

**THE EFFECT OF A NON-CONTACT BOXING PROGRAM ON THE SELF-
PERCEIVED QUALITY OF LIFE IN INDIVIDUALS WITH PARKINSON'S
DISEASE**

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Abstract

Non-contact boxing programs have become a forced, intense exercise option for individuals with Parkinson's disease looking to delay the disease symptoms. Many studies focused on how forced, intense exercise can impact the motor symptoms for individuals with Parkinson's disease, but few have studied its impact on non-motor symptoms, such as socialization and independence with activities of daily living (ADL). This study focused on how a non-contact boxing program impacts the self-perception of quality of life, to include ADL independence and socialization. A mixed method convergent design guided quantitative and qualitative data collection through questionnaires, discussion groups and phone interviews. The quantitative findings indicated that the 14 study participants' pre/post PDQ-39 subdomain scores of ADL and social, increased over time indicating a worsening of symptoms. These findings are in alignment with the natural progression of Parkinson's disease. The qualitative findings of this study are in direct contradiction to the quantitative findings. The themes and patterns identified during the discussion groups revealed that participants felt their ADL independence and social skills have improved from their participation in the a Parkinsons disease boxing program. These qualitative results support Bandura's Social Cognitive Theory views of environment, behavior and personal factors influencing and changing a chosen outcome. This study's findings indicate that a non-contact boxing program can facilitate positive self-perception of quality of life, specifically ADL independence and socialization and has the ability to be a positive intervention for those with Parkinson's disease.

Keywords: non-contact boxing therapy, activities of daily living (ADL), Forced intense exercise, neurodegenerative disease, occupational therapy, Parkinson's disease

The Effect of a Non-Contact Boxing Program on The Self-Perceived Quality of Life in Individuals with Parkinson's Disease

Introduction

Forced, intense exercise has gained popularity in recent years as a treatment alternative for neurodegenerative diseases, such as stroke, dementia, and Parkinson's disease (PD). In particular, a more recent alternative treatment method has been non-contact boxing therapy for individuals with Parkinson's disease¹ (Ahlskog, Geda, Graff-Radford, & Petersen, 2011). Ahlskog et al.¹ (2011) found the benefits of this alternative intervention included reduced or delayed disease symptomology and the improved overall functional status of individuals with PD. Understanding how non-contact boxing affects other aspects of the lives of individuals with PD may provide insights to both those individuals and occupational therapists regarding this available intervention option.

Parkinson's disease affects 60,000 new people each year, with 1 in 100 people over the age of 60 being diagnosed with this neurodegenerative disease² (Elbaz, Carcaillon, Kab & Moisan, 2016). There is no singular cause of PD, just as there is no set progression of the disease or its symptoms for those individuals that are affected² (Elbaz et al., 2016). A person first, multidisciplinary treatment approach customized to each individual is warranted and recommended to address areas of mobility, daily living activities, strength, balance, and the individual needs of the client³ (Sturkenboom et al. 2014). While occupational therapists often conduct this type of treatment, it is not a stand-alone intervention and the disease often requires multiple treatment options⁴ (Foster, Bedekar & Tickle-Degnen, 2014). Non-contact boxing as an intervention has shown to combat the symptoms associated with PD, such as balance and gait. However, there is little focus on the impact of a boxing therapy program on the self-perceived quality of life, specifically ADL independence and socialization in individuals with Parkinson's disease.

Purpose of the Study

The purpose of this mixed methods study was to explore how a non-contact boxing therapy program can impact the self-perception of ADL independence and socialization among individuals with Parkinson's disease. This was achieved using a mixed method convergent design approach to explore the self-perceived quality of life of individuals with the equivalent to Stage II PD, who are involved in a non-contact boxing therapy program. This convergent research design involved the collection and comparison of quantitative and qualitative data to analyze and interpret the results about self-perceived quality of life from pre-program assessment to current status in the intervention. The study also explored perceptions of how a forced, intense exercise program using non-contact boxing affected the quality of life in individuals with PD specifically ADL independence and socialization.

Literature Review

The progression of Parkinson's disease is diverse, complex and unique for each person. Due to that diversity and the importance of individualizing treatment to each person, occupational therapy (OT) is one choice to provide a client-centered approach, custom designed to focus on mobility, activities of daily living (ADL), self-care, socialization and other work-related or meaningful activities³ (Sturkenboom et al. 2014). The combination of the expertise of OT with the innovative nature of forced, intense exercise can provide individuals with PD an intervention that is solely concentrated on his/her specific disease process.

The inclusion of forced, intense exercise with traditional therapy interventions have been shown to improve cognition, gait, and balance in people with PD⁴⁻⁷ (Kunkel et al., 2018; Kurt, Büyükturan, Büyükturan, Erdem & Tuncay, 2018; Li et al., 2012; Moriello, Denio, Abraham, DeFrancesco &

Townsend, 2013). This improvement in cognition, gait and balance has been attributed to high intensity exercises and their positive influence on the brain's activity dependent neuroplasticity resulting in improved motor and non-motor function⁸ (Fisher et al., 2008). The addition of a forced, intense exercise such as non-contact boxing provides individuals the opportunity to impact their disease symptoms and possibly improve their overall function for daily activities.

Combs et al. (2011) and Seibert, Calzacorta, Jones and Johnson (2017) identified non-contact boxing therapy intervention as a beneficial alternative treatment due to its whole-body movements, strength and endurance requirements and its residual effect on functional physical outcomes.⁹⁻¹⁰ The authors indicated that the use of forced, intense exercise and more specifically, non-contact boxing, results in the improvement of symptoms of PD⁹ (Combs et al., 2011). Reviews by Lizoń, Cholewa and Uher (2017) and Murray, Sacheli, Eng and Stoessl (2014) found a positive link between exercise and increased social participation and executive functions, which equated to an improvement in quality of life of individuals with PD. The relationship between exercise and decreased motor symptoms in individuals with PD has been studied with positive effects and resulted in increased overall physical function and ability to socialize with others¹¹⁻¹⁴ (Lizoń et al., 2017; Murray et al., 2014; Ayan, Varela, Vila, Seijo-Martinez & Cancela, 2016, Hirsch, Iyer & Sanjak, 2016)¹².

Boxing Therapy and Parkinson's Disease

Forced, intense exercise interventions have gained in popularity and studies have been conducted with the purpose of examining the effects of various forms of exercise on the motor and non-motor symptoms of Parkinson's disease. The results of those studies revealed that if exercise in conjunction with traditional therapies is intense enough, can have a positive and beneficial effect on the gross motor outcomes for patients with PD^{15-17,9} (Iar, Bega & Slowey, 2018; Janyacharoen, Srisamai & Sawanyawisuth; 2018; Seibert, Calzacorta, Jones & Johnson, 2017).

The effects of physical exercise are known to lead to remarkable health related benefits in healthy individuals as well as those less healthy. The neuroprotective properties that exercise has on the dopamine levels of the brain is encouraging and studies have shown that maintaining high levels of physical exercise from young adulthood lowers one's risk for PD^{12,18} (Alberts, Linder, Penko, Lowe & Phillips, 2011; Hirsch et al., 2016). These exercise-induced changes in the brain can oftentimes improve symptoms of PD. It has been further studied that the combination of aerobic and skilled exercise has the most effect on neuroplasticity in the brain, resulting in motor and cognitive improvements, facilitating brain repair and modifying the disease progression^{12,19} (Hirsch et al., 2016; Petzinger et al., 2015).

There have been many studies using various forms of forced, intense exercise with individuals with PD, such as Tai Chi, Ai Chi, Yoga, dance and music therapy, LSVT BIG, aerobic exercise, aquatics, and boxing therapy. Researchers have found that involving the above interventions resulted in improved postural stability, balance, increased motivation and quality of life, improved cognition, gait and gait related activities, and the ability to stay in the workforce longer^{5,7,8,20-21} (de Dreu, van de Wilk, Poppe, Kwakkel & van Wegen, 2012; Ebersbach et al., 2014; Kunkel et al., 2018; Kurt et al., 2018; Li et al., 2012; Moriello et al., 2013).

An encouraging example of these interventions is boxing therapy. Non-contact boxing programs are used in addition to pharmacological PD treatments and provide support of its beneficial impacts for its clients. The success behind non-contact boxing therapy for those experiencing symptoms of PD is its promotion of high levels of endurance, explosive strength, and whole-body movements coordinating both the upper and lower body. The integration of those movements counteracts and challenges the

symptoms of PD and acts as an effective intervention in conjunction with traditional treatments for improving function in clients^{10,22} (Combs et al., 2011; Sheehy, McDonough & Zauber., 2017).

Boxing in and of itself, is a sport that requires flexibility, coordination and weight shifting in order to produce results. The use of non-contact boxing therapy for people with PD, even though modified in its delivery, is still intense and taxing on the body and a challenge for all individuals who choose to experience it. It is because of that high intensity, full body workout that individuals with PD are showing positive results²² (Sheehy et al., 2017).

In a case study by Combs et al. (2011) six subjects with idiopathic PD participated in 24-36 boxing training sessions for 12 weeks; each session was 90 minutes in length. The sessions consisted of boxing drills, stretching, strengthening and endurance exercises. Patients were tested at baseline, 12, 24 and 36 weeks using the Functional Reach test, Berg Balance Scale, Activities-specific Balance Confidence Scale, Time Up and Go, Six-Minute Walk Test, gait speed, cadence, stride length, step width, activities of daily living and motor exam subscales of the UPDRS and the Parkinson's Disease Quality of Life questionnaire (PDQL)¹⁰ (Combs et al., 2011). The six subjects in this study demonstrated short term and long-term improvements in balance, gait, ADLs, and quality of life and continued to make improvements up to the 36-week tests¹⁰ (Combs et al., 2011). These positive outcomes were attributed to the full body approach of the boxing intervention¹⁰ (Combs et al., 2011).

Seibert, Calzacorta, Jones & Johnson (2017) investigated 12 participants with PD enrolled in a PD boxing program for one year. Individuals participated in weekly exercise classes, observations and interviews every three months. Study subjects demonstrated improvements in balance, picking up objects, walking, and sit to stand transitions. This intervention allowed the individual with PD to perceive themselves as a boxer rather than a victim of the disease¹¹ (Seibert et al., 2017).

Combs et al. (2013) conducted a prospective, single-blind, randomized controlled trial with 31 subjects with PD who agreed to 90 minutes of 24-36 exercise sessions over 12 weeks. Participants were randomly assigned to boxing training or traditional exercise groups. The traditional exercise group completed a warm-up, strength, endurance, balance and cool-down activities, while the boxing group completed a warm-up and then were led through a series of boxing-specific, and endurance activities followed by a cool-down²³ (Combs et al., 2013).

Data was collected one week prior to the start of the study and within one week of completion with the following assessments: Berg Balance Scale, Activities Specific Balance Confidence Scale, Timed Up and Go, Dual-Task Timed Up and Go, gait velocity, Six-Minute Walk Test, and the PDQL²³ (Combs et al., 2013). Results of this study revealed a significant difference between pre and post-tests in the exercise group for the Activities Specific Balance Confidence Scale²³ (Combs et al., 2013). In addition, both groups demonstrated statistically significant improvements in the Berg Balance, Timed Up and Go, Dual Task Timed Up and Go and PDQL. Only the boxing group demonstrated statistically significant improvements from pre to post-test scores in gait velocity and gait endurance on the six-minute walk test²³ (Combs et al., 2013). While this study showed great improvements in balance for the exercise group, boxing therapy remains a viable and feasible alternative for improving functional gait and endurance for individuals with PD²³ (Combs et al., 2013).

According to the literature, incorporation of a boxing therapy program provides those diagnosed with PD a new-found confidence and strength to fight back against a disease depriving them of their independence^{10,11,16,24-26} (Combs et al., 2011, 2013; Combs-Miller et al., 2019; Larson et al., 2018; Seibert et al., 2017; Shultz, Stoner, Lambrick & Lane, 2014). The use of boxing therapy as a treatment intervention for PD to decrease or delay cognitive and physical decline is a practice that is practical and

effective in the roles and responsibilities of health care providers, specifically occupational therapists. It was the hope of this study that through the basic tenets of boxing, and its ability to provide the intensity, duration and support necessary for positive functional outcomes, resulted in self-perceived improvements in ADL independence, socialization and quality of life in individuals with PD. The exploration of this alternative treatment has the potential to be a benefit to the field of OT and how it treats PD in order to help their patients remain independent for longer.

A boxing therapy intervention that utilizes both aerobic and skilled exercises, demonstrates a beneficial effect on the neuroprotective properties in the brain, helps to protect dopamine cells and therefore enhance mood, decrease motor impairments, lessen fatigue, improve speech and quality of life and increase motivation and is a viable alternative for influencing function and increasing neuroplasticity^{10,22,27} (Combs et al., 2011, 2013; Farley, 2004; Sheehy et al., 2017). The potential of this intervention has not been fully explored and while further study of its effects on ADL tasks and social skills is warranted, it is the best alternative intervention available to those who are waiting on a cure for this debilitating disease.

Methodology

This study utilized a mixed methods approach, which allowed for the incorporation of quantitative and qualitative findings to provide a more in-depth understanding of how a non-contact boxing program impacts the individual and how occupational therapists may benefit from that knowledge and apply it in their practice. Creswell and Creswell (2018) define mixed methods research as “a collection of both qualitative (open-ended) and quantitative (closed-ended) data in response to research questions” (p. 215). This study incorporated a convergent design approach. It is considered convergent due to the order in which data was collected and analyzed. Using a convergent design, quantitative and qualitative data was collected at similar times, merged for comparison, and then completed an in-depth interpretation of the findings²⁷ (Creswell & Creswell, 2018). The rationale for employing a convergent design is to allow the researcher to establish a baseline at the beginning of a study with merged quantitative and qualitative findings in order to neutralize the known weakness of both methods and provide a more comprehensive interpretation of the results²⁸ (Creswell & Creswell, 2018). The design incorporated rigorous procedures for conducting quantitative and qualitative research, merging the findings from both types of research and understanding how those findings relate to a chosen theory²⁹ (Creswell, Plano Clark, Gutmann, & Hanson, 2003). Then those findings are used for the interpretation and synthesis of information in later chapters to answer the research questions of the study²⁸ (Creswell & Creswell, 2018).

Population and Sample

The population of interest for this study were those individuals with PD that were participating in a non-contact boxing program offered by a local boxing gym. The selection of study participants was completed through convenience sampling. Potential participants were recruited from a PD boxing program located in Escondido, CA and identified by their length of time enrolled in the boxing program. The purpose of identifying individuals by time in program allowed for an increase in meaningfulness and validity of the findings.

The boxing facility used their own classifications for Parkinson’s disease levels to place individuals with PD in the appropriate boxing class. The classification system used by the boxing gym was similar to the established stages developed by Hoehn and Yahr³⁰ (1967). For the purposes of this study, all participants were in Class 2, according to the boxing program class descriptions. The Hoehn and Yahr scale Stage II and PD boxing Class 2 are similar in level of dysfunction and symptoms seen in

individuals with PD. Table 3.1 shows a side by side comparison of Hoehn and Yahr (1967) stages and PD boxing class descriptions.

Inclusion and Exclusion Criteria

The participant pool was selected based on the following criteria: a) participants have a prior diagnosis of Parkinson's disease, b) participants must be enrolled in a PD boxing program for at least one year, c) participants must be in PD 2 Class of Parkinson's disease according to PD boxing class criteria (See Table 1), d) willing to engage in a guided discussion group and complete questionnaire. Exclusion criteria for this study were any participant who scored below 19 on the Mini Mental State Exam, to indicate impaired cognition or did not complete all necessary requirements for the quantitative and qualitative portions of this study. For the purpose of this study the MMSE was used solely as an exclusion criteria.

Instrumentation

Quantitative Data

The PDQ-39 is the most widely used disease specific measurement tool for PD that identifies eight subdomains of patient health status: mobility, activities of daily living, cognitions, bodily discomfort, communication, emotional well-being, stigma and social functions³¹ (Jenkinson, Fitzpatrick, Peto, Greenhall, & Hyman, 1997).

For this study, activities of daily living (ADL) and social subdomains of the PDQ-39 were utilized to represent participants' independence in daily tasks (ADL) and socialization with others (social). These subdomains of the PDQ-39 consist of six questions for the ADL domain and three questions for the social domain, with a 5-point Likert Scale ("never" = 0; to "always" = 4).

Qualitative Data

Qualitative data collection strategies for the study included guided discussion groups and a phone interview that utilized open-ended questions to enhance the understanding and merged those insights with the quantitative data. Qualitative inquiry through guided discussion helped to facilitate and identify common themes amongst program participants.

The discussion groups for the current study were held at the PD boxing gym, which provided participants a well-known and comfortable environment. This researcher provided a professional but casual atmosphere to allow for full engagement of the participants in the discussion.

A script with questions for the guided discussion groups and phone interview was developed from the research questions, peer reviewed by two colleagues; an OT and PT, experts in the area of geriatrics, as well as an OT professor at Eastern Kentucky University who recently completed a study on non-contact boxing. The discussion script was consistent to ensure that the same open-ended questions were asked to all participants in all groups, making the data more easily analyzed and interpreted.

Data Collection

Once IRB approval was granted and informed consent documents were signed, the researcher began collecting the quantitative and qualitative data which included (a) the Mini Mental State Exam for exclusion criteria, (b) pre-program PDQ-39 assessment information obtained by permission from the boxing gym (c) administered a current PDQ-39, (d) and guided discussion groups and phone interview. The MMSE was administered in person at the PD boxing gym before the current PDQ-39 were administered. Each participant completed the MMSE with either the researcher or research assistant. All 14 participants scored between 24-30 on the MMSE, which is within normal limits for this test and met the inclusion criteria for this study³² (Folstein, Folstein, McHugh & Fanjiang, 2001). Upon MMSE

confirmed eligibility, the participant's subdomain scores on the pre-enrollment PDQ-39 for the PD boxing program were obtained. The subdomains scores of the pre PDQ-39 were collected and placed into an Excel spreadsheet. The data was reviewed and then prepared for analysis utilizing the Statistical Package for Social Sciences (SPSS) version 26. Participants who met the inclusion criteria were asked to complete the current PDQ-39 questionnaire so that the subdomain scores of ADL and social could be used for the quantitative portion of this study.

For the qualitative data collection, all participants contributed in a guided discussion group. If a participant was unable to attend one of the scheduled discussion groups, an individual phone interview was completed at an agreed upon time. All discussion group and phone interview participants were asked the same open-ended questions. Participants were identified based on their length of time in the PD boxing program, e.g., one year or less, two years, three or more years. Participants were categorized for data analysis by length of time in the non-contact boxing program. However, the discussion groups were conducted with all three levels of time in the same groups. These guided discussion groups were conducted face-to-face at the PD boxing gym on a predetermined date and lasted no more than 60 minutes, the phone interview was completed within one week of the discussion groups.

At the beginning of each guided discussion group/phone interview, each participant was asked if they had any questions about the process, informed consent was reviewed and were notified that their responses would be recorded to aid in the accuracy and trustworthiness of the transcription. All participants gave permission for audio recording. No unusual circumstances were encountered during this data collection phase.

A total of two group discussions were completed; one large discussion group of 11 individuals and a smaller group of two were conducted at the boxing gym. In addition, one phone interview of one person was completed. All discussions and interviews were completed over a one-week period. All discussions included core questions and probing questions to help facilitate a better understanding of each participants experience with the PD boxing program and how it has impacted their lives.

Data Analysis

The primary method of data collection and analysis for the quantitative portion of the study was completed through the PDQ-39. The MMSE was used to rule out dementia for inclusion criteria with all participants scoring 24 or higher on the MMSE. These current subdomain scores were interpreted, analyzed and compared to the pre-enrollment PDQ-39 subdomain scores.

The primary source of qualitative data analysis was the recordings of the guided discussion groups and individual phone interview. The recorded discussions were transcribed via Descript software and then carefully read and coded by this researcher using constant comparative coding to identify common content, attitudes and processes. They were then grouped into similar categories to isolate common themes. Participants were assigned identification numbers from 01 – 14 for all PDQ-39 results in order to protect their identity.

Descriptive Statistics

There was a total of 14 participants for the quantitative and qualitative data analysis. Of the total number of participants, three were female and 11 were male. This corresponded with the Parkinson's Foundation literature revealing men are diagnosed with PD 1.5 times more than women³³ (Marras et al., 2018).

While age was not an inclusion criterion, the study participants age range was between 57 and 85 years old. The participants were placed into groups based on their length of time in the PD boxing program. Table 1 contains a description of the participants based on their group.

Table 1

Demographic Characteristics of the Participants

	Group 1 (1 year)	Group 2 (2 years)	Group 3 (3+ years)
# of Respondents	4	2	8
# of Males/Females	4/0	2/0	5/3

Quantitative Results

The mean and standard deviation (sd) of the pre and post ADL subdomain scores of participants that completed the PDQ-39 indicated an increase in the post ADL subdomain scores as compared to the pre subdomain scores (Table 2). This increase in subdomain scores suggest that participants perceived ADL independence as more of an issue over time. This is true of the degenerative nature of Parkinson's disease and the gradual decrease in function over time^{34,35} (Clarke, 2007; Giroux, 2019). While these scores only compared the total groups pre and post ADL subdomain scores and did not separate out differences among groups, the individual groups were also listed in Table 2 for comparison.

Table 2

Comparison of Pre and Post ADL Subdomain Scores by total Groups and individual Groups

		Mean	N	SD	Std Error Mean
Total	Pre ADL	20.832	14	17.753	4.74
	Post ADL	30.952	14	25.040	6.70
Group 1	Pre ADL	13.540	4	7.888	3.944
	Post ADL	28.125	4	20.796	10.398
Group 2	Pre ADL	47.91	2	2.94	N/A
	Post ADL	62.50	2	17.70	
Group 3	Pre ADL	17.707	8	17.501	6.187
	Post ADL	24.478	8	24.442	8.641

To determine if there was a significant difference in the total groups' and individual groups' ADL independence subdomain pre and post scores, a Paired Sample t-test was completed. All assumptions were met. The results of the Paired Sample t-test for all participants revealed no statistically significant difference between independence in ADL levels before and after participation in a boxing therapy program (Table 3).

Table 3

Paired Sample t-test results for total group, Group 1 and Group 3: ADL Subdomain

	Mean	SD	Std Error Mean	95% confidence Lower	95% confidence Upper	t	df	Sig.(2-tailed)
Total Pre/post	-10.12	18.03	4.81	-20.53	.290	-2.1	13	.056
Group 1	-14.60	12.95	6.50	-35.20	6.02	-2.25	3	.110
Group 3	-6.80	21.70	7.70	-24.91	11.40	-.883	7	.407

The results suggest that there was no difference in groups 1 and 3 pre and post test scores in the ADL subdomain of the PDQ-39 for individuals with PD, indicating length of time in the PD boxing program did not influence these scores.

Due to the small number of participants in group 2, a Wilcoxon Signed Rank Test was completed to determine if there was a significant difference between the pre and post scores for group 2 and ADL independence. The Wilcoxon Signed Ranks Test indicated that the ADL subdomain post-test scores for group 2 were significantly higher than the pre-test scores $Z = 3.00$, $p = .180$, which indicates no significant difference in the variables and suggests a worsening of ADL abilities.

The mean and standard deviation (sd) of the pre and post social subdomain scores of participants that completed the PDQ-39 indicated an increase or maintaining of the post social subdomain scores as compared to the pre subdomain scores (Table 4). This increase in subdomain scores suggest that participants perceived their social skills as more of an issue over time. This is also true of the degenerative nature of Parkinson's disease³⁴ (Clarke, 2007) and the onset of feelings of isolation and depression that the disease causes and contributes to the disease burden and poor quality of life³⁶ (Marinus, Zhu, Marras, Aarsland & van Hilten, 2018). While these scores only compared the total groups pre and post social subdomain scores and did not separate out differences among groups, the individual groups were also listed in Table 4 for comparison.

Table 4

Comparison of Pre and Post Social Subdomain Scores by total Groups and individual Groups

		Mean	N	SD	Std Error Mean
Total	Pre Social	8.9279	14	14.786	3.951
	Post Social	13.690	14	25.234	6.744
Group 1	Pre Social	20.832	4	22.048	11.024
	Post Social	20.832	4	24.999	12.50
Group 2	Pre Social	12.500	2	17.677	N/A
	Post Social	41.665	2	58.923	
Group 3	Pre Social	2.082	8	3.856	1.363
	Post Social	3.125	8	6.200	2.192

To determine if there was a significant difference in the total social subdomain pre and post scores from the PDQ-39 and the total group pre and post scores, a Paired Sample t-test was completed. All assumptions were met. The paired sample t-test revealed no statistically significant difference between socialization after participation in a non-contact boxing program (Table 5). A Paired Sample t-test was also completed for groups 1 and 3 to determine if length of time affected social scores. They revealed no statistically significant difference between socialization after the participation in a non-contact boxing program for group 1 and group 3.

Table 5

Paired Sample t-test: Social Subdomain

	Mean	SD	Std Error Mean	95% confidence Lower	95% confidence Upper	t	df	Sig.(2-tailed)
Total Pre/post	-4.762	16.90	4.51	-14.52	5.00	-1.055	13	.311
Group 1	.000	6.80	3.40	-10.82	10.82	.00	3	1.00
Group 3	-1.04	8.30	2.91	-7.94	5.90	-.357	7	.732

The results suggest that there was no improvement in groups 1 and 3 pre and post test scores in the social subdomain of the PDQ-39 for individuals with PD, indicating length of time in the PD boxing program did not influence these scores. Due to the low number of participants in group 2, a Wilcoxon Signed Rank Test summary was completed to determine if there was a relationship between the number of years of participation in a non-contact boxing program and socialization.

The Wilcoxon Signed Ranks Test indicated that the social subdomain post-test scores for group 2 were significantly higher than the pre-test scores $Z = 1.00$, $p = .317$, which indicates no significant difference in the variables and suggests a worsening of social skills.

To determine if there was an association between number of years participation in a non-contact boxing program and self-perception of ADL independence as measured by the ADL subdomain of the PDQ-39, the Spearman's Rank Order Correlation (Spearman's rho) was completed. Table 6 results showed no relationship between the number of years of participation and the independence score. Based on the results of the study, no statistically significant correlation was found between the number of years of participation in a boxing therapy program and independence as measured by the ADL subdomain score of the PDQ-39.

Table 6

Spearman's Rank Order Correlations: Independence (ADL)

	Groups	Post ADL		
Spearman's rho	Total Groups	Correlation Coefficient	1.000	-.164
	Post-ADL scores			

	Sig. (2-tailed)		.575
	N	14	14

To determine if there was an association between length of time in the boxing program and self-perception of socialization as measured by the social subdomain of the PDQ-39, the Spearman's Rank Order Correlation (Spearman's rho) was completed. Table 7 results showed there was no relationship between the number of years participation and the social score. Based on the results of the study, no statistically significant correlation was found between the number of years of participation in a boxing therapy program and socialization as measured by the social subdomain score of the PDQ-39.

Table 7
Spearman's Rank Order Correlations: Socialization (Social)

Groups	Post-social		
Spearman's rho	Total Groups	Correlation	1.000
	Post-Social scores	Coefficient	-.350
		Sig. (2-tailed)	.226
		N	14

Qualitative Results

Shortly following the completion of the PDQ-39, two guided discussion groups and one phone interview of the 14 participants were conducted to complete the qualitative portion of the study, which identified commonly used phrases and words from which codes were produced. Those codes were then categorized into two overall themes and four subthemes. All participant responses are represented in these codes and subsequent themes and subthemes. Two themes and four subthemes emerged from the discussion groups.

Two themes with subsequent subthemes emerged without bias or leading questions during the guided discussion groups and phone interview. The information gathered from the phone interview was consistent with the group discussions revealing similar codes and themes. Each subtheme was developed by common words and repeated phrases found in the transcripts. The subtheme consisted of codes and quotes to support the themes and thus support each research question. The words and phrases mentioned the most during the guided discussions and phone interview were as follows: exercise (x9), physically fit (x8), slows the progression (x7), confidence (x7), maintaining (x5), camaraderie (x5), fightback (x4), companionship (x4).

Theme 1: Group Independence and Support

Many of the participants spoke about how the PD boxing program has helped them maintain their level of independence. For example. Participant #05 remarked, "It's not so much getting better as it is maintaining what you have as long as you can." Participant #06 also commented on this topic, "What I don't know, is what if I wasn't doing this (program)? Would I be deteriorating as rapidly? I consider that I am not getting a lot worse, I am getting a little worse. But again, what I don't know is, if I wasn't doing this would I be going downhill really fast. I don't want to find out."

Participant #03 commented that staying active contributed to their overall independence in their daily lives despite the degenerative nature of the disease; "I've gotten a lot worse this last year. But I

wouldn't give up boxing because you don't know what would happen. So, I will still do this as long as I can."

Participant #10 spoke about the benefits of being part of a group, "Nobody gets down on each other, everybody picks each other up, supports each other.... it's all like a group thing, and to be a part of it is actually really helpful, super helpful."

Subtheme 1a: Sense of Physical Independence

Participant #03 spoke about being and staying active, "I've always been active and athletic, and I wanted to keep that as much as possible and I thought maybe this boxing would help me do some of the things that I was afraid to do before. It's great". Participant #13 stated, "I feel my energy is optimized. I am able to do more things." Participant #11 commented that her participation at the boxing gym made her realize how far the disease had progressed but because of her enrollment and consistent attendance she "can now jump rope and do the hula hoop again."

Subtheme 1b: Sense of Control of Their Situation

Participants found that the PD boxing program positively impacted their daily lives. For example, participant #01 felt that the boxing program influenced the disease progression, "I wanted to be as proactive as possible right from the start. I wanted to make sure that I stayed on top of whatever I could to stop the progression.

Another participant #07, commented on the benefits of this program, "It gives us strength and hope. I think that is what it is, and I know I feel that exercise is the only thing supposedly proven, that slows down the progression. So, to me it's like taking medicine but better because medicine doesn't always work."

Many participants remarked on the benefit of a routine and taking control of their health. Participant #08 commented, "It has helped me own my disease and take responsibility for new things that would impact me being healthier and more responsive." Participant #10 stated, "We're here saying we are doing this for me, for us, we are trying to take control of our self, of our condition and it's alright". The overall response from participants was overwhelmingly positive in favor of the PD boxing program for its perceived benefits and for the feeling of control it gives them in their daily lives.

Theme 2: Influencing Positive Social Interactions

When participants were asked what keeps them coming back to classes at the boxing gym, the overwhelming answer was the camaraderie the program provided and the friendships the members have gained. Participant #10 stated, "We have got to be out there doing something. Socializing is the best thing I think for us to do. I like to come in here and joke around with everybody and make everybody laugh". The same participant also remarked, "Nobody gets down on each other, everybody picks each other up, supports each other, we joke around, we laugh, we cuss, fight, whatever the case may be." Participant #01 stated, "Well in here my socialization has changed because there's no judgement. You see people that are farther along [in the disease process] and still doing the workouts and that has helped me connect with [others] rather than just be within myself. I've been doing this for a few years and then I became a coach just recently and so it's helped me". Participant #06 commented, "...for me the bigger part is the camaraderie with the group and seeing everybody in class. It's great. The physical conditioning, mental conditioning and camaraderie are what keeps me coming back".

Subtheme 2a: Sense of Belonging to a Group

The inclusion of being part of a group setting, where all participants are going through similar issues was a subtheme that came up often during the discussion groups and phone interviews. Participant #10 commented, "The coaches, camaraderie and the companionship of this group of people who know what

I'm going through and understand what's happening, keeps me coming back," is another supportive statement for the benefits the PD boxing program has on the socialization of its members.

There were many participants that commented on the dissemination of knowledge to members by the coaches and the information they receive from each other that also aides in group socialization as they talk about the newest study, the best doctors or difficulties they are having that day during class. Participant #12 stated, "It's just knowing that we understand each other. You don't have to explain a lot and we understand each other and then I think we learn so much from each other. I think just being able to go to a person and say I started having this, have you ever had it? What did you do to make it better? So, we are just helping each other." Participant #04 stated, "[The director] is a Parkinson's expert and so well-read on the topic, every conference she goes to she brings back information". Participant #09 commented, "[we talk] about the work that is being done and which doctors to avoid, that kind of underground information. It's a good place to pick up and share information".

Subtheme 2b: Sense of Solidarity

Participants often remarked on the importance of having others that understand the disease and are on a similar journey. Participant #09 stated, "you get to hear other people's horror stories and be scared together." Participant #07 commented, "Everybody's going through the same journey and battle and it helps me to see that there are some people that have had it [PD] for 17 years or 20 years and they're are still coming to the boxing gym. So, it gives me hope."

The overall feelings and experiences collected from the study participants during the discussion groups highlighted the positive impact that the non-contact boxing program had on those individual self-perceptions of ADL independence and socialization.

Conclusion

Forced, intense exercise is a topic that is both relevant and has the potential to provide individuals with PD a renewed sense of quality of life ^{1,6,37} (Ahlskog, 2018; Cascaes de Silva et al., 2016; Kurt et al., 2018). Participants of the study completed both quantitative and qualitative inquiries focused on their self-perception of quality of life with a focus on ADL independence and socialization. The findings of the quantitative portion of the study demonstrated a self-reported decline in all aspects of the respective PDQ-39 subdomains amongst all participants no matter the length of time in the boxing program. These results are in line with the degenerative nature of Parkinson's disease. Conversely, the results of the qualitative portion of the study contradict the quantitative findings, as participants verbalized positive feelings and attitudes toward their own perceived level of ADL independence and socialization. The difference in quantitative and qualitative findings demonstrate that the study participants' perception of their own personal quality of life does not align with the results of a valid and reliable measure, such as the PDQ-39. This indicated that perceived quality of life can be improved through interventions that are meaningful to the individual.

The results of the study revealed that length of time in a PD boxing program did not influence individual's self-perception of quality of life and that those in the program for one year verbalized similar feelings and experiences as those in the program for longer periods of time. Participants' responses were specifically in regard to the program itself and indicates a consistency in the value of the PD boxing program to its participants. Clarke et al. ³⁸ (2016) found that low-dose, patient-centered, goal-directed occupational therapy of 762 participants with mild to moderate PD for 15 months was not associated with immediate or clinically meaningful improvements in ADL or quality of life. The study also suggested that a more intense therapy program for individuals at all stages of PD would be beneficial for improvements in the areas of quality of life and ADLs. The study by Clarke et al. (2016)

support the results of this study in determining that length of time is not a factor in improvements in ADL independence, socialization or quality of life.

The quantitative data revealed an increase in ADL and social post PDQ-39 subdomain scores when compared to participants pre-PDQ-39 subdomain scores. This increase in subdomain scores from pre to post tests indicated that performance was declining in the areas of ADL and social. This decline may be attributed to the natural disease progression of PD, which may have impacted how each individual rated themselves on the assessment.

Cascaes da Silva et al.³⁷ (2016) found that while exercise had a positive impact on overall health related quality of life, areas of quality of life that were the most compromised according to the PDQ-39, were activities of daily living and social support subdomains. The findings by Cascaes da Silva et al. (2016) supports the quantitative findings of this study, as evident by the increase in pre to post-subdomain scores of study participants. No other studies measured the influence of a boxing therapy program on ADL independence or socialization.

The contradiction between quantitative and qualitative results could be that the PDQ-39 subdomain of ADL and social support only consists of a few items on the assessment tool, therefore, limiting a comprehensive assessment of those areas. A more comprehensive assessment of ADL independence and socialization may have found different results. In a comparison study by Eadie et al. (2018) the perceived social support and patient reported outcomes in quantitative and qualitative data for individuals with communication disorders such as PD found that the integration of both methods of study was important for interpreting results. Eadie et al. (2018) found that study results can differ due to the quantitative assessment tools not accounting for length of time living with the disease, treatment and course of the disease and incorporating a qualitative portion aids in exposing the feelings and perceptions of the individuals that the quantitative assessment cannot³⁹ (Eadie et al., 2018).

Lamotte et al.⁴⁰ (2015) completed a review using the PDQ-39 to measure QOL, failed to show any improvements in two studies looking at forced, intense exercise and PD. The authors questioned the sensitivity of the PDQ-39 assessment tool as an accurate measure of quality of life for PD. The results of Lamotte et al. (2015) study may help to explain the differences in findings of the study and the need for use of an assessment tool that has a larger focus on ADL independence and socialization skills for individuals with PD.

While Eadie et al. (2018) found that an increase in perceived social support had a positive effect on health-related quality of life among individuals with communication disorders. Conversely, the same study found an absence of social support had a negative impact on their overall perception of quality of life. The study by Eadie et al. (2018) supports a reason why the discrepancies exist in the current study and an increase in feelings of support aide in participants' overall perception of quality of life. The findings of Eadie et al. (2018) reinforce the themes found during the qualitative portion of the study and support the important influence that socialization can have on one's perceived quality of life.

The quantitative and qualitative results of the study diverge in regard to the perceived impact a non-contact boxing therapy program has on the quality of life, specifically ADL independence and socialization, of individuals with Parkinson's disease. The quantitative results of the PDQ-39 indicate a perceived worsening of overall quality of life among study participants; however, the qualitative results indicate a perceived improvement. These results may be indicative of the degenerative nature of Parkinson's disease and its impact on one's ability for functional independence. As indicated, the quantitative results showed no statistically significant difference in the length of time in the PD boxing program and the self-perception of quality of life; however, the qualitative results described a different

perception of how a PD boxing program has made an impact on ADL independence and socialization. During the guided discussion groups the majority of participants voiced their support of the PD boxing program and noted how it has helped them to delay symptoms and maintain a level of independence that medication alone could not provide.

The discrepancies found between the quantitative and qualitative findings may be attributed to the PDQ-39's focus on tasks that are completed in a home setting and does not have the individual apply those questions to tasks done outside of that setting. In contrast, the group discussion questions directly asked study participants to talk about how the PD boxing program made an impact on their ADL independence and socialization skills which resulted in contradictory responses.

The study results revealed that the feelings of support from others, having access to disease-related information and the friendships that the non-contact boxing therapy program provides its members differs from the quantitative data when looking at its impact on quality of life. The qualitative data supports the integration of this intervention for those with PD despite the reality of the disease progression. The study also explored qualitative factors, considering the self-perception amongst participants of the PD boxing program and how they felt the boxing program impacted their ADL independence and ability to socialize with others. Of those individuals that participated in the guided discussion groups and phone interview, all but one stated that their ADL independence and socialization skills have improved or been maintained since beginning the non-contact boxing therapy program.

The qualitative results indicated support for the positive impact the non-contact boxing intervention has had on participants perceived level of ADL independence and socialization despite the self-reported decline in the quantitative data. During the discussion groups and phone interviews, participants commented on having improved access to disease information and education on new studies on PD. The access to education is also a factor in the difference between the study findings. Navarro-Peternella and Marcon (2012) found that education and guidance programs for individuals with PD helped to improve their relationship with and understanding of the disease and therefore improved their quality of life. The authors also determined that health professionals that focus on improving the quality of life of individuals with PD produced a positive impact on quality of life and helped to reduce the impact of the disease ⁴¹ (Navarro-Peternella & Marcon, 2012). This access to education aids in participants' improved self-perception of their overall quality of life as compared to their reality of the disease process.

A study by Meinert and Hatkevich ⁴² (2019), authors found that a non-contact boxing program had positive impacts for seven individuals with PD on social engagements, mood, well-being and social connectedness. The study by Meinert and Hatkevich (2019) supports this current study and the positive impact non-contact boxing has on the non-motor symptoms of PD.

A phenomenological study conducted by Humphrey, Howell and Custer ⁴³ (2019) of 10 individuals with PD participating in a non-contact boxing program, found that the program allowed improved participant relationships, social activity and provided a feeling of support from others in similar situations. The study by Humphrey et al. (2019) supports this current study and the positive impact a non-contact boxing program can have on the socialization skills of those with PD.

The increase in self-reported scores could be that individuals score themselves based on lack of understanding of their abilities. Parveen and Goberman ⁴⁴ (2017) found that self-under-estimation of health-related quality of life in individuals with PD may be attributed to unawareness of abilities on their unaffected side, depression or apathy and denial of symptoms. Most of the study's participants'

pre and post ADL and social subdomain test scores increased over time indicating more of an issue in those areas.

While previous research has concluded that forced, intense exercise is beneficial to decreasing or delaying the severity of motor symptoms of Parkinson's disease and possibly preventing the onset of neurodegenerative diseases^{18,21,45-47} (Amara et al., 2018; Alberts et al., 2011; Cugusi et al., 2014; Ebersbach et al., 2010; Morberg, Jensen, Bode & Wermuth, 2014), limited research exists on forced, intense exercise and its impact on the overall quality of life in individuals with Parkinson's disease, specifically ADL independence and socialization.

This mixed methods study added to the existing body of knowledge of non-contact boxing therapy and PD. The merging of quantitative data for an objective measure of quality of life with qualitative data for a subjective measure of quality of life allowed for a comprehensive understanding of the impact this PD boxing program may have on its participants. The use of a mixed methods study provides the researcher the ability to observe the impact of non-contact boxing on PD through different lenses of data analysis. The effects a non-contact boxing therapy intervention can have on ADL independence and socialization amongst individuals with Parkinson's disease has not been the sole focus of any study. The utilization of a mixed methods study provided insight for occupational therapists to the quantitative vs. qualitative data discrepancies found between perception and reality of quality of life for individuals with PD. The study delved into the feelings and beliefs of those individuals with PD's self-perception of their quality of life while participating in a non-contact boxing intervention. Even though the quantitative findings revealed a decline in independent ADL function in study participants as seen in the ADL subdomain scores of the PDQ-39, with 78.6 % of the scores increasing from pre to post test, the qualitative findings showed an improved self-perception among study participants in the areas of ADL independence. In addition, quantitative results revealed four of the 14 participants or 28.6 % had an increase of their social domain scores indicating a decline in socialization. Results also revealed 10 of the 14 participants or 71.4 % maintained their scores for the social subdomain, indicating participants perceived that their ability to socialize has remained consistent through the PD boxing program. In contrast, qualitative study results revealed that all participants felt their social skills have improved because of their involvement in non-contact boxing.

Combs et al. (2013) completed a study that discovered an improvement over time in overall quality of life among individuals with PD during community-based exercise, which included boxing therapy. Participants of Combs et al. (2013) study completed the Parkinson's disease Quality of Life Scale which is a 37- item self-administered survey. However, the study did not examine boxing's effect on individual's ADL independence or socialization. The study by Combs et al. (2013) differs from this study in that their participants showed an improvement in overall quality of life influenced by improved motor function and regardless of their time in the boxing program. While Combs et al. (2013) overall improvement in quality of life supports the incorporation of a boxing therapy program for those with PD, it does not highlight its effect on an individual's self-perception of ADL independence and social skills.

The result of this mixed methods study found a disconnect between the quantitative and qualitative findings, indicating that despite the progressive nature of PD, the support and control individuals feel as a result of this non-contact boxing therapy intervention provided them with a heightened self-perception of their personal quality of life.

The available access to education about PD through the PD boxing program may contribute to the discrepancies in the findings. The members of the PD boxing program are well informed of the disease

progression, symptoms and latest interventions and treatments through the dedication of their coaches and gym staff. This easily accessible information helped in their understanding and acceptance of PD and by default, improved their personal relationships⁴⁰ (Navarro-Peternella & Marcon, 2012). This study supports the theme: Influencing Positive Social Interactions and the subtheme: Sense of Control of their Situation.

Another factor that may attribute to the difference in findings is the influence that discussion groups have on the participants. Memduhoglu, Kotluk and Yayla (2017) suggest that discussion groups have a significant effect on self-efficacy, improve one's ability to recognize and express problems and improve level of awareness and ability to seek alternative solutions.⁴⁸ The participation in the PD boxing program provides camaraderie to its participants such that their perception of their own personal ADL and social skills are elevated. That camaraderie may contribute to the increased self-perception of quality of life that emerged as a theme in the qualitative portion of the study. This finding supports the theme: Group Independence and Support; and subthemes: Sense of Belonging and Sense of Solidarity. Similarly, Bradbury-Jones, Sambrook and Irvine (2008), found that discussion groups allow participants to hear the opinions of others which help them to convey their own thoughts on a topic.⁴⁹ The authors also found that the use of group discussions "enhanced the credibility of their research by providing an environment that encouraged the interaction and clarification of dialogue among participants" (p. 666). The study by Bradbury-Jones et al. (2008) supports the subthemes: Sense of Belonging and Sense of Solidarity and allows participants to feel that they are not alone in their journey.

Summary

This mixed method convergent design study's quantitative findings determined that most individuals in the study self-reported their ADL independence and social skills as worsening as evident by their subdomain scores on the PDQ-39. These findings are in line with the natural neurodegenerative progression of PD and the decline in motor and non-motor functions (Clarke, 2007).

The study qualitatively determined that a non-contact boxing intervention provides its members a sense of community where they feel they are all on the same level, going through the same journey and supporting each other along the way. It is that environment that allows an individual to feel a sense of control over an often times overwhelming disease and to feel that they can change the outcome for as long as they are able. The qualitative findings of the study support Bandura's idea that a change in the environment and behaviors can produce a positive impact on one's self-perception of ADL independence and socialization despite the natural disease progression of PD. Bandura's (1986;1999) belief that a change in social environment can positively impact behaviors and provide a sense of control over a situation is in line with the study's results.^{50,51}

Bandura's SCT helps to make sense of the discrepancies in the study as it is one of the most widely implemented theoretical frameworks for understanding physical activity behavior⁵² (Uszynski et al. 2018). Uszynski et al. (2018) found that one's self-efficacy is an important factor in improving physical activity which emboldens an individual's ability to cope with challenges which then helps to improve their self-perception of quality of life. It is that change in self-perception that modifies an individual's outlook and actions toward their disease. For the results of the study, the qualitative findings support Bandura's theory that a positive change in environment has a reciprocal effect on behavior. This result was verbalized by the study participants in the group discussions and phone interview and was contradictory to the quantitative findings, revealing that perception is often reality.

The study established that despite the discrepancies found between the quantitative and qualitative data due to the degenerative nature of the disease and that the study only focused on ADL independence and

socialization and not motor skill benefits, a non-contact boxing program has the potential to instill a sense of empowerment to take control of their situation, leading to an improved self-perceived quality of life. This intervention is an invaluable asset to traditional treatment interventions and should be encouraged by occupational therapists to advocate and educate their clients with PD to its potential positive impact on quality of life and remaining independent for as long as possible.

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