

Table S2

Parkinson's disease: Study Design Details and Participant Characteristics for Lee Silverman Voice Treatment LOUD (LSVT LOUD®)/LSVT® Extended (LSVT-X®)/LSVT® Companion™ as Treatment Modalities

Source	N	Study design	Sex (% female)	Age range (years)	Dysarthria type	Inclusion/exclusion criteria	Inferential statistics	Power analysis	Control group	Baseline data collected	Control intervention	Number of treatment sessions	Mode of treatment delivery	Home exercise plan	Patient-reported outcomes	Treatment effect size
Alharbi et al. (2019)	8	Prospective; quasi-experimental	33.00%	52-81	Hypokinetic	Inclusion: • No previous speech or voice therapy Exclusion: • > mild depression • > mild cognitive impairment	Yes	No	No	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	No
Baumann et al. (2018)	11	Prospective; quasi-experimental	36.30%	55-74	Hypokinetic	Inclusion: 1, 2 • No history of speech problems, neurological, vascular, or psychiatric disease (controls)	Yes	No	Yes	Yes – single baseline	Yes – normal loudness	16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	No
Baumgartner et al. (2001)	20	Prospective, quasi-experimental	25.00%	Mean = 66	NR	Inclusion: 1 Sought treatment for voice/speech problems associated with PD	Yes	No	No	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No
Cannito et al. (2012)	8	Prospective, quasi-experimental	37.50%	52-81	Hypokinetic	Inclusion: 1, 2 • No current speech treatment No pre-existing vocal fold pathology	Yes	No	No	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No
Constantinescu et al. (2011)	34	Prospective, randomized controlled trial	21.00%	54-85	Hypokinetic	Inclusion: 2 • Vocal fold structure and movement consistent with PD • Stimulable for	Yes	Yes	Yes	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No

						increased loudness											
						<ul style="list-style-type: none"> Stable medications Exclusion: 2, 3, 7 <ul style="list-style-type: none"> Unable to give informed consent due to cognition Severe, uncorrected visual/auditory disturbance History of alcohol abuse Participation in LSVT LOUD® in the prior 12 months											
de Azevedo et al. (2015)	10	Prospective, quasi-experimental	50.00%	59-88	NR	Inclusion: 1 <ul style="list-style-type: none"> Levodopa-replacement medication Hoehn and Yahr stages 2-3	Yes	No	No	Yes – single baseline	Yes	16 (2 days p/week for 8 weeks)	In person, individual	No	No	No	No
Dias et al. (2016)	20	Prospective, quasi-experimental	15.00%	42-78	NR	Inclusion: 1 <ul style="list-style-type: none"> Stages 2-4 per Hoehn & Yahr scale Voice complaints Access to a computer with headset microphone, camera and internet Exclusion: 5 <ul style="list-style-type: none"> Cognitive decline Aphasia Receiving speech therapy	Yes	No	No	Yes – single baseline	No	16 (2 days p/week for 8 weeks)	Telepractice, individual	No	Yes	No	No
El Sharkawi et	8	Prospective, quasi-experimental	25.00%	57-77	NR	Inclusion: 1 Exclusion: 2	Yes	No	No	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No	No

al. (2002)						History of gastro-intestinal disease, gastro-esophageal surgery, head and neck cancer										
Griffin et al. (2018)	29	Prospective, quasi-experimental	Not reported	Mean = 68	Hypokinetic	NR	Yes	No	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	Telepractice, individual	Yes	No	No
Halpern et al. (2012)	16	Prospective, quasi-experimental	50.00%	54-81	NR	Inclusion: 1 Exclusion: 1 • Depression History of neurosurgery, head and neck cancer, gastro-intestinal disease or surgery, smoking	Yes	No	Yes	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No
Howell et al. (2009)	3	Prospective/retrospective, quasi-experimental	0.00%	63-72	Hypokinetic	Inclusion: • Familiar with Microsoft Windows applications Have a computer operating Windows XP, broadband internet, webcam, headset and microphone, Windows Media Player, Skype and email accounts	Yes	No	Yes	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person + telepractice, individual	Yes	No	No
Huber et al. (2003)	6	Prospective, quasi-experimental	17.00%	63-78	NR	Inclusion: 1	Yes	No	Yes	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	No
Körner Gustafsson et al. (2019)	2	Prospective, single-subject	0%	51	NR	NR	Yes	No	Yes	Yes – multiple baselines	No	4 weeks – not further specified	In person, individual	Yes	Yes	No
Levy et al. (2020)	57	Prospective, randomized controlled trial	28.00%	Mean = 66.5	Hypokinetic	Inclusion: 1 • Stable medications	Yes	Yes	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	Yes

Author (Year)	N	Study Design	Prevalence	Age	Motor	Inclusion/Exclusion	Speech	Language	Memory	Executive	Baseline	Other	Intervention	Setting	Blind	Follow-up	Dropouts
Manor et al. (2005)	8	Prospective, quasi-experimental study	13.00%	55-84	NR	Inclusion: 1 Exclusion: 1	Yes	No	No	Yes – single baseline	No		8 (1 x 75 minute session p/week for 8 weeks)	In person, group	Yes	Yes	No
Moya-Gale et al. (2018)	15	Prospective, quasi-experimental	33.00%	58-82	Hypokinetic	Inclusion: • No history of speech/language problems prior to PD • Native Castilian Spanish speakers • MMSE score ≥25/30 Exclusion: 5	Yes	No	No	Yes – multiple baselines	N/A		16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No
Nakayama et al. (2020)	21	Prospective; quasi-experimental	61.50%	64 - 69	NR	Inclusion: • Possible PD per the MDS criteria Exclusion: 1, 4, 7 • Cerebrovascular disease that could	Yes	No	No	Yes – single baseline	No		16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	No

						result in dysarthria											
Narayana et al. (2010)	10	Prospective, quasi-experimental	25.00%	Mean = 60	NR	Inclusion: 1, 2 • Stimulable for increased loudness • Levodopa therapy Exclusion: 7	Yes	No	No	Yes – single baseline	No	Not reported	Not reported	No	No	No	No
Ramig & Dromey (1996)	17	Secondary analysis, quasi-experimental	12.00%	49-79	NR	Post-hoc exclusion: • Extraneous movements (tremor, dyskinesia) and/or inability to perform syllable repetition • Minimum flow offset <0.75 L/s • Poor quality flow/pressure data	Yes	No	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	No	No
Ramig et al. (1995)	45	Prospective, quasi-experimental	27.00%	32-83	NR	Inclusion: • Residents of Denver, Colorado Exclusion: 6 • PD etiology other than idiopathic Post-hoc exclusion: • Lack of compliance with pre- and post-treatment assessments and treatment protocols	Yes	No	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No	No
Ramig et al. (1996)	35	Prospective, quasi-experimental	Not reported	Not reported	NR	Exclusion: 6	Yes	No	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No	No
Ramig et al. (2001a)	29	Prospective, quasi-experimental	50.00%	Mean = 67.9	NR	NR	Yes	No	Yes	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No	No

Ramig et al. (2001b)	29	Prospective, quasi-experimental	19.00%	Mean = 61.3	NR	NR	Yes	No	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No
Ramig et al. (2018)	64	Prospective, randomized controlled trial	31.50%	48-85	NR	Inclusion: 1, 3 <ul style="list-style-type: none"> • Not smoked in last 4 years • Clinically stable on medications • Hoehn & Yahr stages 1-4 • MMSE ≥ 25 • Beck Depression Inventory ≤ 24 • Any severity of speech and voice disorder Exclusion: 2, 3, 5, 7 <ul style="list-style-type: none"> • Intensive speech treatment within 2 years • Previous LSVT LOUD® Dysphagia requiring immediate attention 	Yes	Yes	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No
Sackley et al. (2018)	89	Prospective, quasi-experimental	22.00%	Mean age = 67	NR	Inclusion: 1 <ul style="list-style-type: none"> • Patient- or carer-reported problems with speech Exclusion: 1, 7 <ul style="list-style-type: none"> • Speech-language therapy for speech-related problems in the past 2 years 	No	Yes	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No

						Investigator's view that speech- language therapy was not indicated											
Sale et al. (2015)	39 **	Prospective, quasi- experimental	31.20%	Not reported	NR	Inclusion: • Idiopathic PD or PSP • Age 30-80 Exclusion: • Unable to understand study instructions • Chronic and ongoing alcohol or drug abuse • Active depression, anxiety or psychosis Other atypical parkinsonian syndrome	Yes	No	Yes	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	No	
Saffari an et al. (2019)	23	Prospective; quasi- experimental	52.00%	Not reported	NR	Inclusion: 3 • H&Y stage 1-2 • Diagnosed with PD 1-8 years prior • Levodopa- replacement therapy; no medication changes during study • Monolingual native Persian speakers • Right- handed • Voice or speech concerns Exclusion: 5, 7 • History of stroke, head trauma, brain surgery	Yes	Yes	Yes	Yes - single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	Yes	

						<ul style="list-style-type: none">• Depression severity >10 per the GDSMMSE < 26											
Sapir et al. (2007)	29	Prospective, quasi-experimental	51.70%	Not reported	NR	Not reported	Yes	No	Yes	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	No	Yes	
Sapir et al. (2002)	35	Prospective, quasi-experimental	NR	NR	NR	Exclusion: 6	Yes	No	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No	
Sauvageau et al. (2015)	9	Prospective, quasi-experimental	11.10%	58-75	Hypokinetic	Not reported	Yes	No	No	Yes – multiple baselines	No	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No	
Searl et al. (2011)	15	Prospective, quasi-experimental	40.00%	44-83	NR	Inclusion: 1 <ul style="list-style-type: none">• >18 years old• Physically/cognitively able to participate in weekly 90 minute sessions• Understand American English• Optimal pharmacological management of PD Exclusion: 3, 4, 6 <ul style="list-style-type: none">• Previous history that may have altered speech production Previous LSVT or other speech therapy targeting loudness	Yes	No	No	Yes – single baseline	No	8 (1 x 90 minute session p/week for 8 weeks)	In person, group	Yes	Yes	Yes	
Spielman et al. (2007)	15	Prospective-retrospective, quasi-experimental	25.00%	45-82	NR	Exclusion: 7 High-effort voice therapy contraindicated	Yes	No	Yes	Yes – multiple baselines	Yes	16 (2 days p/week for 8 weeks)	In person, individual	Yes	Yes	No	
Spielman et	12	Prospective, quasi-experimental	50.00%	50-84	NR	Exclusion: 1, 4, 7	Yes	No	Yes	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	No	

al. (2011)						<ul style="list-style-type: none">• Participation in external speech/voice therapy during the 6 month follow-up period (treatment group) or entire study (control group)• Severe untreated depression Neurological illness or complication from STN-DBS surgery											
Theodoros et al. (2006)	10	Prospective, quasi-experimental	20.00%	Mean age = 73	Hypokinetic	Exclusion: 1, 2, 7 <ul style="list-style-type: none">• History of other speech disturbance• History of alcohol abuse	Yes	No	No	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	Telepractice, individual	Yes	No	No	
Theodoros et al. (2016)	52	Prospective, randomized controlled trial	30.80%	50-87	Hypokinetic	Inclusion: 1, 2 <ul style="list-style-type: none">• Age 18-89• PD severity between 1-5 on the modified Hoehn & Yahr scale• English speaking• Adequate cognition to participate in assessment and treatment• Stimulable for loud speech• Vocal structure and function consistent	Yes	Yes	Yes	Yes – multiple baselines	Yes	16 (4 days p/week for 4 weeks)	In person (control) and telepractice (experimental), individual	Yes	Yes	No	

						with PD per ENT evaluation											
						<ul style="list-style-type: none">• Stable medications Exclusion: 1, 2, 3, 7											
						<ul style="list-style-type: none">• History of alcohol abuse• Inadequately aided vision or hearing for videoconferencing• Previously completed LSVT LOUD®											
Traverse (2016)	9	Prospective, quasi-experimental	55.60%	67-77	Hypokinetic	Inclusion: <ul style="list-style-type: none">• Membership at a Parkinson's health group• Possession of a disability card• No more than mild cognitive changes• Able to attend in-person sessions	Yes	No	No	Yes – single baseline	No	12 (3 days p/week for 4 weeks)	In person, group	Yes	Yes	No	
Tripoliti et al. (2011)	20	Prospective, quasi-experimental	NR	NR	Hypokinetic	Inclusion: <ul style="list-style-type: none">• PD either treated with deep brain stimulation of the subthalamic nucleus, or medically treated only	Yes	No	Yes	Yes – single baseline	Yes	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No	
Whitehill et al. (2011)	12	Prospective, quasi-experimental	58.30%	56-78	Hypokinetic	Inclusion: 3 <ul style="list-style-type: none">• Normal oral-peripheral structures• No aphasia or apraxia of	Yes	No	No	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	In person, individual	No	No	No	

						speech per the Cantonese Aphasia Battery											
Wohler t (2004)	11 *	Prospective, quasi-experimental	18.20%	53-85	Hypokinetic	Inclusion: 2 • MMSE ≥ 26/30	No	No	Yes	Yes – single baseline	Yes	16. Participants assigned to one of three treatment schedules: 1) 4 days p/week for 4 weeks, 2) 2 days p/week for 8 weeks, 3) 2 days p/week for 4 weeks + additional homework sessions	In person, individual	Yes	No	No	
Wight & Miller (2015)	33	Retrospective, quasi-experimental	21.20%	48-82	NR	Inclusion: 1, 2 • Self-reported effects of speech disorder on communicative effectiveness • Stimulable for louder speech Exclusion: 2 • Voice intensity not deemed to be a problem by clinician/patient • History of speech/language impairment prior to PD	Yes	No	No	Yes – single baseline	No	16 (4 days p/week for 4 weeks)	In person, individual	Yes	Yes	Yes	

Note. NR, not reported. PD, Parkinson's disease; MDS, Movement Disorders Society; H&Y, Hoehn & Yahr Scale; DBS, deep brain stimulation; GDS, Geriatric depression scale; MMSE, Mini-mental state examination; ORL, otorhinolaryngologist; STN-DBS, sub-

thalamus deep brain stimulation. ENT; ear-nose-throat surgeon/otorhinolaryngologist. Inclusion criteria: ¹Diagnosis of PD; ²Presence of hypokinetic dysarthria; ³Age-typical hearing or corrected hearing. Exclusion Criteria: ¹Dementia; ²Neurological diagnoses other than PD; ³Disorders of speech and/or language unrelated to PD; ⁴Hearing impairment; ⁵Non-pharmacological treatments for PD (e.g., deep-brain stimulation); ⁶Laryngeal pathology that contraindicated speech and voice therapy; ⁷History of laryngeal disorders, surgery, or damage and/or respiratory/laryngeal dysfunction unrelated to PD. *Initially enrolled 20 participants; analysis completed on 11 participants. ** $n = 23$ with Parkinson's disease, $n = 16$ with progressive supranuclear palsy.