The Effectiveness of LOUD Crowd® Group Therapy for People with Parkinson's Disease

Fran Pomaville, Ph.D., CCC-SLP
Sabrina Nii, M.S., CCC-SLP
Brooke Findley, Ed.D, CCC-SLP
Michael Lucas, M.A., CCC-SLP

Disclosure Statement

The Parkinson's Research Clinic housed at the Speech, Language, and Hearing Clinic at California State University, Fresno is a 2018, 2019, and 2020 recipient of Parkinson Voice Project's National SPEAK OUT!® and LOUD Crowd® Grant Program.

The Parkinson Voice Project is a nonprofit organization in Richardson Texas, established by Samantha Elandary and the National Parkinson Foundation in 2005. [3] https://www.parkinsonvoiceproject.org/

Learning Objectives

- Participants will be able to list 3 potential benefits of the LOUD Crowd® program for individuals with Parkinson's Disease.
- Participants will be able to define what it means to "Speak with Intent".
- Participants will be able to compare and contrast two programs for the treatment of speech/voice problems in individuals with Parkinson's Disease:
  1) the SPEAK OUT! and LOUD Crowd® program, and 2) Lee Silverman Voice Treatment® (LSVT).

Why are programs like this needed?

- Parkinson's Disease (PD) affects 1 in every 100 adults over the age of 60
- If diagnosed before the age of 60 = “Young Onset Parkinson’s Disease” (YOPD)
- Approximately 90% of individuals with PD struggle with speech production (hypokinetic dysarthria) and many also have swallowing problems
- Only 3 – 4% receive Speech Therapy
- Speech Characteristics:

Voice	**Articulation**	**Prosody**
“soft”/⬇loudness/breathy	imprecise consonants (⬇ROM)	inappropriate silences (akinesia)
hoarse or harsh vocal quality	“compressed speech”	short rushes of speech
monopitch, monoloudness		palilalia (festinating)

[1, 2] Parkinson’s Disease Foundation, n.d.; Freed, 2020

What is the SPEAK OUT!® and LOUD Crowd® Therapy Approach?

SPEAK OUT!®

- The program begins with an assessment using the protocol provided by Parkinson's Voice Project [4] but modified to meet our needs.
- Assessment/baseline data and a pre treatment video recording is collected.
- The Voice Handicap Index (VHI) is completed by the client.
- During the first session, the client is also introduced to the concept of speaking with intent.
  - Intent means to be focused, purposeful, and deliberate. A purposeful and deliberate cognitive focus on increasing attentiveness to speech production.
  - In terms of speech, "say it like you mean it", "speak with gusto"
    When we do this, our speech sounds louder, clearer, and more expressive.
    Then, the same concept can be applied to other activities such as writing, walking, etc…
- Stimulability testing is conducted.

What is the SPEAK OUT!® and LOUD Crowd® Therapy Approach?

- The client participates in six weeks (12 total sessions) of SPEAK OUT!® in a 1:1 setting.
- The concept of intent is revisited daily and the client is frequently cued to use intent.
- Each treatment session includes:
  - A warm-up exercise
  - Ah Exercise
  - Glide Exercise
  - Counting exercise
  - Reading Exercise
  - Cognitive Exercises
- Once the client completes the 12 sessions, is comfortable with the program, and has made progress, a SPEAK OUT!® discharge is completed.
  - A post treatment video recording is completed.
  - The client completes a post treatment Voice Handicap Index (VHI).

What is the SPEAK OUT!® and LOUD Crowd® Therapy Approach?

LOUD Crowd®.

- When a client completes SPEAK OUT!® the client enters the maintenance portion of the program; LOUD Crowd®.
- LOUD Crowd® is a group maintenance program that follows the same treatment activity sequence as SPEAK OUT!® but is conducted in a group setting.
- The client is encouraged to continue participation in LOUD Crowd® for the long term to maintain progress and skills.

What is the SPEAK OUT!® and LOUD Crowd® Therapy Approach?

SPEAK OUT!® Refresher

- A client may choose to participate in a SPEAK OUT!® Refresher if they experience a decline in function or a notable progression in Parkinson's symptoms occurs.
- The concept of a refresher allows the client to have the opportunity to strengthen their skills by cycling through SPEAK OUT!® for another set of sessions before returning to LOUD Crowd® for maintenance.

Why does it work?

- The symptoms of Parkinsonism are caused by a lack of Dopamine.
- Dopamine is a neurotransmitter which helps control automatic movements such as walking, talking, etc.… It helps carry neurologic impulses across synapses.
- Dopamine also affects motivation and drive to get things done.
- We have 2 basic motor systems that control movement: the **Pyramidal System** and the **Extrapyramidal System**

- **Extrapyramidal System**
  - Responsible for automatic movements that we perform without conscious effort
  - This pathway includes passing through the Substantia Nigra where Dopamine is produced
  - Without enough Dopamine, automatic movements are disrupted such as those we see in Parkinsonism
- **Pyramidal System**
  - Responsible for intentional/purposeful movements
  - This is a more direct route which is not as impacted by the lack of Dopamine so intentional, deliberate movements are preserved
  - This system works better for individuals with PD because the lack of Dopamine does not impact it in the same way
  - We activate the Pyramidal System when we consciously and purposefully produce a movement
  - When people with PD use INTENT, speech improves, they stand up straighter, handwriting improves, facial expressions increase, etc.

A brief review of the literature….

Speech-language pathologists (SLPs) currently offer several promising treatments designed to improve voice and speech production in individuals with PD. These treatments often incorporate high intensity, clinician lead exercises designed to increase muscular effort and motor unit recruitment. [5]

Documented treatment results include improvements in vocal loudness, articulatory accuracy, intelligibility, prosody, and swallowing. [6-19]

Lee Silverman Voice Treatment (LSVT) (aka: LSVT LOUD®)

- Most widely known evidence-based approach for treating voice and speech production deficits associated with PD [5, 6, 11-33, 35, 36, 40]
- SLPs who want to use it must become certified by completing a 12-14 hour training seminar with renewal required every 2 years. Grad students using LSVT must also be certified **and** supervised by an LSVT certified SLP.
- A structured intervention targeting *vocal loudness* and vocal scaling
- 16 individual tx sessions (1 hour each) delivered 4 times a week for 4 weeks
- Sessions incorporate a series of effortful, loud vocalizations, speech exercises, & generalization activities designed to promote recalibration of the perception of effort and loudness [6]
- Introduced in 1987
- Both short-term and long-term (up to 6, 12, and 24 months) efficacy data exists regarding improved communication and swallowing [6, 10, 14-36]
- Additional research investigating modifications (i.e., scheduling changes or group tx) have resulted in similar outcomes to the traditional program [33, 37-39]
- Continued daily homework practice and carryover exercises recommended for maintenance with more recent addition of an optional group therapy component called LOUD for LIFE® (separate certification) [40]

SPEAK OUT!® and LOUD Crowd®

- A structured intervention targeting *speaking with intent* [3]
- SPEAK OUT!® was designed to be administered over 12 individual therapy sessions, approximately 40 minutes each over 4 weeks; however it allows for the Tx schedule to be modified, as needed (i.e., twice a week for 6 weeks)
  - Tx sessions = a series of speech, voice and cognitive exercises/activities that progress in the following sequence: a) warm up vocalizations, b) sustained vowel productions, c) pitch glides, d) counting, e) reading, and f) cognitive activities. Tx and daily home exercise activities are provided in the SPEAK OUT Workbooks, provided by PVP.
- LOUD Crowd® consists of weekly group therapy sessions (50-60 minutes) designed to facilitate maintenance of improvements made while in SPEAK OUT!®. Although separate programs, they are actually combined into one continuous curriculum. The transition from one to the other is emphasized and facilitated from the beginning.
  - Group Sessions offer ongoing vocal practice during structured and unstructured activities, accountability, support, and encouragement from peers. The same sequence of activities is used as for SPEAK OUT® with cognitive activities selected that encourage conversations and interactions with other members of the group.
- Several studies evaluating SPEAK OUT!® and LOUD Crowd® have documented the following:
  - significant increases in vocal intensity during tasks such as vowel prolongations, reading, monologue and conversational speech [7, 41, 42-46, 48, 49]
  - improved pitch and loudness variation (a less monotone voice) [41, 43, 44]
  - improved pitch range and vocal quality [44]
  - increased intelligibility at the sentence level [45], although measures of conversational intelligibility are needed

Other Treatments

- Levadopa (L-dopa)
  While L-dopa significantly improves motor performance in patients with PD, its effects on relieving the speech and voice symptoms remains controversial. Some studies demonstrated improved vocal intensity and word intelligibility with L-dopa while others showed no significant differences in the speech of participants with or without L-dopa. [58-62]

- Deep Brain Stimuation (DBS)
  Although DBS significantly improved motor functions, research evidence suggests that its effect on speech is inconsistent. Improvement was reported in some cases while other studies observed no effects or even the development of dysarthria as an adverse effect of DBS. [63-72]

- Respiratory Muscle Strength Training
  Overall, the studies reviewed showed that the effects of respiratory muscle strength training on vocal intensity and respiratory measures were mixed for participants with PD with a positive significant effect only observed in some participants [50, 51]. When considering potential treatments designed to improve voice quality in patients with PD, the research done on respiratory muscle strength training is inconclusive and does not support its use for functional gains in voicing and intelligibility.

- Music Therapy / Group Singing
  Overall, the evidence is inconclusive regarding singing therapies and their impact on speech production in individuals with PD. While improved vocal intensity, intelligibility, articulation, and mood were observed in some studies (52-55], other studies reported no significant effect on those measures [56,57]. In addition, the singing therapy studies reviewed utilized different exercise components and frequency of training, making comparison among those studies difficult. Although this treatment approach was named singing therapy, choral singing usually took up a small portion of the group therapy. All of the singing programs reviewed included breathing and vocal exercises, which usually took a larger portion during the session than the actual singing activity. As a result, the effects of singing itself on speech and voice improvement for participants with PD was unclear.

OUR STUDY:

The Effectiveness of LOUD Crowd® Group Therapy for Maintaining Vocal Intensity and Intelligibility in Individuals with PD

This research is part of a 2-phase study that was approved by the California State University, Fresno (CSUF) Committee for the Protection of Human Subjects (Protocol #863).

Originally, this study was designed to be more longitudinal in nature with ongoing data collection over time. In March of 2020, our LOUD Crowd® group was suspended due to restrictions imposed by COVID 19. It was re-instated as an online program several weeks later; however, it was decided that this suspension and change in format was a variable that might impact the reliability of our data. Therefore, this study will include data gathered between the dates of January 28, 2019 and February 3, 2020.

Purpose

This study was designed to evaluate the effectiveness of the LOUD Crowd® group therapy program for maintaining vocal loudness and speech intelligibility in individuals with Parkinson's Disease after they completed the SPEAK OUT!® program.

Participants

- Inclusion Criteria: between the ages of 55 and 85 years, diagnosed with PD for a minimum of 5 years, and completed the SPEAK OUT!® program.
- 12 Participants (9 male and 3 female)
- Ages ranged from 57 to 84 years
- Length of time since diagnosis ranged from 6 to 19 years

Research Design
Pre-test, Post-test, and Maintenance Probe Measures

- A case series design utilizing pre-test, 3 month post-test, final, and maintenance probe measures
- Measures included:
  - mean vocal intensity level (dBSPL) during sustained /ɑ/ productions
  - mean vocal intensity level (dBSPL) during a 2-minute conversational speech sample
  - percent intelligibility during a 50-utterance conversational speech sample
  - participants self-reported their perceptions regarding their voice quality and its impact on their quality of life using the Voice Handicap Index (VHI).

- Pre-test measures taken upon completion of SPEAK OUT!® and prior to starting LOUD Crowd®
- These measures were repeated an the end of every semester in which they participated in the program
- For the purpose of data analysis, post-test measures were those taken after participating in LOUD Crowd® for one semester
- Final measures were those taken at the end of their continuous enrollment period (range = 6 weeks to 1 year)
- Maintenance probe measures were those taken after being away from the program for 2 months

Treatment Procedures & Materials

- Vocal warm up exercises done with intent
  - "*may, me, my, moe, moo*"
  - sustained /ɑ/ for as long as the participants were able to maintain it
  - vocal glides (low-to-high and high-to-low)
  - counting exercises
- Reading activity that required participants to read aloud sentences and phrases from the LOUD Crowd® Workbook with intent
- One or more cognitive activities requiring participants to think and speak
- Throughout the LOUD Crowd® sessions, conversation between the participants was allowed and encouraged as long as the participants were using a strong, intentional voice.

Results: SPEAK OUT®
A Comparison of Pre- vs. Post-test Measures

- a comparison of pre- verses post-test measures utilizing a paired sample *t*-test

Paired Samples t-test Results from Prior to and Following Participation in SPEAK OUT!®

Measures	Mean		Std. Deviation		*p*
	Pre-test	Post-test	Pre-test	Post-test	
Vocal intensity for sustained /ɑ/ (*n*=12)	68.1167	82.8583	9.6901	5.1304	<0.001
Vocal intensity for 2 minute speech sample (*n*=12)	59.6583	67.7750	5.5448	8.5204	0.001
Percent intelligibility for 50-utterance sample (*n*=9)	92.4556	97.3556	15.0527	3.8390	0.232
VHI scores (*n*=12)	60.1667	47.9167	30.5103	20.8390	0.072

Results: LOUD CROWD®
A Comparison of Pre- vs. Post-test Measures

- a comparison of pre- verses post-test measures utilizing a paired sample *t*-test
- The dependent samples *t*-test takes the average of the participants' scores for a particular pre-test measure and calculates if the change across those same participants' average for the post-test was significant (*p*-value < 0.05)
- Pre-LOUD Crowd® measures were compared to measures taken after 1 semester (approximately 3 months) of participating in LOUD Crowd® to see if there was a significant difference between these two measures. Eleven participants were included in this analysis (# 12 did not complete semester)

Results Revealed:

- no significant difference between the pre- and post-test measures for vocal intensity for sustained /ɑ/ ($t(10) = 1.382$, $p = .197$)
- no significant difference between the pre- and post-test measures for percent intelligibility for the 50-utterance speech sample ($t(10) = -1.641$, $p = .132$)
- no significant difference between the pre- and post-test measures for VHI scores ($t(10) = -1.002$, $p = .340$)
- this demonstrates stability and maintenance of these measures while attending the first semester of LOUD Crowd®.
- The difference in pre- and post-test scores for vocal intensity during a 2 minute speech sample just met significance ($t(10) = 2.245$, $p = .049$)
- A closer look at the raw data revealed a slight decrease in the group's average conversational loudness levels from 67.18 dB (pre-test) to 63.54 dB (post-test)

Paired Samples t-test Results from Prior to and Following Participation in LOUD Crowd® for 1 semester (n=11)

Measures	Mean		Std. Deviation		t(10)	*p*
	Pre-test	Post-test	Pre-test	Post-test		
Vocal intensity for sustained /ɑ/	81.6364	79.4545	5.08474	5.92644	1.382	.197
Vocal intensity for 2 minute speech sample	67.1818	63.5455	4.53471	3.93354	2.245	.049
Percent intelligibility for 50-utterance sample	97.1818	97.8182	4.09434	4.46807	-1.641	.132
VHI scores	43.3636	50.6364	22.97944	19.28353	-1.002	.340

Results: LOUD CROWD®
Two Month Maintenance Probes

- comparison of final measures taken at the end of their continuous enrollment period to those taken after 2 months of non-participation (i.e., maintenance probes) using a paired sample *t*-test
- Maintenance probe measures were taken on January 27, 2020 or February 3, 2020, when participants returned after being away from the program for approximately 2 months due to winter break at the University. The program was suspended shortly after that due to the COVID Pandemic.
- Participants 10 and 12 were not available for the maintenance probe measures.

Results revealed:

- no significant changes in conversational intelligibility ($t(8) = -2.286$, $p = .052$)
- no significant changes in VHI scores ($t(8) = -.025$, $p = .981$)
- therefore, these measures remained stable after 2 months of non-participation in LOUD Crowd®.
- vocal intensity for sustained production of /ɑ/ ($t(8) = 4.455$, $p = .002$) and for 2 minute speech samples ($t(8) = 3.212$, $p = .012$) demonstrated statistically significant decreases
- these results suggest a significant decline in vocal loudness following 2 months of non-participation

Paired Samples t-test Results from Final Semester of Participation to the 2-month Maintenance Probe (n= 9)

Measures	Mean		Std. Deviation		t(8)	*p*
	Final Measure	Maint. Probe	Final Measure	Maint. Probe		
Vocal intensity for sustained /ɑ/	83.7778	77.4444	7.11561	7.58471	4.455	.002
Vocal intensity for 2 minute speech sample	67.1111	63.5556	3.95109	2.74368	3.212	.012
Percent intelligibility for 50-utterance sample	97.6667	99.4444	2.69258	1.66667	-2.286	.052
VHI scores	46.2222	46.3333	18.5390	21.81742	-.025	.981

Results: LOUD CROWD®
Changes in Measures Based on Time Spent in Program

- a preliminary analysis of changes based on time spent in the program using a univariate linear regression analysis
- these results must be considered preliminary due to the small number of participants and limited period of time for data gathering
- an attempt was made to assess any changes in measures (dependent variables) over time using a series of univariate linear regression analyses
- for this analysis, the researchers explored the total change in scores when comparing pre-test measures to final measures taken after the total number of weeks they attended
- the length of participation time for the 12 participants varied and ranged from 6 weeks to 1 year with a mean of 34 weeks

Results revealed:

- The first linear regression explored whether weeks spent participating in the LOUD Crowd® program could be used to predict changes in vocal intensity on production of /ɑ/
  - results of this analysis indicated non-significant findings ($F(1, 10) = .037$, $p = .852$, $R^2 = .004$)
- Subsequent tests also indicated non-significant findings for total changes in intelligibility ($F(1, 10) = .874$, $p = .372$, $R^2 = .080$) and VHI scores ($F(1, 10) = .168$, $p = .691$, $R^2 = .016$).
- A significant regression equation was found for changes in conversational intensity based on weeks spent in LOUD Crowd® ($F(1, 10) = 8.289$, $p = .016$, $R^2 = .453$).
- Coefficients for this model suggested that change in conversational intensity was equal to -10.620 + .234 (number of weeks spent in LOUD Crowd®). As such, participants' conversational intensity increased by .234dB for each additional week enrolled in the LOUD Crowd® program

Mean Results and Standard Deviations for Total Change in the Dependent Variable and Weeks in Loud Crowd (n =12)

Measures	Mean	Std. Deviation
Weeks in Loud Crowd	34.1675	17.05545
Total Change in Vocal Intensity for sustained /ɑ/	-3.5000	5.80752
Total Change in Vocal Intensity for 2 minute speech sample	-2.6250	5.92807
Total Change in Percent intelligibility for 50-utterance sample	.5833	2.27470
Total Change in VHI scores	5.0000	15.82863

Discussion: regarding vocal loudness…

- The findings for sustained /ɑ/ productions are consistent with those from several other studies that showed improvement or maintenance of vocal loudness during sustained vowels and reading samples while participating in LOUD Crowd® for up to 6 weeks [41,43], and 8 weeks [42,46,48,49].
- The current study was unique in its measurement and analysis of conversational loudness during a spontaneous speech sample; however, research regarding sentence or monologue productions also demonstrated improvement or maintenance of vocal loudness during participation in LOUD Crowd® [41,46].
- The current study found a slight (yet statistically significant, $p = .049$) decrease in the group's average conversational loudness after 3 months in LOUD Crowd®, which is inconsistent with the improvements or maintenance of vocal loudness documented in the other studies that looked at reading samples, sentence productions or monologues.
- This study was also unique in the administration of a maintenance probe measure taken after 2 months of non-participation in LOUD Crowd®. It revealed a statistically significant decrease in both vocal loudness measures, which may support the importance of ongoing participation in a program that emphasizes maintenance of vocal loudness in individuals with PD.
- The improvements or maintenance of vocal intensity noted in this study were also comparable to studies of LSVT® revealing that the effects of this treatment are similar [25,29,36]. These findings were also consistent with the vocal improvements seen in group therapies using LSVT® [38,39].

Discussion: regarding speech intelligibility…

- No other studies were found that assessed conversational speech intelligibility during or after participation in LOUD Crowd®.
- Results showed that improvements in speech intelligibility made during SPEAK OUT!® were maintained after 3 months of participating in LOUD Crowd®, and for up to 2 months after discontinuing LOUD Crowd®.
- Participants maintained improved speech intelligibility despite some decreases in conversational loudness once the program was discontinued, suggesting that vocal loudness alone does not account for improvements in intelligibility.
- Few studies on LSVT® have looked specifically at conversational intelligibility. Levy, et al. [13] demonstrated improved conversational intelligibility following LSVT® and Cannito, et al. [10] demonstrated improved sentence level intelligibility in most participants after completion of LSVT®, but neither assessed maintenance over time.

Discussion: regarding VHI scores…

- Results of this study showed that VHI Scores were maintained after 3 months of participating in LOUD Crowd®, and for up to 2 months after discontinuing.
- Results are consistent with other studies that assessed participant perceptions regarding their voice quality and its impact on their quality of life using the VHI or Voice Related Quality of Life (VRQL) during or after participation in LOUD Crowd®. These studies demonstrated improved VHI or VRQL scores after participation in SPEAK OUT!® with maintenance of these improved scores for up to 6 weeks [41], or 8 weeks [42,46,48,49] while participating in LOUD Crowd®.
- Similarly, a number of studies demonstrated improved VHI scores after completing LSVT® [31,35,38] with one showing maintenance of improved scores for up to 6 months [31]. An additional study found that an extended version of LSVT® did not improve VHI scores [33].
- It may be possible that the maintenance of improved VHI scores may be partially due to psychosocial benefits of the group therapy format. Group therapy for communication disorders may offer other benefits not found in 1:1 treatment [38,39,47].

Discussion: changes based on time spent in the program…

- This is something other studies have not explored, and the findings must be considered preliminary due to the small number of participants.
- The number of weeks in the program predicted a change in conversational loudness with increased time in the program resulting in increases in conversational loudness.
- For vocal intensity of /ɑ/, percent intelligibility, and VHI scores, the amount of time in the program did not predict a significant change. Rather, these variables remained stable during participation in the LOUD Crowd® program.

Limitations

- Lack of a control group
- Small sample size
  - A future study should include data from a larger number of participants over a longer period of time. In addition, those individuals who complete the SPEAK OUT!® program and choose not to go on to LOUD Crowd® could serve as controls, greatly strengthening the study.
- Home practice as a variable
- Completion of VHI protocols

Conclusions

- The results of the present study suggested that the LOUD Crowd® program is effective for maintaining vocal loudness and speech intelligibility in individuals with Parkinson's disease (PD) after they have completed the SPEAK OUT!® program.
- A comparison of pre-LOUD Crowd® test measures to measures taken after 1 semester (approximately 3 months) of participating in LOUD Crowd®, revealed maintenance and stability for vocal intensity of sustained /ɑ/ productions, speech intelligibility, and VHI scores. There was a slight decrease in conversational loudness noted.
- A comparison of measures gathered at the end of their final semester of continuous enrollment in the program with maintenance probe measures taken after 2 months of non-participation revealed that there were no significant changes for conversational intelligibility and VHI scores. However, a statistically significant decrease was noted for vocal loudness during sustained /ɑ/ productions and conversational speech samples following 2 months of non-participation. This may support the importance of ongoing participation in a program that emphasizes maintenance of vocal loudness in individuals with PD.

Questions??

References

- A detailed reference list will be provided as a separate document