- If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.
- This handout is for reference only. Non-essential images have been removed for your convenience. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.

Technical issues with the Recording?

- Clear browser cache using these instructions
- Switch to another browser
- Use a hardwired Internet connection
- Restart your computer/device

Still having issues?

- Call 800-242-5183 (M-F, 8 AM-8 PM ET)
- Email customerservice@SpeechPathology.com

CONTINUED®

ONLINE CONTINUING EDUCATION FOR THE LIFE OF YOUR CAREER

Behavioral Voice Interventions for Persons with Parkinson's Disease

Kelly Richardson, PhD, CCC-SLP

Moderated by:
Amy Natho, MS, CCC-SLP, CEU Administrator, SpeechPathology.com

CONTINUED®

Need assistance or technical support?

- Call 800-242-5183
- Email customerservice@SpeechPathology.com
- Use the Q&A pod

CONTINUED®

CONTINUED

How to earn CEUs

- Must be logged in for full time requirement
- Log in to your account and go to Pending Courses
- Must pass 10-question multiple-choice exam with a score of **80%** or higher
  - Within **7 days** for live webinar; within **30 days** of registration for recorded/text/podcast formats
- Two opportunities to pass the exam

CONTINUED

Behavioral Voice Interventions for Persons with Parkinson's Disease

Kelly Richardson, Ph.D., CCC-SLP
Assistant Professor
Department of Communication Disorders
University of Massachusetts Amherst

CONTINUED

CONTINUED

Learning Outcomes

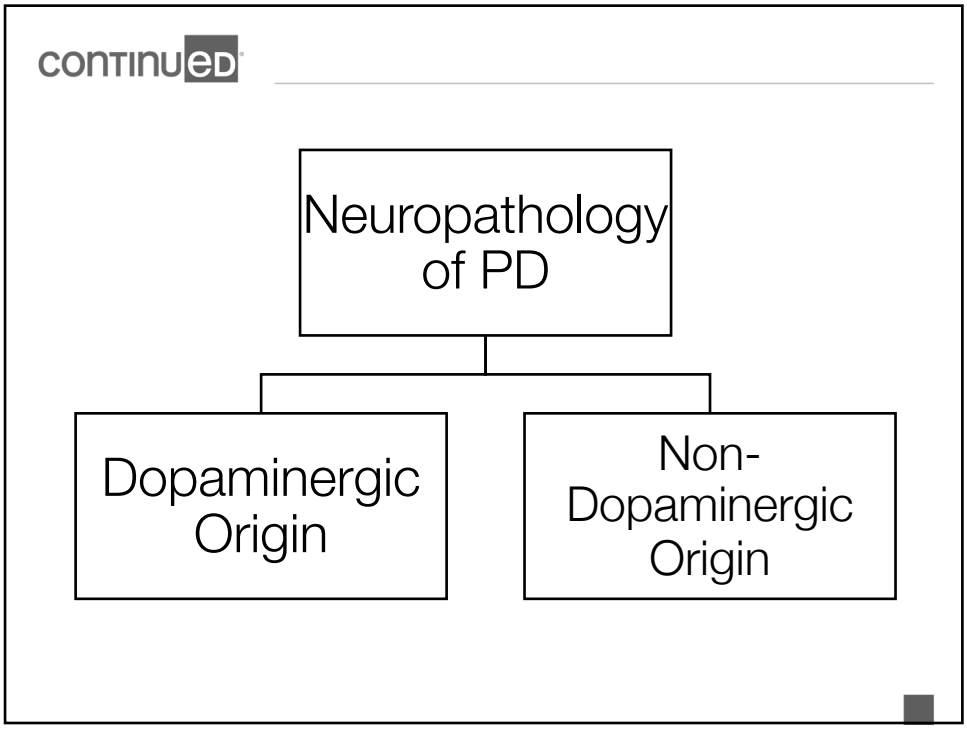
After this course, participants will be able to:

- List and describe the motor and non-motor features of Parkinson's disease.
- Describe the features of hypokinetic dysarthria.
- Describe the current evidence-based voice treatments for hypokinetic dysarthria.

CONTINUED

Incidence & Prevalence of PD

- Est. 1 million in US
- Est. 7 million worldwide
- Diagnosis by exclusion (rule out other disorders)
- Medication trial supports diagnosis



Neuropathology of Parkinson's Disease

- Dopaminergic origin
  - Degeneration of dopamine-producing neurons is particularly evident in a part of the substantia nigra called the pars compacta
  - The decreased level of dopaminergic innervation to the striatum results in the characteristic motor symptoms of PD

Neuropathology of Parkinson's Disease

- Dopaminergic origin
  - Motor symptoms
    - Tremor
    - Rigidity
    - Akinesia/Bradykinesia
    - Postural Instability
  - Reduced amplitude of movement
    - Walking, writing, voice, resonance, breathing, articulatory gestures

Neuropathology of Parkinson's Disease

- Non-dopaminergic origin
  - Degeneration of non-dopaminergic neurotransmitters include noradrenergic, serotonergic, glutamatergic, and cholinergic systems within cortical, brainstem, and basal ganglia regions (Fox, 2013)

CONTINUED

Neuropathology of Parkinson's Disease

- Non-dopaminergic origin
  - Non-motor symptoms (*list is not exhaustive*)
    - Apathy
    - Anxiety
    - Fatigue
    - Cognitive deficits (e.g. attention, memory)
    - Sleep disturbance
    - Gastrointestinal disturbance
    - Olfactory disfunction

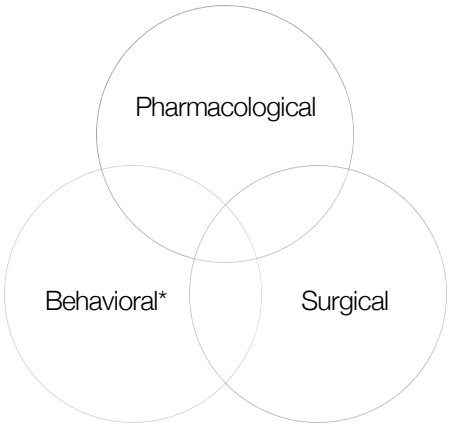
CONTINUED

Hypokinetic Dysarthria*

- Patients with PD exhibit a high prevalence of speech and voice deficits (Darley, Aronson, & Brown, 1969)
  - Reduced loudness (2 - 4 dB decrease in SPL; Adams et al., 2006; Fox & Ramig, 1997)
  - Monoloudness/monopitch
  - Hoarse, harsh, breathy
  - Slurred/distorted speech
  - Short rushes of speech (festination)
  - Variable speech rate
  - Inappropriate pauses
  - Neurogenic dysfluencies
  - Vocal tremor
  - Shorter utterances

* Symptom presentation is heterogeneous

Therapeutic Options

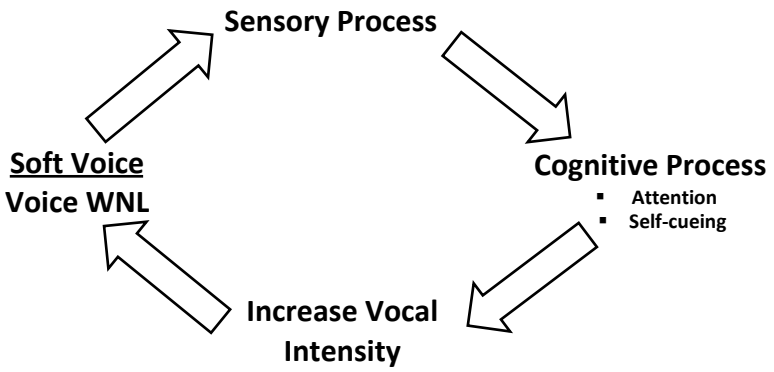


Hypokinetic Dysarthria

- Clinically, two speech and voice symptoms are often targeted in therapy
  - Soft voice (Boutsen, Park, Dvorak & Cid, 2018; Ramig, Sapir, Fox & Countryman, 2001)
  - Speech rate (Blanchet & Hoffman, 2014; Blanchet & Snyder, 2010)
- These symptoms are likely to impact perceptions of speech intelligibility and speech naturalness

CONTINUED

Foundation of Voice Treatment



CONTINUED

Treatment Considerations

- Cognitive load/effort
- Sensory perception
- Fatigue
- Motivation
- Access to services
- Technological proficiency
- Neural Plasticity
  - Repetition
  - Saliency
  - Use it or lose it
  - Specificity

CONTINUED

Behavioral Voice Interventions

CONTINUED

LSVT LOUD®

- Lee Silverman Voice Treatment (LSVT) LOUD®
- In-person or telepractice (LSVT e-LOUD)
- Requires training/certification
- Began as a treatment for PD, but now includes other neurological disorders
- Intensive voice treatment:
  - 1-hour sessions, 4 days a week x 4 weeks (16 sessions)
  - Home practice on treatment/non-treatment days
  - Techniques intended to increase vocal loudness and increase communication effectiveness/speech intelligibility

LSVT LOUD®

- Core concepts of the program
  - Target: Vocal intensity ("Think Loud")
  - Mode: Intense dosage and high effort
  - Calibration: Recalibrate sensory feedback
  - Treatment tasks involve a speech hierarchy
  - Clinician modeling ("do what I do")
  - Daily homework and carry-over exercises
  - Quantify improvements over time (fundamental frequency, amplitude, duration)
  - Maintenance

LSVT LOUD®

Used with permission from LSVT Global

LSVT LOUD®

- Clinical Outcomes:
  - Vocal intensity (Ramig et al., 1995; Ramig et al., 2001a; Ramig et al., 2001b)
  - Articulation (Dromey et al., 1995; Spielman et al., 2003)
  - Swallowing (Sharkawi et al., 2003)
  - Facial expression (Spielman, Borad, & Ramig, 2003)
  - Respiratory kinematics (Huber et al., 2003)
  - Aerodynamics (Ramig & Dromey, 1996)
  - Vocal fold adduction (Garren et al., 2000; Smith et al., 1995)
  - PET (Liotti et al., 2003)
  - Voice quality (Baumgartner, Sapir, Ramig, 2001)

LSVT LOUD® Maintenance

- LOUD for Life®
- Tune-up sessions
- LSVT Companion® Client Edition
- LSVT LOUD Homework Helper Videos

SpeechViveTM

- The SpeechVive is a prosthetic device
- Uses an external sound to automatically elicit increased vocal intensity
- Lombard effect
- Mitigates impact of cognitive decline

Used with permission from SpeechVive Inc.

SpeechVive™

- The external sound only plays when the patient speaks
- SpeechVive employs trained speech-language pathologists to provide free training and ongoing support
- The SLP providing treatment gathers baseline data and calibrates the SpeechVive to immediately increase the patient's target sound pressure level
- Target increase is 3-5 dB SPL
- Calibration takes 5-10 minutes with specialized software
- Calibration software provides baseline and tracks data over time
- Recalibrate as needed

CONTINUED

SpeechVive™

Used with permission from SpeechVive Inc.

CONTINUED

SpeechVive™

- Clinical Outcomes:
  - Increased vocal intensity (Matheron et al., 2017; Richardson et al., 2014; Sadagopan, Neeraja, & Huber, 2007; Stathopoulos et al., 2014)
  - More efficient respiratory patterns during speech breathing (Sadagopan, Neeraja, Huber, 2007)
  - Improved glottal efficiency (Stathopoulos et al., 2014)
  - Improved speech intelligibility (Richardson et al., 2014)

SpeechVive™

- A recent study examined the long-term effects of the SpeechVive on respiratory and laryngeal speech functions for speakers with PD (Kiefer et al., 2019)
  - Speech breathing more efficient (higher recoil forces)
  - Speakers used more laryngeal valving to increase loudness
  - Users of the SpeechVive did not acclimate to the device

SPEAK OUT!®

- Training course includes instruction on individual therapy (SPEAK OUT! ®) and group therapy (The LOUD Crowd®)
- Patients attend information session prior to SPEAK OUT®
- The program typically consists of twelve therapy sessions and daily home practice
- SPEAK OUT! emphasizes ***speaking with intent***
- Six-week follow-up (review exercise and establish a daily home practice routine)
- Transition to The LOUD Crowd

The LOUD Crowd®

- The LOUD Crowd
  - Attend weekly group sessions to practice SPEAK OUT! exercises
  - Maintenance through group sessions
  - Peer support
- SPEAK OUT! Refreshers
  - Meet with trained clinician every six months to evaluate progress

SPEAK OUT!® & LOUD Crowd®

- Clinical Outcomes:
  - Improved vocal intensity, cepstral peak prominence, Acoustic Voice Quality Index (AVQI), voice-related quality of life (Levitt & Walker-Batson, 2018; Boutsen et al., 2018)
  - Improvements in pitch range, sustained vowel duration, reading intelligibility, and vocal quality (Boutsen et al., 2018)
  - Long-term gains in SPL maintenance reported at 6 months and 12 months (Watts, 2016)

CONTINUED

Choral Singing

- Growing interest in use of choral singing program to help reduce the speech and voice symptoms associated with PD (Di Benedetto et al., 2009; Elefant, Baker, Lotan, Lagesen, & Skeie, 2012)
- Physical acts of speaking and singing share overlapping neural networks (Brown, Martinez, & Parsons, 2006; C. P. Thaut, 2014; Wan, Rüüber, Hohmann, & Schlaug, 2010)
  - Inferior pre- and postcentral gyrus, the superior temporal gyrus, and the superior temporal sulcus

CONTINUED

Choral Singing

- Use of singing as a speech rehabilitation tool has been reported in treatment studies:
  - Nonfluent aphasia (Tomaino, 2012)
  - Traumatic brain injury (Baker, Wigram, & Gold, 2005)
  - Autism spectrum disorder (Wan, Rüber, Hohmann & Schlaug, 2010)
  - Apraxia of speech (Jungblut, Huber, Mais, & Schnitker, 2014)
  - Fluency impairment (Davidow, Bothe, Andreatta, & Ye, 2009)

Choral Singing

- To date, few studies available for persons with PD
- Studies include a variety of therapeutic singing protocols, treatment durations, and outcome measures
- Example protocol
  - Music Therapy Voice Protocol (MTVP)
  - Vocal warmup and singing exercise
  - 12-14 sessions

Choral Singing

- Clinical Outcomes:
  - Increased vocal intensity during singing (Elefant et al., 2012), reading (Haneishi, 2001), and conversational speech (Yinger & Lapointe, 2012)
  - Increase in pitch accuracy and vocal range (Elefant et al., 2012)
  - PRO improved speech intelligibility (Haneishi, 2001)
  - Improvements in vowel articulation (F1/F2 plot) and speech intelligibility (Higgins & Richardson, 2019)

Choral Singing

- As an emerging area of study, however, the reported data on therapeutic singing are variable
- Shih et al. (2012) reported no treatment-related changes in vocal intensity, pitch range, phonation time, maximum loudness, voice-related quality of life after 12, 90-min choral singing sessions
- Large-scale randomized controlled trials are warranted

Clear Speech

- Various forms of instruction (e.g. clear, over-enunciate, and hearing impaired)
- Other examples:
  - Say all sounds clearly and firmly – exaggerate the sounds and do not leave any sounds out
  - Make sure the lips meet firmly for b, p, and m sounds
  - Try to “explode” the sounds t, d, k, and g
  - Pause between words and remember to keep the vocal loudness up until the end of the sentence
  - Start by practicing single words, then two and three word phrases, short sentences, and paragraphs

CONTINUED

Clear Speech

- Studies of clear speech in healthy adults have identified acoustic correlates of clear speech compared with habitual speaking (Goberman & Elmer, 2005; Lam, Tjaden, & Wilding, 2012; Tjaden & Wilding, 2004)
  - Reduced rate
  - Increased fundamental frequency
  - Increased pause frequency and duration
  - Increased loudness
  - Expansion of vowel space area

CONTINUED

Clear Speech

- Studies investigating clear speech in healthy adults and people with hearing loss show that people can increase intelligibility by 17-26% with the cue to speak more clearly (Picheny, Durlack & Braida, 1986)
- Clear speech benefit

CONTINUED

Clear Speech

- Clinical Outcomes for Clear Speech and PD
  - Decreased articulation rate, increased mean fundamental frequency (F_o), and increased speaking F_oSD (Goberman & Elmer, 2005)
  - Improved speech intelligibility (Tjaden, Sussman, & Wilding, 2014)
  - Increase vocal intensity (Tjaden et al., 2014)

CONTINUED

Altered Auditory Feedback

- Delayed auditory feedback
  - Speech signal processed with variable time delay
  - Used to help slow down speaking rate
  - May enhance intelligibility and improve fluency
  - Evidence
- Frequency altered feedback
  - Frequency-shifted acoustic signal

CONTINUED

Questions?

CONTINUED

References

- Adams, S.G., Dykstra, A.D., Abrams, K., Winnell, J., Jenkins, M., & Jog. M. (2006a). Conversational speech intensity under different noise conditions in hypophonia and Parkinson's disease. *Canadian Acoustics, 34*, 96-97.
- Baker, F., Wilgram, T., & Gold, C. (2005). The effects of a song-singing programme on the affective speaking intonation of people with traumatic brain injury. *Brain Injury, 19*(7), 519-28.
- Baumgartner, C., Sapir, S., & Ramig, L. (2001). Voice quality changes following phonatory-respiratory effort Treatment (LSVT®) versus respiratory effort treatment for individuals with Parkinson disease. *Journal of Voice, 15*, 105-114.
- Blanchet, P.G., & Hoffman, P.R. (2014). Factors Influencing the Effects of Delayed Auditory Feedback on Dysarthric Speech Associated with Parkinson's Disease. *Journal of Communication Disorders, Deaf Studies & Hearing Aids, 2*(1),1-11.
- Blanchet, P., & Snyder, G. (2010). Speech rate treatments for individuals with dysarthria: A tutorial. *Perceptual and Motor Skills, 110*(3), 965-982.
- Boutsen, F., Park, E., Dvorak, J., & Cid, C. (2018). Prosodic improvement in persons with Parkinson disease receiving SPEAK OUT!® voice therapy. *Folia Phoniatrica et Logopaedica, 70*, 51–58.

CONTINUED

CONTINUED

References

- Brown, S., Martinez, M.J., & Parsons, L.M. (2006). Music and language side by side in the brain: A PET study of the generation of melodies and sentences. *European Journal of Neuroscience, 23,* 2791–2803.
- Davidow, J.H., Bothe, A.K., Andreatta, R.D., & Ye, J. (2009). Measurement of phonated intervals during four fluency-inducing conditions. *Journal of Speech, Language, and Hearing Research, 52*(1), 188-205.
- Di Benedetto, P., Cavazzon, M., Mondolo, F., Rugiu, G.,Peratoner, A., & Biasutti, E. (2009). Voice and choral singing treatment: A new approach for speech and voice disorders in Parkinson's disease. *European Journal of Physical and Rehabilitation Medicine, 45*(1), 13–19.
- Dromey, C., Ramig, L., Johnson, A. (1995). Phonatory and articulatory changes associated with increased vocal intensity in Parkinson disease: a case study. *Journal of Speech and Hearing Research, 38*, 751-763.
- El Sharkawi, A., Ramig, L., Logemann, J. et al. (2002). Swallowing and voice effects of Lee Silverman Voice Treatment: a pilot study. *J Neurol Neuropsychiatry Psychiatry, 72* 31-36.

CONTINUED

References

- Elefant, C., Baker, F. A., Lotan, M., Lagesen, S.K., & Skeie, G.O. (2012). The effect of group music therapy on mood,speech, and singing in individuals with Parkinson's disease—A feasibility study. *Journal of Music Therapy, 49,* 278–302.
- Fox, S.H. (2013). Non-dopaminergic treatments for motor control in Parkinson's disease. *Drugs, 73*(13) 1405-15.
- Fox, C.M., & Ramig, L.0. (1997). Vocal sound pressure level and self-perception of speech and voice in men and women with idiopathic Parkinson's disease. *American Journal of Speech-Language Pathology, 6*(2), 85-94.
- Garren, K., Brosovic, G., Abaza, M., & Ramig, L. (2000, June). Voice therapy and Parkinson disease: measures of vocal fold adduction. Paper presented at: the Voice Symposium, Philadelphia, PA.
- Goberman, A.M., & Elmer, L.W. (2005). Acoustic analysis of clear versus conversional speech in individuals with Parkinson's disease. *Journal of Communication Disorders,* 38(3), 215-30.
- Huber, J., Stathopoulos, E., Ramig, L., & Lancaster, S. (2003). Respiratory function and variability in individuals with Parkinson disease: pre and post Lee Silverman Voice Treatment (LSVT®). Journal of Medical Speech-Language Pathology*, 11,* 185-201.

CONTINUED

CONTINUED

References

- Jungblut, M., Huber, W., Mais, C., & Schnitker, R. (2014). Paving the Way for Speech: Voice-Training-Induced Plasticity in Chronic Aphasia and Apraxia of Speech—Three Single Cases. Neural Plasticity, 1-15.
- Kiefer, B.R., Snyder, S., Stathopoulos, E.T., Sussman, J.E., Richardson, K., Matheron, D., & Huber, J.E. (2019, June). The long-term effects of the SpeechVive device for speakers with Parkinson's disease. Poster presented at the 2019 Boston Speech Motor Control Symposium, Boston, MA.
- Lam, J., Tjaden, K., & Wilding, G. (2012). Acoustics of Clear Speech: Effect of Instruction. *Journal of Speech, Language and Hearing Research, 55, 1807-1821*.
- Levitt, J. & Walker-Batson, D. (2018). The Effects of The "Speak with Intent" Instruction for Individuals with Parkinson's disease, *Journal of Communication Disorders and Assistive Technology, 2*, 1-15.
- Liotti, M., Ramig, L.O, Vogel D, et al. (2003). Hypophonia in Parkinson's disease. Neural correlates of voice treatment revealed by PET. *Neurology, 60* 432-440.
- Matheron, D., Stathopoulos, E.T., Huber, J.E., & Sussman, J.E. (2017). Laryngeal Aerodynamics in Healthy Older Adults and Adults With Parkinson's Disease. *Journal of Speech, Language, and Hearing Research, 60,* 507-524.

CONTINUED

References

- Picheny, M. A., Durlach, N. I., & Braida, L. D. (1986). Speaking clearly for the hard of hearing II: Acoustic characteristics of clear and conversational speech. *Journal of Speech and Hearing Research, 29*, 434–445.
- Ramig, L., Countryman, S., Thompson, L., & Horii, Y. (1995). Comparison of two forms of intensive speech treatment for Parkinson disease. *Journal of Speech and Hearing Research, 38,* 1232-1251.
- Ramig. L., & Dromey. C. (1996). Aerodynamic mechanisms underlying treatment-related changes in vocal intensity in patients with Parkinson disease. *Journal of Speech and Hearing Research, 39,* 798-807.
- Ramig, L., Sapir, S., Fox, C., & Countryman, S. (2001). Changes in vocal intensity following intensive voice treatment (LSVT) in individuals with Parkinson disease: A comparison with untreated patients and normal age-matched controls. *Movement Disorders, 16,* 79–83.
- Ramig, L.O., Sapir, S., Countryman, S. et al. (2001a). Intensive voice treatment (LSVT) for patients with Parkinson's disease: a 2 year follow up. *Journal of Neurology. Neurosurgery, and Psychiatry, 71,* 493-498.

CONTINUED

CONTINUED

References

- Ramig, L.O., Sapir, S., Fox, C., & Countryman, S. (2001b). Changes in vocal loudness following intensive voice treatment (LSVT) in individuals with Parkinson's disease: a comparison with untreated patients and normal age-matched controls. *Movement Disorders, 16,* 79-83.
- Richardson, K., Sussman, J.E., Stathopoulos, E.T., & Huber, J. (2014). The effect of increased vocal intensity on interarticulator timing in speakers with Parkinson's disease: A preliminary analysis. *Journal of Communication Disorders, 52*, 44-64.
- Sadagopan, N., & Huber, J. (2007). Effects of Loudness Cues on Respiration in Individuals with Parkinson's disease. *Movement Disorders, 22*, 651-9.
- Shih, L.C., Piel, J., Warren, A., Kraics, L., Silver, A., Vanderhorst, V., & . . . Tarsy, D. (2012). Singing in groups for Parkinson's disease (SING-PD): A pilot study of group singing therapy for PD-related voice/speech disorders. *Parkinsonism & Related Disorders,18,* 548–552.
- Smith, M., Ramig, L.O, Dromey, C., Perez, K., Samandari, R. (1995). Intensive voice treatment in Parkinson's disease: laryngostroboscopic findings. *Journal of Voice, 9,* 453-459.

CONTINUED

References

- Spielman, J., Borod, J., Ramig, L. (2003). Effects of intensive voice treatment (LSVT) on facial expressiveness in Parkinson's disease: preliminary data. *Cognitive and Behavioral Neurology, 16*, 177-188.
- Stathopoulos, E.T., Huber, J.E., Richardson, K., et al. (2014). Increased vocal intensity due to the Lombard effect in speakers with Parkinson's disease: Simultaneous laryngeal and respiratory strategies. *Journal of Communication Disorders, 48*, 1-17.
- Thaut, C.P. (2014). Vocal intonation therapy (VIT). In M. H. Thaut & V. Hoemberg (Eds.), Handbook of neurologic music therapy (pp. 179–184). New York, NY: Oxford University Press.
- Tjaden, K., & Wilding, G.E. (2004). Rate and loudness manipulations in dysarthria: Acoustic and perceptual findings. *Journal of Speech, Language, and Hearing Research, 47*, 766–783.
- Tjaden, K., Sussman, J.E., & Wilding, G. (2014). Impact of clear, loud, and slow speech on scaled intelligibility and speech severity in Parkinson's disease and multiple sclerosis. *ournal of Speech, Language, and Hearing Research, 57*(3), 779-92.
- Tomaino, C.M. (2012). Effective music therapy techniques in the treatment of nonfluent aphasia. Annals of the New York Academy of Sciences, 1252, 312-7.

CONTINUED

CONTINUED

References

- Wan, C.Y., Rüüber, T., Hohmann, A., & Schlaug, G. (2010). The therapeutic effects of singing in neurological disorders. Music Perception: *An Interdisciplinary Journal, 27,* 287–295.
- Watts, C.R. (2016). A Retrospective Study of Long-term Treatment Outcomes for Reduced Vocal Intensity in Hypokinetic Dysarthria. *BMC Ear, Nose and Throat Disorders,16*(2), 1-7.
- Yinger, O.S., & Lapointe, L.L. (2012). The effects of participation in a group music therapy voice protocol (G-MTVP) on the speech of individuals with Parkinson's disease. *Music Therapy Perspectives*, *30* (1), 25–31.