The Effects of a Telehealth Exercise Program on Self-efficacy and Adherence in Individuals with Parkinson’s disease

A thesis submitted in partial fulfillment of the requirements
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Adapted Physical Activity

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Dedication

I dedicate this thesis to my mother and father for always believing in me from day one. I am so thankful to have parents like you.

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Abstract

The Effects of a Telehealth Exercise Program on Self-efficacy and Adherence in Individuals with Parkinson’s disease

By
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Master of Science of Kinesiology

Exercise interventions for people with Parkinson’s disease (PD) have proven beneficial in reducing disability, however adherence to exercise can be a problem for individuals with PD. Self-efficacy (SE) to exercise is a strong determinant of participation in formal exercise programs for individuals with PD. Additionally barriers such as travel distance, cost, and lack of qualified professionals may restrict regular exercise participation. Advances in technology such as videoconferencing may make it easier for people with PD to connect with qualified exercise practitioners and engage in regular exercise programs. The purpose of this study was to compare a telehealth (TH) and self-guided exercise program on SE to exercise and adherence in individuals with PD. A total of twelve adults with idiopathic PD (9 male, 3 female; 69.33 ± 9.42 years) participated in this study, all participants were 1-3 on the Hoehn and Yahr scale. Six participants in the TH participated in private exercise sessions which focused on strength and balance training through videoconferencing (one hour, 2x/week, 12 weeks). Six participants in the self-supervised group were asked to follow the same program as the TH group but through a self-guided exercise manual. SE was evaluated using the Self-efficacy for Exercise Questionnaire 9-item (SEE) and adherence was measured by the number of sessions completed. Secondary outcomes of activities of daily living and fall efficacy were measured through the United Parkinson’s Disease Rating Scale Part II (UPDRS-II) and Fall Efficacy Scale-
International (FES-I). All questionnaires were completed before and after the exercise program. Results of the study showed high adherence levels in the TH group (96.7%) compared to the self-supervised group (36.8%). No changes were found in FES-I, UPDRS-II and PDQ-39 scores in either group. Individuals with PD were receptive to TH exercise programming as shown in the high rate of adherence. Although SE to exercise, balance confidence, ability to perform activities of daily living and quality of life did not increase over the 12 week program, our findings suggest that TH may be an effective method to provide exercise programming to individuals with PD.
Introduction

Parkinson’s disease (PD), the second most common neurological disorder, is a neurodegenerative disease that affects more than one million individuals in the United States (NIH, 2004; Sherer, Chowdhury, Peabody, and Brooks, 2012). PD is caused by a loss of dopamine producing cells located in the substantia nigra which are responsible for movement (Saleeby and Kollias, 2014). This disease is typically characterized as a movement disorder with physical symptoms that include bradykinesia, tremor, rigidity, and postural instability and ultimately has an effect on activities of daily living (ADLs) (Sherer et al., 2012). Disease severity is assessed by physical symptoms. The Hoehn and Yahr (H&Y) scale is the most widely used scale to measure disease severity. The scale ranges from a score of one (less severe) to five (most severe). PD is thought to be associated with age and environment and may also be transmitted through genes (Sherer et al., 2012). By nature PD is a slow and progressive disorder, and currently has no known cure.

Treatments for physical symptoms range from pharmacological treatments to surgical treatments such as deep brain stimulation (NIH, 2004). These interventions are administered in hopes of increasing dopamine production, which may minimize the physical characteristics associated with PD. Treatments such as deep brain stimulation often focus on improving the physical symptoms, but many times are either ineffective or carry risks of potential side effects (Sherer et al., 2012). Non-invasive treatments for the physical symptoms, such as exercise, have been shown to improve physical functioning, leg strength, balance, walking and ultimately health related quality of life in people with PD (Goodwin et al., 2008). Additionally, exercise has been found to stimulate the area in the brain responsible for releasing dopamine,
reducing the symptoms caused by the disease (Sutoo and Akiyama, 2003; Shin, Jeong, An, Lee, & Sung, 2016).

PD is a progressive disorder and as the disease advances, people with PD show a reduction of physical activity levels compared to healthy peers (Ellis, Cress, Wood and Schenkman, 2015). Furthermore, individuals with PD experience diminished strength and functional capacity (Bridgewater and Sharpe, 1997). People with PD are also at an increased risk of falls and decreased performance of ADLs (Bloem et. al., 2001).

The physical symptoms of PD often limit the amount of activity people with PD engage in, which may lead to sedentary lifestyles (Ellis and Schenkman, 2014). Skidmore and colleagues (2008) investigated home activity levels of people with PD and found that as people scored higher on the Hoehn & Yahr scale, there was a decrease in overall steps and average steps per minute throughout the day. The researchers concluded that home activity levels were related to both disease severity (physical symptoms) and disease stage (Hoehn and Yahr scale). As PD progresses, the physical characteristics worsen, which further inhibits participation in physical activity. Unfortunately, these disabling characteristics not only lead to less active lifestyles, but also contribute to a number of barriers to exercise.

Within the PD population, adherence is also a critical issue (Ellis et al., 2013; Leopold, Polansky and Hurka, 2004; Forkan et al., 2006; Crizzle and Newhouse, 2012). Both pharmacological adherence (Leopold, Polansky and Hurka, 2004) and exercise adherence (Ellis et al., 2013; Forkan et al., 2006; Crizzle and Newhouse, 2012) have been shown to be poor within this population.

Psychological mechanisms that drive successful initiation and adherence to participation in physical activity have yet to be fully recognized (Higgins et al., 2014).
However, the Social Cognitive Theory may give insight to understand physical activity behaviors and aid in the development of clinical interventions to promote the initiation and adherence of physical activity (Keller, Fleury, Gregor-Holt, Thompson, 1999). The Social Cognitive Theory is a theoretical perspective that combines personal, environmental, and behavioral influences that affect human functioning (Bandura, 1986). One way to increase physical activity levels for people with PD may be to consider a theory driven foundation to implement exercise interventions for this population (Goodwin et al., 2008).

The concept of self-efficacy stems from this theory and is defined as the judgment of one’s ability to succeed in specific situations or accomplish a certain task (Bandura 1997). One can improve his or her self-efficacy through mastery experience (sense of accomplishment in a task), vicarious experiences (learning by watching someone similar to be successful), verbal persuasion (encouragement by others) and somatic and emotional states (being able to reduce anxiety in an uncomfortable position). All of these can greatly influence one’s belief in their ability to accomplish a certain task. Therefore, establishing goals and having confidence in one’s own ability to do a certain task may promote adherence to exercise in individuals with PD (Eriksson, Arne and Ahlgren, 2013). Although self-efficacy for exercise is an important factor to engage individuals with PD to exercise, other barriers may have an effect on levels of engagement.

Fear of falling among people with PD negatively affects levels of activity with approximately 70% of this population reporting limitations in ADLs due to fear of falling (Lindholm et al., 2014). Improving perceived self-efficacy to exercise and decreasing avoidance of physical activity for people with PD may be a critical component to focus on reducing fear of falling as a barrier to physical activity
(Rahman et al., 2011). Intervention should look at new methods to accommodate these barriers to exercise.

Telehealth (delivery of health-related services and information via telecommunications technologies) is a widespread technology that involves the delivery of health care services to a remote location with the goal of increasing access to care (Achey et al., 2014). Telehealth in the form of real-time videoconferencing (simultaneous two-way video and audio transmission) is currently used in various disciplines such as mental health, primary physician care, multidisciplinary teamwork, and specialist consultations (Wade et al., 2010). In a systematic review about the cost-effectiveness of telehomecare (delivery of healthcare services to a patient’s home), 91% of the studies showed that the use of telehomecare was more cost-effective than traditional hospital visits (Gangon and Rojas, 2008). Other benefits of telehomecare included decreased hospital time, increased patient compliance and satisfaction, and improved quality of life.

Videoconferencing interventions (communication through the use audio and visual means) for people with PD have recently been used for medical consultations and physical activity programs. Research in this area has elicited participant satisfaction and adherence as well as development of personal connections to PD specialists (Venkatraman et al., 2014, Dorsey et al., 2013; Ellis et al., 2013). However, no study has examined the effects of telehealth as a way to administer exercise programming for individuals with PD.

The purpose of this study was to examine the effects of a telehealth exercise program on self-efficacy and adherence to exercise for individuals with PD. This study will provide scientific evidence on the efficacy of a low cost and readily accessible intervention that can help clinicians and individuals with PD utilize a new
avenue to exercise programs. It is of interest to explore technologies that have the potential to positively influence lifestyle changes of those with PD.

**Assumptions**

- Participants will not engage in other forms of physical activity (resistance and balance training) that will alter the results during the course of the intervention.
- Participants will be truthful during data collection through the use of questionnaires.
- Participants will understand questions from the questionnaires.

**Limitations**

- Sample size
- Higher disability severity as determined by the Hoehn and Yahr scale (score of 4 and 5).
- Sensitivity of questionnaires

**Delimitations**

- The ability/familiarity to use a computer
- Participants who are not currently participating in an exercise program
- Disability score of 1-3 on the Hoehn and Yahr scale
- Ages 40-85

**Operational Definitions**

- Self-efficacy: The perception of one’s ability to perform or complete a certain task as measured by the Self-efficacy for Exercise Scale.
- Exercise adherence: The ability of a person to continually adhere to each exercise session as measured by the number of sessions that are completed by the participant.
Hypothesis

- A telehealth exercise program will improve self-efficacy to exercise for people with Parkinson’s disease.
- A telehealth exercise program will improve exercise adherence for people with Parkinson’s disease.
- A telehealth exercise program will improve balance confidence, abilities to perform activities of daily living and quality of life for people with Parkinson’s disease.

Significance of the Study

Exercise research for people with PD has focused primarily on balance and strength outcomes with little attention given to barriers to exercise and their effects on adherence to exercise. Research has examined the use of telehealth technology in people with PD as a means of medical consultation and physical activity programs, but has yet to use this technology as a tool for exercise programing. Examining such effects could potentially alter the way exercise programming is offered for populations who are less apt to leave the house for exercise.
Literature Review

Parkinson's disease

Parkinson’s disease (PD) is a progressive neurological disorder affecting one million Americans and with an estimate of 50,000-60,000 new cases diagnosed every year (NIH, 2004). It has also been estimated that there are 4-6 million people worldwide living with PD and it is currently the second leading neurological disorder (NIH, 2004). Although the cause is unknown, age may play a factor as people over the age of 60 are 2-4% more likely to have PD (Sherer et al., 2012). Parkinson’s disease is caused by the loss of dopamine producing cells in the substantia nigra which have an effect on motor functions that interfere with activities of daily living (ADLs) and unfortunately worsen as the disease progresses (McKeith, 2004). The cardinal signs of PD such as bradykinesia (slow movement), tremors at rest (starting on one side then moving to the other) and rigidity (muscle stiffness) may affect a person’s ability to accomplish simple tasks such as brushing teeth or cutting food. Along with the typical physical symptoms, PD also involves secondary motor symptoms such as freezing, mask-like expression, and stooped posture. Freezing can occur during walking or the initiation of walking which feels as if “the feet are stuck to the ground”, a mask-like expression is described as a decrease in facial expressions, and a stooped forward posture is usually associated with PD and linked to rigidity and bradykinesia.

Due to physical limitations, roughly 98% of individuals with PD spend their day in sedentary and light-intensity activities and most associate with an inactive lifestyle (Dontje et al., 2013). Compared to their healthy peers, individuals with PD tend to lead more sedentary lifestyles, have poorer balance and experience more falls (Fertl et al., 1993; Bloem et al., 2001). Additionally, fear of falling contributes to
limited activity in roughly 70% of individuals with PD (Koller et. al, 2007; Bloem, 2001). However, exercise has proven to be beneficial in improving fear of falling. In a randomized control trial by Lorena and colleagues (2014) noted that balance among forty-eight individuals with PD who had fallen or were at risk of falling showed a trend of improvement in balance confidence scores based off the FES-I. This small improvement was seen after just one month of home based balance training. It is important to encourage those with PD to engage in activities that will improve their balance.

**Physical Activity in Parkinson’s disease**

Parkinson’s disease is associated with a variety of characteristics in the motor area including bradykinesia, tremors at rest and rigidity. The adverse effects of these motor problems lead to sedentary lifestyles which in turn contribute to health problems such as cardiovascular disease and osteoporosis (Speelman, 2011). Therefore, it is important to investigate physical activity in this population. A better understanding of physical activity behaviors and ways to enhance physical activity levels for people with PD could lead to better health and overall quality of life.

In a study by Skidmore and colleagues (2008), in-home physical activity levels of people with PD was measured and showed that as PD severity progressed, physical activity decreased. Researchers examined physical activity levels in 24 participants with varying stages of PD (2-4) measured by the Hoehn and Yahr scale (scale measuring disease stage) and the United Parkinson’s disease Rating Scale (scale for measuring disease severity). A microprocessor-linked step activity monitor (SAM) was used to measure mean steps per day and maximum steps per hour. SAM was calibrated to each participant’s height and step length during a home visit from the researcher and then mounted on the right ankle. Participants were asked to wear
SAM for 2 days only removing it while sleeping and showering. The results indicated that those at stage 3 and higher on the Hoehn and Yahr scale and those who reported more disease severity on the UPDRS, displayed both a decrease in steps per day and average steps per minute during their most active hour compared to those at stage 2 and lower. Participants who were at more severe levels on the Hoehn and Yahr scale (3 and 4) compared to those at less severe levels (2 and 1) had significant decreases in average steps per day (5,147 vs. 2,708) and steps per hour (20.7 vs. 9.6).

A person who engages in less than 5,000 steps per day is typically characterized with sedentary lifestyles (Tudor-Locke et al., 2004). In a meta-analysis of 42 studies, Bohannon (2007) reported adults 65 and over engaged in an average of 6,500 steps per day which falls below the recommended 10,000 steps per day. It has been suggested that 30 minutes of moderate to vigorous physical activity for older adults should elicit 7,000 to 10,000 steps (Tudor-Locke et al., 2011). According to the previous study by Skidmore and colleagues (2008), individuals classified at stage 3 and higher on the Hoehn and Yahr scale were far below the average steps per day at only 2,708. Surprisingly, Shulman et al., (2008) reported that the transition from stage 2 to 3 on the Hoehn and Yahr scale marks a critical point in which gait and balance disturbances have a greater effect on ADLs and most importantly, independence. The authors reported an association between patient-reported disability on ADLs and level of disease severity in which housework, dressing, transferring in and out of bed, and traveling in the community became more difficult during the transition from stage 2 to 3.

Another study that used direct measurement of physical activity levels among those with PD used an accelerometer and self-reported measures (Jones, Wieler, Carvajal, Lawrence and Haennel, 2012). Researchers recruited 11 PD outpatients with
either a 1 or 2 on the Hoehn and Yahr scale and measured their physical activity by tracking minute by minute energy expenditure and average steps per day using and accelerometer (SenseWear Pro Armband). Participant energy expenditure was recorded by metabolic equivalent task (MET) through sensors on the arm band and by input of demographic characteristics into the armband. Energy expenditure was later interpreted using the Ainsworth’s Compendium of Physical Activity which referred to sedentary activity as less than 2 METs (sleeping, sitting, watching television). The self-reported measurement of physical activity was assessed using a questionnaire designed to report frequency of activities performed in the past 7 days. Participants of the study were asked to wear the accelerometer on their upper arm of their least affected side for 48 hours. Once the initial testing had been completed, the researchers calculated the scores from the armband and questionnaire. Overall steps per day averaged 5,458 and participants spent roughly 19.4 hours per day in sedentary MET levels. However, reports from the questionnaire indicated that participants felt their physical activity was at a moderate level rather than the light intensity which was revealed by the accelerometer.

Both of these studies show that people with PD have low levels of physical activity closely associated with sedentary lifestyles. This may be attributed to severity of symptoms or stage of their disease. Interestingly Speelman (2011) suggested that sedentary lifestyles in people with PD may be a compensatory strategy in order to control further complications that may be encountered while engaging in physical activities such as walking and other ADLs.

Activities of Daily Living and Parkinson’s disease

Limitations in ADLs and decrease in quality of life for people with PD can be attributed to the decline in motor function (Lorena, 2014). Motor symptoms such as
tremors at rest, rigidity, and bradykinesia negatively affect simple tasks such as walking, standing up from a chair, transferring in bed and eating (Morris et al., 2005). In some cases, individuals with PD have reported limitations in ADLs as more of a burden than the actual physical symptoms of PD (Shenkman et al., 2002). For this reason, both exercise and pharmacological treatments have been investigated in hopes of improving motor symptoms that have negative effects on ADLs.

Yousefi et al., (2009) sought to find an effective therapeutic regimen combining exercise and pharmacological routines. Twenty-four male participants diagnosed with idiopathic PD at stages 2 and 3 on the Hoehn and Yahr scale was recruited for the study. Participants were then randomly divided into a control group which followed a pharmacological adherence program and an experimental group that received an exercise program plus the pharmacological treatment. Those in the experimental group completed a 10 week group exercise program targeting flexibility and strength exercises. Sessions lasted one hour and were conducted four times a week. Measurements of ADLs and Quality of Life were measured using two questionnaires. ADLs were measured using the subscale of the Short Parkinson Evaluation Scale (SPES)/Scales for Outcomes in Parkinson’s disease (SCOPA), this is a 7 question response which covers ADLs such as speech, feeding, hygiene etc. and were on a scale from a 0 to 3 scale (0= normal, 3=severe difficulty). Quality of life was measured using the PDQL (Parkinson’s disease Quality of Life Questionnaire) which consists of 4 subscales (Parkinson symptoms, systemic symptoms, social functioning and emotional functioning). Higher scores on this scale indicated greater quality of life. After treatment, there were significant differences between the control and intervention groups in the PDQL and ADL scores. Those in the experimental group saw improved scores on both self-reported questionnaires.
Although combining exercise programming with pharmacological regimes has shown to improve quality of life, the progression of this disease may lead to more complicated drug therapy (Suzukamo, 2006). By nature PD is progressive requiring pharmacological treatments to help manage early symptoms, yet physical activity interventions may be the most effective approach for life-long disease management (Quinn et al., 2010).

Therefore in order to slow the progression of PD, early interventions should take place to prevent or delay activity limitations. In a study by Hariz and Forsgren (2011), untreated community patients with PD who went for first time neurological visits already exhibited restrictions in ADLs and quality of life. Additionally, patients who stated more axial symptoms (speech difficulties, muscle rigidity, gait disturbances and postural instability) of PD reported less activity participation as well as a decrease in quality of life. Due to these early restrictions, the authors stated that a personalized exercise program early on in the disease progression should be implemented in hopes of improving participation in ADLs.

*Parkinson’s disease and Adherence*

Adherence to exercise proves to be challenging for healthy older adults as well as those with chronic disabilities (Ellis et al., 2013). For those with PD, lack of adherence to other health aspects such a medicinal therapy may negatively affect their PD symptoms. In a study examining medication adherence, 35 of 39 participants had reported missing doses in a 28 day period (Leopold, Polansky and Hurka, 2004). The investigators also reported that those who missed doses also missed at least one dose per week. The most common reason for this occurrence was forgetfulness or participants were too busy. Such reasons for lack of adherence to pharmacological treatments may translate to exercise behaviors. Exercise or physical activity is much
more time consuming than adhering to daily medicine intake and additionally the
individual must determine when and where to engage in activity (Chao, Foy, Farmer,
2000). Unlike medicinal regimens, misconceptions of physical activity may be viewed
as harmful and that physical activity may do more harm than good especially for
someone with a chronic disability (Chao et al., 2000).

Investigating factors which contribute to sustained participation in exercise
may ease disability in those with PD (Ellis et al., 2013). Crizzle and Newhouse (2012)
examined exercise motivation in four individuals with PD. After a six week aquatic
program, participants stated that the most important motivators for exercise adherence
were the exercise leaders, improvements in physical function, and social support.
Although motivators may encourage exercise participation, barriers to exercise are
predominantly more of a factor in adherence to exercise (Forkan et al., 2006). Such
barriers to exercise for older adults included lack of interest, poor health, weakness,
fear of falling, pain, bad weather, lack of time, and limited access to exercise
resources (Ellis et al., 2013). Additionally, Forkan and colleagues (2006) discovered
that after a period of physical therapy, older adults with poor balance displayed poor
adherence to home exercise programming. Among the participants, changes in health
status and lack of motivation were among the highest reasons to not continue with the
exercise regimen.

Recently, Ellis and colleagues compared self-reported barriers to exercise in
two groups of people with PD (Ellis et al., 2013). Participants were divided into two
groups, most active and least active, based on their responses to the Stages of
Readiness to Exercise Questionnaire. This questionnaire was used to determine
physical activity levels of the participants within the last 6 months. Of the 260
participants, with an average of 2.4 on the Hoehn and Yahr scale, 164 were assigned
to the exercise group and 96 assigned to the non-exercise group. Those in the non-exercise group reported that the three biggest barriers were low outcome expectations to exercise, lack of time, and fear of falling. These barriers were 2-4 times more likely to be a factor in the non-exercise group than in the exercise group. The authors suggest that although these are prominent barriers to exercise and reasons to not adhere to such regimens, these barriers are potentially changeable and an important component to consider when working with this population. Interestingly, those in the exercise group (although in smaller numbers) reported that low outcome expectation, lack of time and fear of falling were relevant but were still involving themselves in exercise.

The previous studies have shown that there are problems with adherence to health benefits in individuals with PD. In order to ensure proper exercise interventions for individuals with PD, there needs to be a theory driven foundation in order to properly implement an intervention (Goodwin et al., 2008).

**Social Cognitive Theory**

Social cognitive theory is a theoretical perspective that combines personal, behavioral and environmental influences that affect human functioning (Bandura, 1986). The interactions between these constructs influences people to create interactions that can affect new or different behaviors as well as promote behavior change. The interactions between all three products are a result of “triadic reciprocity”. These influences are then shaped by observational learning, reinforcement, self-control and self-efficacy. Research in the area of health behaviors has used this theory to positively change health behaviors.
Self-efficacy

The concept of self-efficacy stems from the Social Cognitive Theory and by definition is the perception of one’s ability to perform a certain task (Bandura, 1997). Self-efficacy states that a person can strengthen their self-efficacy through four main constructs; mastery of experience (sense of accomplishment in a task), vicarious experiences (viewing someone else at an equal level who is out performing), verbal persuasion (hearing you are doing well by others) and maintaining somatic and emotional states (being able to reduce anxiety in an uncomfortable position).

Older individuals with chronic health problems may not engage in physical activity due to physical limitations and may be less confident than younger adults to change exercise habits (Lee, Arthur, Avis, 2008). Therefore, it is important for those administering exercise programs to incorporate the four constructs of self-efficacy. Researchers have successfully implemented interventions with the focus of improving self-efficacy by targeting self-efficacy constructs (Cheal, Clemson, 2001; Parent, Fortine, 2000; Luzzo and Taylor, (2008); Brown, Malouff and Schutte, 2005; Lisa, Malouff and Schutte, 2005).

Mastery of experience in the form of practice opportunities in real life settings helped to improve older adults’ self-efficacy in fall-risk situations by incorporating outdoor activities in a fall prevention program (Cheal, Clemson, 2001). Such outdoor activities included climbing stairs and crossing streets. The more familiar and successful the participants were around those situations, the better they felt about being able to accomplish said tasks outside of the program. However, regardless of amount of practice avoiding more difficult and unfamiliar obstacles will hinder the development of a strong sense of efficacy. In order to develop a strong sense of
efficacy, difficult tasks also need to be attempted and obstacles must be worked through (Bandura, 1994).

Observing the successes and failures of other individuals with similar physical abilities may positively or negatively affect their self-efficacy. Parent and Fortine (2000) examined whether vicarious experiences of those leading active lifestyles post-surgery led to reduced anxiety and increased self-efficacy of those recently out of surgery. Twenty-seven individuals undergoing cardiac surgery were paired with a former patient who reported to have an active lifestyle post-surgery. The control group (n=29) received standard routine information on surgery and recovery by a health professional. Reports following surgery in the experimental group showed increases in self-efficacy after four weeks, as well as, more active lifestyles than those in the control groups who did not have a partner. The researchers concluded that vicarious experiences have an impact on the perception of one’s capabilities if they see someone they can relate with who has done well facing adversity.

Similarly hearing positive feedback, verbal persuasion, by a coach or mentor may impact perception of ability while facing adversity or difficult situations. Bandura (1996) and Strecher, McEvoy, De Vellis, Becker, and Rosenstock (1986) have suggested strategies for clinicians, coaches or mentors to promote self-efficacy for a given behavior as well as performance confidence. Clinicians should recognize a patient’s past and present accomplishments and reinforce them verbally, provide positive feedback for patient efforts, and facilitate the adoption of new and positive health behaviors. Additionally, Baker and colleagues (2001) stated that clinicians should encourage participation in regular goal-directed programs in order to improve self-efficacy for exercise in individuals with chronic disabilities such as arthritis.
Finally, somatic and emotional states can have a large effect in the context of improving self-efficacy. When someone is new to exercise, there may be an increased somatic state. If the person perceives everyone is looking at them negatively it may be detrimental to the growth of their self-efficacy (Lisa, Malouff and Schutte, 2005). Along those same lines, the negative somatic state may then cause negative emotions related to that activity such as anxiety and fear. For example, if a patient is learning a new task such as using an assistive device, one way to reduce feelings of anxiousness and fear may be to reassure the patient that those feelings will subside once the necessary skills are learned (Marks, Allegrante, Lorig, 2005). Therefore, if the emotional state is improved, a change in self-efficacy can be expected (Bandura, Adams, 1977).

For individuals with PD, it has been reported that self-efficacy rather than disease severity was a greater predictor of participation in formal exercise programs (Ellis et al., 2011). Therefore, improving self-efficacy should be a focus of exercise interventions to promote adherence and thereby increase physical function which will increase the ability to perform ADLs (Ellis, Schenkman, 2014). It is important to note that in order for people with PD to adhere to exercise programs, there must be adequate support from the instructor and noticeable improvements in physical function (Crizzle et al., 2012). In fact, Ellis and colleagues (2013) found that a major barrier to exercise for people with PD was low outcome expectations. The authors also stated that lack of time and fear of falling were commonly cited barriers to exercise. Therefore it is important to address self-efficacy for engagement in regular and sustained exercise (Ellis et al., 2011). Interventions need to try and accommodate the most efficient and effective ways of administering exercise for individuals with PD.
Telehealth

As technology advances, new ways of presenting health care is emerging. Telehealth utilizes electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration (Achey et al., 2014). Such services are provided through videoconferencing, internet use, streaming media, and wireless communication. The emergence of these services can yield a number of opportunities for healthcare services. Such applications of telehealth range from chronic disabilities to pediatric specialty care (Wade et al., 2010). Most notably, technologies such as Instant Messaging and videophones are highly accessible, low cost and are able to break down distance and time barriers (Forducey et al., 2012).

Video delivery can be a cost effective alternative in administering health care to patients in their home by the use of on-call specialists in both regional and rural areas (Wade et al., 2010). Recently, telehealth has been used to treat people with chronic disabilities such as stroke which like PD is a chronic disability (Forducey, 2008). Telestroke or the application of telemedicine for those who have experienced a stroke was established in 1999 (Hess and Audebert, 2013). Telestroke seeks to treat people post stroke via high-quality video conferencing through the internet using laptops, tablet computers and hand held technology. This technology is used in order to consult with a specialist when access to care may be limited.

Telemedicine programs are reaching more people than ever before and are growing quite rapidly in Canada, the Netherlands and some areas of the United States for those with PD (Achey et al., 2014). Research for people with PD using interactive video-conferencing (IVC) technology can be dated back to 1993 (Hubble et al., 1993). Hubble and colleagues stated that interactive video conferencing had the ability to
enhance consultation health services and improve interim care. In their research, nine participants with PD were recruited to undergo assessment of their motor symptoms. The UPDRS and Hoehn and Yarh scales were used as the assessment tools to measure motor symptoms and signs of PD. Participants were first assessed in person by their primary physician then on another day were assessed using IVC by a non-affiliated neurologist. Researchers concluded that the scores of both conditions were in close agreement and that interactive video conferencing was reliable in terms of assessments. In a post interview, participants were in favor of IVC as a means of improving access to care. Although this study showed possible trends to improving health care for those with PD, the researchers stated that this type of technology should not become a substitute to hands-on care but serve as a link to those who find it difficult to receive care.

Currently much of the research that has been done has focused mostly on specialty care such neurology and speech therapy (Achey et al., 2014). Very little attention has been focused on increasing levels of physical activity or exercise programming. In a one-time telemedicine consultation patients interacted with a PD specialist via videoconferencing (Venkataraman et. al., 2014). This 30-60 minute consultation focused on a neurological assessment and later discussed recommendations for possible treatments. Eighty-six percent of recommendations were to exercise more. It was not specified by the researchers if patients were given resources to facilitate participation in exercise. In the same study, the results of a post consultation online survey revealed that 85% of participants (n=55) felt the same or more connection with the specialist via videoconferencing compared to a traditional doctor visit.
In a similar study, researchers investigated the feasibility, effectiveness and cost-effectiveness of a videoconferencing consultation to provide specialty care to people with PD (Dorsey et al., 2013). Two groups, a video-conferencing group and usual in-person group, received care from a specialist over 7 months. Both groups interacted with a specialist 3 times during the 7 months for their respected treatment group. Measurements of quality of life and motor scores through the PDQ-39 and the UPDRS were not statistically significant between the two groups. In terms of time-efficiency, the video-conferencing group saved more time interacting with the specialist than the in-person group. The video-conferencing group spent 53 minutes on average connecting and interacting with the specialist (“computer on, to computer off”) whereas the in-person group spent 255 minutes on average traveling to the location, interacting with the specialist and traveling back home (“door to door time”). These findings support previous literature that people with PD see transportation as a barrier to exercise let alone go to a specialist appointment (Telemedicine, 2013). In addition, 93% of the telemedicine visits were completed resulting in high retention rates. In order to get a better understanding of how adherence is maintained using this system, long term telemedicine visits should be evaluated.

In a technology based intervention which aimed at increasing physical activity levels, participants with PD interacted with a virtual exercise coach each day for one month through a tablet computer (Ellis et al., 2013). Participants were instructed to plug a pedometer into the tablet and interact with the virtual exercise coach for 5 minutes a day. Results after the one month intervention showed a 100% retention rate, 80% satisfaction, and an adherence of 85% to daily walking. In addition, improvements in gait speed and the 6-minute walk test were significant. This study
shows that even in a small amount of time, improvements in functional mobility can increase as well as satisfaction when using mobile health technologies.

The future of telemedicine is leaning towards a greater picture of involving more integrated health services such as therapists and exercise trainers (Achey et al., 2014). Such technology may even allow for one exercise specialist to reach a number of patients at one time (Marzinzik et al., 2012). Exercise research in people with PD has focused primarily on balance and strength outcomes with little attention given to barriers to exercise such as self-efficacy and how that may affect individuals’ quality of life and adherence to exercise programs. Research has examined the use of telehealth technology in people with PD as a means of medical consultation and as a tool to increase physical activity. However, researchers have yet to use this technology as a tool for exercise programing. Examining such effects could potentially alter the way exercise programming is administered for populations who are less apt to leave the house for exercise. Research in this area may provide an innovative method to promote exercise and thus, future studies should investigate mobile health technologies to increase active lifestyles (Ellis, Lantham, and DeAngelis, 2013).
Methods

Participants

Twelve participants with idiopathic PD (nine males and three females, 74.17±9.56 years of age and 2.25±0.58 on the H&Y scale) were recruited from local PD support groups. To participate in this study, individuals with PD met the following criteria: a confirmed diagnosis of idiopathic PD, a score between a 1-3 of the Hoehn and Yahr scale, age 40-85 years old, physician’s medical clearance to participate in 45 minutes of moderate intensity balance and resistance training exercise, ability to read and communicate in English, ability to use a computer, and maintenance of a consistent medication protocol for one month prior to initial data collection.

Participants were excluded if they had: additional musculoskeletal, neurological conditions or a cardiovascular disorders, a change in medication type or dosage within the month prior to data collection, current participation in an exercise related research study or formal exercise program, no active spotter and lack of internet access.

Research Design

During the recruitment process, participants received a medical release form and an informed consent form. Following recruitment and initial screenings completed, participants were scheduled for pre-intervention data collection. Upon arrival to the pre-data collection, participants turned in their medical release (signed by their primary physician) and signed informed consent form. Once the pre-intervention data collection was completed, participants were assigned to either the telehealth group or the self-supervised group. In order to control for disease severity, a stratified randomization technique was utilized to divide participants using the modified Hoehn and Yahr scale (1-3). The two groups, based on severity of disease,
are as follows: less severe 1-2 and more severe 2.5-3. As enrollment occurred, every other participant within the severity groups was randomized into the intervention group.

Each individual received a home visit from the researchers in order to establish a safe exercise environment, distribute exercise equipment and set up video-conferencing software if necessary. Participants randomized into the self-supervised group received an exercise manual (Appendix F) and were given instructions on how to use the manual. Data collection occurred at pre- (week 1), mid- (week 6) and post- (week 12) intervention. Data collections at pre- and post-intervention were completed in person, and mid-intervention was administered through the mail.

Research Variables and Instruments

Each participant completed four questionnaires at pre-, mid-, and post-intervention, and adherence was monitored throughout the duration of the study. Exercise self-efficacy and adherence were primary outcomes while balance confidence, quality of life and ability to perform activities of daily living (ADLs) were secondary measurements.

Self-efficacy was measured using the Self-Efficacy for Exercise Scale (SEE Scale). This is a nine-item questionnaire designed to assess a person’s beliefs in their ability to exercise twenty minutes three times per week at a moderate intensity. Each of the nine statements was answered by choosing a number on a scale from zero (not confident) to ten (very confident). This scale has been shown to be a reliable and valid measurement of self-efficacy for exercise in the older adult population (Resnick and Jenkins, 2000). This scale has not been tested in individuals with PD.

Adherence was measured by the number of exercise sessions through video-conferencing and was noted by the researcher. The self-supervised group’s adherence
was measured by the number of times the participant stated that they completed one full workout in their exercise manual. Participants were encouraged to record the number of minutes engaged in exercise. If participants skipped a scheduled exercise day, participants were asked to mark ‘zero minutes’ in their manual for the day they missed.

Balance confidence was measured using the Fall Efficacy Scale – International (FES-I). This 16-item questionnaire is designed to assess a person’s concern with functional balance. The FES-I was rated on a 1 (not at all concerned) to 4 (very concerned) scale. Quality of life was measured using the Parkinson’s disease Questionnaire-39 (PDQ-39). This questionnaire covers eight areas of health and ADLs including: mobility, activities of daily living, emotional well-being, stigma, social support, cognitive impairment (cognitions), communications, and bodily discomfit. The PDQ-39 was scored on a scale from 0 to 156 and correlates higher scores with more severe symptoms and lower scores indicating lower levels of symptoms. The MDS-UPDRS Part II: Motor Aspects of Experiences of Daily Living (M-EDL) is a questionnaire that is used to assess experiences of ADLs and how motor function may affect those activities. It consists of 13 items, which are designed to investigate the level of difficulty experienced while performing specific ADLs within the past week.

The SEE scale, FES-I, and MDS-UPDRS Part II were measured at pre- (week 1), mid- (week 6) and post- (week 12) intervention. The PDQ-39 was measured at pre- and post-intervention only. Questionnaires that were measured at mid-intervention were mailed to the participant’s home with instructions to be returned within one week.

*Intervention Protocol*
The intervention was performed at the participant’s home either through videoconferencing (telehealth group) or self-supervised using an exercise manual (self-supervised group). Both groups underwent a combination of strength and balance exercises, which was augmented with the use of resistance bands and cuff weight (ankle and wrist). Exercise progressions were explained in the manual or demonstrations were shown to the participants. Participants were directed to self-select the level of exercise they preferred. Exercise progression (with/without resistance) was recorded in the manual. Participants in the telehealth group did not receive a manual but were guided by the researcher who followed the same manual as the self-supervised group.

Participants from both groups were asked to perform 45 minutes of balance and resistance exercise using resistance bands and wrist/ankle weights two times a week for 12 weeks. Both groups were asked to choose specific times and days to exercise to be consistent throughout the course of the 12 weeks. Participants in the intervention group had regularly scheduled exercise meetings with the researcher. When the participants connected with the researcher through videoconferencing, they were guided through a warm-up consisting of flexibility and dynamic movements, which lasted approximately five minutes. They were then guided through balance and resistance exercises for approximately 35 minutes. The exercises were at a self-selected progression, in which participants had the ability to choose which level (1, 2, or 3) they choose for the particular exercise (please see attached manual example for exercise descriptions).

The participants who were randomly assigned to the self-supervised group were provided with an identical exercise program to that of the telehealth group. Initially, an orientation was provided with specific instructions on how to perform the
exercises at home. Participants were instructed to perform the exercise program two times per week for 12 weeks. The exercise protocol included upper and lower body resistance exercises as well as balance exercises. Every four weeks phone calls were made to monitor adherence and safety and to answer any questions.

Statistical Analysis

Data collected from the SEE, FES-I, PDQ-39, and UPDRS-II were extracted into Microsoft Excel for further visual analysis.

Human Subjects Protocol

This study was submitted and approved by the university’s institutional review board.
Results

Twelve participants were recruited for this study. Six were randomized into the telehealth group (TH), and six were randomized into the self-supervised group. Three participants in the self-supervised group dropped out: one for back pain, one after week six and the other did not complete the program upon receiving the manual. Over the course of the study, participants completed four questionnaires at pre- (1 week), mid- (6 weeks) and post- (12 weeks). The primary outcomes of interest were self-efficacy to exercise and exercise adherence as measured by the Self-Efficacy for Exercise Scale (SEE) and number of sessions completed. Secondary outcomes of balance confidence, ADLs and quality of life were recorded by the Fall Efficacy Scale – International, the United Parkinson’s disease Rating Scale II, and the Parkinson’s disease Questionnaire - 39.

Analysis from these questionnaires only included pre- and post-data from both groups. Mid-data sets have been removed from data analysis due to concerns about validity. During pre- and post-data collections, participants completed the SEE, FES-I, UPDRS-II, and PDQ-39 questionnaires under the supervision of the researcher following balance and mobility assessments. Questionnaires from the SEE, FES-I, UPDRS-II, and PDQ-39 at mid-data point were mailed and completed at home. It is uncertain whether participants’ spouses or caregivers aided in the completion of the questionnaires at home, an uncontrolled environment.

Telehealth Group

Participants in the TH group participated in 12 weeks of exercise sessions through video-conferencing guided by an exercise instructor (researcher). Adherence to the program was measured each time a participant in the TH group completed a full
exercise session. After the 12-week intervention, participants in the TH group saw an adherence rate of 96.7%.

Total scores of the SEE scale ranged from 0 (indicating lowest self-efficacy) to 90 (indicating highest self-efficacy). In the TH group, scores for self-efficacy for exercise revealed a 3.4% decrease in mean SE scores from pre- to post-data collection with mean scores of 58.83 and 56.83. Of the nine questions that were asked, the perceived barrier to “to exercise alone” was the least common barrier to exercise among the group with percent improvement of 7.69% (6.5 to 7) from pre- to post-data collection. Of the nine questions that were asked, “if you felt depressed” was the highest reported barrier to exercise on average with pre-intervention score of 6.3 to post-intervention score 5.3; a 15.87% decrease.

Total possible score on the FES-I questionnaire ranged from 0 (indicating highest balance confidence) and 64 (indicating lowest balance confidence). Scores of the Fall-efficacy Scale – International (FES-I) showed that as a group from pre-to post-intervention, there was a 10.04% decrease in balance confidence with a score of 33.17 to 36.50. Following the intervention, scores of the UPDRS-II questionnaire ranged from 0 (indicating highest ability to perform ADLs) and 52 (indicating lowest ability to perform ADLs) remained relatively unchanged with scores from pre- and post-data at 16.5 and 17.5 respectively. A reported 6.06% increase in disability from pre to post. Lastly, scores of the PDQ-39 questionnaire ranged from 0 (indicating high quality of life) to 156 (indicating low quality of life) reported increased disability in sub-categories of mobility, ADLs, emotional well-being, social support, communication and bodily discomfort. Social support and stigma scores were reported decreased by the participants; 27.27% and 13.89%.
Following total scores of the SEE, FES-I, UPDRS-II and PDQ-39 for the TH group as a whole, the next section will discuss participants’ individual scores in further detail.

Participant #1

Participant #1 was a 72 year old male, 2.5 on the H&Y scale and completed all 24 exercise sessions. He had an initial SEE score of 34 and a post-data score of 32; a 5.88% decrease in overall SE. Results from the FES-I reported an initial score of 32 with a post-intervention score of 42 for a 31.25% decrease in balance confidence. UPDRS-II scores for Participant #1 from pre- to post-intervention data revealed a 42.85% decrease in ADL ability from 14 to 20. Participant #1 showed a 106.06% decrease in quality of life scores on the PDQ-39 with scores reported at 33 at pre-data and 68 for post-data. All eight sub-scale scores of the questionnaire were increased (mobility, activities of daily living, emotional well-being, stigma, social support, cognitive impairment, communication and bodily discomfort).
Figure 1a - Participant #1 Self-efficacy Questionnaire standardized scores at pre- and post- data point.

Figure 1b - Participant #1 Fall-efficacy Questionnaire standardized scores at pre- and post-data point.
Figure 1c - Participant #1 UPDRS-II

Questionnaire standardized scores at pre- and post-data point

Figure 1d – Participant #1 PDQ-39

Questionnaire standardized scores at pre- and post- data point
Participant #2

Participant #2 was a 69 year old female, 2.5 on the H&Y scale and completed 22 of the 24 exercise sessions. She had an initial SEE score of 66 and a post-data score of 86; a 30.3% increase in overall SE. Results from the FES-I reported an initial score of 29 with a post- intervention score of 28 for a 3.45% increase in balance confidence. UPDRS-II score for Participant #2 from pre- to post-intervention data revealed a 20% increase in ADL ability from 5 to 4. Participant #2 showed a 147.37% decrease in quality of life scores on the PDQ-39 with scores reported at 19 at pre-data and 47 for post-data. Scores on six of the eight sub-scale increased (mobility, activities of daily living, emotional well-being, stigma, cognitive impairment and communication), whereas social support and bodily discomfort remained unchanged.
Figure 2a – Participant #2 Self-efficacy

Questionnaire standardized scores at pre- and post-data point

Figure 2b – Participant #2 Fall-efficacy

Questionnaire standardized scores at pre- and post-data point
Figure 2c – Participant #2 UPDRS-II
Questionnaire standardized scores at pre- and post-data point

Figure 2d – Participant #2 PDQ-39
Questionnaire standardized scores at pre- and post-data point
Participant #3

Participant #3 was a 77 year old female, 3 on the H&Y scale and completed 23 of the 24 exercise sessions. She had an initial SEE score of 28 and a post-data score of 23; a 17.86% decrease in overall SE. Results from the FES-I reported an initial score of 54 with a post- intervention score of 55 for a 1.85% decrease in balance confidence. UPDRS-II score for Participant #2 from pre- to post-intervention data revealed a 12% decrease in ADL ability from 25 to 28. Participant #3 showed a 1.3% decrease in quality of life scores on the PDQ-39 with scores reported at 77 at pre-data and 78 for post-data. Five of the eight sub-scale scores increased (emotional well-being, stigma, social support, cognitive impairment and communication), two were reported increased (mobility and activities of daily living) and one remained unchanged (stigma).
Figure 3a – Participant #3 Self-efficacy

Questionnaire standardized scores at pre- and post-data point

Figure 3b – Participant #3 Fall-efficacy

Questionnaire standardized scores at pre- and post-data point
Figure 3c – Participant #3 UPDRS-II

Questionnaire standardized scores at pre- and post-data point

Figure 3d – Participant #3 PDQ-39

Questionnaire standardized scores at pre- and post-data point
Participant #4

Participant #4 was an 80 year old male, 2 on the H&Y scale and completed all 24 exercise sessions. He had an initial SEE score of 54 and a post-data score of 50; a 7.71% decrease in overall SE. Results from the FES-I reported an initial score of 28 with a post- intervention score of 34 for a 21.43% decrease in balance confidence. UPDRS-II score for Participant #4 from pre- to post-intervention data revealed a 5.56% decrease in ADL ability from 18 to 19. Participant #4 showed a 17.91% increase in quality of life scores on the PDQ-39 with scores reported at 67 at pre-data and 55 for post-data. Two of the eight sub-scale scores increased (mobility and bodily discomfort), five decreased (emotional well-being, stigma, social support, cognitive impairment, and communication) and one remained unchanged (activities of daily living).
Figure 4a – Participant #3 Self-efficacy

Questionnaire standardized scores at pre- and post-data point

Figure 4a – Participant #3 Fall-efficacy

Questionnaire standardized scores at pre- and post-data point
Figure 4c – Participant #4 UPDRS-II

Questionnaire standardized scores at pre- and post-data point

Figure 4d – Participant #4 PDQ-39

Questionnaire standardized scores at pre- and post-data point
Participant #5

Participant #5 was a 72 year old male, 1.5 on the H&Y scale and completed 22 of the 24 exercise sessions. He had an initial SEE score of 84 and a post-data score of 79; a 5.45% decrease in overall SE. Results from the FES-I reported an initial score of 35 with a post-intervention score of 38 for an 8.57% decrease in balance confidence. UPDRS-II scores for Participant #5 from pre- to post-intervention data revealed a 4.55% increase in ADL ability from 22 to 21. Participant #5 showed an 18% decrease in quality of life scores on the PDQ-39 with scores reported at 50 at pre-data and 59 for post-data. Five of the eight sub-scales increased (mobility, emotional well-being, stigma, communication and bodily discomfort), one decreased (cognitive impairment) and two remained unchanged (activities of daily living and social support).
Figure 5a – Participant #5 Self-efficacy

Questionnaire standardized scores at pre- and post-data point

Figure 5b – Participant #5 Fall-efficacy

Questionnaire standardized scores at pre- and post-data point
Figure 5c – Participant #5 UPDRS-II

Questionnaire standardized scores at pre- and post-data point

Figure 5d – Participant #5 PDQ-39

Questionnaire standardized scores at pre- and post-data point
Participant #6

Participant #6 was a 60 year old female, 2 on the H&Y scale and completed 23 of the 24 exercise sessions. She had an initial SEE score of 87 and post-data score of 71; an 18.39% decrease in overall SE. Results from the FES-I reported an initial score of 21 with a post-intervention score of 22 for a 4.76% decrease in balance confidence. UPDRS-II score for Participant #6 from pre- to post-intervention data revealed a 13.33% increase in ADL ability from 15 to 13. Participant #6 showed a 34.62% increase in quality of life scores on the PDQ-39 with scores reported at 26 at pre-data and 17 for post-data. Two of the eight sub-scales increased (mobility and bodily discomfort), five decreased (activities of daily living, emotional well-being, stigma, cognitive impairment, and communication), two decreased (cognitive impairment) and one remained unchanged (social support).
Figure 6a – Participant #6 Self-efficacy

Questionnaire standardized scores at pre- and post-data point

Figure 6b – Participant #6 Fall-efficacy

Questionnaire standardized scores at pre- and post-data point
Figure 6c – Participant #6 UPDRS-II

Questionnaire standardized scores at pre- and post-data point

Figure 6d – Participant #6 PDQ-39

Questionnaire standardized scores at pre- and post-data point
Self-supervised Group

Participants in the control group were asked to complete 24 exercise sessions over 12 weeks through a self-guided exercise manual. Of those in the self-supervised group, only three participants turned in their exercise manuals at the end of the intervention. Only one participant in the group completed the 12-week intervention as was measured though the data recordings in the exercise manual. Of the three participants that dropped out of the program, two did not return for post-intervention data collection, and one dropped due to back pain from a previous injury. The following results are based on the three participants who completed pre- and post-intervention data collection.

Adherence to the program was measured by each time a participant in the self-supervised group completed a full exercise session. After the 12-week intervention, participants in the self-supervised group saw an adherence rate of 36.8%.

Total scores of the SEE scale ranged from 0 (indicating lowest self-efficacy) and 90 (indicating highest self-efficacy). In the self-supervised group, scores for self-efficacy for exercise revealed a 25.97% decrease in mean SE scores from pre- to post-intervention data collection with mean scores of 77 and 57. Of the nine questions that were asked, the perceived barrier of exercising “if the weather was bothering you” was the least common barrier to exercise among the group with the highest mean score of 84. Of the nine questions that were asked, “if you did not enjoy it” and “you felt pain when exercising” were the highest reported barriers to exercise on average with scores of 53 and 54.

Total scores of the FES-I questionnaire ranged from 0 (indicating highest balance confidence) and 64 (indicating lowest balance confidence). Scores of the Fall-efficacy Scale – International (FES-I) showed that as a group from pre-to post-
intervention, there was a 12.73% increase in balance confidence with a change in score of 36.67 to 32. Following the intervention, scores of the UPDRS-II questionnaire ranged from 0 (indicating highest ability to perform ADLs) and 52 (indicating lowest ability to perform ADLs). Mean scores for the self-supervised group ranged from 14 to 16.62 in pre- to post-intervention data collection, a reported 18.71% increase in disability from pre- to post-intervention. Lastly, scores of the PDQ-39 questionnaire ranged from 0 (indicating high quality of life) to 156 (indicating low quality of life) reported increased disability in sub-categories of mobility, activities of daily living, emotional well-being, social support, communication and bodily discomfort. Social support and stigma scores were reported decreased by the participants; 27.27% and 13.89%.
### Self-supervised Group

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<th>PRE</th>
<th>POST</th>
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<tr>
<td>UPDRS-II</td>
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<tr>
<td>PDQ-39</td>
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Figure 7 – Self-supervised Group Mean Scores SEE, FES-I, UPDRS-II, and PDQ-39 Questionnaire standardized scores at pre- and post-data point
Discussion

Individuals with Parkinson’s disease (PD) tend to lead physically inactive lifestyles (Dontje et al., 2012) compared to their healthy peers without PD. Additionally, compared to their healthy peers, people with PD have poorer balance and tend to fall more frequently (Fertl et al., 1993; Bloem et al., 2001). These factors may not only lead to secondary health complications but an avoidance of activities of daily living (ADLs) and exercise all together. Therefore, it is important to engage individuals with PD in exercise interventions that are tailored to their needs in hopes of improving physical activity participation (Hariz and Forsgren, 2011). However, adherence to exercise programs may be challenging for those with chronic disabilities (Ellis et al., 2013). Certain barriers to exercise, such as limited access to exercise resources, lack of motivation, and low self-efficacy to exercise, are prevalent concerns when trying to engage a person with PD in exercise (Ellis et al., 2013; Forkan et al., 2006; Ellis and Schenkman, 2014). Fortunately, telehealth technology has been shown to be a strong resource in delivering healthcare to individuals with PD (Hubble et al., 1993; Venkataraman et al., 2014; Dorsey et al., 2013; Ellis et al., 2013). The objective of the study was to examine the effects of a telehealth exercise program on self-efficacy and adherence in individuals with PD.

Adherence was high in the telehealth group (TH) (96.7%) compared to that of the self-supervised group (36.8%). However, results of this study revealed no trend of improvements in self-efficacy to exercise in either the TH group or the self-supervised group. In addition to high adherence rates, participants post-intervention expressed positive reactions towards telehealth exercise programming. Ability to perform ADLs, balance confidence and quality of life had no trends of improvement in either group.
Adherence

Over the 12-week intervention, a total of 24 exercise sessions were to be completed for each participant. Of these sessions, participants in the TH group only missed five sessions in total. This 96.7% adherence rate is much higher than the average adherence rate of 75.5% to other exercise programs for individuals with PD (Pickering, Fittong, Ballinger, Fazakarley, Ashburn, 2013; Allen et al., 2013). Sessions missed among the TH group were due to time conflicts and illness. Since telehealth exercise has the means of adapting to certain time constraints or time barriers, rescheduling sessions was time-efficient. Several studies reported that participants’ adherence to exercise may be caused by lack of transportation or time (Ellis et al., 2011; Ene, McRae, and Schenkman, 2011). Telehealth exercise eliminated those barriers by providing exercise in the comfort of participants’ homes. This may play an integral part in the health and wellbeing of someone with PD.

Bassett and colleagues (2003) recommend that home-based exercise programs should involve self-reported documentation for exercise within the PD population. For this reason, participants in the self-supervised group were asked to mark their repetitions and sets for each exercise they performed. Of the three that returned for post-intervention data collection, only one participant filled out the whole manual; the other two participants did not fill in anything. Of the two participants that returned blank manuals, one stated he completed five sessions before quitting and the other reported saying he completed the whole program. Accordingly, upon review of numerous studies involving exercise and reported adherence in individuals with PD, an estimated 65% of participants do not adhere to at-home rehabilitation programs (Bassett, 2003). Although both groups had home programming, the TH group showed a much higher adherence and retention rate than that of the self-supervised group.
Self-efficacy

Self-efficacy to exercise is a strong predictor of exercise behavior and those with high self-efficacy are more likely to regularly engage in physical activity and exercise than people with low self-efficacy for exercise. Self-efficacy to exercise increased over the course of the program for one participant in the TH group and did not change for the self-supervised group.

Scores on the SEE scale may have been affected by severity of PD. Although research has shown that self-efficacy to exercise is a greater predictor of exercise participation than disease severity (Ellis et al., 2011) in general, participants with less severity scored higher on the SEE scale. Three participants with scores on the Hoehn and Yahr scale between 1.5 and 2 reported higher exercise self-efficacy than two participants with H&Y scores between 2.5 and 3. One participant with a score of 2.5 on the Hoehn and Yahr scale reported a higher overall self-efficacy to exercise compared to the other five participants in the TH group. Additionally, this participant was the only one who showed improvements in exercise self-efficacy from pre- to post-data collection (30.3% increase).

The SEE scale consists of questions directly related to barriers to exercise. For instance, question 9 states “How confident are you right now that you could exercise three times per week for 20 minutes if you felt depressed.” The barrier of depression was reported to be the significant barrier to exercise for only the TH group. Interestingly, participants’ confidence to exercise when depressed decreased over the course of the program. Depression is common among individuals with PD, and research has shown that about 50% of people have a dual diagnosis of PD and depression (Dobkin et al., 2008). As participants began to incorporate regular exercise
into their routine, they may have realized that feeling depressed was indeed a barrier to participation.

Although the results of this study did not show significant improvements in exercise self-efficacy, it should be noted that exercise and self-efficacy among this group have not been evaluated using this type of exercise programing. Ellis and colleagues (2011) found that individuals with PD who were ‘exercisers’ had higher self-efficacy compared to those who identified as ‘non exercisers’. Due to the inclusion/exclusion criteria of the study, our participants among the TH group were ‘non exercisers’. Additionally, in the time frame of the study, individuals may not have identified as an ‘exerciser’.

Verbal persuasion, mastery experience and emotional and somatic states were the main constructs of SE included in this intervention. The researcher acted as the positive verbal persuasion, in addition to the maintenance of emotional and somatic states of the participant. The self-selected exercise progressions from the manual served as mastery experience, which is considered to be the most influential source of improving self-efficacy (Bandura, 1997). For this reason, self-selected exercise progressions were a main aspect of this intervention in hopes of improving self-efficacy. However, scores on the SEE scale did not improve from pre- to post-intervention, possibly due to the lack of the construct of vicarious experience. Participants may have benefited from viewing someone with a similar condition or physical limitations while exercising (Bandura, 1997).

The SEE scale is a measure of confidence to exercise independently. Since participants in the TH group were being supervised during their exercise sessions, the questionnaire may not have been a good indicator of independent exercise confidence.
It is also important to note that highly supervised exercise may decrease self-efficacy to exercise (Carlson et al., 2001).

**FES-I**

In regards to balance confidence, from pre- to post-intervention data collection, participants in the TH did not see any trend of improvements. However, four questions stood out, which may offer insight into their balance ability perception. Confidence in ‘getting dressed’, ‘getting in and out of a chair’, ‘walking around neighborhood’, and ‘going out to a social event’ all had positive pre- to post-intervention results. Since PD is a progressive disease, no change or small improvements are seen as positive. The item ‘getting dressed’ showed improved balance confidence for three participants. The item of ‘getting in and out of chair’ and ‘walk around the neighborhood’ both had unchanged scores for five participants. Lastly, ‘going out to a social event’ was unchanged for the TH group from pre- to post-intervention data collection. Since PD is a progressive disorder, unchanged scores from pre- to post-intervention data collection may show maintenance in balance confidence.

Results from previous studies using the FES-I to assess individuals with PD fall risk found that a sum greater than 30 indicated a greater risk of falls (Alemeida, Valenca, Negreiros, Pinto and Olivera-Filho, 2014). At the beginning of the study, three participants from both severity groups were below 30. However, post-data revealed only two participants were below 30, thus at a low risk of falling. This change in balance confidence may have been elicited by the participants’ awareness to a new exercise program. The individuals in the TH group were ‘non exercisers’ which may have prompted them to report higher balance confidence before they began the exercise program.
**UPDRS-II**

Scores of the UPDRS-II assessing ability to perform ADLs did not see prominent changes from pre- to post-data collection in the TH group. As has been recorded in a previous study, a score greater than 16 on the UPDRS-II constitutes as functional impairment (Alemeida, Valenca, Negreiros, Pinto and Olivera-Filho, 2014). Of the six participants in the TH group, four participants reported numbers above 16 at pre- to post-intervention data collection and only two remained under a score of 16. Participant #3 who was a 3 on the H&Y scale reported higher functional impairments than the TH group average from pre- to post-intervention data collection, revealing that severity of the disease may have had effect. Results from this participant are supported by other research, in which disease severity constitutes as an indicator to balance problems and functional limitations (Wood, Bilclough, Bowron, Walker, 2002). Furthermore, Park and colleagues (2013) reported that UPRDS scores did not improve within a three-month period but did improve after six months. As our program was only 12 weeks, this may explain our results of no change on the UPDRS-II.

**PDQ-39**

The PDQ-39, a quality of life assessment, followed similar results of the FES-I and UPDRS-II with regards to no improvements from pre- to post-intervention data collection. However, sub-categories of ‘stigma’ and ‘cognitive impairment’ did improve for the TH group. Schrag, Jahanshahi, and Quinn (2000) stated that along with depression, disability, and postural instability, cognitive impairment had the greatest influence on quality of life in individuals with PD. Even though other components of the questionnaire did not improve following the intervention,
improvements in cognition serve as a step towards better quality of life through exercise.

Other Findings

Upon completion of the program, participants were asked to fill out a survey on their views about the program during post-intervention data collection. A full list of questions can be seen in Appendix D. In the TH group, when asked about the connection of telehealth exercise sessions to that of in-person sessions, four of the six participants stated there was the ‘same’ connection (66.7%) and the remaining two felt there was ‘more’ of a connection (33.3%). These responses are important because it shows that even though results of the program may not have shown large changes in SE, connections were made between the instructor and participant. This is important for adherence to exercise in this population (Crizzle and Newhouse, 2012). When asked ‘If there had been any changes in their life since beginning the program,’ three participants reporter they felt stronger, two reported better balance and one looked forward to a maintenance program.

In follow-up phone calls about the intervention, feedback from the program was positive and informative, which can serve as guidance for future research. Comments such as “excellent” and “well-organized” in reference to the exercise program showed how receptive participants were to telehealth exercise. After the course of the 12 week, two participants continued with telehealth exercise with the researchers. One participant stated that the program “gave me more courage to go out” and also started walking daily for up to 15 minutes at a time, a significant improvement from depending on her wheelchair.

When asked about the questionnaires, most remained neutral stating “don’t remember them” and “no big deal.” However, one participant felt as if the questions
were “standard and not related to exercise.” This could be related to the SEE scale and FES-I questionnaires that did not directly related to PD. The same participant reported that the word ‘confident’ in the SEE scale “was difficult to deal with.” She did not know “whether I could do it or that I would do it.” The confusion to this questionnaire could have posed a problem for other participants even though they did not verbally state it. For this reason, the SEE scale and FES-I questionnaire may not have been sensitive enough for individuals with PD.

**Limitations and Future Research**

Through the course of this study, a few limitations were identified. One limitation of this study was the small sample size that was recruited. This small sample cannot accurately represent the Parkinson’s population as a whole. Therefore, we suggest that future studies look at larger sample sizes with varying degrees of PD. Another limitation was the use of two separate exercise instructors. Even though the exercises were directly from the manual, certain verbal cues or encouragement may have altered the way participants felt about their self-selected exercise progressions, which may have affected self-efficacy. Another limitation may have been the chosen exercises for the manual. These exercises may not have been challenging enough for our participants in order to elicit increases in self-efficacy, balance confidence and quality of life. Future studies that involve telehealth exercise programs should have a larger range of exercise difficulties for participants to choose from.

Also, questionnaires were not completed in the same location for pre-, mid- and post-intervention data collection. Pre- and post-intervention questionnaires were administered in a university-based lab, while mid-data questionnaires were done at home. We cannot be certain that the participants themselves filled it out since there
was no supervision from the researcher. Spouses or caregivers of the participants may have assisted with filling it out in order to meet deadline dates.

Lastly, future research should examine telehealth exercise in partners or small groups. Increasing the number of people per telehealth sessions may elicit more positive results through the use of vicarious learning. Although there is much research to be done within this population examining the effects of telehealth exercise, future research should examine telehealth exercise in other disability populations.

Clinical Significance and Conclusion

In conclusion, excellent adherence levels and positive feedback from participant’s post-intervention show that telehealth exercise programming is feasible for individuals with PD. Additionally, these exercises can be done at in the comfort of people’s homes which may be a large motivator for individuals with PD. Reports from the questionnaires did not show a trend of improvement in self-efficacy, balance confidence, ADLs, or quality of life. However, this study showed that telehealth exercise is a viable alternative for exercise for people with PD. Telehealth exercise has the potential to bring high quality exercise programs to this population.
References


Appendix A

California State University, Northridge
CONSENT TO ACT AS A HUMAN RESEARCH SUBJECT

The Effects of a Telehealth Exercise Program on Balance, Mobility, Self-efficacy, and Adherence in individuals with Parkinson’s Disease

You are being asked to provide consent to participate in a research study titled “The Effects of a Progressive Telehealth Exercise Program on Balance, Mobility, Self-efficacy, and Adherence in individuals with Parkinson’s Disease” a study conducted by Elizabeth Garcia and Robert Stone as part of the requirements for the M.S. degree in Kinesiology at California State University, Northridge. Participating in this study is completely voluntary. Please read the information below and ask questions about anything that you do not understand before deciding if you want to allow your child to participate. A researcher listed below will be available to answer your questions.

RESEARCH TEAM

Department of Kinesiology
18111 Nordhoff St.
Northridge, CA 91330- 8287

Researcher: Elizabeth Garcia
909-524-9516
elizabeth.garcia.32@my.csun.edu

Researcher: Robert Stone
619-768-3734
robert.stone.350@my.csun.edu

Faculty Advisor: Dr. Teri Todd
818-677-2182 ext.5090
teri.todd@csun.edu

PURPOSE OF STUDY
The purpose of this research is to examine the effects of a telehealth exercise program on balance, mobility, self-efficacy and adherence in individuals with Parkinson’s Disease (PD).

SUBJECTS
Inclusion Requirements
1) Confirmed diagnosis of idiopathic Parkinson’s disease
2) Scored between a 1-3 of the Hoehn and Yahr scale
3) Aged between 40-85 years old
4) Obtain medical clearance to participate in 45 minute moderate intensity balance and resistance training exercise.
5) Ability to read and communicate in English as to understand the instructions.
6) Ability to use a computer
7) Maintained consistent medication protocol for 1 month prior to initial data collection.

Exclusion Requirements
1) Additional musculoskeletal or neurological condition or cardiovascular disorder that would inhibit their ability to participate in cardiovascular exercise.
2) Change in medication type or dosage within the month prior to data collection.
3) Current participation in an exercise related research study.
4) Current participation in a formal exercise program.
5) Lack of access to internet.
6) Cannot provide a person in close proximity that can “spot”, perform CPR and call emergency services (911) should it be necessary.

Time Commitment
This study will involve total of 25 hours of your time over the 12 weeks (3 months), including 18 hours of physical activity intervention (45minutes/ 2times/ 12weeks) and 5 hours of balance assessments and questionnaires (2 hours for pre and post data collection, 1 hour for mid data collection through mail).

PROCEDURES
Recruitment
Upon being recruited for this study, you will be required to obtain medical clearance from your primary physician prior to any data collection. Once medical clearance has been obtained, you may come back and sign the consent form. Upon consent, you will receive a home visit from the researchers in order to establish a safe exercise environment.

Home Visit/Initial Meeting
The home visit from the researchers will provide you a safe exercise area, instructions on how to use video-conferencing technology and provide you exercise equipment. An active spotter will be required to be in the vicinity of the exercise space in order to ensure safety. Once this home visit has been completed, on a future day you will be directed to come to the Center of Achievement through Adapted Physical Activity on the California State University, Northridge campus for a brief one-on-one explanation of the balance tests and questionnaires. This time will also be used to explain which group you have been assigned into and what participation in that group entails. At this time, we will begin initial data collection.

Data collection procedures
You will visit CSU Northridge 2 times during the study. When you come for the initial data collection, we will collect your consent and medical release forms. You will be randomly selected into either telehealth group or self-supervised group then we will take your height and weight.

Questionnaires
You will be asked to fill out 4 questionnaires that will assess your balance confidence, exercise tendencies, activities of daily living and overall quality of life. These questionnaires will take about 35 minutes to complete. All questionnaires will be
administered in person at the CoA with the exception of the mid data collection in which the questionnaires will be mailed to you and returned within one week’s time.

**Balance and Mobility**
You will then take part in five balance assessments. The first two tests will be done on a balance machine which involves a moving platform. You will be secured with a harness system to eliminate the risk of falls. The first will require you to lean your body in multiple directions while aiming for targets on a computer screen and the second will require you to maintain balance as the force plate below you moves. The third test will require you to step across another platform for a distance of 3 meters and the fourth test will use that same platform in which you will be asked to rise from a seated position. Both tests will be done three times. Lastly, you will stand up from a chair, walk a short distance, turn around, and sit back down in the chair. This will be done once.

These assessments will take about 2 hours to complete.

The questionnaires will be administered before exercise programs begin, during the 6th week and after the program ends on the 12th week. Balance assessments will be taken at the beginning of the exercise program and at the 12th week. We will give you appointment dates for all the rest of the visits.

**Intervention procedures**
Elizabeth Garcia and Robert Stone will be conducting the video-conferencing exercise program. The exercise program will take place at your home. The exercise program will run two days per week for 45 minutes. Exercise will include upper body, lower body and balance training using both ankle/wrist weights along with resistance bands. Times and dates will be provided at the initial data collection meeting.

If you are chosen for the control group, you will follow an identical exercise program through an exercise manual and receive an identical set of exercise equipment as the intervention group for the 12 weeks of the study. Two weekly phone calls will be made in order to monitor your progress as well as answer any questions you may have.

**RISKS AND DISCOMFORTS**
While you understand that we strive to prevent any possible complications or injuries, there are risks involved in participation such as:
- Cardiovascular complications such as heart attack, stroke and in the rarest cases, death,
- Dehydration
- Bodily injuries such as sprains, and fractures due to falls, including loss of consciousness
  and intracranial bleeding, and in the rarest cases, death.
- Physical fatigue
- Muscle cramps
- Emotional distress

In an attempt to minimize these risks, certain precautions will be taken such as:
- Physician clearance will be obtained to ensure you do not have any contraindications for the exercise protocol
- An initial home visit by the researchers will be given in order to provide a safe exercise environment.
- You will be asked to drink plenty of water in order to keep yourself hydrated during the exercises.
- You will be required to have another person in close proximity that can “spot”, perform CPR and to call emergency services (911) should it be necessary.
- You will be encouraged to take a break should you experience physical fatigue.
- You will be allowed to stop at anytime during the balance/mobility tests or questionnaires should you feel distressed or concerned. You should feel free to ask questions or address concerns during these tests.

BENEFITS

Subject Benefits
The benefits of this project will be having you complete an organized exercise program, preparing you for community-based fitness programs, and teaching you the benefits to your overall health that exercise can provide.

Benefits to Others or Society
The study findings can contribute to building scientific evidence for treating individuals with PD.

ALTERNATIVES TO PARTICIPATION
The only alternative to participation in this study is not to participate.

COMPENSATION, COSTS AND REIMBURSEMENT

Compensation for Participation
You will not be paid for your participation in this research study.

Costs
There is no cost to you for participation in this study. All parking permits will be provided free of charge.

Reimbursement
Since there is no cost to you there will be no need for reimbursement.

WITHDRAWAL OR TERMINATION FROM THE STUDY AND CONSEQUENCES
You are free to withdraw from this study at any time. If you decide to withdraw from this study you should notify the research team immediately. The research team may also end your participation in this study if you do not follow instructions, miss scheduled visits, or if your safety and welfare are at risk.

CONFIDENTIALITY

Subject Identifiable Data
All identifiable information that will be collected about you will be removed and replaced with a code. A list linking the code and your identifiable information will be kept separate from the research data.

Data Storage
All research data will be stored electronically on a secure computer with password protection. All paper research data will be stored in a locked file cabinet at the Center of Achievement through Adapted Physical Activity in the main office where only the
primary investigators, Elizabeth Garcia and Robert Stone, and faculty advisor, Dr. Teri Todd will have access to the cabinet. Both forms of data will remain accessible to the primary researcher and the faculty advisor up to three years after the completion of the study after which all data will be destroyed.

**Data Access**
The researcher and faculty advisor named on the first page of this form will have access to your study records. Any information derived from this research project that personally identifies you will not be voluntarily released or disclosed without your separate consent, except as specifically required by law. Publications and/or presentations that result from this study will not include identifiable information about you.

**Data Retention**
The researchers intend to keep the research data for approximately 3 years and then it will be destroyed.

**IF YOU HAVE QUESTIONS**
If you have any comments, concerns, or questions regarding the conduct of this research please contact the research team listed on the first page of this form. If you are unable to reach a member of the research team listed on the first page of the form and have general questions, or you have concerns or complaints about the research study, research team, or questions about your rights as a research subject, please contact Research and Sponsored Projects, 18111 Nordhoff Street, California State University, Northridge, Northridge, CA 91330-8232, or phone 818-677-2901.

**VOLUNTARY PARTICIPATION STATEMENT**
You should not sign this form unless you have read it and been given a copy of it to keep. **Participation in this study is voluntary.** You may refuse to answer any question or discontinue your involvement at any time without penalty or loss of benefits to which you might otherwise be entitled. Your decision will not affect your future relationship with California State University, Northridge. Your signature below indicates that you have read the information in this consent form and have had a chance to ask any questions that you have about the study.

_I agree to participate in the study._

---

Subject Signature   Date

Printed Name of Subject   Date

Researcher Signature   Date

Printed Name of Researcher   Date
Appendix B

<table>
<thead>
<tr>
<th>How confident are you right now that you could exercise three times per week for 20 minutes if:</th>
<th>Not Confident</th>
<th>Very Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. the weather was bothering you</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>2. you were bored by the program or activity</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>3. you felt pain when exercising</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>4. you had to exercise alone</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>5. you did not enjoy it</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>6. you were too busy with other activities</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>7. you felt tired</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>8. you felt stressed</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>9. you felt depressed</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
</tbody>
</table>
Appendix C

FES-I

Now we would like to ask some questions about how concerned you are about the possibility of falling. Please reply thinking about how you usually do the activity. If you currently don’t do the activity (e.g. if someone does your shopping for you), please answer to show whether you think you would be concerned about falling IF you did the activity. For each of the following activities, please tick the box which is closest to your own opinion to show how concerned you are that you might fall if you did this activity.

<table>
<thead>
<tr>
<th></th>
<th>Not at all concerned 1</th>
<th>Somewhat concerned 2</th>
<th>Fairly concerned 3</th>
<th>Very concerned 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cleaning the house (e.g. sweep, vacuum or dust)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Getting dressed or undressed</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Preparing simple meals</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Taking a bath or shower</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Going to the shop</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Getting in or out of a chair</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Going up or down stairs</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Walking around in the neighbourhood</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Reaching for something above your head or on the ground</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Going to answer the telephone before it stops ringing</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Walking on a slippery surface (e.g. wet or icy)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Visiting a friend or relative</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Walking in a place with crowds</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>Walking on an uneven surface (e.g. rocky ground, poorly maintained pavement)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Walking up or down a slope</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>Going out to a social event (e.g. religious service, family gathering or club meeting)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

FES-I: Prof Lucy Yardley and Prof Chris Todd
### Appendix D

**PDQ-39 QUESTIONNAIRE**

Please complete the following

Please tick one box for each question

<table>
<thead>
<tr>
<th>Due to having Parkinson's disease, how often during the last month have you...</th>
<th>Never</th>
<th>Occasionally</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always or cannot do at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Had difficulty doing the leisure activities which you would like to do?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Had difficulty looking after your home, e.g. DIY, housework, cooking?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Had difficulty carrying bags of shopping?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Had problems walking half a mile?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Had problems walking 100 yards?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Had problems getting around the house as easily as you would like?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Had difficulty getting around in public?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Needed someone else to accompany you when you went out?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Felt frightened or worried about falling over in public?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E

(Post-intervention questions TH group)

Did you enjoy the exercise program?  Y / N

Do you plan on continuing to use the manual?  Y / N

Do you plan to continue to exercise?  Y / N

Would you recommend this program to a friend or relative with Parkinson’s Disease?  Y / N

Did you feel that this program was effective in improving your physical fitness?  Y / N

Compared to an in-person exercise session, did you feel you had more, same or less of a personal connection with your exercise trainer?  More  Same  Less

Have there been any changes in your life since the beginning of the exercise program? (ex. More energy, able to catch yourself before you fell)
Sit to Stand (3 sets of 10 reps.)

Position - Seated facing forward
- Lean forward so that your weight shifts over your heels
- Raise slightly out of your seat.
- Lean back to gently sit back down into the seat to return to the starting position to complete the repetition.

Progression #1 - Stand up slightly while still being able to keep your hands in contact with the sides of the chair.

Progression #2 - Come to a complete standing position.

<table>
<thead>
<tr>
<th></th>
<th>1st Time</th>
<th>2nd Time</th>
<th>3rd Time</th>
<th>4th Time</th>
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<tbody>
<tr>
<td>Record Sets / Reps / Progression #</td>
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