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Links Between Physical Activity Levels and Parkinson's Disease Medication Ingestion Time: A Case Study

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Links Between Physical Activity Levels and Parkinson's Disease Medication Ingestion Time: A Case Study

by

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Abstract

Background: People with Parkinson's Disease (PD) possess many motor symptoms that interfere with activities of daily living which can lead to decreased quality of life or loss of independence. Physical activity can help reduce some motor and non-motor symptoms of PD, but this population remains at remarkedly lower levels of physically activity than recommended. **Purpose:** We investigated whether or not activity levels of an individual with PD would increase within about an hour after medication ingestion. **Methods:** An older adult male (age 74 years) diagnosed with PD participated in the study. Pre-screening protocol for inclusion and exclusion criteria was completed in a medicated state, and included the Physical Activity Readiness Questionnaire (PAR-Q) to help ensure safe participation in functional assessments, the Mini-Mental Sate Examination (MMSE) to help rule out evidence of cognitive declines, and measures of height and weight used to calculate body mass index (BMI) to rule out obesity. The participant donned an ActiGraph GT3X+ accelerometer (ActiGraph, LLC, Pensacola, Florida, USA) worn at the hip via attachment of an elastic belt and wore it for one week, while continuing normal daily activities. He also kept a daily activity log in which he recorded major activities performed during awake periods for seven consecutive days. Activity time and duration, as well as, times of medication ingestion were included in the log. After seven days, the participant returned the accelerometer and daily activity log to the lab and underwent a battery of tests to assess physical function and symptom and disease severity. These tests included measurement of vitals, medication records, a plantar pressure detection threshold (PPDT) test, balance assessments using a force-plate, functional mobility tests—the Dynamic Gait Index (DGI), the Tinetti (gait and balance) test, and the Timed-Up-and-Go (TUG) test. Gait kinematics, including speed, cadence, and step length, were assessed using a 20-foot GAITRite computerized

walkway system (CIR Systems, Havertown, PA, USA) under three conditions: 1) normal walking, 2) fast walking, and 3) dual-task walking. Symptom and disease severity were assessed using the modified Hoehn & Yahr (H&Y) scale to assess the stage of PD and the Unified Parkinson's Disease Rating Scale—motor section (UPDRS-III) to assess PD motor symptom severity. **Results:** According to review of the functional assessments, the participant presented with a mild disease stage, moderate motor symptom severity, and moderate gait and balance impairments, and was categorized as slight-moderate fall risk dependent on environment and task being performed. The participant had no trouble altering his walking speed; however, normal walking speed decreased when performing the dual task walking condition, as expected. His greater symptom severity on the right side than the left side corresponded to smaller right-side step length to support bilateral differentiation in this participant with PD. Accelerometer data revealed that over one week the participant engaged in physical activities that kept him in the sedentary range, which is consistent of the PD population. Peak physical activity, associated with walking often occurred within 70 minutes of PD medication ingestion time and was greatest for weighted walking during exercise. **Conclusion:** This participant should be encouraged to include weighted walking often into his exercise schedule and to plan to start exercise within one hour after PD medication ingestion.

Introduction

Parkinson's Disease (PD) is a neurodegenerative disorder first described by Dr. James Parkinson in his 1817 publication, *An Essay on the Shaking Palsy* (Jankovic, 2008). As the second most common neurodegenerative disease, PD most commonly occurs after the age of 50. It affects 2% of the population aged 65 years and older and 4% of the population over the age of 85 years (Opara, Malecki, Malecka, & Socha, 2017). The four cardinal motor symptoms of PD include resting tremor, rigidity, bradykinesia, and postural instability. Symptoms of PD relate to the loss of dopaminergic neurons in the basal ganglia (BG), specifically in the substantia nigra pars compacta (SNc), which leads to a lower concentration of dopamine in the brain (Kaur, Gill, Bansal, & Deshmukh, 2017). The BG are responsible for motor control, motor learning, executive functions, as well as behavior and emotions, so insufficient amounts of dopamine impair the BG's ability to successfully regulate motor control, resulting in the motor symptoms described and more (Lanciego, Luquin, & Obeso, 2012). When the disease progresses, and symptoms become more prominent, people with PD can experience difficulties with hand function and walking, which makes them nine times more susceptible than age-matched controls to recurrent falls (Bloem, Grimbergen, Cramer, Willemsen, & Zwinderman, 2001). In fact, more than half of people with PD struggle with falls (Opara et al., 2017). The motor symptoms that are characteristic of PD influence kinematic and kinetic properties of gait. These influences on gait can have significant effects on daily physical activity and quality of life (QoL), specifically with an increased fall risk and fear of falling, which is why gait is a major concern when considering this population (see (Hondzinski, Kadivar, & Hegwood, 2014) for details).

With no cure for PD, it is important that researchers study different types of interventions that have the potential to deter the onset and/or progression of the disease and its

symptoms. Successful outcomes in this regard not only would help ensure better QoL in this population but could also improve the economic impact associated with disabilities. As PD progresses, symptoms become more severe and lead to impairment of daily activities and/or fall-related injuries. The increased symptom severity and increased risk of injury directly transforms into increased medical and nonmedical costs, whether it be an increase in dosage of medications, hospitalization, living assistance, money loss due to absenteeism at work, or disability payments (Dall et al., 2013). These researchers determined that in 2010 people with PD in the United States spent approximately 1.9 million days in the hospital to exceed the days expected for demographically matched healthy (non-PD) populations by 801,000 days. Extra healthcare usage resultant of PD diagnoses included 1.26 million physician office visits, 57,000 outpatient visits, 31,000 emergency visits, 24,000 home health days, and 26,000 hospice days (Dall et al., 2013). The cost of all the aforementioned PD medical encounters in 2010 was estimated to be approximately $14 billion; $8.1 billion higher ($12,800 per capita) than projected for a similar healthy population (Dall et al., 2013). Of these extra medical costs, approximately 24% were paid by Medicare, 24% were paid by Medicaid and other government funded programs, 19% were paid by commercial insurers, and 33% were out-of-pocket expenses of the families—these percentages are equal to $1.9 billion, $1.9 billion, $1.5 billion, and $2.7 billion, respectively (Dall et al., 2013). With no expected cure for PD in the immediate future, deterring disease onset and progression could help greatly reduce this economic burden.

Proven benefits of exercise and physical activity in the young and old, alike, include fall prevention, increased functional ability in activities of daily living, decreased anxiety and depression, and an overall better QoL (Kosma, Buchanan, & Hondzinski, 2017). Different exercise protocols can alleviate or delay some of the motor symptoms associated with PD

(Mantri, Fullard, Duda, & Morley, 2018). Even though physical activity is a modifiable characteristic that when increased could produce a better QoL, people with PD participate in approximately 30% less physical activity than age-matched healthy peers (Lamont, Morris, Woollacott, & Brauer, 2016). Inactivity becomes a risk factor that can exacerbate the motor and non-motor PD symptoms and creates a vicious cycle (de Carvalho Lana, de Araujo, Cardoso, & Rodrigues-de-Paula, 2016). Thus, monitoring physical activity in people with PD can offer quantitative evidence of whether disease-related interventions can increase mobility in this population.

One way to quantify physical activity in the natural environment, involves the use of accelerometers. Recent studies using accelerometers to measure physical activity in people with PD found that an average of 75% of the wear time for an average day of the week was spent in sedentary behaviors, 22% was spent in low-to-moderate physical activity, and only 2% was spent in moderate-to-vigorous physical activity (Benka Wallen, Franzen, Nero, & Hagstromer, 2015). Such information is needed to determine whether interventions that could possibly help in decreasing motor symptoms in PD also increase overall physical activity in this population. Moreover, accelerometer studies are relatively easy to perform and cost and time efficient. The data collected could be used to help plan exercise interventions specific to an individual. For example, it could offer insight into the times of day that an individual would be more likely to engage in exercise, which is the basis of this case study. Specifically, the purpose of this study was to determine if the physical activity of a person with PD increased according to PD medication ingestion time. We hypothesized that activity would increase within about an hour after medication ingestion. Although the "ON" time (time with reduced symptom severity) of PD medication varies greatly across people, one hour past medicine ingestion is often used for the

start of training protocols (e.g., Kadivar, Corcos, Foto, & Hondzinski, 2011). Although additional data collection is warranted to determine application of such findings to others with PD, the outcomes could be useful when planning an activity schedule for this person.

Methods

Subject

An older adult male diagnosed with PD completed pre-screening evaluations and functional assessments for a clinical trial for people with PD from which this case study was developed. Before prescreening and assessments, he gave informed consent for experimental procedures approved by Louisiana State University and Pennington Biomedical Research Center Institutional Review Boards.

Pre-screening

The participant was screened for inclusion and exclusion criteria in a medicated state (see appendix A). We used the Physical Activity Readiness Questionnaire (PAR-Q) to determine whether he could safely participate in the functional assessments. The PAR-Q identifies the small number of adults for whom physical activity might be unsuitable. Although the participant had carpal tunnel on the right side, arthritis in the left shoulder, and was being prescribed blood pressure medication, he also had physician's approval for participation in physical activity. Other pre-screening assessments are described in the following paragraph.

The participant was screened for cognitive impairment using the Mini-Mental Sate Examination. According to this brief 30-point assessment, a score of 24/30 or less is an indication of cognitive decline (Folstein, Folstein, & McHugh, 1975). The participant's height and weight using a standard measuring tape and scale, respectively, were used to calculate his body mass index (BMI) and to provide anthropometric data (see appendix B). Table 1 shows several participant characteristics associated with the pre-screening. Self-report responses to the pre-screening questionnaire (see appendix C) provided most information needed for selection criteria. A taste test, responses to a Fruit and Wine Frequency questionnaire, a three-day food

record, and neurologist assessment needed for the clinical trial were either not performed or performed, yet not provided in this document.

Table 1. Participant Characteristics and Vitals

Age (years)	74
Height (cm)	177
Mass (kg)	92.5
BMI	29.5
Blood Pressure (mmHg)	137/83
Body Temperature (°F)	97.5
Heart Rate (bpm)	73
Oxygen Saturation (%)	97
MMSE	30/30

Functional Assessments

Accelerometer data provided values for locomotor activity. These data were used to determine overall physical activity levels and whether PD medication ingestion time influenced locomotor activity levels in this participant. Other assessments provided insight into the participant's vitals, sensory perception, functional abilities and severity of symptoms and the disease stage.

Locomotor Activity

The participant was fitted with an ActiGraph GT3X+ accelerometer (ActiGraph, LLC, Pensacola, Florida, USA), set to sample at 30 Hz. It was attached to an elastic belt and worn around the waist slightly above the right anterior superior iliac spine similar to elsewhere (Conradsson, Nero, Löfgren, Hagströmer, & Franzén, 2017). The participant kept a daily activity log to record all major activities performed during awake periods for seven consecutive days. Time and duration of activities along with the times of PD medication intake were also included. The participant was instructed to wear the belt at all times while awake, except for when showering, bathing, or swimming. The ActiGraph GT3X+ is a lightweight accelerometer that

records changes in acceleration in three planes (vertical, anteroposterior, and mediolateral) (Nero, Benka Wallen, Franzen, Stahle, & Hagstromer, 2015). The ActiGraph GT3X+ is a validated instrument (Kelly et al., 2013) and is one of the most widely used accelerometers in research. It is capable of detecting minute-by-minute physical activity intensity using previously validated activity count cut points, estimating time in sedentary, low-to-moderate, and moderate-to-vigorous intensity behaviors. Providing a sensitive estimate of steps/day, and its minute-by-minute output can be used to describe simple ambulatory patterns in terms of cadence (steps/min) (Matthews et al., 2008). This type of accelerometer has been used successfully in studies of PD patients to evaluate locomotor activity (Nero et al., 2015).

Data from the ActiGraph GT3X+ were downloaded in 60 second epochs and analyzed using Actilife Version 6.13.3 (ActiGraph Corp., Pensacola, FL). In brief, we used the Choi wear-time algorithm (Choi, Liu, Matthews, & Buchowski, 2011) to screen raw data for valid wear time prior to substantive analyses. Consistent with standard practice, we required a minimum of ten hours of valid wear time to count as a valid day (Lent et al., 2016; Shiroma, Freedson, Trost, & Lee, 2013). For graphical presentation of the average vector magnitudes across time, we averaged the individual 60 second epochs into 10 min segments from 7:30AM – 12:00AM. Physical activity was based on time walking, which was estimated using vector magnitude (the 3D movement distance of the accelerometer). Data from a weekly mean were compared to vector magnitude cut-points for sedentary, low moderate, and moderate-to-vigorous activity in people with mild to moderate PD (Benka Wallen et al., 2015) using visual inspection. Peak vector magnitudes and the time of peak vector magnitude within one hour of medication ingestion times were reported along with the associated activity from the activity log (see appendix D) for comparisons.

Vitals and Sensory Assessment

After seven days of wearing the accelerometer, the participant returned the accelerometer and daily activity log to the lab to undergo a battery of tests to assess his physical function as well as symptom and disease severity. The participant was weighed with a standard scale to determine changes in weight from prescreening. Blood pressure was measured in a seated position with arm chest level using a Deluxe Arm Blood Pressure Monitor (HoMedics, Commerce Township, MI, USA). Body temperature was measured by scanning the forehead using an iProven Dual Mode Thermometer Model: DMT-489 (iProvèn, Beaverton, OR, USA). Heart rate and oxygen saturation were measured at the finger using a FaceLake FL400 Pulse Oximeter (FaceLake, Buffalo Grove, IL, USA). These values were recorded and presented in Table 1. A list of the participant's medications and their pharmacology was compiled (see Table 2). Loss of protective plantar sensation was evaluated using a 5.07-gauge Darco Foot Filament monofilament (Darco, Inc, USA) at five plantar sites on both the left and right foot—hallux, base of the first metatarsal, base of the fifth metatarsal, midsole, and heel (Eils et al., 2002). The monofilament was pressed to the skin at a 90° angle for approximately one second with enough force to allow a slight curve to form in the monofilament at each site on the foot. The plantar sites were assessed randomly until 15 total trials had been collected on each foot (5 sites x 3 trials each). In order to accurately assess this element of sensation, the participant was asked to close his eyes and say "yes" if or when he felt the monofilament touch his foot. The efficacy of this protective plantar sensation is analyzed based on the number of correct responses given by the participant. If the participant answers "yes" for at least two out of the three trials for a given plantar site, the protective plantar sensation is determined intact for this particular location. The number of plantar sites with intact sensation is then totaled for each foot and averaged between

feet in order to produce a plantar pressure detection threshold (PPDT) score, which can range from 0 (significant sensory reductions) to 5 (intact protective sensation) similar to elsewhere (Hondzinski, Li, & Welsch, 2010).

Table 2: Medications and Pharmacology

Anti-Parkinson Medications			
Medication	*Dosing Information*	*Classification*	*Pharmacology*
Carbidopa/Levodopa 25-100 mg	Take 2 tablets by mouth every 3 hours from 6am-6pm	Carbidopa is a decarboxylase inhibitor	Prevents the breakdown of levodopa in the brain to maintain blood concentration levels longer.
		Levodopa is a nervous system agent	Levodopa is a precursor to dopamine, so it is converted into dopamine in the brain. (Synthetic dopamine)
Entacapone 200mg	Take one tablet by mouth with each dose of carb/levo up to 6 times daily	COMT inhibitor	Stops COMT from metabolizing levodopa which results in higher concentrations of levodopa in the brain.
Amantadine 100 mg	Take one capsule by mouth once daily	Glutamate antagonist (dopamine promotor) or antiviral	Increases dopamine release and blocks dopamine reuptake
Medications Not Indicated for Parkinson's Treatment			
Medication/Vitamins	*Dosing Information*	*Classification*	*Pharmacology*
Losartan 100mg	Take one tablet by mouth daily	Anti-hypertensive Angiotensin receptor blocker (ARB)	Relaxes muscle cells and dilates blood vessels to lower BP
Clopidogrel 75mg	Take one tablet by mouth daily	Anti-platelet drug or blood thinner	Prevents platelets from sticking together and forming clots which would cause stroke, heart attack, or other complications
Pantoprazole 40mg	Take one tablet by mouth daily	Proton Pump Inhibitor (PPI)	Blocks production of acid in the stomach to reduce GERD or acid-reflux
Rousuvastatin 40 mg	Take one tablet by mouth daily	Statin	Used in the reduction of cholesterol levels and to prevent CVD
OTC Medications: Multivitamin, fish oil, and ibuprofen			

*Medication class information and pharmacology information was found from https://www.clinicalpharmacology.com

Balance Assessment

A force platform was used to record center-of-pressure (COP) during stance. The participant stepped onto the platform with his heels eight cm apart. A chalk outline of his feet was used for calibration of the system and to ensure the same foot placement across trials. The participant was instructed to stand still for three 30-second trials with eyes opened and eyes closed (6 total trials were performed, alternating eyes opened—EO and eyes closed—EC). Rest was provided, as requested.

Balance Clinic software was used to determine two variables of sway for each trial: the 95% confidence interval of the COP area (AREA95) and the average velocity of the COP trace (VELavg). Data were average across three trials for each condition. Mean values of CoP used to estimate falls risks were based on mean of non-fallers plus three SD; the following designated non-fallers: AREA95-EO < 6.6 cm^2; AREA95-EC < 10.4 cm^2; VELavg-EO < 2.2 cm/s; VELavg-EC < 2.9 cm/s (Melzer, Benjuya, & Kaplanski, 2004).

Functional Mobility Assessment

The participant's functional mobility was assessed using the Dynamic Gait Index (DGI), the Tinetti (gait and balance) test, and the Timed-Up-and-Go (TUG) test. Each tool assesses functional mobility of movement in slightly different ways as described below.

The DGI is a fall risk indicator that challenges participants to perform simple-to-difficult gait patterns that require straight line walking, speed changes, obstacle avoidance (moving around cones or stepping over a shoebox), head movements (looking vertically or horizontally while walking at normal pace), pivoting, and stair use (Shumway-Cook, Baldwin, Polissar, & Gruber, 1997). The DGI has eight categories of analysis that can be scored 3 (normal) to 0 (severe impairment)—which means that the higher the score, the better performance with 24

indicating a normal gait pattern. The examiner scores each task based on the ability of the participant to continue normal gait pattern and pace without deviating or stumbling (Herman, Inbar-Borovsky, Brozgol, Giladi, & Hausdorff, 2009). A score of 19 or less indicates fall risk or gait impairment in older adults (Shumway-Cook et al., 1997). The 95% confidence interval of non-fallers was 21.02-22.63, while that for fallers was 16.23-19.62 for people with PD (Dibble & Lange, 2006).

The Tinetti test is another tool used to assess gait and balance impairment but includes criteria that the DGI does not. The Tinetti is separated into two sections—one for balance and one for gait. The highest possible score for the gait assessment section is 12, and the highest possible score for the balance assessment is 16. The two scores are added and then evaluated based upon the Tinetti Tool Score key provided (Svoboda et al., 2017). The higher the score, the better the performance. There are three possible classifications of fall risk: high (≤ 18), moderate (19-23), and low (≥ 24) (Kegelmeyer, Kloos, Thomas, & Kostyk, 2007).

The Timed-Up-and-Go (TUG) test evaluates the time, in seconds, to stand from a standard arm chair, walk 3 m, turn (or walk around a cone), walk back, and sit down with his or her back against the back of the chair (Shumway-Cook, Brauer, & Woollacott, 2000). This test measures the temporal aspects of gait and mobility and is capable of finding gait or balance abnormalities. Three trials of the test are performed, with sufficient rest between each trial, and the average of these three times is taken. A lower score indicates better performance. A study using PD fallers and non-fallers showed that the 95% confidence interval of non-fallers was 8.27-11.03 seconds, while that for fallers was 11.38-16.05 seconds (Dibble & Lange, 2006).

Assessment of Gait Kinematics

A 20-foot GAITRite computerized walkway system (CIR Systems, Havertown, PA, USA) was used to assess multiple gait variables—speed, cadence, and step length. These kinematic variables were assessed under three conditions: 1) normal walking, 2) fast walking, and 3) dual-task walking. In normal and fast walking trials, the participant was asked to walk at a comfortably paced/normal walking speed or a speed that was as fast as possible, respectively. In dual-task walking trials, the participant was asked to spell a five-letter word backwards while crossing the walkway at normal walking speed. The dual-task walking test is commonly used to assess the impact of a combined cognitive and motor challenge (Beauchet et al., 2008). The participant was given a 2-meter acceleration and deceleration distance on either end of the walkway and performed three crossings under each condition, with rest provided as needed. Data for each variable of interest were averaged for three crossings in each condition. This type of analysis has been used to assess gait characteristics of PD patients (Nelson et al., 2002).

Assessment of Parkinson's Symptoms and Disease Stage

Table 3. Hoehn & Yahr Scale for Stages of PD

H&Y Stage	Characteristic
1	Unilateral involvement only
1.5	Unilateral and axial involvement
2	Bilateral involvement without impairment of balance
2.5	Mild bilateral disease without recovery on pull test
3	Mild to moderate bilateral disease; some postural instability; physically independent
4	Severe disability; still able to walk or stand unassisted
5	Wheelchair bound or bedridden unless aided

The modified Hoehn & Yahr (H&Y) scale assesses the stage of PD (Opara et al., 2017). The modified H&Y scale is used to distinguish five stages (with two ½ stages) of injury and disability and defines them as five stages of progression of the disease. These stages range from

unilateral damage without disorders (stage I), to stage V, when the patient is confined in a wheelchair or bed with details about each stage in Table 3. This is the most commonly used scale worldwide (Opara et al., 2017).

The Unified Parkinson's Disease Rating Scale—motor section (UPDRS-III) assesses PD motor symptom severity. The UPDRS-III scale is an in-depth motor examination commonly used in clinical and research settings. UPDRS-III is used to assess speech, facial expression, resting and intentional tremor, rigidity, rapid movements of the fingers, rapid hand movements, alternating movements, leg movements, getting up from a chair, posture, stability of posture, and bradykinesia. Each item is scored using the following scoring system: 0 = no involvement; 1 = detectable (slight) disorder; 2 = moderate (mild) disorder; 3 = considerable (or moderate) disorder; 4 = no function or severe disorder (Opara et al., 2017). Total scores range from 0 to 108, for no to severe impairment, respectively. Impairment scores are then characterized as follows: less than or equal to 11.2 denotes mild impairment, greater than or equal to 54.4 denotes severe impairment, between 11.2 and 54.4 denotes moderate impairment, and score changes greater than 5 points denote symptom severity fluctuations of clinical significance (Schrag, Sampaio, Counsell, & Poewe, 2006).

Results

Functional Assessments

Table 4 displays the scores and interpretation of analyses associated with disease stage, motor symptom severity, and several measures of functional gait and balance. Participant values can be directly compared to fall risk values for people with PD and older adults for balance, TUG, DGI, and Tinetti (see Table 4). The participant presents with a mild disease stage, moderate motor symptoms, and moderate gait and balance impairments. Although TUG results classified him as a non-faller, his DGI score classified him between the two groups and one of his balance measures (EC AREA95) classified him as a faller. Using several assessments allowed a comprehensive evaluation of functional gait and balance in the participant that is not provided by individual assessments (Dibble, Christensen, Ballard, & Foreman, 2008).

Table 4. Assessment of Disease Stage, Symptoms, and Functional Gait and Balance

Assessment		**Score**			**What does this mean?**
		Participant	**PD**	**Older adults**	
Hoehn & Yahr (PD stage)		2.5	2.5	NA	Mild bilateral disease with recovery on pull test
UPDRS-III (PD motor symptoms)		35	>11.2 <54.4	NA	Moderate impairment (right side > left side)
Plantar Pressure Detection Threshold		4/5	NA	5[1]	Reduced protective foot sensation
Balance	EO AREA95 (cm^2)	6.36	NA	>6.6[2]	Within non-fallers
	EO VELavg (cm/s)	1.46	NA	>2.2[2]	Within non-fallers
	EC AREA95 (cm^2)	14.25	NA	>10.4[2]	Within fallers
	EC VELavg (cm/s)	2.09	NA	>2.9[2]	Within non-fallers
Timed-Up-and-Go (sec)		10.13	>11.38[3]	>14[4]	Mobility score associated with non-fallers
Dynamic Gait Index		20/24	<19.62[3]	<19[5]	Dynamic gait is between fallers and non-fallers
Tinetti		22/28	<20[6]	<19[6]	Moderate gait and balance impairment

UPDRS=United Parkinson's Disease Rating Scale; EO=eyes open; EC=eyes closed; NA=no data applicable; references correspond to superscripts in reference list.

Gait Kinematics

Figure 1 displays the results for gait kinematics for normal, fast, and dual task walking conditions. As expected, increased gait speed, cadence, and step length accompanied the fast walking condition, whether considering mean or individual trial data. Interestingly, only gait speed and step length decreased when performing dual task walking compared to the normal walking condition (individual trial data overlapped; not shown) (Bond & Morris, 2000). Additionally, the participant's right step length for each condition was consistently shorter than then his left step length.

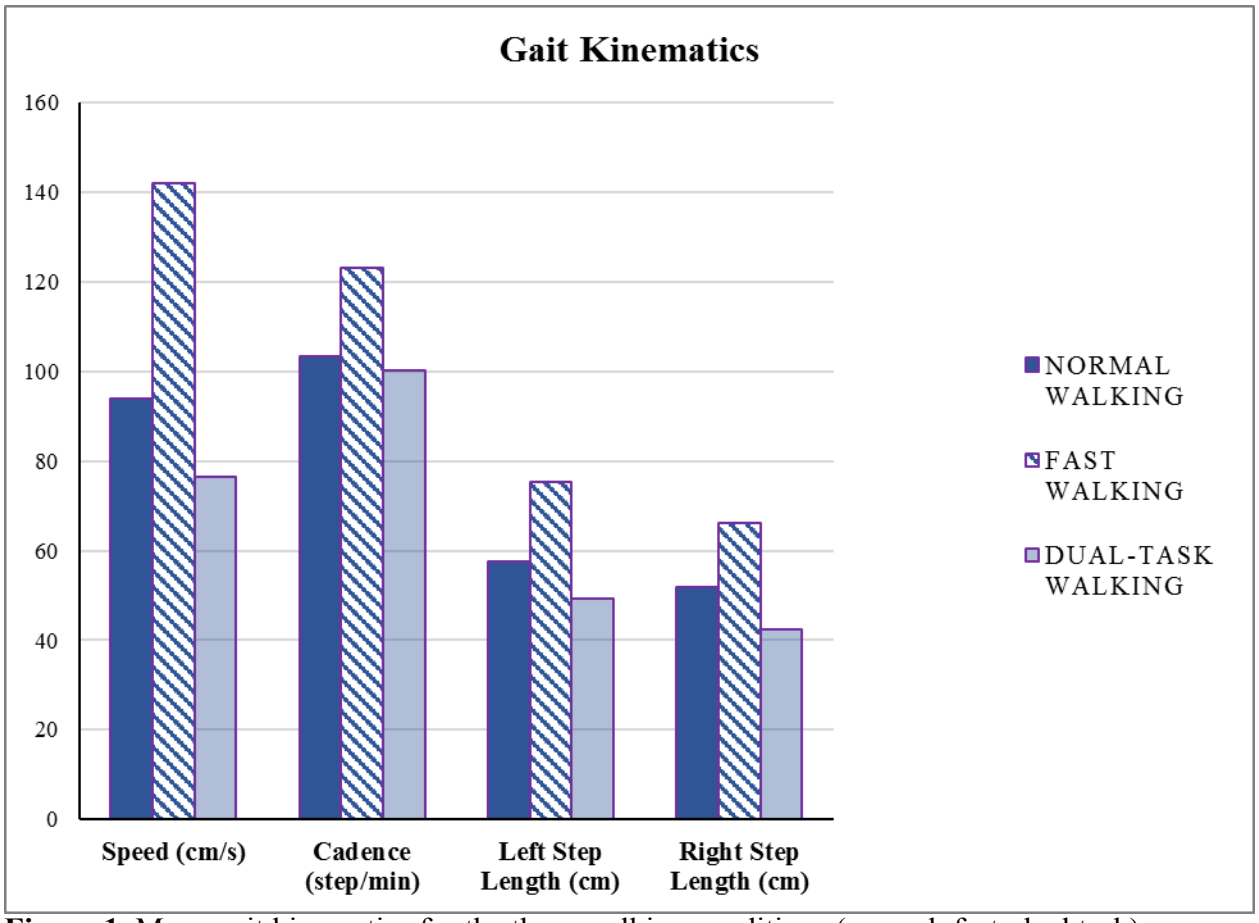

Figure 1. Mean gait kinematics for the three walking conditions (normal, fast, dual task) are shown.

Locomotor Assessment

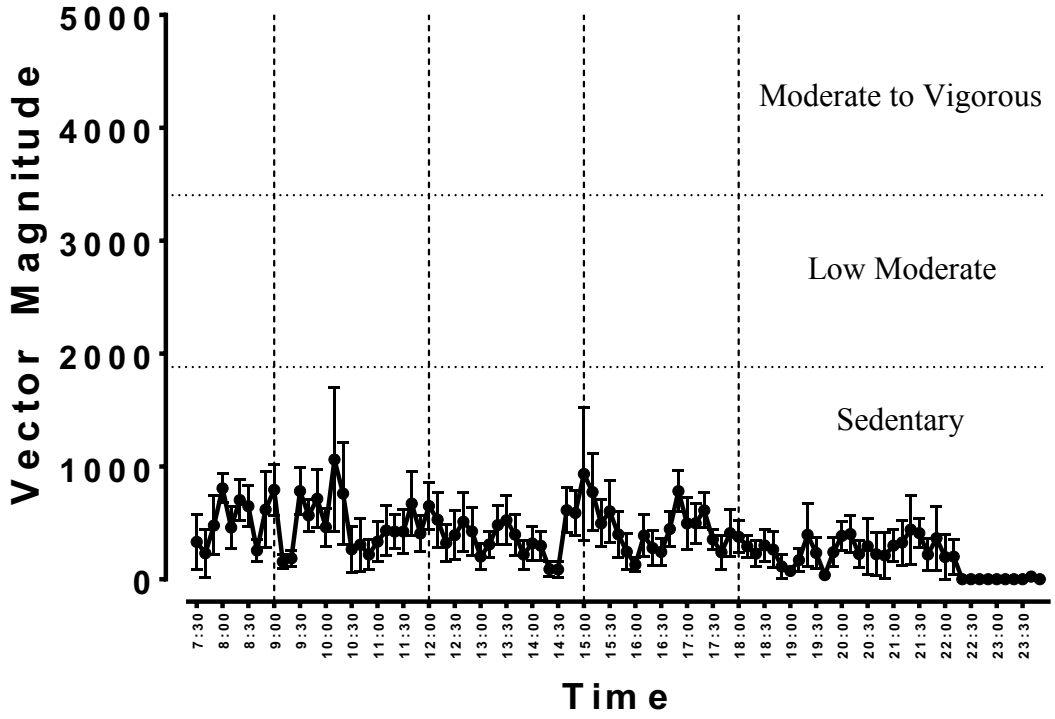

Figure 2. Mean vector magnitude (VM) across 10-minute epochs for 7 days are shown. Error bars represent ±1 standard deviation. Horizontal dotted lines represent cut-points which separate sedentary and low moderate (1860) and low moderate and moderate-to-vigorous (3400) activity levels. Vertical lines represent approximate time of medication ingestion. VM is in counts/min.

As expected, physical activity measures (presented as vector magnitude, VM) averaged for one week show that the participant is mainly sedentary as assessed by accelerometer activity at the hip (Fig 2.). We examined daily physical activity measures alongside the daily activity logs to determine whether relationships between PD medicine ingestion time and physical activity existed. Reports of walking corresponded to the highest peaks of VM, thus the highest physical activity levels (Fig. 3). The participant reached low moderate and moderate-to-vigorous activity levels when walking was reported. For three of the four instances (second instance Day 1 and first instance Day 4 and Day 5, Fig. 3), this was observed within 70 minutes after medication ingestion. In one instance, the participant could not remember whether he took his medication

prior to shopping or in between stores. In the two instances of reported walking in which low moderate activity levels were achieved, the participant reported that walking was associated with shopping (first instance, Day 1) and with unweighted-walking for his physical therapy session (Day 4). Unweighted walking involved an overhead support harness. For the remaining epochs of physical activity, all but one remained in the sedentary category. Physical activity levels when performing upper body movements in exercise class (see Day 6, Fig. 3) and indoor slow pedaling on a stationary bike (see Day 5, Fig. 3) did not reach levels outside the sedentary category.

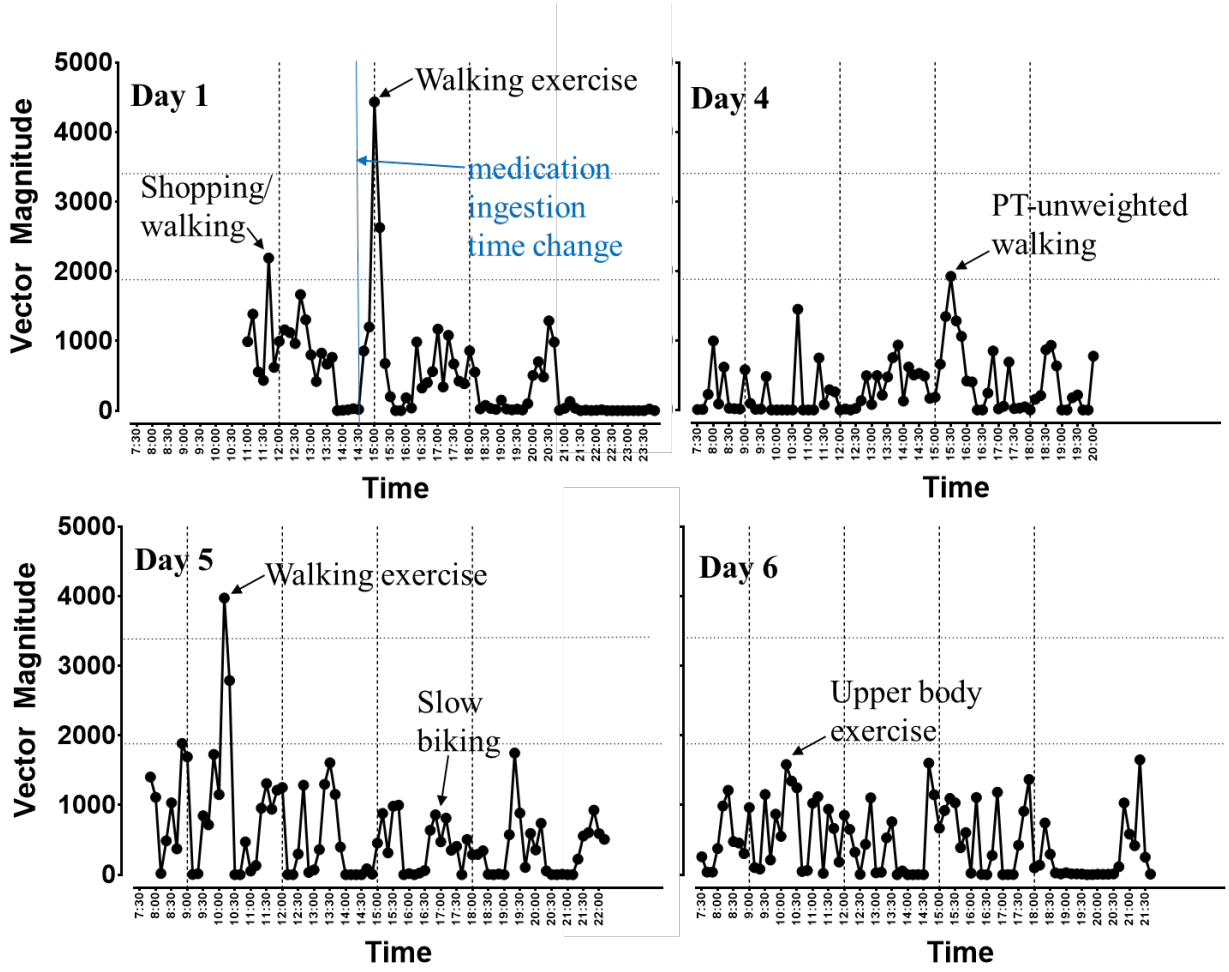

Figure 3. Mean vector magnitude (VM) across 10-minute epochs for 4 of 7 days are shown. Horizontal dotted lines represent cut-points which separate sedentary and low moderate (1860) and low moderate and moderate-to-vigorous (3400) activity levels. Vertical lines represent approximate time of medication ingestion with one exception noted. Walking and exercise activities are noted. VM is in counts/min.

Discussion

The purpose of this study was to determine if the physical activity of a person with PD increased according to PD medication ingestion time. Functional assessments offered insight into the physical abilities of the participant. Identifying disease stage and assessing motor symptoms also provided insight into the potential effects of Parkinson's on these abilities. Accelerometer data obtained during normal daily activity provided insight into physical activity primarily associated with locomotion, which as expected, often linked to PD medication ingestion time.

Physical Function

The mild stage of the disease and moderate motor symptom severity associated with moderate impairment in gait and balance. Assessments used to classify fall risk were inconsistent, similar to previous data on older women (Kosma et al., 2017). Data from the present study provided evidence to suggest that the participant is most susceptible to falling when eyes are closed. His scores would place him in a category of slight-moderate fall risk (between fallers and non-fallers) depending on the environment and task, which are known to influence fall risk (Gazibara et al., 2016).

Gait Kinematics

Gait irregularities, characteristic of people with PD, were observed in this case study. Reduced gait speed, shorter step length, and increased cadence to counteract the shorter step length exists in people with PD (Morris, Iansek, Matyas, & Summers, 1994). The participant achieved similar values to those previously reported for this population (Brusse, Zimdars, Zalewski, & Steffen, 2005; Paker et al., 2015). Cadence and step length both have relative contributions to gait speed, thus an individual can increase gait speed by increasing cadence, increasing step length, or both. In order to perform fast walking trails, the participant increased

each of these measures relative to normal walking speed. In contrast, step length decreased, while cadence remained similar to normal walking conditions when performing dual task walking. The ability to modulate walking cadence consistently remains intact in PD (Morris et al., 1994) to explain why it was the decreased step length that contributed to decreased gait speed in this condition. The gait speed changes observed in the present participant agree with outcomes in the literature for people with PD, which indicate that performing cognitive activity (i.e. spelling five letter words backwards) while walking induces gait slowing (Kleiner et al., 2017).

Kinematic gait assessments in each condition also revealed that the participant's right step length was consistently shorter than the left step length (see Fig. 1). Bilateral differences are often observed in people with PD (Plotnik, Giladi, Balash, Peretz, & Hausdorff, 2005). The greater the severity of symptoms on the participant's right side than the left side corresponded with the smaller steps on the right side to support this bilateral differentiation in this participant.

Locomotor Activity

Accelerometer data showed that the participant engaged in few low moderate-to-vigorous epochs of locomotor physical activity. The sedentary range, which existed for data averaged over seven days, resembles previous reports that physical activities of people with PD are 30% less active than healthy age-matched individuals (Lamont et al., 2016).

Weighted walking appears to increase locomotor physical activity in this participant. At first this seemed surprising, considering his participation in exercise classes and involvement in stationary indoor biking. These exercises did not raise physical activity levels out of the sedentary category. Clearly, the hip-based accelerometer may not detect as much movement during performances of upper-body-focused activities (like those performed in his exercise class) or slow biking. Such physical activity would be underestimated and contribute to the estimated

sedentary behavior identified for this participant and possibly for others reported in the literature (Benka Wallen et al., 2015; Nero et al., 2015). Further review of daily VM indicated that peak moderate to vigorous locomotor activity in this participant often occurred within 30-70 minutes of PD medication ingestion time. This would likely allow the participant enough time to ensure he was in an "ON" state, similar to the 60 minutes used for research training studies (i.e., Kadivar et al., 2011; Rochester et al., 2008). Whether this link appears because physical activity was planned around medication ingestion time through experience or not remains unknown, but a link did exist for this participant.

Limitations

This study has several limitations, primarily that data were collected on only one participant which limits the generalizability of these findings. Location of the accelerometer may have impacted its ability to accurately identify types of physical activity not linked to locomotion. Upper-body-focused movements and slow stationary biking, which may induce higher levels of physical activity than recorded, did not reach low moderate levels, thus may require other equipment to monitor physical activity in this participant and possibly this population. Additionally, accelerometer data were collected during an atypical week for the participant (i.e. the participant went on a vacation); thus, the data do not represent the routine normally followed by the participant. The imprecise manner in which activities were recorded in the daily activity log further hindered our ability to make more concrete connections between increased physical activities in this participant and PD medication ingestion time. Ensuring accurate recording of medication intake is critical to true understanding of the data and is needed in future studies. Although the preliminary results of this study are limited, many results matched

those previously reported, thus it appears that a connection between activity levels and PD medication ingestion time may exist for people in this population.

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Appendices

Appendix A

Inclusion and Exclusion Criteria

Inclusion Criteria: Men and women diagnosed with Stage 2-3 Parkinson's disease (Hoehn & Yahr) as confirmed at the screening visit by the study neurologists and meeting all criteria listed below will be included in the study:

- Subjects 50-80 years of age.
- BMI 18.5-30.
- Stable on medications for at least 2 months.
- Walks w/o assistive device.
- Willing to consume 22.5 mg wild blueberry or placebo powder a day for 8 weeks.

Exclusion criteria: Individuals that have the following conditions:

- Subjects with prior history of Type 1 or uncontrolled Type 2 diabetes (A1C > 7%).
- Subjects who are demented.
- Subjects who have severe difficulty swallowing.
- Subjects with diagnosis or signs of neuropathy.
- Subjects with evidence of rheumatoid arthritis.
- Subjects with diagnosed osteoarthritic conditions of the spine or lower extremities (including hips) sufficient to affect gait.
- Subjects with pre-existing medical condition that significantly affects gait.
- Subjects with pre-existing gait defect (unless caused by PD).
- Women who are pregnant or who are lactating.
- Women of childbearing potential who are not using an effective method of birth control (i.e., barrier method, intrauterine and cervical devices, oral contraceptives, hormonal injections (Depro Provera®), condoms with spermicidal gel or foam, contraceptive patch (Ortho Evra), diaphragm, or abstinence), are not surgically sterilized (including tubal ligation and hysterectomy), or not at least 2 years postmenopausal. All women of childbearing potential will have a pregnancy test performed at the screening. If a subject becomes pregnant during the study, they will be dropped.
- Subjects with a history or evidence of significant gastrointestinal dysfunction, e.g. irritable bowel syndrome; inflammatory bowel disease; ulcerative colitis or Crohn's disease; regional enteritis; diverticulosis or diverticulitis; significant gastroparesis; GI stricture, partial or complete gastrectomy or small bowel resection; chronic diarrhea; peptic ulceration, colonic ulceration, or GI bleeding.
- Subjects who have chronic use of laxatives or cathartics. The use of stool softeners is acceptable. Use of bulking agents, if required, should remain constant.
- Subjects who are taking concomitant therapy with medications known to be nephrotoxic, such as aminoglycosides, methicillin, and cyclosporin.
- Subjects who have evidence of clinically significant renal dysfunction or disease, e.g. serum creatinine >1.5 mg/dL in males and >1.4 mg/dL in females and/or BUN >50 mg/dL, proteinuria of >1 gram/day or 4+ proteinuria on dipstick urinalysis.
- Subjects with clinically significant cardiovascular dysfunction and/or history (within the preceding 6 months) of significant cardiovascular dysfunction, e.g., congestive heart failure or serious arrhythmia or myocardial infarction; transient ischemic attacks or cerebrovascular accident during the preceding six months; diagnosis of symptomatic autonomic neuropathy with a history of orthostatic hypertension, syncope, or hypertension

with a systolic blood pressure of ≥ 180 mm Hg or diastolic blood pressure ≥110 mm Hg at the time of screening visit; history of hypotension, dizziness/fainting with systolic blood pressure of ≤ 90 mm Hg or diastolic blood pressure ≤ 60 mm Hg at the time of screening visit.

- Subjects who have evidence within the preceding 6 months of hepatic disease or dysfunction, e.g. AST, ALT, alkaline phosphatase or total bilirubin twice the upper limit of normal; hepatitis; jaundice; cirrhosis.
- Subjects with clinically significant pulmonary, neurologic, hematologic, immunologic, neoplastic or metabolic disease.
- Subjects with evidence or recurrence of malignancy within the past five years, other than excised basal cell carcinoma.
- Subjects for whom surgery is anticipated during the study period or has had surgery in the last 6-months.
- Subjects with a history of substance abuse or alcoholism within the past 5 years, or significant psychiatric disorder that would interfere with the subject's ability to complete the study.
- Subjects who have donated blood during the month prior to study entry or planned during the study.
- Subjects who have participated in other studies using an investigational drug during the preceding 3 months.
- Subjects who are allergic to blueberries.
- Subjects who are allergic to red dye or blue dye food coloring.
- Subjects who consume and drink daily servings of berries (i.e., blueberries, strawberries, bilberries, cranberries, elderberries, and raspberries), grapes, fruit juices that contain berries and grapes, and wine more than 3 times per week in the preceding 2 months.
- Subjects who have had a fluctuation in body weight >10% in the preceding 2 months.
- Subjects who are taking prescription or over the counter medication or supplements for desired weight loss.
- Subjects who have peripheral vascular disease in the arms and/or legs.
- Subjects who have a history of blood clots.
- Subjects who have active deep brain stimulators.

Appendix B

Body Mass Index (BMI) Charts

https://www.vertex42.com/ExcelTemplates/bmi-chart.html

Body Mass Index (BMI) Table for Adults

Obese (>30) | Overweight (25-30) | Normal (18.5-25) | Underweight (<18.5)

HEIGHT in feet/inches and centimeters

WEIGHT		4'8"	4'9"	4'10"	4'11"	5'0"	5'1"	5'2"	5'3"	5'4"	5'5"	5'6"	5'7"	5'8"	5'9"	5'10"	5'11"	6'0"	6'1"	6'2"	6'3"	6'4"	6'5"
lbs	(kg)	142cm		147	150	152	155	157	160	163	165	168	170	173	175	178	180	183	185	188	191	193	196
260	**(117.9)**	**58**	**56**	**54**	**53**	**51**	**49**	**48**	**46**	**45**	**43**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**32**	**31**
255	(115.7)	57	55	53	51	50	48	47	45	44	42	41	40	39	38	37	36	35	34	33	32	31	30
250	**(113.4)**	**56**	**54**	**52**	**50**	**49**	**47**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**
245	(111.1)	55	53	51	49	48	46	45	43	42	41	40	38	37	36	35	34	33	32	31	31	30	29
240	**(108.9)**	**54**	**52**	**50**	**48**	**47**	**45**	**44**	**43**	**41**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**33**	**32**	**31**	**30**	**29**	**28**
235	(106.6)	53	51	49	47	46	44	43	42	40	39	38	37	36	35	34	33	32	31	30	29	29	28
230	**(104.3)**	**52**	**50**	**48**	**46**	**45**	**43**	**42**	**41**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**
225	(102.1)	50	49	47	45	44	43	41	40	39	37	36	35	34	33	32	31	31	30	29	28	27	27
220	**(99.8)**	**49**	**48**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**34**	**33**	**32**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**
215	(97.5)	48	47	45	43	42	41	39	38	37	36	35	34	33	32	31	30	29	28	28	27	26	25
210	**(95.3)**	**47**	**45**	**44**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**28**	**27**	**26**	**26**	**25**
205	(93.0)	46	44	43	41	40	39	37	36	35	34	33	32	31	30	29	29	28	27	26	26	25	24
200	**(90.7)**	**45**	**43**	**42**	**40**	**39**	**38**	**37**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**
195	(88.5)	44	42	41	39	38	37	36	35	33	32	31	31	30	29	28	27	26	26	25	24	24	23
190	**(86.2)**	**43**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**	**23**	**23**
185	(83.9)	41	40	39	37	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22
180	**(81.6)**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**
175	(79.4)	39	38	37	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21
170	**(77.1)**	**38**	**37**	**36**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**
165	(74.8)	37	36	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	20
160	**(72.6)**	**36**	**35**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**	**19**	**19**
155	(70.3)	35	34	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	20	20	19	19	18
150	**(68.0)**	**34**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**
145	(65.8)	33	31	30	29	28	27	27	26	25	24	23	23	22	21	21	20	20	19	19	18	18	17
140	**(63.5)**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**17**
135	(61.2)	30	29	28	27	26	26	25	24	23	22	22	21	21	20	19	19	18	18	17	17	16	16
130	**(59.0)**	**29**	**28**	**27**	**26**	**25**	**25**	**24**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**
125	(56.7)	28	27	26	25	24	24	23	22	21	21	20	20	19	18	18	17	17	16	16	16	15	15
120	**(54.4)**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**
115	(52.2)	26	25	24	23	22	22	21	20	20	19	19	18	17	17	16	16	16	15	15	14	14	14
110	**(49.9)**	**25**	**24**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**
105	(47.6)	24	23	22	21	21	20	19	19	18	17	17	16	16	16	15	15	14	14	13	13	13	12
100	**(45.4)**	**22**	**22**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**14**	**13**	**13**	**12**	**12**	**12**
95	(43.1)	21	21	20	19	19	18	17	17	16	16	15	15	14	14	14	13	13	13	12	12	12	11
90	**(40.8)**	**20**	**19**	**19**	**18**	**18**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**12**	**11**	**11**	**11**
85	(38.6)	19	18	18	17	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	10	10
80	**(36.3)**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**11**	**11**	**11**	**11**	**10**	**10**	**10**	**9**

Note: BMI values rounded to the nearest whole number. BMI categories based on CDC (Centers for Disease Control and Prevention) criteria.

https://www.vertex42.com

BMI = Weight[kg] / (Height[m] x Height[m]) = 703 x Weight[lb] / (Height[in] x Height[in])

Appendix C

WBANA PD Pre-screening Questionnaire

Age _____ Sex _____

Current Medications _____

_____

_____

What assistive device do you use to walk?

_____

Instructions: Mark Yes or No to the following questions.

1.	**Do you have prior history of Type 1 diabetes?**	**___Yes**	**___No**
2.	**Do you have prior history of Type 2 diabetes? What is your A1C? _____**	___Yes	___No
3.	**Do you have significant trouble swallowing?**	___Yes	___No
4.	**Have you been diagnosed with neuropathy?**	___Yes	___No
5.	**Do you have signs of rheumatoid arthritis?**	___Yes	___No
6.	**Do you have numbness/tingling/burning sensations in your feet that would affect your ability to sit down, stand up, walk, turn, or stair climb?**	___Yes	___No
7.	**Do you have osteoarthritis that would affect your ability to sit down, stand up, walk, turn, or stair climb?**	___Yes	___No
8.	**Have you been diagnosed with osteoarthritic condition(s) of the spine or lower extremities (including hips) that affects your gait?**	___Yes	___No
9.	**Do you have a pre-existing gait difficulties not caused by Parkinson's Disease?**	___Yes	___No

10. Do you have a history or signs of significant gastrointestinal dysfunction? (This includes: irritable bowel syndrome; inflammatory bowel disease; ulcerative colitis or Crohn's disease; regional enteritis; diverticulosis or diverticulitis; significant gastroparesis; gastrointestinal (GI) stricture, partial or complete gastrectomy or small bowel resection; chronic diarrhea; peptic ulceration, colonic ulceration, or GI bleeding)	___Yes	___No
11. Are you a chronic user of laxatives or cathartics? (The use of stool softeners is acceptable and the use of required bulking agents should remain constant throughout the study)	___Yes	___ No
12. Are you taking concomitant therapy with medications known to be nephrotoxic, such as aminoglycosides, methicillin, and cyclosporine?	___Yes	___ No
13. Do you have a history, within the past 6 months, of significant cardiovascular dysfunction? (This includes: congestive heart failure or serious arrhythmia, myocardial infarction, cardiac surgery; transient ischemic attacks or cerebrovascular accident during the preceding six months; diagnosis of symptomatic autonomic neuropathy with a history of orthostatic hypertension, syncope, or hypertension with a systolic blood pressure of ≥180 mm Hg or diastolic blood pressure ≥110 mm Hg at the time of screening visit; history of hypotension, dizziness/fainting with systolic blood pressure of ≤ 90 mm Hg or diastolic blood pressure ≤ 60 mm Hg at the time of screening visit)	___Yes	___ No
14. Within the preceding 6 months, do you have evidence of hepatic disease or dysfunction? (This includes: AST, ALT, alkaline phosphatase or total bilirubin twice the upper limit of normal; hepatitis; jaundice; cirrhosis)	___Yes	___ No
15. Do you have significant pulmonary, neurologic, hematologic, immunologic, neoplastic, or metabolic disease?	___Yes	___ No
16. Do you have significant renal dysfunction or disease?	___Yes	___ No

17.	**Within the past 5 years, do you show evidence or recurrence of malignancy, other than excised basal cell carcinoma?**	___Yes	___ No
18.	**Do you have an anticipated surgery during the study time period?**	___Yes	___ No
19.	**Have you had surgery during the last 6-months?**	___Yes	___ No
20.	**Within the past 5 years, do you have a history of substance abuse or alcohol abuse?**	___Yes	___ No
21.	**Do you have a history of a psychiatric disorder? If yes, what is it and what medication do you take to control it?** _____	___ Yes	___ No
22.	**Have you donated blood during the last month? If yes, when _____**	___Yes	___ No
23.	**Do you plan on donating blood during the study?**	___Yes	___ No
24.	**Have you participated in another study using an investigational drug during the preceding 3 months?**	___Yes	___ No
25.	**Are you allergic to blueberries?**	___Yes	___ No
26.	**Are you allergic to red or blue dye food coloring?**	___Yes	___ No
27.	**Do you consume and/or drink daily servings of berries (i.e., blueberries, strawberries, bilberries, cranberries, elderberries, and raspberries), grapes, fruit juices that contain berries and grapes, and wine more than 3 times a week? (have you done so in the preceding 6 weeks)**	___Yes	___ No
28.	**Within the past 2 months, do you have a more than 10% fluctuation in body weight?**	___Yes	___ No
29.	**Are you taking prescriptions, over the counter medication, or supplements for desired weight loss?**	___Yes	___ No
30.	**Do you have peripheral vascular disease in your arms/legs?**	___Yes	___ No
31.	**Do you have a history of blood clots?**	___Yes	___ No
32.	**Have you had neurosurgery (ex. A deep brain stimulator)? If yes, for what condition/s? _____** _____	___Yes	___ No

The following questions, 27 and 28, are applicable to females only. Males should mark N/A.

33.	**Are you pregnant or lactating?**	**___ Yes**	**___ No**	**___ N/A**

34. Are you of childbearing potential and <u>not</u> using an effective method of birth control, condoms with spermicidal gel or foam, contraceptive patch, <u>not</u> sustaining abstinence, <u>not</u> surgically sterilized, or <u>not</u> at least 2 years postmenopausal?
(Effective methods of birth control include: barrier method, intrauterine and cervical devices, oral contraceptive, hormonal injections)

___Yes ___ No ___ N/A

Appendix D

BB001 Daily Activity Log

Friday March 23, 2018

10:38 am: Put on device and began data collection

Driving

11:00 am: Shopping (slow walking)

11:45 am: Driving

12:00 pm: Take meds: Carbidopa/Levodopa and entacapone

12:05 pm: Shopping

12:25 pm: Driving

12:30 pm: Home—prep lunch

1:00 pm: Lunch

1:30 pm: Nap

3:00 pm: Take meds: Carbidopa/Levodopa and entacapone

3:15 pm: Walk ¾ mile

3:45 pm: Shower and rest

4:45 pm: Drive to town for party

5:30 pm: Party—sitting

6:00 pm: Take meds: Carbidopa/Levodopa and entacapone

6:15 pm: Dinner—sitting

8:30 pm: Home—ready for bed

*other meds (losartan, crestor, pantoprazole, and plavix) are taken at night

9:00 pm: Lights Out

Saturday March 24, 2018

6:00 am: Get up, toilet, etc. Take meds: Carbidopa/Levodopa and entacapone and amantadine

7:30 am: coffee

8:00 am: Paper

9:00 am: shower, etc., dress. Take meds: Carbidopa/Levodopa and entacapone

10:00 am: Meeting—sitting

12:00 pm: Home (something else illegible) -- Take meds: Carbidopa/Levodopa and entacapone

12:30 pm: Lunch

1:00 pm: Prep to go to New Orleans—laundry, shower, pack

2:30 pm- 4:00pm: Drive to New Orleans

3:00 pm: Take meds: Carbidopa/Levodopa and entacapone

4:00 pm – 6:00 pm: Visit with family

6:00 pm: Take meds: Carbidopa/Levodopa and entacapone

7:00 pm – 9:30pm: Out to dinner with family

9:00 pm: Take meds: Carbidopa/Levodopa and entacapone

*Other meds (losartan, crestor, pantoprazole, and Plavix) are taken at night

9:30 pm: Bed

Sunday March 25, 2018

6:30 am: Get up, had coffee, breakfast. Take meds: Carbidopa/Levodopa and entacapone and Amantadine

7:30 am – 8:30 am: Read paper

8:30 am- 9:30am: Shower and dress

9:00 am: Take meds: Carbidopa/Levodopa and entacapone

9:30 am: Help with brunch prep

11:00 am: Brunch and family socializing (possibly until 3:30 pm)

12:00 pm: Take meds: Carbidopa/Levodopa and entacapone

3:00 pm: Take meds: Carbidopa/Levodopa and entacapone

3:30 pm: Drive from New Orleans

4:45 pm: Shopping

5:00 pm: TV sports

6:00 pm: Take meds: Carbidopa/Levodopa and entacapone

6:30 pm: Prepare dinner

7:00 pm: Dinner and TV

9:00 pm: Take meds: Carbidopa/Levodopa and entacapone

*Other meds (losartan, crestor, pantoprazole, and Plavix) are taken at night

9:30 pm: Bedtime

Monday March 26, 2018

7:00 am: Get Up (assuming he took his morning meds--Carbidopa/Levodopa, entacapone, and amantadine here, unless he woke up at 6am and took them)

8:30 am: Coffee, breakfast, TV, computer

9:00 am: Take meds: Carbidopa/Levodopa and entacapone

9:45 am: shower (accelerometer off)

10:15 am: email correspondence

11:00 am: Read

12:00 pm: Take meds: Carbidopa/Levodopa and entacapone

12:45 pm: Lunch (remembered accerlerometer)

1:30 pm: Read

3:00 pm: Take meds: Carbidopa/Levodopa and entacapone

3:30 pm: Physical therapy: 30 minutes unweighted walking, muscle activation procedure

4:15 pm: Home. Maintenance work

5:00 pm: Shopping

6:00 pm: Watch TV. Take meds: Carbidopa/Levodopa and entacapone

6:30 pm: Prepare dinner

7:00 pm: Dinner

7:30 pm: TV

9:00 pm: Take meds: Carbidopa/Levodopa and entacapone

*Other meds (losartan, crestor, pantoprazole, and Plavix) are taken at night

10:00 pm: Bedtime

Tuesday March 27, 2018

7:45 am: Wake up. Coffee. Breakfast. Take meds: Carbidopa/Levodopa and entacapone and amantadine

8:45 am: Correspondence

9:00 am: Take meds: Carbidopa/Levodopa and entacapone

9:45 am: Exercise—warm-up, strength and walking

10:30 am: Stretch and rest

11:00 am: 2017 Taxes

12:00 pm: Lunch. Take meds: Carbidopa/Levodopa and entacapone

1:15 pm: Clean out closet with help

2:00 pm: Nap

3:00 pm: Take meds: Carbidopa/Levodopa and entacapone

3:30 pm: Computer

5:00 pm: TV news/indoor bike

6:00 pm: News. Take meds: Carbidopa/Levodopa and entacapone

7:00 pm: Dinner and TV

9:00 pm: Take meds: Carbidopa/Levodopa and entacapone

*Other meds (losartan, crestor, pantoprazole, and Plavix) are taken at night

10:00 pm: Bed time

Wednesday March 28, 2018

6:05 am: Get up. Take meds: Carbidopa/Levodopa and entacapone and amantadine

6:15 am: Coffee

6:30 am: Breakfast

7:00 am: TV news

8:00 am: Taxes

9:00 am: Take meds: Carbidopa/Levodopa and entacapone

9:30 am: Exercise class

10:30 am: Volunteer reading

11:30 am: Lunch

12:00 pm: Take meds: Carbidopa/Levodopa and entacapone

1:00 pm: Nap

2:00 pm: Taxes

3:00 pm: Read. Take meds: Carbidopa/Levodopa and entacapone

6:00 pm: Dinner out. Take meds: Carbidopa/Levodopa and entacapone

9:00 pm: Take meds: Carbidopa/Levodopa and entacapone

*Other meds (losartan, crestor, pantoprazole, and Plavix) are taken at night

9:30 pm: Bedtime

Thursday March 29, 2018

6:30 am: Coffee. Take meds: Carbidopa/Levodopa and entacapone and amantadine

7:30 am: Airport

8:30 am: Flight. Had lunch on the flight

9:00 am: Take meds: Carbidopa/Levodopa and entacapone

12:00 pm: Take meds: Carbidopa/Levodopa and entacapone

1:30 pm: Land

2:00 pm: Relative's home. Play with kids outside

3:00 pm: Take meds: Carbidopa/Levodopa and entacapone

4:30 pm: Rest

5:30 pm: Shower

6:00 pm: Rest (Forgot accerlerometer). Take meds: Carbidopa/Levodopa and entacapone

6:30 pm: Dinner

9:00 pm: Take meds: Carbidopa/Levodopa and entacapone

*Other meds (losartan, crestor, pantoprazole, and Plavix) are taken at night

10:00 pm: Bedtime

Friday March 30, 2018

6:30 am: Accelerometer On. Take meds: Carbidopa/Levodopa and entacapone and amantadine

7:00 am: Coffee

8:00 am: Breakfast

9:00 am: Take meds: Carbidopa/Levodopa and entacapone

9:15 am: Errands in car

12:00 pm: Take meds: Carbidopa/Levodopa and entacapone

The subject removed the accelerometer around noon on this day.