28	30.84	14.07	28	2.7%	0.39	[-0.14; 0.92]
Vinke, 2022	46.90	21.50	29	39.20	20.80	29	2.7%	0.36	[-0.16; 0.88]
Soulas, 2011	49.89	11.06	35	39.12	16.09	35	2.7%	0.77	[0.28; 1.26]
Lin, 2021	63.20	26.43	40	45.20	29.74	40	2.7%	0.63	[0.18; 1.08]
Lu_LA, 2022	64.00	9.60	81	40.60	5.70	81	2.7%	2.95	[2.50; 3.40]
Lu_GA, 2022	64.70	7.80	76	42.40	9.10	76	2.7%	2.62	[2.18; 3.05]
Liu, 2019	39.05	14.23	45	31.45	17.75	45	2.7%	0.47	[0.05; 0.89]
Krause, 2022	39.00	15.00	46	28.80	18.00	46	2.7%	0.61	[0.19; 1.03]
Acera, 2019	38.10	13.03	48	27.46	14.61	48	2.7%	0.76	[0.35; 1.18]
Pintér direc., 2022	28.40	15.00	52	17.30	10.80	52	2.7%	0.84	[0.44; 1.24]
Jiang, 2023	36.73	16.86	53	27.29	16.51	53	2.7%	0.56	[0.17; 0.95]
Bjerkness, 2020	27.00	12.00	53	20.00	15.00	53	2.7%	0.51	[0.12; 0.90]
Lyons, 2005	41.70	11.80	59	28.20	13.60	59	2.7%	1.05	[0.67; 1.44]
Pintér omni., 2022	24.50	12.20	57	18.90	13.90	57	2.7%	0.43	[0.05; 0.80]
Lezcano, 2016	41.10	14.10	64	26.10	14.10	64	2.7%	1.06	[0.69; 1.43]
Jost, 2024	31.80	14.50	61	23.40	14.60	61	2.7%	0.57	[0.21; 0.94]
Tykock, 2012	64.95	30.09	74	39.51	17.54	74	2.7%	1.03	[0.68; 1.37]
Moran, 2020	37.59	21.15	137	29.98	23.31	137	2.8%	0.34	[0.10; 0.58]
Williams, 2010	37.50	14.60	183	32.50	15.80	183	2.8%	0.33	[0.12; 0.53]
Boussac, 2021	31.30	11.40	303	26.80	13.50	303	2.8%	0.36	[0.20; 0.52]
Total (95% CI)			**1992**			**1992**	**100.0%**	**1.26**	**[0.88; 1.63]**

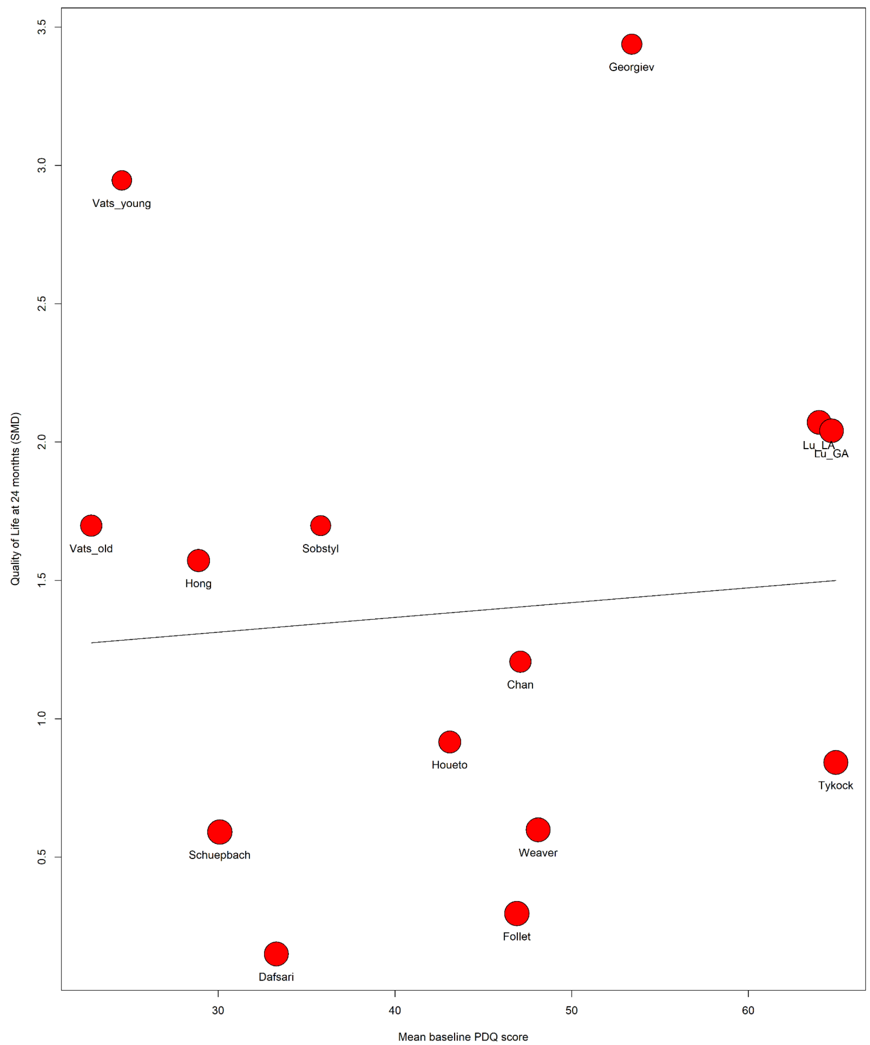
Heterogeneity: $Tau^2 = 1.3191$; $Chi^2 = 621.58$, df = 37 ($P < 0.01$); $I^2 = 94\%$
Test for overall effect: $Z = 6.55$ ($P < 0.01$)



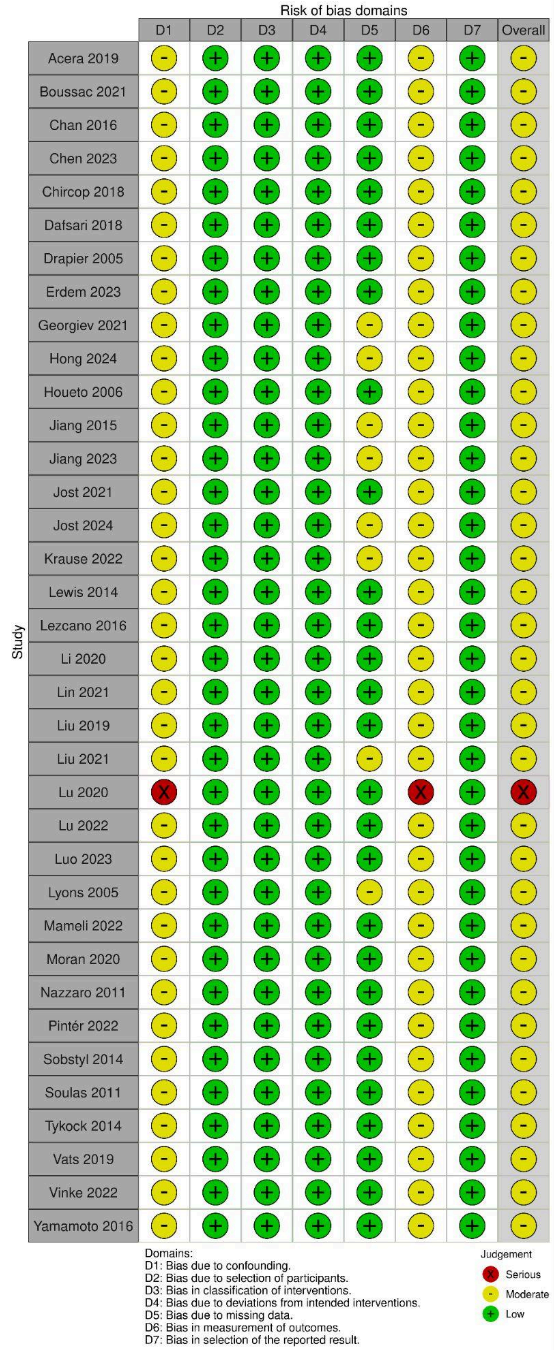
Supplementary Figure 2. Meta-regression modeling for the impact of mean baseline PDQ score and QoL at 12 months follow-up (p = 0.011).



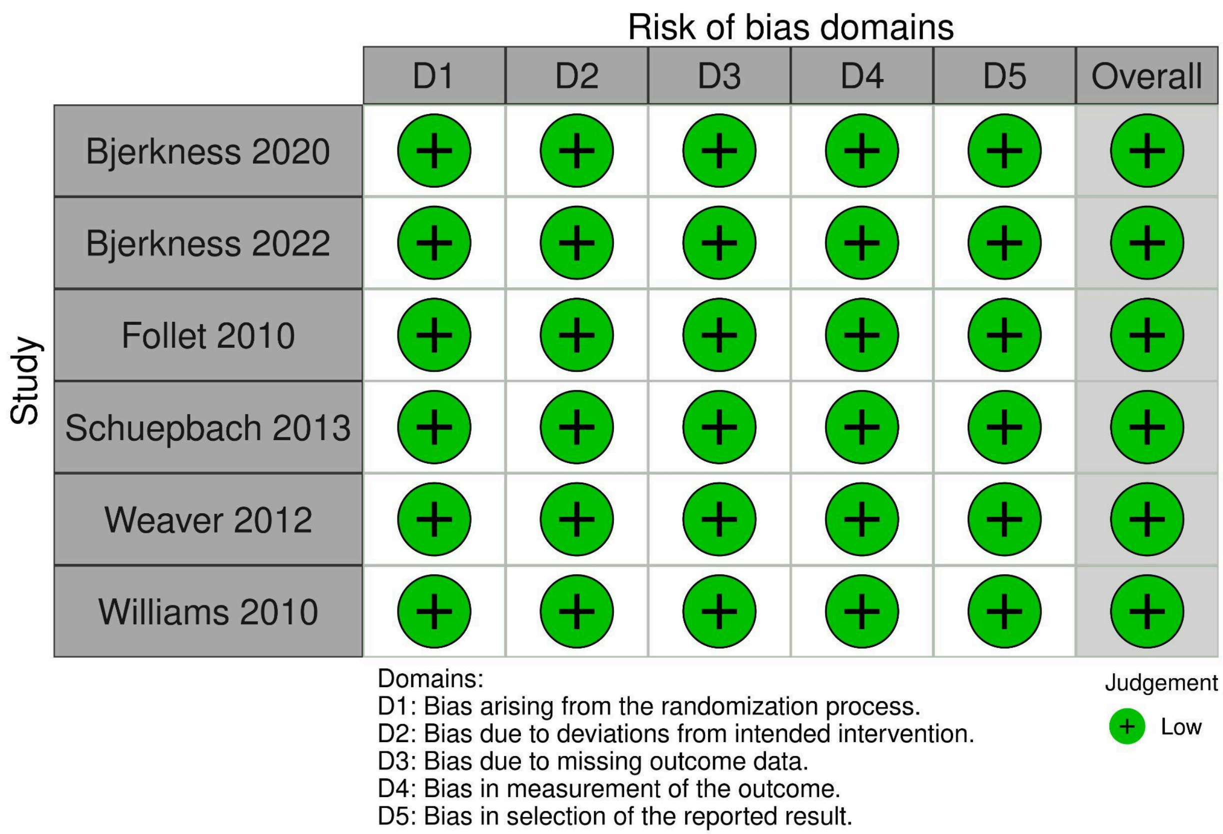
Supplementary Figure 3. Meta-regression modeling for the impact of mean baseline PDQ score and QoL at 24 months follow-up (p = 0.772).



Supplementary Figure 4. Critical appraisal of individual studies according to Cochrane's tools for assessing risk of bias in non-randomized studies (ROBINS-I).



Supplementary Figure 5. Critical appraisal of individual studies according to the Cochrane's Collaboration's tool for assessing risk of bias in randomized trials (RoB 2).



Supplementary Figure 6. Funnel plot of the follow-up period of 12 months showing signs of asymmetry, indicating small-study effect, confirmed by Egger's test (p=0.0003).