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I, Emily Marie Miller,

hereby submit this work as part of the requirements for the degree of:

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This work and its defense approved by:

Chair: Bradley R. Willcox
Amy L. Barnard

THE RELATIONSHIPS AMONG EXERCISE, DEPRESSION, AND DISABILITY IN PATIENTS WITH PARKINSON'S DISEASE

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Emily M. Miller

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Committee Chair: Dr. Bradley R.A. Wilson

Abstract

AN ABSTRACT OF THE THESIS FOR THE MASTER OF EDUCATION DEGREE IN HEALTH PROMOTION AND EDUCATION, PRESENTED ON JANUARY 29, 2004, AT THE UNIVERSITY OF CINCINNATI, OHIO.

TITLE: The Relationships Among Exercise, Depression, and Disability in Patients with Parkinson's Disease.

MASTERS COMMITTEE MEMBERS: Dr. Bradley R.A. Wilson (Chair) and Dr. Amy L. Bernard

The purpose of this study was to determine if patients with Parkinson's disease (PD) who exercised experienced less feelings of depression than those who did not exercise. There were approximately 1.5 million people with PD in the United States (Koller, 1993). PD was reported in all ethnic groups and races and males and females had similar numbers of cases (Eller and Dan, 1997). PD primarily struck older adults, however, a form of PD was found in teenagers (Lieberman, et. al., 1982, Eller and Dan, 1997). Depression, "a state of being associated with feelings of hopelessness or a sense of defeat" (Landers, 1997, p.1), occurred in as many as one half of patients with PD (American Parkinson Disease Association, 1995). It was found that depression was difficult to diagnose because of an overlapping of the physical symptoms of PD and depression which include: slowed movement, reduced facial expression, fatigue, sleep disturbance, diminished concentration, stooped posture, constipation, and diurnal variation (Bonander, 1997; Hutton and Hutton, 1995). Landers (1997) stated that "exercise is related to positive mental health as indicated by relief in symptoms of depression and anxiety" (p.1). In this study, 70 patients with PD completed a set of questionnaires (UPDRS, Beck Inventory, and General Lifestyle Inventory) during an appointment with their neurologist. The

UPDRS was used to evaluate disability associated with PD, Beck Inventory was used to evaluate depression and the General Lifestyle Inventory was used to document exercise practices. Correlations were completed to determine relationships between each type of exercise (cardiovascular, strength training and flexibility) and disability associated with PD and each type of exercise and depression. Significant negative relationships were found for flexibility exercise and depression, cardiovascular exercise and PD disability, and strength training exercise and PD disability. Flexibility was a vital part of maintaining a patient's range of motion and for keeping muscles from becoming stiff and painful. Increased cardiovascular and strength training exercise were related to decreased PD disability which suggested that people who exercised more were less disabled from PD. Causation was not determined, therefore, it was not know if the patient's increased exercise kept them less disabled or if the patient had increased exercise because they were less disabled.

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Chapter One

The Problem

There were approximately 1.5 million people in a year with Parkinson's disease (PD) in the United States and the prevalence rate was approximately 200 cases per 100,000 people (Koller, 1993). PD affected approximately one percent of the United States population ages 50 and older (Eller & Dan, 1997). It was found that PD struck people between the ages of 50 and 80 with the average age being 60 (Eller & Dan, 1997). All ethnic groups and races had reported cases of PD, and males and females had similar numbers of cases reported (Eller & Dan, 1997). Furthermore, a form of PD was found that struck teenagers (Lieberman, Gopinathan, Neophytides, & Goldstein, 1982).

The extent of PD varied from patient to patient, "not everyone with PD experiences the same symptoms. The symptoms can appear slowly and in no particular order. They may affect one side of the body more than the other" (American Academy of Neurology, 1994, p.2). Eller and Dan (1997) defined Parkinson's Disease as "a degenerative disease of the central nervous system that is progressive in nature" (p. 903). More specifically, PD patient's nerve cells which produced dopamine died which resulted in an imbalance between dopamine and acetylcholine and this imbalance led to a lack of coordination of movement that often appeared as tremors, stiff muscles and joints, and/or difficulty moving (Somerset Pharmaceuticals, 1997).

According to Lieberman, et al. (1982), patients with PD experienced two forms of symptoms- primary and secondary. Primary symptoms included: rigidity, tremors,

bradykinesia (delay of movement/slowness of movement), difficulty with balance, and difficulty with walking (Lieberman, et al., 1982). Secondary symptoms included: depression, sleep disturbances, dementia, forced eye closure, speech problems, drooling, difficulty swallowing, weight loss, constipation, breathing problems, difficulty voiding, dizziness, stooped posture, swelling of the feet, and sexual problems (Lieberman, et al., 1982).

The cause of PD was unknown but theories of causation included: chemical reactions within the body, exposure to toxic substances, certain genetic factors, and accelerated aging (American Academy of Neurology, 1994). There were no diagnostic tests for PD, doctors relied on careful physical examinations and patient's history (American Academy of Neurology, 1994). PD was a chronic disease, once diagnosed "symptomatic treatment for Parkinson's disease is usually successful, especially in the early years, although it does not stop its progress or cure the disease" (American Academy of Neurology, 1994, p.4). Treatments for PD included: medications, diet, exercise, surgery, and support groups.

Depression was defined as "a state of being associated with feelings of hopelessness or a sense of defeat...all people feel 'down' or 'blue' even when circumstances would dictate otherwise" (Landers, 1997, p.1). In addition, Landers stated that "all people feel 'depressed' at times, but a 'depressed' person feels this way much of the time" (p.1). In order to be clinically diagnosed with depression, at least five of the following symptoms had to be experienced during the same two week period with either the first and/or second points being present: (1) depressed mood, (2) marked loss of

interest/pleasure in all or almost all activities, (3) significant weight loss or weight gain, (4) insomnia/hypersominia, (5) agitation, (6) fatigue or loss of energy, (7) feeling of worthlessness, (8) diminished ability to think or concentrate, and (9) recurrent thoughts of death or suicide (Hutton & Hutton, 1995).

"Approximately 25% of Parkinson's patients become depressed even prior to the development of any motor symptoms of the disease" (Hutton & Hutton, 1995, p.3). "Depression occurs in as many as one-half of patients with PD. Although depression is usually considered an appropriate reaction to a disabling illness, patients with PD experience depression more than patients with other similarly disabling illnesses" (American Parkinson's Disease Association, 1995, p. 3). It was found that depression was difficult to diagnose because of an overlapping of the physical signs of PD and depression which included: slowed movement, reduced facial expression, fatigue, sleep disturbance, diminished concentration, stooped posture, constipation, and diurnal variation (Bonander, 1996; Hutton & Hutton, 1995).

It was postulated in 1995 that exercise "decreased anxiety and depression" and "enhanced feelings of well-being" (American College of Sports Medicine, p.5). Corbin and Pangrazi (1996) concluded that "physical activity appears to relieve symptoms of depression and anxiety and improve mood" (p. 4). Landers found evidence that supported the claim that exercise was "related to positive mental health as indicated by relief in symptoms of depression and anxiety" (1997, p.7). Stamford (1995) devised a list of reasons of why exercise enhanced mind function and emotional state. That list included the following reasons: increased alpha-wave activity (calming effect), was a

physical/stress release (decreases muscle tension), enhanced sleep, released seratonin (relaxing/satisfying effect), and distracted mind from negative/stressful thoughts. The benefits from exercise were similar to those of other treatments for depression; exercise was at least as effective as more traditional therapies for depression (Landers, 1997).

Exercise was essential for keeping PD patients strong and flexible and it was stated that exercise was "nearly as important as your medications" (Carter, 1995, p.1). It was also stated that good physical fitness would help improve how well patients lived with PD. The National Institute of Neurological Disorders and Stroke (1994) stated "Exercises will not stop disease progression, but they may improve body strength so that the person is less disabled...Exercises can also improve the emotional well-being of parkinsonian patients by giving them a feeling of accomplishment" (p. 26). Hutton and Hutton (1995) stated that "one should not forget that activity is a natural antidepressant" (p. 3).

Statement of the Problem

The purpose of this study was to determine if patients with Parkinson's disease (PD) who exercised experienced less feelings of depression than those who did not exercise.

Hypothesis

Hypothesis 1. There will be a negative relationship between cardiovascular exercise and depression in PD patients.

Null Hypothesis 1. There will be no relationship between cardiovascular exercise and depression in PD patients.

Alternate Hypothesis 1. There will be a positive relationship between cardiovascular exercise and depression in PD patients.

Hypothesis 2. There will be a negative relationship between flexibility exercise and depression in PD patients.

Null Hypothesis 2. There will be no relationship between flexibility exercise and depression in PD patients.

Alternate Hypothesis 2. There will be a positive relationship between flexibility exercise and depression in PD patients.

Hypothesis 3. There will be a negative relationship between strength training exercise and depression in PD patients.

Null Hypothesis 3. There will be no relationship between strength training exercise and depression in PD patients.

Alternate Hypothesis 3. There will be a positive relationship between strength training exercise and depression in PD patients.

Hypothesis 4. There will be a negative relationship between cardiovascular exercise and disability in PD patients.

Null Hypothesis 4. There will be no relationship between cardiovascular exercise and disability in PD patients.

Alternative Hypothesis 4. There will be a positive relationship between cardiovascular exercise and disability in PD patients.

Hypothesis 5. There will be a negative relationship between flexibility exercise and disability in PD patients.

Null Hypothesis 5. There will be no relationship between flexibility exercise and disability in PD patients.

Alternative Hypothesis 5. There will be a positive relationship between flexibility exercise and disability in PD patients.

Hypothesis 6. There will be a negative relationship between strength training exercise and disability in PD patients.

Null Hypothesis 6. There will be no relationship between strength training exercise and disability in PD patients.

Alternative Hypothesis 6. There will be a positive relationship between strength training exercise and disability in PD patients.

Delimitations

This study was delimited to patients with PD that lived in the Greater Cincinnati area and who were receiving treatment for PD in the Greater Cincinnati area.

Limitations

Participants are self reporting exercise behaviors, Parkinson's disease disability and depression. Participants were responsible for returning the survey at the end of their office visit.

Assumptions

It was assumed that all participants were honest in their answers to the inventory questionnaires.

Operational Definitions

1. Depression: a state of being associated with feelings of hopelessness or a sense of defeat as measured by the Beck's Depression Inventory. Inventory responses could range from 0 to 63 with responses divided into 4 categories.

2. Disability: measured by the UPDRS Inventory. Responses to the UPDRS could range from 0 to 199.

3. Cardiovascular Exercise: At least 15 minutes of continuous activity such as walking, biking, swimming, gardening, etc.

4. Flexibility Exercise: At least 5 minutes of stretching or range of motion activities.

5. Strength Training Exercise: At least 10 minutes of resistance activity such as weight training, resistance bands, etc.

Chapter Two

Review of Literature

The literature review identifies the definition and characteristics of Parkinson's disease (PD), the extent of PD, and the history of treatment of PD. The literature review also examines the definition and characteristics of depression, the association of depression and PD, and the treatments for depression. Finally the literature review discusses the benefits of exercise, the association of exercise and depression and the association of exercise and PD. The purpose of this study was to determine if patients with Parkinson's disease who exercised experienced less feelings of depression than those who did not exercise.

Parkinson's Disease

Definition and Characteristics of Parkinson's Disease. Eller and Dan (1997) stated that "Parkinson's Disease is a degenerative disease of the central nervous system that is progressive in nature" (p. 903). More specifically, PD patients' nerve cells which produced dopamine died which resulted in an imbalance between dopamine and acetylcholine. This imbalance led to a lack of coordination of movement that often appeared as tremors, stiff muscles and joints, and/or difficulty moving (Somerset Pharmaceuticals, 1997). Primary symptoms of PD included: rigidity, tremor, bradykinesia (delay in movement and/or slowness of movement), difficulty with balance, and difficulty in walking (Lieberman, et al., 1982). Secondary symptoms included:

depression, sleep disturbances, senility, forced eyelid closure, speech problems, drooling, difficulty swallowing, weight loss, constipation, breathing problems, difficulty in voiding, dizziness, stooped posture, swelling of the feet, and sexual problems (Lieberman, et al., 1982). The American Academy of Neurology (1994) found that "not everyone with Parkinson's experiences the same symptoms. Moreover, the symptoms can appear slowly and in no particular order. They may affect one side of the body more than the other" (p. 2).

Extent of Parkinson's Disease. Lieberman, et al., (1982) found that PD was a "growing national problem, with over a million victims in the United States alone" (p. 1). "Most physicians and lay people are not aware of PD's true impact: and do not realize that more people suffer from it than multiple sclerosis, muscular dystrophy and amyotrophic lateral sclerosis (Lou Gehrig's Disease) combined" (Bernstein, 1995, p. 1). PD affected approximately one percent of the US population ages 50 and older (Eller & Dan, 1997). "There are 20 new cases of PD per 100,000 people per year" (Lieberman, et al., 1982 p. 1). It was found that Parkinson's disease struck people between the ages of 50 and 80 with the average age being 60. In addition, all ethnic groups and races had reported cases of PD and no group showed significant differences, and males and females had similar numbers of cases reported (Eller & Dan, 1997). Furthermore, a form of PD was found that struck teenagers (Lieberman, et al., 1982).

History and Treatment of Parkinson's Disease. PD was recognized in 1817 by a British physician, James Parkinson (Youdim & Riederer, 1997). "In 1867, scientists noticed that extracts of the deadly nightshade plant eased some symptoms...and began to

prescribe the extracts" (Youdim & Riederer, 1997, p. 53). It was not until the mid 1900's that pharmacologists learned how the extracts effected the brain (Youdim & Riederer, 1997).

In 1939, Russell Meyers, a neurosurgeon, was the first to experiment with surgery to relieve tremor and rigidity. The results revealed that the procedure was risky and difficult, "out of 100 operations performed, 39 brought relief of symptoms, while 17 patients died" (East, 1996, p. 3).

In 1952, Dr. Lars Leksell introduced the idea of pallidotomy (Cosgrove, 1995). Pallidotomy was a surgical technique that created a lesion on the fiber bundles that connected the thalamus and the globus pallidus (East, 1995). During the 1950's, thalamotomy became widely accepted but it was only effective in eliminating tremor, was less effective at reducing rigidity, and it was often found to aggravate bradykinesia (Cosgrove, 1995).

In the 1960's L-dopa (levodopa) was developed and "is still a mainstay of therapy" (Youdim & Riederer, 1997, p. 54). Additional drugs were developed to relieve symptoms but no drugs were able to prevent neurons from further degradation (Youdim & Riederer, 1997).

In the 1980's, fetal tissue transplants (bits of live tissue from aborted fetuses were transplanted into the brains of PD patients) were performed in an attempt to make the brain of the PD patient start producing dopamine. They were successful (East, 1995).

In 1992, Dr. Lauri Laitinen found stereotactic pallidotomy to be successful 80-90% of the time. The procedure for a stereotactic pallidotomy or thalamotomy was to

define the surgical target within the pallidum by a CT and/or MRI scan (Cosgrove, 1995). Next, the patient was taken to the operating room where an electrical probe was inserted into the brain and through electrical stimulation the correct part of the brain was found (and sometimes the wrong area was found) (Cosgrove, 1995). If the brain responded to the previous stimulation by stopping the tremor and rigidity, the procedure was to then electrically stimulate the brain as to leave a lesion which impeded the continuance of the tremor and rigidity (Cosgrove, 1995). Furthermore, patients experienced long lasting relief of symptoms (Cosgrove, 1995). "Stereotactic pallidotomy is not without certain risks although major morbidity and mortality is less than 1%" (Cosgrove, 1995). Approximately 7-10% of patients experience a blind spot in the lower visual field (Cosgrove, 1995).

Drug treatment for PD consisted of five categories of drugs plus a few drugs used to treat drug side effects (primarily hallucinations) (Purdy, 1997). Purdy (1997) described the five categories as:

1. Anticholinergics: Trihexyphenidyl (Artane®), Benztropine (Cogentin®), Procyclidine (Kemadrin®). Anticholinergics were the first drugs available for treating Parkinson's disease. This class of drugs works by eliminating some of the excess acetylcholine, thus trying to create a more normal balance between acetylcholine and dopamine. These drugs are still being used in treating the symptoms of PD, but primarily to help control tremors. There are many adverse reactions.

2. Levodopa-Carbidopa: Sinemet®, Levodopa-Carbidopa (generic), Sinemet CR®. Levodopa belongs to a class of substances known as amino acids. When levodopa

enters the brain it is converted to dopamine. Carbidopa (an enzyme inhibitor) is combined with the levodopa to help protect it from attack by harmful enzymes and vitamin B-6, thus allowing more to be available for transport to the brain. It also helps to protect against nausea. Levodopa-Carbidopa must pass through the digestive system before reaching the brain. Because of this process, it is believed only a small percentage of the drug actually reaches the brain. Adverse effects include: dyskinesia, hallucinations, weakness, fatigue, hypotension, and mental confusion.

3. Dopamine Agonists: Bromocriptine (Parlodel®), Pergolide (Permax®), Pramipexole (Mirapex®), Ropinirole (Requip®). This class of drugs is often referred to as "imitators of dopamine". They act directly on the dopamine receptors at the synapse where nerve response is initiated. They are sometimes prescribed alone, but are most often prescribed in conjunction with levodopa/carbidopa. The adverse effects are similar to levodopa/carbidopa.

4. Monoamine Oxidase-Type B Inhibitors: Deprenyl "Selegiline" (Eldepryl®) capsules, Deprenyl "Selegiline" (Carbex®) tablets. When dopamine is released from the dopamine-producing neurons, it acts on the dopamine receptors at the synapse to produce the proper response. The dopamine left at the synapse afterwards is then reabsorbed so it can be used at a later time. However, it is vulnerable to attack by enzymes, one of which is called monoamine oxidase type-B (MAO-B). If the activity of the MAO-B can be slowed, the dopamine will be available for a longer period of time. Deprenyl does, in fact, inhibit the activity of the MAO-B enzyme. In addition it is thought to provide a mild antidepressant effect as well. It is often prescribed alone when the Parkinson's

disease is first diagnosed and is also prescribed along with levodopa/carbidopa. Adverse effects include: nausea, dizziness, abdominal pain, confusion, hallucinations, and insomnia.

5. Catechol-O-Methyl-Transferase (COMT) Inhibitors: Tolcapone (Tasmar®), Entacapone. COMT, like MAO, is an enzyme that breaks down, not only dopamine but also levodopa. If this catabolic reaction can be prevented, more dopamine should be available. This class of drugs does just that. The levodopa is spared outside the brain, thus allowing more to get to the brain, and, inside the brain, the attack on the dopamine is halted.

Depression

"Depression is a state of being associated with feelings of hopelessness or a sense of defeat ... all people feel 'down' or 'blue' even when circumstances would dictate otherwise" (Landers, 1997, p. 1). In addition, Landers stated that "all people feel 'depressed' at times, but a 'depressed' person feels this way much of the time" (1997, p. 1). "Depression is the most common primary care psychiatric diagnosis and, in fact, one of the most common of all types of primary care diagnoses" (Nicoloff & Schwenk, 1995, p. 44). It was estimated in 1995 that $43.7 billion was spent on the medical care and work dysfunction cost for major depression (Nicoloff & Schwenk). It was estimated that depressed individuals spent 1.5 times more on health care and 3 times more on pharmacy costs than non-depressed individuals (Simon, Vonkorf, & Barlow, 1995). According to Bonander;

> Approximately 6% of the US population will have a major depression sometime during their life. A major depression is one which significantly limits one's functionality. In the older population, depression is a very significant problem. There are about 45 million people over the age of 65. It is estimated that between 10% and 20% of these people are having a major depression at any point in time. That means somewhere between 4.5 and 9 million older people are having a major depression at any point in time (1996, p. 1).

In order to be clinically diagnosed with depression, at least five of the following symptoms had to be experienced during the same two week period with either the first and/or the second points being present: (1) depressed mood, (2) marked loss of interest/pleasure in all or almost all activities, (3) significant weight loss or weight gain, (4) insomnia/hypersominia, (5) agitation, (6) fatigue or loss of energy, (7) feelings of worthlessness, (8) diminished ability to think or concentrate, and (9) recurrent thoughts of death or suicide (Hutton & Hutton, 1995).

Parkinson's Disease and depression. "Approximately 25% of Parkinson's patients become depressed even prior to development of any motor symptoms of the disease" (Hutton & Hutton, 1995, p. 3). "Depression occurs in as many as one-half of patients with PD. Although depression is usually considered an appropriate reaction to a disabling illness, patients with PD experience depression more than patients with other similarly disabling illnesses" (American Parkinson Disease Association, 1995, p. 3). Depression was found to be a result of biochemical changes within the body and/or drug induced (Hutton & Hutton, 1995). It was found that depression was difficult to diagnose

because of an overlapping of the physical signs of PD and depression which included: slowed movement, reduced facial expression, fatigue, sleep disturbance, diminished concentration, stooped posture, constipation, and diurnal variation (Bonander, 1996; Hutton & Hutton, 1995). It was found that depression masked the early phases of PD which resulted in a lack of recognition of the PD (Bonander, 1996; Hutton & Hutton, 1995). Although there were no objective tests of depression, doctors relied on tests like Beck Depression Inventory, Geriatric Depression Scale, SCL-90, and Hamilton Rating Scale (Bonander, 1996).

Treatment of depression. Once a patient was diagnosed with depression treatment of depression included counseling, education, antidepressants, stimulants, electro-convulsive therapy (ECT), and exercise (Bonander, 1996). Antidepressants that worked the best included Selective Serotonin Reuptake Inhibitors (SSRI). Furthermore, there was approximately a 70% response rate regardless of the antidepressant used (Bonander, 1996). SSRI's had to potential to produce negative reactions in patients that were also taking monoamine oxidase (MAO) inhibitors (Eldepryl and its derivatives). Furthermore, if the patient was on a MAO inhibitor (Eldepryl or a derivative) then the PD treatment would be discontinued for the duration of the depression treatment (Bonander, 1996). When a patient with PD experienced severe depression, treatment of the depression would be more important than the treatment of the PD (Lieberman, 1982). Therapies alternative to medical intervention had included therapies of exercise and increased activity and counseling (Bonander, 1996).

Exercise

Benefits of Exercise. It was found that the benefits of regular physical activity within the general population included: (1) improvement in cardio-respiratory function, (2) reduction in Coronary Artery Disease risk factors, and (3) decreases mortality and morbidity. In addition to those benefits, it was postulated that exercise "decreased anxiety and depression" and "enhanced feelings of well-being" (American College of Sports Medicine, 1995, p. 5). According to the American College of Sports Medicine (1995), exercise improved general health, reduced the risk factors for heart disease both of which decreased morbidity (disease/illness) and mortality (death from diseases/illnesses). Exercise had the potential to benefit the body physically and mentally (American College of Sports Medicine, 1995).

Exercise and Depression. "We now have evidence to support the claim that exercise is related to positive mental health as indicated by relief in symptoms of depression and anxiety" (Landers, 1997, p. 7). In 1996, Corbin and Pangrazi concluded that physical activity appeared to relieve symptoms of depression and anxiety and improve mood. In addition to this, Corbin and Pangrazi (1996) found that "regular physical activity may reduce the risk of developing depression, although further research is needed on this topic" (p. 4). Carlucci, Goldfine, Ward, Taylor, and Rippe (1991) found that "regular exercise programs have been associated with decreases in depression and with enhanced self-esteem" (p. 50). Stamford (1995) found that "research now backs up such claims in finding that exercise enhances mind function and emotional state" (p. 79).

Some ways exercise can help include:

- Rhythmic exercises like running or rowing increase alpha-wave activity in the brain, which produces a calming state similar to meditation.
- Exercise can help get your mind off whatever is bothering you. This may be especially important for depression, because the mind has a tendency to trap itself in repeated negative thoughts. Solitary activities may not provide enough distraction. Fast-paced sports that require concentration, like tennis or racquetball, may be more suitable.
- On the other hand, solo exercises like bicycling or in-line skating offers a time to focus and be truly alone. This can be a good time to work out hard feelings and aggression.
- Group exercises like team sports can bring you out of your shell and let you enjoy other's company.
- Having more energy from exercise can help you overcome problems that otherwise would fester.
- Exercise helps you feel alert and promotes creativity, both of which can improve your mood.
- Exercise is a release. It tires you in a good way, easing muscle tension and calming and refreshing you. This release is especially helpful to those with aggressive personalities. For overachievers, exercise commitments can serve as a good excuse to leave work before midnight.

- Exercise enhances sleep, allowing more of the deep sleep that "recharges your batteries" more fully.
- Exercise may cause changes in the brain. Any level of exercise may lead to release of serotonin, a substance that contributes to feeling relaxed and satisfied. Vigorous exercise also causes the brain to release endorphins- chemicals that ease pain and provide a sense of well being. Although this effect only results from hard workouts, research suggests that the more you exercise and the more fit you become, the greater your output of endorphins (Stamford, 1995, p. 79).

Landers (1997) found that exercise reduced depression best: after weeks of regular exercise, when done several times a week, with more vigorous exercise, and for those who were more depressed. Furthermore, he found that benefits of exercise (reduced anxiety and depression) were similar to those for other treatments, as well as exercise was at least as effective as more traditional therapies for depression. Carlucci, et al. (1991) found that exercise helped patients who had a wide range of medical conditions. Poser and Ronthal (1991) found that patients with degenerative neurologic diseases benefited from starting new activities and from continuing established exercise routines. Furthermore, these benefits were centered around the goal of "maintaining independence for as long as their condition allowed" (p. 86) In addition, they observed that exercise provided mental stimulation, maintained or increased functional capacity, improved appetite, improved sleep, and helped alleviate depression. When Poser and Ronthal (1991) began their research, they found a "scarcity of research" on the effects of exercise on patients who have degenerative neurologic diseases (p. 86). Given that exercise

considerations varied tremendously, these were their general guidelines for exercise recommendations:

- Evaluate an elderly patient's concomitant cardiac or other medical problems before recommending any type of exercise or activity.
- Include family, caregivers, and friends in the exercise plan: The patient will be more likely to stick to the routine you recommend.
- Motivate patients by encouraging them to pursue activities that they enjoy- even if it's simple recreation such as playing bridge or shooting billiards.
- Assess the patient's economic situation and access to exercise facilities before suggesting exercise options.
- Rule out contact sports for these patients. Elderly patients have usually forsaken them anyway, but injuries to the neck or spine of a young MS patient can exacerbate the condition.
- Suggest swimming or other water activities for any patient who is not afraid of water and who has access to a swimming pool.
- Advise patients to use stationary exercise equipment to make sure the devices have safety features, such as side rails for treadmill.
- Refer patients and their caregivers to national and local specialty organizations that proved exercise and activity resources. (Poser and Ronthal, 1991, p. 86).

Poser and Ronthal (1991) specified that "bradykinesia alone should not interfere with any activity although it is quite likely that patients will no longer be able to participate in sports that require quick or fine movements, such as tennis, ping pong or golf" (p. 88).

When bradykinesia and rigidity were both present activities of walking, swimming, stationary bicycling, and isometric and isotonic exercises were recommended and the use of exercise machines were encouraged (Poser and Ronthal, 1991).

Exercise and Parkinson's Disease. Carter (1995) found that "good nutrition and physical fitness are two achievable goals that will help improve how well you live with PD" (p. 1). "Nearly as important as your medications, regular exercise is essential for keeping you strong and flexible" (Somerset Pharmaceuticals, Inc., 1997, p. 7). Poser and Ronthal (1991) emphasized "that the vast majority of patients affected with these diseases [PD, MS, and Alzheimer's Disease] can and should stay as active as possible for as long as possible, but in individually designed programs" (p. 92). Carter (1995) recommended three kinds of exercise (stretching, strengthening, and aerobic) for people with PD. The National Institute of Neurological Disorders and Stroke (NINDS) (1994) stated that "exercises will not stop disease progression but they may improve body strength so that the person is less disabled. Exercises also improve balance, helping overcome gait problems, and can strengthen certain muscles so that people can speak and swallow better" (p. 26). NINDS (1994) also stated that "exercises can also improve the emotional well being of parkinsonian patients by giving them a feeling of accomplishment" (p. 26). Purdy (1997), a PD patient himself, recognized exercise's important role in the health and well being of PD patients by dropping the word "drug" from the title of his guide. In his guide, he stated all of the benefits (for muscles, joints, cardiovascular) of exercise and concludes the section with "Let us not forget that exercise also has a good effect on the mind. It should be done on a regular basis and in moderation" (Purdy, 1997). During

their study of the psychological issues of PD (which did not focus on exercise), Hutton and Hutton stated that "one should not forget that activity is a natural antidepressant" (1995, p. 3).

Summary

PD was found to be a degenerative disease of the central nervous system. Most patients experienced difficulties with muscular control and movement. It was found that depression was the number one secondary symptom of PD. PD was recognized in the early 1800's and has affected approximately one percent of the population over 50 years of age. There was no cure for PD.

Depression was found to be a significant problem in the older population. Most PD cases were found in people over 50 years of age. Researchers have not determined whether people were depressed before PD developed, PD, itself lead to the depression, or people were depressed because they had PD. A major problem for treating depression in PD patients was most PD medications were contraindicated for depression medications. Only one drug therapy was administered at a time. The patient and doctor had to choose which condition was most detrimental to the patient.

Exercise had many benefits for the general population. Recent research indicated that exercise may be related to positive mental health and may reduce the risk of developing depression. It was found that long-term regular exercise reduced depression best. Exercise was very important for the PD patient because it helped with muscular control, muscular strength and joint flexibility/range of motion. All of these aspects

helped the patient maintain independence longer. Several authors and researchers stated that exercise was as important as PD medications.

Benefits were found for exercise and PD and exercise and depression. No research was found that combined the benefits of exercise for the PD patient and the depression associated with the disease.

Chapter Three

Methods

Depression was identified as a secondary symptom that occurred in as many as half of patients with PD (Lieberman, et al., 1982, American Parkinson Disease Association, 1995). Patients with PD experienced depression more than patients with other disabling diseases (American Parkinson Disease Association, 1995). It was found that depression was difficult to diagnose because of an overlapping of the physical signs of PD and depression (Bonander, 1996, Hutton & Hutton, 1995). Landers stated that "all people feel 'depressed' at times, but a 'depressed' person feel this way much of the time" (1997, p. 1). In the same study by Landers, exercise was found to be "related to positive mental health as indicated by relief in symptoms of depression and anxiety" (p. 7). The purpose of this study was to determine if patients with Parkinson's disease who exercised experienced less feelings of depression than those who did not exercise.

Participants

Participants for this study were selected by using a convenience sample. There were 70 patients with PD that participated in the study. The participants lived in the Greater Cincinnati Area and were receiving treatment for PD in the Greater Cincinnati area. Participants had to be able to read, write, and speak English. There was no age limit placed on the participants for the study.

Instrumentation

The stage of progression for PD was determined by the physician/therapist by using the Unified Parkinson's Disease Rating Scale (Harvard University, 1997) (Appendix A). The Unified Parkinson's Disease Rating Scale (UPDRS) was a rating tool used to determine the patient's functional status based on three sections: (1) cognition, behavior, and mood, (2) activities of daily living, and (3) motor skills. UPDRS consisted of a rating of each component based on 0 for absent/normal to 4 for disability present. A score of 0 represented no disability and a score of 199 represented total disability. This instrument is valid and reliable, it is one of the standards used by neurologists to determine and monitor the progression of PD and was recommended by the American Parkinson's Disease Association (Lieberman, et al., 1982).

Beck's Depression Inventory (Appendix B) was used to evaluate depression. The Beck's Inventory consisted of 21 sets of Likert scale questions. The scores of the questions were added together and the number was used to determine the extent of depression: a score of less than four was normal, a score of 5-13 was mild depression, a score of 14-20 was moderate depression, and a score of 21 or more was severe depression. Beck's Depression Inventory was evaluated for internal consistency which was significant at the 0.001 level for all categories except the weight loss category which was significant at the 0.05 level and for split half reliability which had a reliablility coefficient of .86 (Beck, Ward, Mendelson, Mock, and Erbaugh, 1961). Validity was proven when both groups of study produced statistically significant p-values of less than 0.01 (Beck, et al., 1961).

The General Lifestyle Inventory (Appendix C) was developed for this study and consisted of five questions that were used to determine the patient's current information about age and years with PD, frequency of cardiovascular exercise, strength training exercise and flexibility exercise. The General Lifestyle Inventory was found reliable (r = 0.908) using the Pearson Correlation.

Procedures

Possible participants (those that were assessed as "mentally competent" by their physician) were notified of the study through their physician's office at a checkup. The participants were given a brief overview of the study and asked to participate. Once consent from each individual was received, the questionnaires were given to the possible participant to be filled out and returned. The packet of questionnaires contained the UPDRS (Appendix A), the Beck's Depression Inventory (Appendix B), and the general lifestyle inventory (Appendix C). The patients were instructed to complete the packet prior to seeing the doctor. Once the patients completed their questionnaires, the questionnaires were placed in the envelope that was provided, sealed and returned to the receptionist. After the receptionist had given the questionnaire packet to the patient, he/she recorded the patient's name only next to the number of the questionnaire packet on the Name/Inventory Sheet (Appendix D). The receptionist also placed a copy of the UPDRS in the patient's file for the physician. After the office exam, the doctor completed UPDRS and placed it into the envelope that was provided, sealed and returned

to the receptionist. The receptionist placed all sealed envelopes into the boxes that were provided. The contents of the boxes were collected weekly for data compilation.

Data Analysis

Correlations were completed to determine if there was a relationship between exercise and depression and if there was a relationship between exercise and disability. An alpha level of 0.05 was used to determine significance.

Chapter Four

Results and Discussion

Depression was identified as a secondary symptom that occurred in as many as half of patients with PD (Lieberman, et al., 1982, American Parkinson Disease Association, 1995). Patients with PD experienced depression more than patients with other disabling diseases (American Parkinson Disease Association, 1995). It was found that depression was difficult to diagnose because of an overlapping of the physical signs of PD and depression (Bonander, 1996, Hutton & Hutton, 1995). Landers stated that "all people feel 'depressed' at times, but a 'depressed' person feel this way much of the time" (1997, p. 1). In the same study by Landers, exercise was found to be "related to positive mental health as indicated by relief in symptoms of depression and anxiety" (p. 7). The purpose of this study was to determine if patients with Parkinson's disease who exercised experienced less feelings of depression than those who did not exercise.

Results

Seventy-three patients qualified for the research and seventy patients participated (completed and returned the questionnaires). The age range of the participants was 41 to 86 years old with the average age of 70.9 years old. The participants' response range for the Unified Parkinson's Disease Rating Scale (UPDRS) was 8 to 89 with the average at 43.3 (Figure 4.1). The UPDRS, responses could range from 0-199, was used to determine amount of disability. A zero score represented no disability and 199

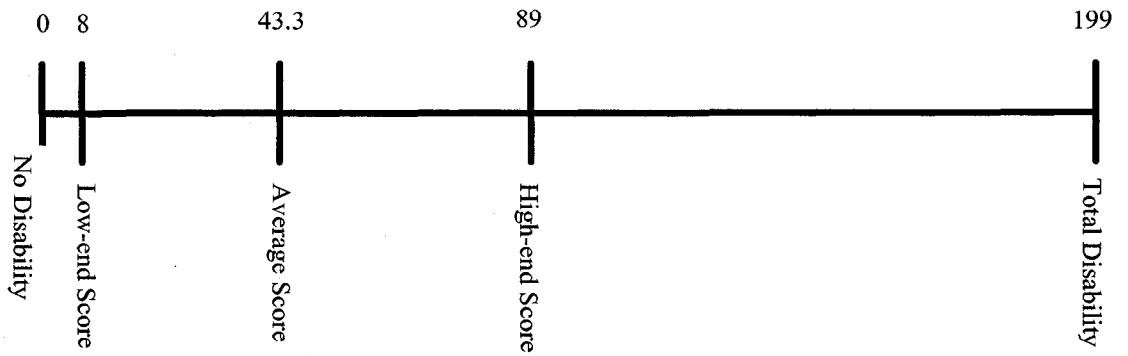

Figure 4.1 Disability ranges based on responses to the UPDRS questionnaire.

represented total disability. The participants' response range for the Beck's Inventory was 0 to 41 with the average at 9.73 (Figure 4.2). The Beck's Inventory was used to determine amount of depression based on the scale of: 0-4 was Normal, 5-13 was Mild Depression, 14-20 was Moderate Depression, and 21+ was Severe Depression. Seventeen participants were classified as normal, 34 participants were mildly depressed, 12 participants were moderately depressed, and 7 participants were severely depressed. The participants' responses to each exercise behavior ranged from 0 to 7 times per week with averages of 2.3 times per week for flexibility exercise, 2.2 times per week for cardiovascular exercise, and 1.0 time per week for strength training exercise (Table 4.1).

Null Hypothesis 1. There will be no relationship between cardiovascular exercise and depression in PD patients. Using a Pearson Correlation, there was a negative relationship ($r = -0.198$) but it was not significant ($p = 0.10$). Therefore, the null hypothesis failed to be rejected.

Null Hypothesis 2. There will be no relationship between flexibility exercise and depression in PD patients. Using a Pearson Correlation, there was a negative relationship ($r = -0.282$) between flexibility exercise and depression which was significant ($p = 0.018$). Therefore, the null hypothesis was rejected. It was concluded that increased flexibility exercising was related to decreased levels of depression.

Null Hypothesis 3. There will be no relationship between strength training exercise and depression in PD patients. There was a negative relationship ($r = -0.229$) but it was not significant ($p = 0.057$) using a Pearson Correlation. Therefore, the null hypothesis failed to be rejected.

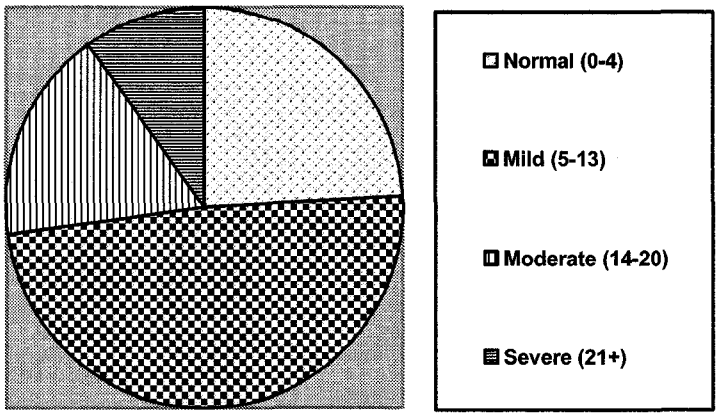

Figure 4.2 Responses to Beck Inventory by depression category.

Days Exercised per Week	Cardiovascular Exercise	Flexibility Exercise	Strength Training Exercise
0	27	32	50
1	8	7	3
2	8	7	5
3	5	3	3
4	8	3	4
5	6	8	1
6	1	1	1
7	7	9	3
Average	2.3	2.2	1.0

Table 4.1 Exercise Frequency by Exercise Type

Null Hypothesis 4. There will be no relationship between cardiovascular exercise and disability in PD patients. Using a Pearson Correlation, there was a negative relationship (r = -0.248) between cardiovascular exercise and disability which was significant (p =0.038). Therefore, the null hypothesis was rejected. It was concluded that more cardiovascular exercising was related to lower levels of disability.

Null Hypothesis 5. There will be no relationship between flexibility exercise and disability in PD patients. Using a Pearson Correlation, there was a negative relationship (r = -0.227) between cardiovascular exercise and disability but was not significant (p = 0.059). The null hypothesis failed to be rejected.

Null Hypothesis 6. There will be no relationship between strength training exercise and disability in PD patients. There was a negative relationship (r= -0.246) between strength training and disability which was significant (p = 0.040), using a Pearson Correlation. It was concluded that more strength training was related to lower levels of disability.

Discussion

Exercise was essential for keeping PD patients strong and flexible. "Exercise will not stop disease progression, but may improve body strength so that a person is less disabled" (National Institute of Neurological Disorders and Stroke, 1994, p.26). Cardiovascular and strength training exercises were significantly associated with lower levels of disability associated with PD. Since the correlations were used it was not determined if the exercises lead to decreased disability or if people exercised because

they were able to exercise. Flexibility exercises increase or maintain range of motion which may have given patients a sense of accomplishment and kept the patient mobile. Both could have helped decrease depression. Flexibility helped to decrease muscle stiffness and soreness which could have reduced pain/discomfort and less feelings of depression. Correlations were done so causation was not determined.

Chapter Five

Conclusions and Recommendations

The purpose of this study was to determine if patients with Parkinson's disease (PD) who exercised experienced less feeling of depression. Approximately 1.5 million people affected with PD in the United States (Koller, 1993). Depression, defined as "a state of being associated with feeling of hopelessness or a sense of defeat"(Landers, 1997, p.1), occurred in as many as one half of patients with PD (American Parkinson's Disease Association, 1995). According to the American College of Sports Medicine, it was postulated that exercise "decreases anxiety and depression" and "enhanced feeling of well being" (1995, p.5). There were 70 participants that participated in the study. Each participant completed the following questionnaires - Unified Parkinson's Disease Rating Scale (UPDRS), Beck Inventory, and General Lifestyle Inventory and their physician completed the UPDRS. Correlations were done to determine if there was a relationship between the three types of exercise (cardiovascular, strength training, and flexibility) and disability (UPDRS) and if there was a relationship between the three types of exercise and depression (Beck Inventory).

There was a negative relationship ($r = -0.198$) between cardiovascular exercise and depression in PD patients but it was not significant ($p = 0.10$). When considering flexibility exercise and depression, there was a negative relationship ($r = -0.282$) in PD patients which was significant ($p = 0.018$). A negative relationship ($r = -0.229$) between strength training exercise and depression in PD patients was found but it was not

significant ($p = 0.057$). There was a negative relationship ($r = -0.248$) between cardiovascular exercise and disability in PD patients which was significant ($p = 0.38$). When considering flexibility exercise and disability, there was a negative relationship ($r = -0.227$) in PD patients but it was not significant ($p = 0.059$). A negative relationship ($r = -0.246$) between strength training and disability in PD patients was found which was significant ($p = 0.040$).

Conclusions

There were significantly less feelings of depression in patients that participated in flexibility exercises. A negative relationship was found between patient's PD related disability and cardiovascular exercise and PD related disability and strength training exercise. For example, low disability of PD score was related to increase cardiovascular or strength training exercise.

Discussion

In 1995, the American Parkinson Disease Association stated "depression occurs in as many as one-half of patients with PD" (p.3). In this study, it was found that 76% of participants were classified a depressed. Forty-nine percent of participants were found to be mildly depressed, 17% were moderately depressed, and 10% were severely depressed.

Landers found "evidence to support the claim that exercise is related to positive mental health as indicated by the relief in symptoms of depression and anxiety" (1997, p.

7). In this study flexibility exercises were the only type of exercise to produce significant results against depression.

"Nearly as important as your medications, regular exercise is essential for keeping you strong and flexible" (Somerset Pharmaceuticals, Inc., 1997, p. 7). The National Institute of Neurological Disorders and Stroke (NINDS) stated that "exercises will not stop disease progression but they may improve body strength so that the person is less disabled" (1994, p. 26). In this study, it was found that cardiovascular exercise and strength training exercise were significantly related to a reduction in PD disability.

Recommendations

For Practitioners. The PD patient needs motivation and help to exercise. Knowledge of the benefits of exercise and knowing how to exercise is not enough to get them exercising. For many patients daily activities can be quite challenging and frustrating, so exercises should be kept simple. The patient with a supportive spouse/care taker that can assist in getting the patient to a group exercise program or that can be an exercise buddy is a great benefit. Exercise programs for PD patients should be very flexible (to accommodate for good days/weeks and bad days/weeks) and personalized (since walking and gait may be affected it may not be practical to ask the patient to go for a daily walk). Range of motion exercises help boost self-esteem and give a sense of accomplishment.

For Future Research. Ultimately an experimental design with a control group would produce the most compelling results: the experiment group would receive

supervised exercise programming/prescription and educational information on health benefits of exercise while the control group would just have their exercise behavior documented. As for this study: it would have been beneficial to have added a Likert scale (strongly agree, agree, neutral, disagree and strongly disagree) to assess the patients feelings regarding exercise and exercise benefits as well as to have asked patients if they thought they were depressed and to rate their depression (normal, mild, moderate, severe). This information would have been valuable to determine the patient's perspective on exercise and whether the patient felt/knew they were depressed. With more participants more significant results may have been produced for the three categories that had negative relationship but lacked significance and for the three categories that were significant a stronger relationship may have been found.

Another area for future research would be to investigate if regular flexibility exercise reduces the risk for developing depression in patients with PD and/or how much regular flexibility exercise reduces the risk. It would be interesting to investigate cardiovascular and strength training exercise also as there was a negative relationship (without significance) with depression however in this study it was not significant.

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Appendix A

Unified Parkinson Disease Rating Scale (UPDRS)

For this inventory please circle the number of the response that best characterizes how you feel PD impacts you and your life. Your honest responses are the best responses.

Section 1: Mental Process, Behavior and Mood

Do you experience any intellectual impairment in your daily life?
0 No Memory Loss
1 Mild Memory Loss (consistent forgetfulness with partial recollection of events with no other difficulties)
2 Moderate Memory Loss (disorientation and moderate difficulty handling complex problems)
3 Severe Memory Loss with disorientation to time and often place, severe impairment with problems
4 Severe Memory Loss with orientation only to person, unable to make judgments or solve problems

Do you experience any thought disorder in your daily life?
0 None
1 Vivid Dreaming
2 Seeing things that aren't there

Do you experience any depression in your daily life?
0 No depression
1 Periods of sadness or guilt greater than normal, never sustained for more than a few days or a week
2 Sustained depression for greater than a week
3 Insomnia, loss of appetite, weight loss

Have you experience any changes in motivation/initiative in your daily life?
0 Normal
1 Less assertive, more passive
2 Loss of initiative or disinterest in leisure activities
3 Loss of initiative or disinterest in day to day (routine) activities
4 Withdrawn, complete loss of motivation

Section 2: Activities of Daily Living
How has your speech changed since your diagnosis with Parkinson's disease?
0 Normal
1 Mildly affected, no difficulty being understood
2 Moderately affected, may be asked to repeat
3 Severely affected, frequently asked to repeat
4 Unintelligible most of time

Have you noticed any changes in your salivation since your diagnosis?
0 Normal
1 Slight but noticeable increase may have nighttime drooling
2 Moderately excessive saliva may have minimal drooling
3 Marked drooling

Have you noticed any changes in your swallowing since your diagnosis?
0 Normal
1 Rare choking
2 Occasional choking
3 Requires soft food

Have you noticed any changes in your handwriting since your diagnosis?
0 Normal
1 Slightly small or slow
2 All words small but legible
3 Severely affected, not all words legible
4 Majority illegible

Have you noticed any changes in your ability cutting food/handling utensils since your diagnosis?
0 Normal
1 Somewhat slow and clumsy but no help needed
2 Can cut most foods, some help needed
3 Foods must be cut, but can feed self
4 Needs to be fed

Have you noticed any changes in your ability dressing since your diagnosis?
0 Normal
1 Somewhat slow but no help needed
2 Occasional help with buttons or arms in sleeves
3 Considerable help required but can do something alone
4 Helpless

Have you noticed any changes in your hygiene since your diagnosis?
0 Normal
1 Somewhat slow but no help needed
2 Needs help with shower or bath or very slow in hygienic care
3 Requires assistance for washing, brushing teeth, going to bathroom
4 Helpless

Have you noticed any changes in your ability to turn in bed/adjust bed clothes since your diagnosis?
0 Normal
1 Somewhat slow but no help needed
2 Can turn alone or adjust sheet but with great difficulty
3 Can initiate but not turn or adjust alone
4 Helpless

Circle the number that relates to falling-unrelated to freezing.

0 None
1 Rare falls
2 Occasional, less than one per day
3 Average of once per day
4 Greater than one per day

Circle the number that relates to freezing when walking.

0 Normal
1 Rare may have trouble starting to walk
2 Occasional falls from freezing
3 Frequent freezing, occasional falls
4 Frequent falls from freezing

Have you noticed any changes in your walking since your diagnosis?

0 Normal
1 Mild difficulty may drag legs or decrease arm swing
2 Moderate difficulties requires no assistance
3 Severe disturbances requires assistance
4 Cannot walk at all even with assistance

Please evaluate your amount of tremor.

0 Absent
1 Slight or infrequent, not bothersome to patient
2 Moderate, bothersome to patient
3 Severe, interferes with many activities
4 Marked, interferes with many activities

Section 3: Motor Exam

What changes in your speech have you noticed?

0 Normal
1 Slight loss of expression, pronunciation, volume
2 Monotone, slurred but understandable, moderately impaired
3 Marked impairment, difficult to understand
4 Unintelligible

Please evaluate your tremor at rest in the following areas.

Face

0 Absent
1 Slight and infrequent
2 Mild and present most of the time
3 Moderate and present most of the time
4 Marked and present most of the time

Right Upper Extremity

0 Absent
1 Slight and infrequent
2 Mild and present most of the time
3 Moderate and present most of the time
4 Marked and present most of the time

Left Upper Extremity

0 Absent
1 Slight and infrequent
2 Mild and present most of the time
3 Moderate and present most of the time
4 Marked and present most of the time

Right Lower Extremity

0 Absent
1 Slight and infrequent
2 Mild and present most of the time
3 Moderate and present most of the time
4 Marked and present most of the time

Left Lower Extremity

0 Absent
1 Slight and infrequent
2 Mild and present most of the time
3 Moderate and present most of the time
4 Marked and present most of the time

Please evaluate your amount of tremor while you are moving in the following areas.

Right Upper Extremity

0 Absent
1 Slight, present with movement
2 Moderate, present with movement
3 Moderate, present with movement and holding still
4 Marked, interferes with feeding

Left Upper Extremity

0 Absent
1 Slight, present with movement
2 Moderate, present with movement
3 Moderate, present with movement and holding still
4 Marked, interferes with feeding

Physician's Evaluation

What changes in your facial expression have you noticed?

0 Normal
1 Slight hypomimia, could be poker face
2 Slight but definite abnormal diminution in expression
3 Moderate hypomimia, lips parted some of the time
4 Masked or fixed face, lips parted ¼ of inch or more with complete loss of expression

Please evaluate the amount of rigidity in each of the following areas.

Neck

0 Absent
1 Slight or only with activation
2 Mild/Moderate
3 Marked, full range of motion
4 Severe

Right Upper Extremity

0 Absent
1 Slight or only with activation
2 Mild/Moderate
3 Marked, full range of motion
4 Severe

Left Upper Extremity

0 Absent
1 Slight or only with activation
2 Mild/Moderate
3 Marked, full range of motion
4 Severe

Right Lower Extremity

0 Absent
1 Slight or only with activation
2 Mild/Moderate
3 Marked, full range of motion
4 Severe

Left Lower Extremity

0 Absent
1 Slight or only with activation
2 Mild/Moderate
3 Marked, full range of motion
4 Severe

Please evaluate your ability to do finger taps (rhythmic finger tapping 3 cm high).

Right

0 Normal
1 Mild slowing and/or reduction in amplitude (height)
2 Moderately impaired, definite and early fatiguing, may have occasional arrests
3 Severely impaired, frequent hesitations and arrests
4 Can barely perform

Left

0 Normal
1 Mild slowing and/or reduction in amplitude (height)
2 Moderately impaired, definite and early fatiguing, may have occasional arrests
3 Severely impaired, frequent hesitations and arrests
4 Can barely perform

Please evaluate your ability to rapidly alternate movements (repeatedly rotate palm-up to palm-down)

Right

0 Normal
1 Mild slowing
2 Moderately impaired, definite and early fatiguing, may have occasional arrests
3 Severely impaired, frequent hesitations and arrests
4 Can barely perform

Left

0 Normal
1 Mild slowing
2 Moderately impaired, definite and early fatiguing, may have occasional arrests
3 Severely impaired, frequent hesitations and arrests
4 Can barely perform

Please evaluate your leg agility (tap heel on ground, amplitude (height) should be 3 inches).

Right

0 Normal
1 Mild slowing and/or reduction in amplitude (height)
2 Moderately impaired, definite and early fatiguing, may have occasional arrests
3 Severely impaired, frequent hesitations and arrests
4 Can barely perform

Left

0 Normal
1 Mild slowing and/or reduction in amplitude (height)
2 Moderately impaired, definite and early fatiguing, may have occasional arrests
3 Severely impaired, frequent hesitations and arrests
4 Can barely perform

Please evaluate your ability to arise from a chair with arms folded across chest.

0 Normal
1 Slow, may need more than one attempt
2 Pushes self up from arms or seat
3 Tends to fall back, may need multiple tries but can arise without assistance
4 Unable to arise without help

Please evaluate your posture.

0 Normal Erect
1 Slightly stooped, could be normal for an older person
2 Definitely abnormal, moderately stooped, may lean to one side
3 Severely stooped with kyphosis (hunching or forward curvature of spine)
4 Marked flexion with extreme abnormality of posture

Please evaluate your gait (length of stride when walking).

0 Normal
1 Walks slowly, may shuffle with short steps, no festination or propulsion
2 Walks with difficulty, little or no assistance, some festination, short steps or propulsion
3 Severe Disturbance, frequent assistance
4 Cannot walk

Please evaluate your postural stability (if someone tries to gently push you off balance while standing do you recover).

0 Normal
1 Recovers unaided
2 Would fall if not caught
3 Falls spontaneously upon standing
4 Unable to stand

Please evaluate the changes in the speed of your body movements.

0 None
1 Minimal slowness, could be normal, deliberate character
2 Mild slowness and poverty of movement, definitely abnormal, or decreased amplitude of movement
3 Moderate slowness, poverty of movement or amplitude
4 Marked slowness, poverty of movement or amplitude

Appendix B

Beck Inventory

_____	0	I do not feel sad.
	1	I feel sad.
	2	I am sad all the time and I can't snap out of it.
	3	I am so sad or unhappy that I can't stand it.
_____	0	I am not particularly discouraged about the future.
	1	I feel discouraged about the future.
	2	I feel I have nothing to look forward to.
	3	I feel that the future is hopeless and that things cannot improve.
_____	0	I do not feel like a failure.
	1	I feel I have failed more than the average person.
	2	As I look back on my life, all I can see is a lot of failures.
	3	I feel I am a complete failure as a person.
_____	0	I get as much satisfaction out of things as I used to.
	1	I don't enjoy things the way I used to.
	2	I don't get real satisfaction out of anything anymore.
	3	I am dissatisfied or bored with everything.
_____	0	I don't feel particularly guilty.
	1	I feel guilty a good part of the time.
	2	I feel quite guilty most of the time.
	3	I feel guilty all of the time.
_____	0	I don't feel I am being punished.
	1	I feel I may be punished.
	2	I expect to be punished.
	3	I feel I am being punished.
_____	0	I don't feel disappointed in myself.
	1	I am disappointed in myself.
	2	I am disgusted with myself.
	3	I hate myself.
_____	0	I don't feel I am any worse than anybody else.
	1	I am critical of myself for my weaknesses or mistakes.
	2	I blame myself all the time for my faults.
	3	I blame myself for everything bad that happens.
_____	0	I don't have any thoughts of killing myself.
	1	I have thoughts of killing myself, but I would not carry them out.
	2	I would like to kill myself.
	3	I would kill myself if I had the chance.

_____ 0 I don't cry anymore than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

_____ 0 I am no more irritated now than I ever am.
1 I get annoyed or irritated more easily than I used to.
2 I feel irritated all the time now.
3 I don't get irritated at all by the things that used to irritate me.

_____ 0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

_____ 0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions than before.
3 I can't make decisions at all anymore.

_____ 0 I don't feel I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel that there are permanent changes in my appearance that make me look unattractive.
3 I believe that I look ugly.

_____ 0 I can work about as well as before.
1 It takes an extra effort to get started at doing something.
2 I have to push myself very hard to do anything.
3 I can't do any work at all.

_____ 0 I can sleep as well as usual.
1 I don't sleep as well as I used to.
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
3 I wake up several hours earlier than I used to and cannot get back to sleep.

_____ 0 I don't get more tired than usual.
1 I get more tired more easily than I used to.
2 I get tired from doing almost anything.
3 I am too tired to do anything.

_____ 0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all anymore.

_____ 0 I haven't lost much weight, if any, lately.
1 I have lost more than 5 pounds.
2 I have lost more than 10 pounds.
3 I have lost more than 15 pounds.

I am purposely trying to lose weight by eating less. Yes____ No____

____ 0 I am no more worried about my health than usual.
1 I am worried about physical problems such as aches and pains; or upset stomach; or constipation.
2 I am very worried about physical problems and it's hard to think of much else.
3 I am so worried about my physical problems, that I cannot think about anything else.

____ 0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

Appendix C

General Lifestyle Inventory

1. What is your age? ___ How many years have you had PD?_____

2. On average, how many days per week do you do stretching/flexibility exercises for at least 5 minutes? Circle the number of days per week.
   0 1 2 3 4 5 6 7

3. On average, how many days per week do you do cardiovascular exercises for at least 15 minutes? Cardiovascular exercises include: walking, biking, gardening, etc. Circle the number of days per week.
   0 1 2 3 4 5 6 7

4. On average, how many days per week do you do resistance or strength training exercises for at least 10 minutes? Circle the number of days per week.
   0 1 2 3 4 5 6 7