Online Journal of Interprofessional Health Promotion

Volume 2 | Issue 2 Article 1

October 2020

Functional Performance in People with Parkinson's Disease: LSVT BIG for LIFE®

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Abstract

This study aimed to observe the effects that an LSVT BIG for LIFE® program had on functional performance and overall health related quality of life. Method. Seven participants with Parkinson's disease participated in onsite LSVT BIG for LIFE sessions throughout a 40-week program. Each session included the completion of seven LSVT BIG® exercises, one functional component task (sit to stand), a mindfulness activity, and a functional activity. Seven standardized assessments including the Box and Blocks Test (BBT), Falls Efficacy Scale (FES), Parkinson's Disease Questionnaire-39 (PDQ-39), Patient Specific Functional Scale (PSFS), Physical Performance Test (PPT), Timed Up and Go (TUG), and Short Blessed Test (SBT) were used to determine functional gains and self-perceived outcomes. Adherence to a homework protocol and verbal feedback regarding group dynamics were also recorded and analyzed. The results indicated a statistically significant change between pre- and post- test averages of the BBT and SBT. Clinically meaningful improvements in gross manual dexterity, functional performance during simulated activities of daily living, cognition, and self-perceived confidence during performance of daily tasks and health related quality of life were also found. A LSVT BIG for LIFE maintenance program may improve or maintain functional performance in people with Parkinson's disease. Because of the preliminary nature of this study and sample size, results could not be effectively generalized.

Functional Performance in People with Parkinson's Disease: LSVT BIG for LIFE

Parkinson's disease (PD) is a neurodegenerative disorder affecting approximately one million Americans and over ten million people worldwide. PD is caused by decreased dopamine release in the brain that leads to a series of motor and non-motor impairments that affect how people with PD perform daily activities. Parkinson's disease is characterized by four primary motor symptoms including resting tremors, bradykinesia, rigidity, and postural instability and non-motor symptoms such as fatigue, depression, sleep disturbances, cognitive decline, dementia, and psychosis/hallucinations (American Parkinson Disease Association, 2019b; Waite, 2014).

Individuals diagnosed with PD generally seek rehabilitation which may include receiving occupational therapy services (American Parkinson Disease Association, 2019a). Occupational therapy is a traditional form of treatment focused on increasing the ability to engage in meaningful activities (Sturkenboom et al., 2013). Sturkenboom et al. (2014) conducted a randomized controlled trial aimed at assessing the effects of a home-based occupational therapy program on improving performance of daily activities in people with PD when compared to a group that did not receive occupational therapy. Using the Canadian Occupational Performance Measure (COPM), results showed self-perceived improvements in performance, and satisfaction with that performance, during activities of daily living in the intervention group; however, the overall body of research on the effectiveness of occupational therapy with this population remains limited. (Sturkenboom et al. 2013).

An adequate amount of empirical evidence demonstrating the positive effects of nontraditional interventions on motor and cognitive impairments in people with PD is available. Nontraditional interventions are defined as interventions that may use traditional exercise

approaches such as practicing balance, fine motor skills, or memory and integrating this into therapy in an unconventional manner (Combs et al., 2011). Activities such as boxing, dance, yoga, and tai chi have all been reported to improve performance skills when used as interventions with the Parkinson's population. Outcomes showed that using these nontraditional approaches resulted in improvements in balance, gait, activities of daily living, functional mobility, cognition, fatigue, freezing gait, walking backwards, and reducing the risk of falling (Combs et al., 2011; Gao et al., 2014; Hackney & Earhart, 2008; Hackney & Earhart, 2010; Romenets, Anang, Fereshtehnejad, Pelletier, & Postuma, 2015; Van Puymbroeck et al., 2018).

The Lee Silverman Voice Treatment (LSVT) BIG is a form of treatment used with the PD population focused on recalibrating the amplitude of movements and improving the motions required for small and large motor tasks. This program was created after the development of the Lee Silverman Voice Treatment LOUD® intervention that was developed to increase the volume and amplitude of speech in those with Parkinson's disease (LSVT Global, Inc., 2019a). LSVT BIG is performed in one-hour sessions, four times a week, for four weeks, and consists of seven standardized exercises, functional component tasks, walking BIG, and individualized hierarchy tasks that are led by an LSVT BIG certified clinician. All exercises are focused on large trunk movements and are categorized as repetitive, sustained, or functional. In addition to the clinician-led sessions, participants are encouraged to adhere to a homework protocol, performed twice daily, that includes the same components as an in-clinic session (LSVT Global, Inc., 2016b). To maintain benefits after completion of the LSVT BIG program, individuals with PD can join a LSVT BIG for LIFE community-based exercise group. LSVT BIG for LIFE groups consist of the LSVT BIG exercises and various functional activities that are intended to maintain and maximize independence and quality of life (LSVT Global, Inc., 2019a).

There is currently no literature regarding the effectiveness of the LSVT BIG for LIFE maintenance program specifically; however, though limited, there are studies addressing the benefits of the four-week LSVT BIG program. In a case series performed by Janssens, Malfroid, Nyffeler, Bohlhalter, & Vanbellingen (2014) it was found that the LSVT BIG program either maintained or improved gait, balance, and bed mobility in three males with PD. Doucet, Blanchard, & Bienvenu (2021) performed a chart review of people with PD that completed the LSVT BIG program. Improvements in manipulation skills, grip strength, and self-perceived performance and satisfaction with that performance during individualized daily activities, such as handwriting, lower extremity dressing, buttoning, and manipulating fasteners, were found after completion. This research provides evidence that the LSVT BIG protocol can be used to manage Parkinson's symptoms, yet due to the lack of effectiveness literature on the LSVT BIG for LIFE program, further research is crucial to evaluate the benefits of a maintenance program for individuals with PD. Therefore, the purpose of this study was to contribute to the body of research by providing a total of twelve LSVT BIG for LIFE group sessions to seven people with PD over a 40-week period to assess the program's effectiveness on improving functional performance of daily tasks and health related quality of life. We hypothesized that participation in a LSVT BIG for LIFE program would maintain or improve functions of daily living by enhancing functional mobility and balance, cognition, gross manual dexterity, daily task performance, and self-perceived health related quality of life.

Method

Research Design

This study used a within-subject, pre/post design to observe the effects of a LSVT BIG for LIFE maintenance program on functional performance in people with Parkinson's disease.

Qualitative and quantitative data were collected over a 40-week period using seven functional assessments to determine longitudinal effects. This study was approved by the Institutional Review Board, and all participants provided written consent.

Participants

This study consisted of seven participants, five men and two women, with an average age of 68.57 +/- 5.19. Four of the seven individuals participated from Weeks 1 – 12 (Onsite session I, OS-I), Weeks 13 – 30 (Remote session, RS), and Weeks 31 – 40 (Onsite session II, OS-II). One individual only participated in OS-I, and two of the seven individuals only participated in OS-II. All participants were recruited through various community hospitals in the Greater New Orleans Area and the Louisiana State University Health Sciences Center—New Orleans (LSUHSC—NO) neurological clinic. Inclusion criteria required a primary diagnosis of Parkinson's disease and previous completion of the LSVT BIG program.

Instruments

Seven pre- and post- assessments were used to determine baseline conditions and track functional performance throughout a 40-week program. For all participants, pre-assessment scores were obtained during the initial session attended; post-assessment scores were obtained during the final session attended. Information regarding each assessment can be found in Table 1. In addition, a standard activity log retrieved from LSVT Global, Inc. (2016a) was administered to each participant to self-track weekly adherence with the LSVT BIG for LIFE homework protocol, defined as: continued completion of the LSVT BIG homework protocol at least once a day for 10-15 minutes (LSVT Global, Inc., 2019b).

Table 1. Assessments

Instrument	Outcome Measure	Reliability/Validity

Timed Up and Go (TUG) (Podsiadlo & Richardson, 1991)	Used to assess balance, functional mobility, and risk for falling	Reliability: - Inter-rater reliability (r=0.99) (Bennie et al., 2003) - Intra-rater reliability (r=0.98) (Bennie et al., 2003) Validity: - Construct validity: TUG correlates with B.I. (Pearson r=-.79) (Steffen & Seney, 2008)
Patient Specific Functional Scale (PSFS) (Stratford, Gill, Westaway, & Binkley, 1995)	Self-reported questionnaire used to assess activity limitations and to measure functional outcomes	Reliability: - Test-retest reliability (ICC=.59) (Cleland, Whitman, Houser, Wainner, & Childs, 2012) - Inter-rater reliability (ICC2, 1=0.713) (Hefford, Abbott, Arnold, & Baxter, 2012) Validity: - Convergent validity with the G.R.C. (r=.69) (Cleland, Whitman, Houser, Wainner, & Childs, 2012)
Box and Blocks (BBT) (Mathiowetz, Volland, Kashman, & Weber, 1985)	Used to assess unilateral gross manual dexterity	Reliability: - Test-retest reliability for right hands (ICC=0.96) (Mathiowetz, Volland, Kashman, & Weber, 1985) - Inter-rater reliability for right hands (r=1.000) and left hands (r=0.999) (Mathiowetz, Volland, Kashman, & Weber, 1985) Validity: - Construct validity: the Box and Blocks test correlates with the M.R.M.T. (r=0.91) (Mathiowetz, Volland, Kashman, & Weber, 1985)
Parkinson's Disease Questionnaire-39 (PDQ-39) (Bushnell & Martin, 1999)	Self-reported questionnaire assessing health related quality of life in people with Parkinson's disease	Reliability: - Test-retest reliability (r=0.86-0.95) (Bushnell & Martin, 1999) Validity: - Convergent validity: correlations between

		the PDQ-39 subscales and scales of the SF-36 (r between –0.32 and –0.88 (Bushnell & Martin, 1999)
Physical Performance Test (PPT) (Reuben & Siu, 1990)	Used to assess functional impairments and functional capacity through the performance of simulated activities of daily living	Reliability: - Inter-rater (r=0.99) (Reuben & Siu, 1990) - Test-retest (ICC=0.895) for 9-point scale (Paschal, Oswald, Siegmund, Siegmund, & Threlkeld, 2006) Validity: - Criterion validity: correlation with basic Katz ADL (r=0.65) (Reuben & Siu, 1990)
Falls Efficacy Scale (FES) (Tinetti, Richman, & Powell, 1990)	Self-reported questionnaire used to assess fear of falling	Reliability: - Test-retest (r=0.71) (Tinetti, Richman, & Powell, 1990) Validity - Convergent validity: correlates with ABC Scale (r=0.84) (Morgan, Friscia, Whitney, Furman, & Sparto, 2013)
Short Blessed Test (SBT) (Katzman et al., 1983)	Screening for cognitive impairment that assesses orientation, attention, and short-term memory	Reliability: not available Validity: - Construct validity: no significant difference between SBT scores and BADL scores (Pearsons r=0.23) (Wade & Vergis, 1999)

Note. B.I. – Barthel Index; G.R.C. – Global Rating of Change; M.R.M.T. – Minnesota Rate of Manipulation Test; SF-36 – Short Form 36; Katz ADL – Katz Activities of Daily Living; ABC – Activities Specific Balance Scale; SAFE – Survey and Fear of Falling in the Elderly; BADL – Barthel ADLs

Supplemental Questions

On the last session of OS-I and OS-II, participants provided feedback regarding group dynamics and thoughts on group sessions after being prompted by informal questions from the group facilitator. Answers provided by participants were recorded and analyzed by the research team to create proper adjustments for future LSVT BIG for LIFE sessions.

Procedures

The LSVT BIG for LIFE program took place over the course of 40-weeks. OS-I and OS-II each consisted of six LSVT BIG for LIFE sessions lasting one-hour each, and adherence to the LSVT BIG for LIFE homework protocol was recorded. RS did not include any group sessions due to the majority of the participants being unavailable during the summer months. However, during RS, all researchers maintained correspondence with participants from OS-I and continued to track adherence to the homework protocol.

Administration of the battery of assessments (Table 1) required approximately one-hour to complete and took place on the eighth floor of the Allied Health building at LSUHSC—NO. All results were recorded manually then transferred electronically for further analysis. During the 40-week program, each of the 12 group sessions consisted of the seven LSVT BIG exercises, one functional component task (sit to stand), a mindfulness activity, and a purposeful activity focused on a symptom associated with Parkinson's disease. Purposeful tasks included activities such as tai chi, dance, and circuit training to challenge balance, incorporate high amplitude movements, enhance functional mobility, and stimulate cognition. Each participant was also encouraged to complete the seven LSVT BIG exercises and one functional component task at home, and record completion on the activity log, so functional gains could be tracked and analyzed.

Data Collection

The research team in this study consisted of six master of occupational therapy students attending LSUHSC—NO, two professors from the LSUHSC—NO occupational therapy department, and one community occupational therapist. All researchers on the project were LSVT BIG certified through online training. Prior to administration of the assessments (Table 1),

the research team discussed procedural dialogue and performed specific administration techniques for each assessment to ensure consistency between raters.

Data Analysis

A comparison of pre- and post- data was performed using a combination of parametric and non-parametric analysis. Outcome measures of BBT, PPT, and PDQ-39 yielded data that were normally distributed, therefore paired *t*-tests were used; the remainder of the outcomes yielded data that did not meet parametric assumptions, therefore Wilcoxon signed-rank tests were used. Effect size measures were also calculated using Cohen's *d* (Cohen, 1988). In addition, supplemental questions and participant responses were summarized, recorded, and analyzed to identify common themes and trends in narrative data.

Results

All seven individuals completed the program with varying levels of attendance and adherence. Because of ongoing recruitment and varying schedules, participants had differing start and end dates throughout the 40-week program. Data were gathered for each participant based on time enrolled in the study and the date pre- and post- assessments were administered. Attendance percentages were calculated based on number of sessions attended within each participant's start and end dates. Homework protocol adherence percentages were also calculated for each participant based on time enrolled (1 time/day X time enrolled). See Table 2 for attendance and adherence.

Participant outcomes, including pre- and post- assessment averages, change scores, significance levels, and effect size measures are noted in Table 3. Effect size determinations for Wilcoxon tests used .1 to indicate a small effect, .3 a moderate effect, and .5 a large effect; effect

size determinations for paired *t*-tests used .2 to indicate a small effect, .5 a moderate effect, and .8 a large effect (Cohen, 1988).

Table 2. Onsite Attendance & At Home Adherence to LSVT BIG for LIFE Program

Participants	Sessions Enrolled	Attendance (sessions)	Adherence to Homework Protocol
1	OS-I, RS, OS-II	91.7%	89.4%
2	OS-I	66.7%	5.2%*
3	OS-I, RS, OS-II	72.7%	2.9%*
4	OS-I, RS, OS-II	100%	57.6%+
5	OS-I, RS, OS-II	80%	66.2%+
6	OS-II	100%	124.7%
7	OS-II	100%	100.0%+

Note. OS-I = onsite session I; RS = remote session; OS-II = onsite session II; participant percentages were calculated individually based on specific start and end dates
* Participant verbally reported not performing home exercises as recommended, but no logs were submitted; adherence shown was based on number of times exercises were performed during onsite sessions, per homework protocol.
+ Data regarding adherence to homework protocol were not reported during specific time frames within the 40 weeks.

Table 3. Participant Assessment Averages

Instrument	Pretest Median (Q1, Q3) n=7	Posttest Median (Q1, Q3) n=7	Δ	*p*	Effect Size Measure (Cohen's *d*)
TUG † (secs)	9.2 (7.9, 13.7)	10.2 (9.7, 13.1)	1.0	0.22	0.51
PSFS (raw score)	3.0 (2.0, 5.0)	5.0 (3.0, 6.0)	2.0	0.11	0.43
FES † (raw score)	24.0 (12.0, 45.0)	17.0 (10.0, 36.0)	−7.0	0.22	0.37

SBT † (raw score)	2.0 (2.0, 4.0)	0.0 (0.0, 2.0)	−2.0	0.03*	0.62
	Pretest M (sd) n=7	**Posttest M (sd) n=7**	**Δ**	***p***	**Effect Size Measure (Cohen's *d*)**
BBT Dominant hand (number of blocks)	39.1 (13.52)	43.4 (12.53)	4.3	0.03*	0.33
BBT Non-dominant hand (number of blocks)	37.6 (13.15)	38.1 (15.09)	0.5	0.85	0.04
PDQ-39 † (percentage)	21.2 (18.25)	21.4 (15.40)	0.2%	0.96	0.01
PPT (raw score)	22.9 (5.96)	22.0 (7.37)	−0.9	0.52	0.13

Note. TUG = Timed Up and Go; PSFS = Patient Specific Functional Scale; BBT = Box and Blocks Test; PDQ-39 = Parkinson's Disease Questionnaire – 39; PPT = Physical Performance Test; FES = Falls Efficacy Scale; SBT = Short Blessed Test. † Lower scores = better performance * Significant results $p < .05$

During the final session of OS-I, qualitative data were obtained from participants 1 through 5 using specific questions prompted by the group facilitator. Questions included: "How did you feel about the group?", "What did you like about the group?" and "What activities did you like?" General analysis of responses included enjoying the activities, the exercises, and the structure of the group. Participants also reported feeling more motivated to be active in daily life. The most frequently used words from the participant responses following the OS-I sessions included "enjoyed," "activities," and "exercise."

Qualitative data were obtained again from participants 1, 3, 4, 6, & 7 on each individual's final session of OS-II. Questions were prompted by the group facilitator and remained consistent with OS-I. General analysis of responses included enjoying the variety of activities, the researcher's group dynamic, and the overall atmosphere of each session. The most frequently

used words from the participant responses following the OS-II sessions were “challenge,” “activities,” and “BIG walking.”

Discussion

This study aimed to determine the functional outcomes of seven participants with PD after participating in a 40-week LSVT BIG for LIFE maintenance program. Due to the progressive nature of this disease, maintaining or improving current functional status was considered a positive outcome. Data were obtained using both participant-reported and clinician-reported measures. Generally, results showed that with increased attendance to onsite sessions and adherence to the LSVT BIG for LIFE homework protocol, functional performance was maintained or improved. Clinically meaningful improvements in gross manual dexterity, functional performance during simulated activities of daily living, and cognition were found based on outcomes from the included assessments. In addition, self-reported scores on the PSFS, PDQ-39, and FES were found to be clinically meaningful, reflecting increased confidence during performance of daily activities and health related quality of life. There was a statistically significant change between the pre- and post- test averages of the BBT (dominant hand; $p = .03$) and the SBT ($p = .03$) and moderate to large effect sizes were seen in the TUG, PSFS, FES, and SBT outcomes despite not reaching significance. By maintaining and/or improving overall function and health related quality of life, results demonstrate that this program can be beneficial for people with PD.

There is currently a substantial lack of research regarding the effectiveness of the LSVT BIG exercise regimen for improving functional performance in people with PD and no published literature concerning the LSVT BIG for LIFE maintenance program. Results of this study were similar to a case series performed by Fishel, Hotchkiss, & Brown (2020) that used the LSVT

BIG protocol. The results from both studies found increased functional mobility, dynamic balance, and functional task performance using different outcome measures. In addition, neither study found statistical significance in health-related quality of life using the PDQ-39; however, participants from both studies noted improved performance during daily tasks and increased confidence during exercise. In contrast, Fishel et al. (2020) found decreased TUG scores (reduced fall risk), whereas the average change score from this study was increased; however, the increase was negligible and could be due to measurement error.

Although there is no literature regarding LSVT BIG for LIFE groups, there is evidence concerning the benefits of support groups for people with neurodegenerative diseases such as PD. Community-based group exercise classes are shown to increase quality of life for individuals with PD (Millage, Vesey, Finkelstein, & Anheluk, 2017). Qualitative data from this study reflect similar outcomes regarding participation in a group setting. A strong support group can be a valuable addition to traditional therapy and exercise by ameliorating the non-motor symptoms such as depression and anxiety as well as improving motor symptoms by motivating clients to complete therapeutic exercises (Artigas, Striebel, Hilbig, & Rieder, 2015). This evidence validates that there are additional benefits that can be gained through participation in a group format such as that provided through an LSVT BIG for LIFE program.

There were limitations to this study that should be considered. Because the stage of PD for each individual was not determined using the Hoehn and Yahr scale, the results obtained in this study could have been influenced by the varying stages of the disease among each participant. In addition, individual medication schedules and changes in medication regimen were not taken into account during this study. Therefore, the researchers did not know whether the participants were on an on or off medication cycle while administering pre- and post-

assessments or during group sessions. Conflicting participants' schedules affected attendance to onsite sessions as well as adherence to the homework protocol; this made it difficult to maintain consistency among gathered data. Finally, this study used convenience sampling to recruit participants, resulting in a limited sample size. Because of this small sample size, the power of statistical tests is limited. However, based on the effect sizes calculated for each assessment, results suggest that this type of intervention can be used to improve function. Due to the limited number of onsite sessions available throughout this research study, future research should consider a more consistent schedule by increasing the frequency of onsite sessions held. Future researchers should also consider these limitations to further enhance research regarding the benefits of a LSVT BIG for LIFE maintenance program. Despite these limitations, this is the first study examining the effects a LSVT BIG for LIFE maintenance program has on functional performance in people with PD. This information is meaningful for practice because it provides clinicians a viable and potentially effective intervention that can be easily implemented to improve function of persons with PD.

Acknowledgment

We gratefully acknowledge the contribution of Francine Bienvenu, LOTR, to this study. In addition to providing expert clinical guidance, she graciously assisted in student supervision and oversight of sessions. This project could not have been completed without her involvement and for that we are truly appreciative.

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