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Relationship between Hope and Exercise in Physically Active Adults with Parkinson's Disease

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Under the direction of the research advisor:

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A Research Project Entitled

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By

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Abstract

This study examined exercise as it relates to hope and optimism among persons with neurodegenerative diseases, such as Parkinson's disease (PD). The purposes of this study were: 1) To determine the relationships between hope, optimism, and exercise-related factors, in persons with PD and, 2) To determine if differences in levels of hope, optimism, and quality of life exist between individuals with PD who choose different primary modes of exercise. An attempt to clarify the status of literature, researchers conducted a non-experimental, prospective, cohort study with a cross-sectional design that focused on exercise organizations for persons with PD that focused on non-contact boxing compared to traditional exercise. Participants participated in a single testing session, including self-report questionnaires and performance-based tests, as well as collecting demographics including exercise related variables (e.g., minutes of exercise per week, intensity, and type of exercise). Minutes of exercise per week was positively and fairly correlated with optimism. Boxers, as compared to non-boxers, were found to have higher levels of hope as well as a better perception of quality of life. The findings of this study suggest that optimism and hope levels were positively affected due to participating in exercise, in particular, for the boxers group.

Introduction

Parkinson's disease (PD) is a neurodegenerative disease that is present in more than one million people within the United States (Baatile, Langbein, Weaver, Maloney, & Jost, 2000). The disease is expressed by signs of tremors, rigidity, postural instability, and slowed movements which are known to cause detriment to an individual's balance, mobility, and quality of life (Jankovic, 2008). In the general population of people with PD, there is an increased risk of dissatisfaction in life and with hope (Gustafsson, Nordstrom, Strahle, & Nordstrom, 2015). Hope is defined as a person's belief in their ability to achieve goals, particularly in settings where the person can influence the results through their personal strengths and skills (Rand, 2009). Optimism is defined as one's ability to maintain a positive expectation of the future (Carver, Scheier, & Segerstrom, 2010) regardless of the controllability of a situation (Rock, Steiner, Rand, & Bigatti, 2014). To date, it is not clear what factors influence hope and optimism in persons with PD.

In a systematic review by Schiavon, Marchetti, Gurgel, Busnello, and Reppold (2017), researchers reported a positive correlation between perceptions of hope, quality of life, and satisfaction in individuals with chronic disease. Higher hope is identified as a protective factor in individuals facing challenges and adversities, thus, positively impacting quality of life (Aspinwall & Tedeschi, 2010; Aspinwall & MacNamara, 2005). Furthermore, healthy individuals who have higher levels of hope have been reported to possess more certainty that their goals will be reached (Snyder, Shorey, Cheavens, Pulvers, Adams, & Wiklund, 2002). The sense of determining that a goal has been met fuels the desire of hope (Snyder et al., 2002). In past research, a strong, positive relationship between hope and health-promoting lifestyles among persons with PD was found, where higher levels of hope are associated with increased positive health behaviors (Fowler, 1997). Health-promoting behaviors were defined as activities, which increased the level of an individual's well-being and produced health potential for individuals, families, communities, and societies (Fowler, 1997).

Researchers have determined that optimism may predict a person's thoughts, feelings, and behaviors when faced with both controllable and uncontrollable situations (Rock et al., 2014). Furthermore, those with higher optimism may not modify their behaviors when faced with these situations but instead shift their thinking about the situation at hand (Scheier, Carver, & Bridges, 1994). While hope and optimism are considered separate concepts, they are interconnected by addressing individuals' beliefs about goal-related outcomes (Rand, 2009).

Hope and optimism are rarely studied together; however, it is suggested that they may be associated with different outcomes depending on the controllability of the situation (Rand, 2009). For example, hope and optimism influence different goal-specific anticipations depending on if the situation is controllable or not (Rand, 2009). Hope and optimism both address one's beliefs about goal-related outcomes (Rock et al., 2014). Moreover, Rand (2009) demonstrated that hope is more advantageous when a person perceives the situation as controllable whereas optimism is more favorable in situations that one may perceive as uncontrollable. An individual with PD may perceive they have little control over their progression of the disease and the symptoms that accompany PD, in which the person may have higher levels of optimism versus hope. Arguably, if persons with PD perceive that there is a level of control through treatments offered for PD (e.g., medications, exercise, etc.), then hope may be a stronger factor for those who view treatments as a form of control over their PD symptoms.

Limited studies exist in the literature that examine hope and optimism in persons within the PD population and no studies were found that examined the relationship between hope and optimism and exercise-related factors such as duration, frequency, intensity, and mode. Therefore, the research aims of this study are 1) to explore the relationships between hope/optimism and exercise-related factors (i.e., intensity, mode, minutes per week), as well as demographic/health characteristics of exercisers with PD (i.e., age, PD severity levels, months since diagnosis, Levodopa Equivalent Daily Dose [LEDD]), and 2) to determine if differences in levels of hope, optimism, and quality of life

exist between individuals with PD who choose different primary modes of exercise. It is postulated that relationships will be seen between hope and optimism with the aforementioned exercise-related variables as well as with age and the severity of their PD ailments. It is also hypothesized that individuals with PD who routinely participate in a non-traditional group exercise mode, specific to PD, will demonstrate higher levels of hope and optimism when compared to those who participate in more traditional exercise modes.

Methods

Research Design

This study is a non-experimental, prospective, cohort study with a cross-sectional design.

Participants

A convenience sample of 100 individuals was recruited from Indianapolis area exercise-based programs for persons with PD. Inclusion criteria for this study comprised: 1) Diagnosed with idiopathic PD; 2) Exercised for a minimum of 60 minutes total per week; 3) Between the ages of 21 to 80 years of age; 4) Able to follow three-step commands; and 5) Rated in stages 1 through 4 on the Hoehn & Yahr Scale (Goetz, Poewe, Rascol, Sampaio, Stebbins, Counsell, . . . Yahr, 2004) that categorizes the progression of PD. Participants were excluded from this study if they had pre-existing neurological conditions other than PD or had a history of brain surgery.

Procedures

Approval to conduct this research was received from the Institutional Review Board at the University of Indianapolis. Data collection for each participant occurred in a single 30 to 45-minute session where researchers reviewed and obtained informed consent, gathered demographics (age and gender), health information (months since diagnosis, LEDD), and administered questionnaires and motor assessments. The questionnaires and assessments were administered to each participant in a random order and all questionnaires, except for the MDS-UPDRS Part II, were read aloud to each

participant. The participants were instructed to take their anti-PD medications one hour before the testing administration began.

Assessments and Questionnaires.

Paper-based, self-report questionnaires and performance tests were used in this study, including the Parkinson's Disease Questionnaire (PDQ)-39 (Jenkinson, Fitzpatrick, Peto, Greenhall, & Hyman, 1997), the Adult Hope Scale (AHS) (Snyder, Harris, Anderson, Holleran, Irving, Sigmon, . . . Harney, 1991), Life Orientation Test-Revised (Scheier & Carver, 1985), and the Movement Disorders Society-Unified Parkinson Disease Rating Scale (MDS-UPDRS) subsections II and III (Goetz, Tilley, Shaftman, Stebbins, Fahn, Martinez-Martin, . . . LaPelle, 2008).

Hope.

The 12-item AHS (Snyder et al., 1991) measures hope by assessing two constructs: Pathways thinking (generating successful plans to meet goals) and agency (meeting goals in the past, present, and future) using an eight-point Likert-type scale (1=definitely false to 8=definitely true) with higher summed scores indicating greater levels of hope (scores range from 8 to 64) (Snyder et al., 1991). Scores for the AHS are generated by summing the four pathway subscale items with the four agency subscale items for a total hope sum while the remaining four filler items were discarded from the summation. Cronbach's alpha for hope were 0.82-0.83, respectively (Rock et al., 2014).

Life Orientation Test.

The eight-item Life Orientation Test is a self-report measure that includes two filler items (Scheier et al., 1994). Eight items are scored, four of the questions are worded positively and four are worded negatively (Scheier et al., 1994). The test examines a person's expectancies with positive and negative outcomes (Scheier et al., 1994). A five-point Likert scale is used to rate one's experiences ranging from 0 (strongly disagree) to 4 (strongly agree) (Scheier et al., 1994). The resulting score measures a person's degree of optimism with a higher score representing a higher level of optimism (Scheier et al., 1994). Cronbach's alpha was reported as .82 (Scheier et al., 1994).

Quality of Life.

The PDQ-39 is a 39-item questionnaire that measures the degree of participation in activities of daily living within the last month prior to completing the study. The questionnaire consisted of a five-point ordinal scoring system (0=never to 4=always, or cannot do at all), with higher scores indicating greater disability (Jenkinson et al., 1997). The PDQ-39 examines the following constructs including: activities of daily living, attention and working memory, cognition, communication, depression, functional mobility, quality of life, social relationships, and social support (Parkinson's Disease Questionnaire-39, 2014). Cronbach's alpha for the PDQ-39 were 0.59-0.94 and the ICC was 0.67-0.87 (Goetz et al., 2004).

Motor Symptoms and Activities of Daily Living.

The MDS-UPDRS, a revision of the original UPDRS, was used to assess the motor signs of PD. Part II focused on motor aspects of experiences of daily living, and consists of 13 items that were answered by participants (Goetz et al., 2008). Part III consists of 18 items, including an observed examination completed by researchers that assessed motor systems associated with PD (Goetz et al., 2008). Internal consistency for each of the four subsets has been established, and Part II and Part III have a high internal consistency, with alpha levels at 0.90 and 0.93, respectively (Goetz et al., 2008). Part II is comprised of multiple questions that self-assesses an individual's activities of daily living (ADLs) (Goetz et al., 2008). In addition, a high test-retest reliability has been shown in both subsets with an ICC of 0.89 for Part II and 0.93 for Part III (Goetz et al., 2008). Scores in the UPDRS range from normal (0) to severe, with overall (4) determining Hoehn and Yahr stage based on composite findings from Part III motor examination. Hoehn and Yahr stages include: "Asymptomatic (0); Unilateral involvement only (1); Bilateral involvement without impairment of balance (2); Mild to moderate involvement, some postural instability but physically independent, needs assistance to recover from pull test (3); Severe disability, still able to walk or unassisted (4); Wheelchair bound or bedridden unless aided (5)" (Goetz et al., 2008). Prior to data collection the

student researchers were trained to score the MDS-UPDRS III using the established MDS training video and instruction from faculty. High interrater reliability was established for the group of researchers ($ICC_{3,1} = 0.96$).

Data Analysis

Data were assessed to determine if parametric assumptions were met, using the Shapiro-Wilks test for normality. Descriptive statistics were conducted and presented as medians and interquartile ranges due to non-normality of the data. All statistical analyses used IBM SPSS (23.0 Edition; SPSS Inc., Chicago, Il., USA) to answer the research aims with an alpha level of $p \leq 0.05$ set for statistical significance. Spearman's rank correlation coefficient (ρ) was used to assess relationships among variables for aim 1. A ρ -value under .25 was considered low, a fair ρ -value fell between .25 -.50, moderate ρ -values fell between .50 -.75, and ρ -values above .75 were considered strong (Portney & Watkins, 2009). For aim 2, an Independent Samples Mann-Whitney U test was used for the between group comparisons (boxing vs. non-boxing).

Results

In total, 100 participants ($n_{males} = 59$, $n_{females} = 41$) with an age range from 45 to 80 ($Mdn = 68.0$, $IQR = 10.0$) were enrolled in the study. The sample consisted of 77 individuals who participated at Rock Steady Boxing (RSB) and 23 individuals who exercise with other programs or individually (non-boxers). A majority of the sample were self-reported as Caucasian/White (92%). Demographics of participants are presented in Table 1. Statistically significant differences were found between boxers and non-boxers for peak Rate of Perceived Exertion (RPE) ($p < .01$), age ($p < .03$), and MDS-UPDRS III scores ($p < .047$).

For research aim 1, only minutes of exercise demonstrated a positive, fair correlation with optimism ($\rho = .34$). All other exercise-related variables had low correlations with hope and optimism ($\rho = .10-.23$). In addition, both hope and optimism had low, inverse relationships with age and LEDD as seen in Table 2. Fair, inverse correlations were seen between hope and the MDS-UPDRS II and

MDS-UPDRS III scores, but not with optimism. Within the mobility section of the PDQ-39, mobility was fairly and inversely related to hope ($\rho = -.35$) and optimism ($\rho = -.28$). For the emotion section of the PDQ-39, emotion was fairly and inversely related to hope ($\rho = -.48$) and optimism ($\rho = -.39$). Moreover, the relationship between hope and optimism was moderately correlated ($\rho = .56$). See Table 2 for correlations between exercise-related variables and hope and optimism.

For research aim 2, the boxers demonstrated significantly higher hope scores when compared to non-boxers ($U = 2.01$; $p = .04$). More specifically, only the agency sub-construct of the AHS demonstrated a statistically significant difference between boxers and non-boxers ($U = 2.66$; $p < .01$). No significant difference was seen in optimism between boxers and non-boxers ($U = 0.94$; $p > .05$). The boxers demonstrated significantly lower scores on the PDQ-39 mobility subsection, indicating better perception of quality of life related to mobility compared to non-boxers ($U = 3.02$; $p < .01$). While the median PDQ-39 summary index was lower for boxers compared to non-boxers, this was not a significant difference ($U = 1.53$; $p = .13$). See Table 3 for correlations between hope, optimism, and quality of life between groups.

Discussion

For the first research aim, the hypothesis was found to be partially supported by the data, in that a fair, positive relationship between optimism and hope and minutes of exercise was demonstrated. While correlations between hope, optimism, and other variables (e.g., boxing mode, PDQ-39 items, MDS-UPDRS II/III) were present, the results indicated fair to low, inverse relationship between variables.

Previous literature has shown that if persons with PD consistently exercise more than 150 minutes a week, over time, the progression of PD symptoms were less compared to those who exercised less time or not at all (Rafferty, Schmidt, Luo, Li, Marras, Davis, . . . Simuni, 2017). Moreover, it is possible that persons with PD who exercise at least 150 minutes per week may feel more optimistic than those who exercise less than 150 minutes per week due to the betterment of

their physical symptoms related to PD. While the relationships between exercise, hope, and optimism were low, this may be reflective of the fact that the majority of the sample routinely exercised at least 150 minutes or more per week, thus, indicating a limitation of the study. It is possible that exercising at least 150 minutes per week is a key frequency for positive feelings relating to hope and optimism. Additionally, it is assumed that positive expectations of the future, regardless of the controllability of a situation, may be mediated by a greater number of the minutes of exercise participated in per week.

For the second research aim, the hypothesis was supported by the data in that there was a statistically significant difference in the hope scores between boxers and non-boxers, with boxers showing higher hope scores than non-boxers. An explanation for this finding is that persons with PD who participate in a non-contact boxing program may be more psychosocially influenced when exercising with people with similar PD severity and factors of group cohesion. In a recent study, participants in a group exercise program found the program to be free of stigma, inclusive, and welcoming as well as a safe space where they could display symptoms without fear of judgement (Sheehy, McDonough, & Zauber, 2017). According to Simpson, Haines, Lekwuwa, Wardle, and Crawford (2006), satisfaction and social support, together, were factors that were found to demonstrate less psychological stress in individuals with PD, thus, more feelings of hope and cohesion within the group can be assumed. Moreover, participating in a group exercise environment may increase one's level of hope when exercising with others who have similar symptoms and gives people confidence to overcome symptoms (Sunvisson & Eckman, 2001).

A second explanation of why boxer showed higher hope scores than non-boxers may be due to the participation in a novel exercise mode (e.g., non-contact boxing) when compared to more traditional forms of group exercise. Non-contact boxing for individuals with PD is a relatively new mode of exercise and has been shown to decrease severity in physical PD-related symptoms (Combs, Diehl, Staples, Conn, Davis, Lewis, & Schaneman, 2011). It is also important to consider that by

participating in non-contact boxing, the boxer group may possess stronger feelings they are ‘fighting their disease’ which may, in fact, provide empowerment and greater hope as it relates to redefining and rejecting stereotypes (Haslam, Jetten, Postmes, & Haslam, 2009) than compared to those who participate in other modes of exercise.

Results from the PDQ-39 suggested that boxers have higher perceived quality of life as evidenced by lower scores on the mobility construct as well as the summary index of the questionnaire as compared to non-boxers. These findings are consistent with prior research in that groups, specifically focusing on exercise for persons with PD, have improved quality of life (Combs, Dyer, Chrzastowski, Didrick, McCoin, Mox, . . . Wayman, 2013; Hackney & Earhart, 2009). Short and long-term improvements in balance and gait occurred after participation in a boxing training program (Combs et al., 2011). Based on the findings by Combs and colleagues (2011), it is possible that because the non-contact boxing program incorporates agility drills and balancing exercises into their program, the boxers perceive their functional mobility as higher than non-boxers.

Additionally, higher levels of hope seen in the boxer group may be attributed to the opportunity to be led by qualified trainers who are invested in the participants’ goals and outcomes. Wiles (2008) found that having trainers lead the classes may help to motivate the boxers to reach their goals giving the boxer group more hope as they persist in achieving their set goals. Group exercise that includes one’s own personal set goals can be significantly increased by having a coaching staff (Middlekamp, van Roojen, Wolfhagen, & Steenbergen, 2016). It is also known that verbal encouragement from others can impact one’s perceived quality of life (Wiles, 2008). By having verbal encouragement from both the participants and coaches alike within a group, individuals may perceive that they are better able to reach their goals than without the support and verbal encouragement.

It is also important to note that the ability to self-regulate emotions on a consistent basis may be involved in creating stronger feelings of hope and optimism. Past research has shown that there

are two substantial moderators when looking at aspects of stress and coping, including controllability and predictability, which have been associated with more effective self-regulation and coping (Bailey, Eng, Frisch, & Snyder, 2007). In this current study, hope was measured by assessing two constructs: Pathways thinking and agency. Pathways thinking is the generation of successful plans to meet one's goals, whereas agency is the meeting of goals in the past, present, and future (Bailey et al., 2007). Bailey and colleagues (2007) also found that the agency construct was the strongest predictor of life satisfaction when compared to the pathways thinking construct. The study found it was best to examine the agency and pathway constructs separately and to analyze the interactions of hope and optimism through which individuals assess their life satisfaction (Bailey et al., 2007).

Rock and colleagues (2014) found that hope was directly related to perceived controllability in the person's environment where there was a significant value for the agency of hope and exercise. In this study, it was found that the agency construct demonstrated a statistically significant difference between boxers and non-boxers, which is supported by the aforementioned studies. This postulates the notion that individuals with PD who participate in vigorous, non-contact boxing modes may demonstrate more hopeful tendencies due to their belief of perceived control over their exercise environment and, thus, advancing their own personal abilities and capacities of reaching their own health-related exercise goals. Therefore, it can be concluded that being a participant in a group exercise environment, such as non-contact boxing, and with people that are having similar life changes due to the same diagnosis, may enhance feelings of hope and optimism by having an emotional support from other group members and a controlled environment.

Limitations

One limitation of this study was that a majority of participants exercised more than 150 minutes per week, in which, according to Oguh, Eisenstein, Kwasny, and Simuni (2014), is the suggested amount of exercise for individuals with PD to decrease the progression of the disease which then may have led to higher levels of hope and optimism across the cohort. Another limitation

is that this study used a convenience sample. The participants volunteered to partake in the study, which could make a difference in hope when referring to the self-efficacy theory. Volunteering one's self to be in the study could indicate that the individual already feels efficacious about exercising and goal attainment and may be more likely to meet the goals they set for themselves and, therefore, could be deemed as more hopeful from the onset. The non-contact boxers may already have had high levels of hope thus, our data did not indicate increased levels of hope as predicted. Another limitation of the study is the restricted mode of exercise. Most participants did both boxing and individual exercise, however, the amount of exercise, type of exercise, and how often they participated in the exercise was all self-reported.

Conclusion

The results of this study suggest that exercising more minutes per week is fairly related to higher levels of optimism in persons with PD. Although the relationships between most exercise parameters and hope, and optimism were low, it is important to keep in mind that a majority of the sample routinely exercised at least 150 minutes or more per week. The 150 minutes of exercise per week may be the peak amount for attaining higher levels of hope and optimism. Additionally, non-contact boxing, as a multi-modal exercise program, may enhance hope more-so than traditional exercise programs for persons with PD. Recommendations for future studies include investigating the amount of exercise needed to achieve high levels of hope and optimism in people with PD. Additionally, further examination of the relationship between levels of hope and optimism in people with PD with greater variability in exercise amounts would be beneficial.

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Table 1

Demographics, health and exercise characteristics

	Total Sample n=100 Median (IQR)	Boxers n=77 Median (IQR)	Non-Boxers n=23 Median (IQR)	<i>p</i>
Age	68.0 (10.0)	67.0 (12.0)	70.0 (9.0)	.03
Male Gender, n(%)	59 (59)	48 (62.3)	11 (47.8)	.24
Race, n(%)				.62
White	92 (92)	70 (90.9)	22 (95.7)	
African American	3 (3)	3 (3.9)	0 (0.0)	
Asian	1 (1)	1 (1.3)	0 (0.0)	
Pacific Islander	2 (2)	1 (1.3)	1 (4.3)	
Not Reported	2 (2)	2 (2.6)	0 (0.0)	
Months Since Dx	65.0 (79.0)	51.0 (77.0)	86.0 (98.0)	.06
MDS-UPDRS II	11.5 (9.0)	11.0 (9.0)	12.0 (7.0)	.30
MDS-UPDRS III	19.5 (19.0)	19.0 (16.0)	29.0 (23.0)	.047
LEDD	462.5 (396.6)	450.0 (386.88)	716.96 (475.0)	.29
Exercise	300.0 (180.0)	300.0 (150.0)	300.0 (340.0)	.34
Minutes of Ex.	15.0 (4.0)	15.0 (3.0)	14.0 (7.0)	<.01
Peak RPE				

Note. Dx = Diagnosis; MDS-UPDRS = Movement Disorders Society-Unified Parkinson Disease Rating Scale; LEDD = Levodopa Equivalent Daily Dose; Ex.= Exercise; RPE= Rate of Perceived Exertion.

* $p \leq .05$.

Table 2

Spearman Rho Correlations (ρ)

	Hope	Optimism
Age	-.07	-.06
Months Since Dx	-.01	.02
MDS-UPDRS II	-.24*	-.19
MDS-UPDRS III	-.28*	-.05
LEDD	-.08	-.12
Exercise		
Minutes of Ex.	.23*	.34*
Peak RPE	.11	.11
Boxing mode	-.20*	-.10
PDQ-39		
Mobility	-.35*	-.28*
Emotion	-.48*	-.39*
Summary Index	-.39*	-.29*
Hope (Total)	1.0	.56*
Optimism	.56*	1.0

Note. Dx = Diagnosis; RPE = Rate of Perceived Exertion; MDS-UPDRS = Movement Disorders Society-Unified Parkinson Disease Rating Scale; LEDD = Levodopa Equivalent Daily Dose; PDQ-39 = Parkinson's Disease Questionnaire-39.

* $p \leq .05$.

Table 3

Differences between groups in hope, optimism, and quality of life

	Total Sample <i>n</i> =100 Median (IQR)	Boxers <i>n</i> =77 Median (IQR)	Non-Boxers <i>n</i> =23 Median (IQR)	<i>p</i>
Hope Total	55.0 (9.0)	56.0 (9.0)	52.0 (7.0)	.04
Agency Construct	28.0 (4.0)	29.0 (4.0)	27.0 (4.0)	<.01
Pathway Construct	27.0 (5.0)	28.0 (5.0)	26.0 (5.0)	.25
Optimism	19.0 (5.0)	19.0 (6.0)	18.0 (5.0)	.35
PDQ-39				
Mobility	10.0 (22.5)	7.5 (20.0)	20.0 (25.0)	<.01
Emotion	16.7 (20.8)	16.7 (20.8)	16.7 (20.8)	.96
Summary Index	16.1 (14.6)	14.2 (15.5)	19.9 (22.8)	.13

Note. PDQ-39 = Parkinson's Disease Questionnaire-39.

**p* ≤ .05.