STUDY PROTOCOL

Exercise snacks for people with Parkinson Disease: A pilot randomised controlled trial

Short title: SNACK PD

H24-02753

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Sponsor	Parkinson Canada

Background & Scientific Justification

Many types of exercise benefit people with Parkinson's Disease (PD) (Carvalho et al., 2015; Choi et al., 2020), contributing to the acceptance of exercise as an important element of treatment (Grimes et al., 2019). Despite this, many people with PD do not exercise, and their activity levels decline over time (Amara et al., 2019). Barriers to exercise include disease-related factors (motor disability, fatigue, apathy) as well as practical factors such as lack of time, facility/program access, weather, and financial burden (Ellis et al., 2013; Johnson et al., 2018; Schootemeijer et al., 2020).

People with PD need time-efficient, accessible exercise options that can be achievable by people with varied motor impairment, through different stages of their illness. Our proposal applies an innovative approach called "exercise snacks" or short bouts of vigorous effort that can be performed anywhere without specialized equipment or significant time commitment. This integrates exercise into daily life in a way that is flexible and achievable even for people who only briefly feel capable of exercising.

Most aerobic exercise interventions studied in PD, including 'high-intensity interval training,' involve bouts of 30-60 minutes of activity multiple times per week (Gilat et al., 2021; Schootemeijer et al., 2022; Ahmad et al., 2023; Malczynska-Sims et al., 2022; van Wegen et al., 2020; Ernst et al., 2023). This presents a practical barrier to exercise, as sustained exercise may not be feasible for many people with PD. Short exercise bouts within daily life are seen by inactive adults as convenient and simple (Thøgersen-Ntoumani et al., 2023) and align with updated World Health Organization guidelines on physical activity and sedentary behavior (Bull et al., 2020) and the Canada 24-hour Movement Guideline for Adults' recommendation to break up long periods of sitting (Ross et al., 2020). Exercise snacks can significantly improve fitness, in a manner similar to traditional aerobic training and high-intensity interval training in other populations (Little et al., 2019; Jenkins et al., 2019; Islam et al., 2022). We hypothesize that they will also benefit people with PD.

Exercise interventions must be accessible to benefit more people with PD. The majority of aerobic exercise interventions in PD exclude those with mild cognitive impairment or who need help walking or with daily activities (Ernst et al., 2023). Furthermore, most exercise interventions do not include a home component (Ernst et al., 2023). In the Canadian Community Health Survey, rural residents were more likely to report poor access to exercise facilities as barriers to physical activity (Pelletier et al., 2022). Since exercise snacks can be deployed to rural or remote environments within a participant's home, we expect our intervention to be of particular benefit to our population in the Interior of British Columbia, where there is a much higher proportion of rural residents than the provincial average (CIHI, 2003).

To develop the specific list of interventions presented in this study, we then undertook an iterative intervention design process. First, a series of one minute Exercise Snacks (28 options) and Active Movement Breaks (30 options) were video recorded by Seven Movements and reviewed by Dr. Wile and Sean Dance for applicability to the study design, safety for the target population and refinement of the options. Further meetings were held to discuss the activity durations and variations to include, with a further series of two minute options video recorded by Seven Movements - as presented in this protocol.

We hypothesize that people with PD will see improvements in walking performance, fear of falling and quality of life in the Exercise Snacks group compared to the Active Movement Breaks group.

Research Objectives & Hypothesis

Objectives

- Conduct a 12-week pilot randomized controlled trial of “Exercise Snacks” compared to a placebo exercise intervention (“Active Movement Breaks”) in people with PD.
- Determine the proportion of people with PD eligible to participate, and rates of recruitment, adherence, and dropout.
- Measure baseline and post-intervention patient reported and device obtained measures of active lifestyle, fear of falling, quality of life, and clinical measures of walking performance and balance in people with PD.
- Evaluate barriers and facilitators for an Exercise Snacks intervention in PD, including qualitative enjoyment ratings and safety.
- Estimate sample size for a future definitive RCT.

Hypothesis

Participants in the Exercise Snacks and Active Movement Break groups will be highly adherent to the prescribed activity.

People with PD randomized to the Exercise Snacks group will see improvements in walking performance, fear of falling and quality of life when compared to the Active Movement Breaks group.

Method

Study Design

An open-label, two-arm parallel-group, randomized pilot trial.

Study Population

We aim to recruit 40 adults with Clinically Established PD from Kelowna, BC from the Humphreys Family Movement Disorder Clinic. This study aims to be broadly inclusive, and the Exercise Snacks and Active Movement Breaks will be designed such that they can be safely performed by people within the target population, with direct observation and coaching through the study interventions (see onboarding session details below) before safely beginning the study period.

Inclusion criteria

- Adults (19 years of age or older) with Clinically Established PD (Postuma et al., 2015).

- Medically cleared to exercise by their physician.
- A score of ≤3 on the modified Hoehn & Yahr scale (i.e. physically independent, may have unilateral or bilateral clinical signs, including mild impairment of postural reflexes).
- Have access to a computer, tablet, or smartphone with internet connection for intervention delivery and tracking.

Exclusion criteria

- Comorbid condition with physical disability preventing participation in exercise (i.e., that cannot be accommodated with modifications to the prescribed exercise).
- A score of >=4 on the modified Hoehn & Yahr scale (meaning they may be able to stand or walk but are not physically independent; this typically includes a need for gait aids such as a cane or walker)
- No access to reliable internet connection.
- Are currently participating in another clinical trial that would interfere with the study procedures described.
- Have a scheduled event (e.g. medical or surgical procedure, prolonged travel in the next 3-4 months) that would interrupt participation in the study.

Our study materials are presented in English. Participants who are not fluent in English will not be excluded and the research team will employ services to allow participation for non-native English speakers, including use of PHSA Interpreting services if needed, as recommended in the UBC Research Ethics Guidance on this matter.

(https://researchethics.ubc.ca/sites/default/files/documents/Exclusion_of_research_participants_based_on_language.pdf).

Outcomes/endpoints

In addition to baseline clinical data, pre/post intervention outcomes will include patient reported measures, and walking and balance testing with a qualified study team member, and a five day window of actigraphy data from a wrist-worn device (Actigraph LEAP) prior to the study period. There will also be additional end-of-study outcomes.

Baseline clinical data

- Demographic information
- Parkinson Disease characteristics and severity (symptom onset, diagnosis date, medication list and levodopa equivalent daily dose calculation) (Jost et al. 2023).
- A recent (within 6 weeks) MDS-UPDRS III examination score (Goetz et al., 2008), including a modified Hoehn and Yahr scale score.

Patient reported pre/post measures

- Canadian Society for Exercise Physiology (CSEP) Get Active Questionnaire (Screening questionnaire to safely participate in physical activity and exercise) (Canadian Society for Exercise Physiology [CSEP], 2017).
- International Physical Activity Questionnaire - Short Form (IPAQ) - a measure of baseline physical activity (Craig et al., 2003).
- Modified Survey of Activities and Fear of Falling in the Elderly (mSAFFE) (Jonasson et al., 2014, Nilsson et al., 2020, Kader et al., 2016), a measure of activity avoidance.
- Parkinson Disease Quality of Life 39 item scale (PDQ-39) (Peto et al., 1998).

Baseline clinical testing

- Functional walking testing: two minute timed walk test (Bohannon et al 2015, Bowman et al., 2024), comfortable 10m walk test (Combs et al. 2014) and Timed Up and Go test (Dal Bello-Haas et al., 2011).
- Berg Balance Scale (Berg et al., 1992).
- Resting heart rate/blood pressure and post-exercise heart rate/blood pressure after a two minute example Exercise Snack (this is described in the study procedures below).

End-of-study outcomes

- Data from Seven Movements Platform
    - Adherence to the study intervention using activities logged in the Seven Movements platform. We will define these based on completion of target exercise:
        - Target: completion of at least 2 sessions five days per week, or 10 per week long block.
        - High (>70%), moderate (50-69%), or low (<50%) adherence.
    - Intensity of the exercise expecting a rate of perceived exertion (RPE) of >4/10 on the Borg CR-10 scale for Exercise Snacks, and greater RPE than the Active Movement Breaks group.
    - A summary of the Exercise Enjoyment Scale ratings of exercises to compare the study groups and assess for outliers / items requiring redesign or exclusion from future use.
- Data from Actigraph LEAP device
    - Actigraphy data (segemented as sedentary time or mild/moderate/vigorous activity) from five day windows pre-study and post-study using actigraphy/accelerometer information from this device.
    - Heart rate data collected during two 5 day windows within the study period to assess the effect of Exercise Snack and active movement break interventions on heart rate.
- Post Intervention Questionnaire
    - Acceptability of the intervention.
    - Barriers and facilitators to study activity.
    - Assessment of platform and technology in study.
    - Adverse events, safety concerns.
- Path of recruitment and reasons for joining/not joining the study.

Study Procedures

1. Recruitment and pre-intervention procedures

Recruitment:
Eligible patients are anticipated to be seen by Dr. Wile at the Humphreys Family Movement Disorder Clinic.

Recruitment workflow will be:

1. Research personnel will be physically and readily available at the Humphreys Movement Disorder Clinic to continue the conversation about the study with potential participants (e.g., answer questions, complete informed consent) after their appointment with Dr. Wile.

2. If the potential participant prefers, the study personnel will arrange a follow-up phone call to discuss the study

3. If the potential participant prefers, they will be given the Study Card to link to the study for more information and the ability to reflect on their own time or discuss with their family without pressure. This study card includes contact information for the potential participant to connect with the study team if and when they are interested.

Consent:
Participants will be given as much time as they wish to review these materials and decide on participation. Participants will have the opportunity to contact study personnel to ask questions prior to committing to participate.

Baseline clinical data:
For participants who have had a clinical appointment with a neurologist within the previous six weeks, consent will be obtained to request those records from their treating clinician to abstract the baseline clinical data. If data cannot be obtained from existing clinical records, it will be obtained by Dr. Wile during the study onboarding visit.

Patient reported measures:
After informed consent, participants can complete pre-study questionnaires for baseline data using an additional survey tool link via Redcap. These measures are listed in the patient reported measures section in the Outcomes/Endpoints section of this protocol.

Pre-intervention review and scheduling:
A study coordinator will review the data for completeness at that time and follow up with participants if there is missing data in the self-reported measures. The study onboarding visit will be scheduled.

2. Study Onboarding Visit - Pre-randomization

After informed consent and completion of initial pre-study questionnaires, participants will be scheduled for a Study Onboarding Visit.

At this visit:

- Any missing baseline clinical data will be collected by Dr. Wile as listed in the outcomes/endpoints section.
- Baseline clinical testing will be done with Roderick Sandilands as listed in the Outcomes/endpoints section.
- Participants will review how to use the Seven Movements platform with a computer, smartphone, or tablet, including accessing instructional videos of their Exercise Snacks or Active Movement Breaks and how to complete post-activity records of their effort and enjoyment.
- Participants will rate RPE for two activity examples (one each from the Active Movement Break and Exercise Snacks groups) with Roderick Sandilands prior to randomization. This will provide a way to show examples with different intensity to explain the RPE concept.
- A baseline resting HR and BP will be collected before and following the Exercise Snack example intervention with Roderick Sandilands.

3. Study Onboarding Visit - Randomization, Group Allocation

- Participants will undergo randomization on the Redcap platform using a participant study ID code, sex, and Hoehn and Yahr scale score as inputs. A computer-generated randomization schedule with variable permuted block sizes will stratify blocks by self-reported biological sex (M/F) and Hoehn and Yahr scale score (1-2 or 2.5-3).
- Participants will review the set of 12 Exercise Snacks or Active Movement Breaks they will perform during the study period with Roderick Sandilands, based on their group assignment. This review will serve as a safety check to ensure the individual participant can safely perform each of the assigned group Exercise Snacks or Active Movement Breaks, and allow an opportunity to review adaptations or modifications if any are needed.
- A plan for incorporating exercise snacks or active movement breaks into participants' daily routines with Roderick Sandilands will follow a standardized brief action planning interview guide.
- The weekly schedule of Exercise Snacks or Active Movement Breaks will then be generated in two six-week blocks, and the simple, flexible structure described in the Study Period section below will be explained to participants.
- Participants will receive the Actigraph LEAP device and review instructions on how to wear the device.
- Participants will confirm their contact information, such that study personnel can conduct planned study contact phone check-ins; participants will be given contact instructions if they have technical questions, or study concerns.

While participants cannot be blinded in exercise interventions, specific study hypotheses will not be disclosed to participants; the study will be described as testing different types of “movement breaks” for improving fitness and mobility.

4.1 Study Period Overview

Both the Exercise Snacks and Active Movement Breaks groups will follow a similar schedule and structure for delivery of the study intervention, using the Seven Movements platform, and will provide the same structured feedback on their perceived effort and enjoyment.

The study lasts 12 weeks and is divided into two 6-week phases. It begins the Monday after the Onboarding visit. Each week, two of the twelve available intervention options will be randomly chosen (without repeating any options) for participants to complete. By the end of the first 6 weeks, all twelve options will have been used. In the second 6-week phase, new random pairs of options will be assigned each week until the study ends.

In both groups, the exercise sessions are flexible in timing and delivery. Participants can choose between the available options for each session and decide when to exercise based on when they feel able. This flexibility allows those with unpredictable treatment responses to pick the best time for them. The exercises are simple, require minimal preparation, and need no special equipment.

Participants can achieve their activity targets on a weekly basis. They will be prescribed ten sessions in each 7-day period, allowing for a rest day. They may elect to perform additional sessions if they wish.

4.2 Seven Movements Platform

The intervention will be conducted in partnership with Seven Movements, a company that specializes in the design and implementation of brief remote exercise interventions through technology, using a custom-built online and app-based exercise snacks platform.

An example illustration of the user interface is shown in Appendix B. The Seven Movements platform provides participants with instructional videos showing safe and effective examples of the exercise options, provides reminders, and allows us to track exercise engagement, effort, safety, and enjoyment within the study. Notifications are provided as a reminder early in the day to be sure they remember to find time, and midday if they have not yet completed any sessions.

Participants will be able to log the timing, duration, and number of sessions completed daily as well as the perceived effort (Borg CR-10 scale; Borg et al., 1982) and enjoyment (Exercise Enjoyment Scale; Stanley et al., 2009) into the platform.

Participants will also be sent weekly self-report surveys via email RedCap link. If participants miss a weekly self-report survey, we will follow-up by email or telephone call to check in and address any concerns. Regular

phone check in sessions (10-15 minutes) will be held at weeks 4 and 8 to assess progress, adjust goals, and address any concerns.

Participants will use anonymous, single-use accounts (e.g., “SNACK-PD-01”) with no identifying information stored.

4.3. Exercise Snacks Group

Participants will perform 2-minute Exercise Snacks, with ten sessions per week (typically 2 per day with 2 rest days), for a 12-week period. Exercises will consist of a mix of seated and standing actions, including body-weight exercises (e.g., squats, chair squats) and aerobic activities (e.g., stair marching in place, seated boxing), aimed at increasing heart rate while ensuring safety and ease of completion.

Participants may adjust the intensity of the exercise through a weeklong period as they become familiar with the movements. Simpler and more advanced versions are presented in the videos, and where appropriate to the exercise some variations are presented that include simple changes like adjustments of the repetition rate, inclusion of vocal elements or use of a provided resistance band. Variations may also include performing movements e.g. with alternate arms vs. simultaneously with both arms.

Participants can thereby tailor their sessions based on current abilities from the two exercise options and their variations.

The specific activities for the Exercise Snacks group are:

1. March in Place
2. Chair Assisted Speed Squats
3. Low Level Lateral Walk
4. Squat then Side Lunge with Overhead Reach
5. Overhead Axe Chop
6. Wide Stance Lateral Duck Unders
7. Chair Sit to Stand with Arm Horizontal Abduction
8. Shadow Boxing Jab BH Combo
9. Shadow Boxing Hook Combo
10. Shadow Boxing Uppercut Combo
11. Chair Sit to Stand to Box (alternating left-right)
12. 1-2-1 Lateral Marching

4.4 Active Movement Breaks Group

Active Movement Breaks will mirror the format, schedule and delivery of Exercise Snacks. The Active Movement Breaks are designed to involve similar muscle groups / body regions compared to the Exercise Snacks interventions to mimic the engagement of the intervention group with less physical intensity. These

activities generally involve low-impact movements and stretches, with variations to accommodate participants' safety and preferences.

1. Chair Assisted Calf Stretch
2. Chair Assisted Long Hip Flexor Stretch
3. Chair Assisted Abductor Stretch
4. Chair Assisted lateral line Stretch
5. Chair Assisted Hamstring Stretch
6. Chair Assisted Wide Stance Rotation Stretch
7. Chair Assisted Long Staggered Stance Lateral Hip Shift, Lateral Line OH Reach Mobilizer
8. Wide Stance Rotation Hip Mobilizer
9. Chair Assisted Single Leg Stance Hip Rotation
10. Chair Assisted Spine Extension Mobilizer
11. Chair Assisted T Spine Rotation Mobillizer
12. Forward Step Shoulder and Spine Extension Mobilizer

4.5 Monitoring and post-intervention assessments

Check in calls from a study coordinator will occur on the Tuesday (day 2) of weeks 1 and 2. These will be designed to address any early logistical issues with the study procedures, Seven Movements platform, or exercises.

A scheduling call will occur during week 10 to schedule a study end visit within 2 weeks of study completion.

Interim safety review calls will occur on the Tuesday of weeks 4 and 8. During these calls, a structured discussion of the individual exercises completed to date will occur and responses will be stored in Redcap including:

- Subjective comments about difficulty, environment needs or limitations of certain exercise options.
- Reasons for preferring one option over another during a weekly block.
- Safety concerns or injuries.
- Technical challenges with the delivery platform or study contact.
- Barriers to completing prescribed amounts of exercise sessions.

A final study review will occur including the same elements for weeks 9-12 during the study end visit.

The study end visit will also include a study specific acceptability questionnaire that will include open-ended questions to help us explore the barriers and facilitators to exercise completion, and rating which elements of the intervention are most effective for participants.

4.6 Actigraph LEAP device

Participants will review the Actigraph wearable device at the baseline assessment, ensuring they understand how to use and charge the device. The device will be fully programmed for the participant prior to use. Specific instruction and support will include:

- How to wear the device correctly.
- How to charge the device (expecting that this will be required only after roughly 5 days of use).
- Participants will be provided with a compatible charger.
- Participants will be asked to wear the device continuously for 5 days prior to starting the intervention, while conducting routine daily activities as usual.
- Participants will again wear the device continuously for the first 5 days of the study period.
- Participants can return the device after this data collection period, and continue the remainder of the study period without the device. This can be done in person if convenient for the participant, or using a provided pre-paid shipping envelope (i.e., at no cost to the participant).
- At week 10 of the intervention period the Actigraph device and charger will be provided back to the participant by the research team either in person or by mail. Participants will be asked to wear the device continuously for the final 5 days of the study period and additionally for 5 days after the end of the study period.
- Participants can remove the device at any time (a) if they find the device uncomfortable to wear, even if they wish for a break of a few hours or overnight (b) if they wish to remove the device for certain activities during the collection periods (c) if they wish to charge the device.

Of note, participants are not required to use any associated software (Actilife) or interact with the device during the wearing period, as all data collection occurs in the background. The device display shows the current time, and the device does not transmit stored data wirelessly in this study (Bluetooth connectivity is disabled), does track participants' location, or contain any personal identifying information. For more details, the device manual is available to participants in full (Actigraph LEAP Device Manual.pdf).

Data Collection and Management

Study data platform

Redcap will be the primary data gathering and management platform for this study. Redcap is provided by UBC Advanced Research Computing (ARC) for data capture in accordance with data privacy and storage described herein: https://arc.ubc.ca/security-privacy/arc-redcap-security-and-privacy

Specifically The ARC REDCap platform meets the requirements of UBC Information Security Policy SC14 and associated Standards, and has undergone a Privacy Impact Assessment (PIA01956). The platform is equipped with multiple security controls:

- The platform runs on server infrastructure physically located in BC, Canada, at the UBC University Data Centre (UDC).
- The platform is integrated with Enhanced UBC CWL Campus-Wide login, with 2-factor authentication for users.
- The platform can be configured by researchers to separate data logically and allow complete separation of Sensitive and Personal Information from de-identified research data within a single project.
- ARC has a Security Incident Response protocol in place to ensure security and privacy incidents are mitigated in a timely manner.
- The ARC REDCap platform and underlying infrastructure are periodically scanned for security vulnerabilities, and patched per the requirements of UBC Information Security Standard M5
- Data stored in the ARC REDCap platform is encrypted.
- The platform is fully supported and maintained by UBC Advanced Research Computing.

Clinical, survey and in person assessments

Baseline clinical data will be captured from the review of participant clinical records or newly obtained at the baseline visit, and input into Redcap.

Patient reported pre/post measures will be collected by Redcap survey link and directly stored within the study database.

Baseline clinical testing outcomes will be directly collected into a Redcap webform at the time of capture.

Seven Movements

Seven Movements exercise completion, RPE and Exercise Enjoyment Scale data, as well as the timing of session completions, will be stored in the Seven Movements platform until study completion, and then imported into the Redcap study database after data collection is complete.

The Seven Movements platform follows GDPR (General Data Protection Regulation) and other data protection laws to ensure privacy. Data storage is done using Google Firebase on secure servers in the US. Data is encrypted in transit and at rest, with strict access controls and continuous monitoring for security.

Actigraph LEAP

The ActiGraph LEAP devices record movement patterns and heart rate during the wearing periods. The research team pre-configures the devices to disable bluetooth wireless connectivity.

To ensure participant privacy from the outset, ActiLife allows the use of de-identified codes instead of personally identifiable information (PII), reducing the risk of data linkage to specific individuals.

Once collected, data is downloaded in proprietary file formats such as *.agd or *.gt3x, which store raw accelerometer readings. These files will be downloaded by USB connection to a UBC CWL password-protected and encrypted study laptop. Access to raw data will be restricted to authorized personnel only (i.e., those authorized in REB), with clear protocols in place for data sharing and transfer. Collecting only the information essential for study objectives, the study team will also ensure all identifiable data is stored separately from analysis datasets. Before data collection, participants will be informed about what data will be recorded, how it will be stored, who will have access, and the measures in place to protect confidentiality. This will be done at both the Informed Consent Form step and again at the Baseline Assessment.

Statistical Analysis

Baseline Clinical Data

For baseline clinical data, descriptive statistics will be used to characterize the study population. Parkinson's disease characteristics such as symptom onset, diagnosis date will be summarized for group equivalence along with our stratification variables (sex and Hoehn and Yahr scale). Continuous variables like symptom duration and levodopa equivalent daily dose (LEDD) will be reported as means and standard deviations (or medians and interquartile ranges if non-normally distributed). Categorical variables such as the more affected side will be summarized using frequencies and percentages. MDS-UPDRS III scores and modified Hoehn and Yahr scores will be analyzed using means and standard deviations. Additionally, resting and post-exercise heart rate and blood pressure data will be compared pre- and post-exercise using unpaired t-tests or Wilcoxon signed-rank tests to assess the cardiovascular response to the Exercise Snack example.

Patient-Reported Pre/Post Measures

Linear mixed models will be used with group and time (and their interaction) as fixed effects and participant ID as a random effect. Stratification factors will be included in the model as fixed effects and to explore their interaction on outcomes. The between group effect estimate with 95% confidence interval will be the main outcome of interest. Within-group changes over time will also be reported as effect estimates from the model with 95% confidence intervals.

Baseline clinical testing

Similarly we will use a linear mixed model to analyze baseline clinical testing data.

End-Of-Study Outcomes

Adherence will be categorized into high, moderate, and low adherence, based on the percentage of completed exercise snacks. The relationship between adherence and outcomes will be explored where appropriate using correlations or linear regression. Rate of perceived exertion (RPE) and Exercise Enjoyment scores will be summarized and evaluated to ensure participants reached the targeted exercise intensity in the Exercise Snacks group and to compare intensity and enjoyment with the Active Movement Breaks group.

Data from the end-of-study questionnaire assessing intervention acceptability will be summarized using descriptive statistics with open-ended responses used to help identify barriers, facilitators, and safety concerns related to the intervention.

Recruitment path and reasons for joining or not joining the study will be summarized using descriptive statistics.

Ethical Considerations

Benefit and risk to participants

Risks to participants are mitigated in this self-administered exercise intervention clinical trial by initial inclusion safety and activity assessments including those recognized by CSEP as determinants of readiness to exercise. We have designed the study elements in consultation with exercise professionals experienced in working with people with PD (Sean Dance) and offer options and variations of exercise to accommodate unpredictable or fluctuating ability. We allow participants to determine the time they feel safest and most capable to complete the session during their day.

The risks associated with the exercise protocols completed for this study are the same as the physical discomfort or strain during exercise performed in daily life including fatigue, fainting, and/or muscle soreness. When feasible, participants will be encouraged to have a support individual present when engaging in activities to minimize any related risk and/or assist in the event help is required.

Furthermore, participation is at-will and participants can stop at any time without any consequence (as explained in the consent form). Participants will be asked to perform activities in a manner that they control, thus further minimizing their risk. This study does not pose any risks greater than what they may normally encounter when using a similar exercise intervention strategy.

Dr. Wile has a potential dual role conflict of interest for participants. Dr. Wile is therefore involved with screening for eligibility at the point of clinical care, but research personnel will conduct any further discussions about the study, enrollment or review of consent documents.

It is foreseeable that during these study procedures, clinical issues or questions may arise from participants that may require further clinical review or attention. In these cases, Dr. Wile will separately schedule and document a clinical encounter regarding that issue through the Humphreys Family Movement Disorder Clinic at KGH. This will include standard clinical documentation to the primary care physician. In the case of patients who already have an established clinical relationship, this will be conducted through the existing clinic chart. For patients with whom there is no current established relationship, a letter to the primary care physician will be written to describe the clinical concerns, and options for next steps will be suggested.

There is no guarantee of benefit to people participating in the study, however the study has the potential to benefit people with PD who are:

- Unable to complete prolonged bouts of exercise.
- Struggling with variable / unpredictable physical ability and motivation to exercise during the day.
- Living in rural, under-served and resource-poor areas where practical barriers to exercise are more likely to exist.

Participants will receive a plain language summary of the results and they will have the option to ask questions.

Reimbursement

Any costs that participants could incur associated with parking for visiting UBC Okanagan will be covered by the study. If there are any unexpected receipts related to costs of the study, participants will be asked to retain them and provide them to the research team at the end of the study period to receive reimbursement.

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Appendices

Appendix A - Exploratory survey response summary

Our exercise platform partner Seven Movements has an established relationship with the Michael J Fox Foundation for Parkinson's Research. Seven Movements approached this organization and conducted two focus groups. A positive response from participants led to development of a survey distributed to participants in the MJFF Parkinson's Buddy Network (https://parkinsonsbuddynetwork.michaeljfox.org/v2/). When discussing this pilot project we invited people from our Kelowna PD support group to participate in the survey. Though we did not collect identifying information or geographic data from respondents, we infer from the timing of responses that 16-20 respondents are from our local population, and 112-116 (total 132 respondents) are from the MJFF Buddy Network. Responses included information about the respondent's demographics, diagnosis of PD and duration, their exercise habits, exercises they find helpful and enjoyable, barriers to exercise and attitudes about brief exercise interventions and technology-based exercise programs.

132 responses were collected from October 11, 2023 to November 21, 2023. Though we expect responses were affected by selection bias, we note nearly 40% of our sample were diagnosed more than 5 years prior to response, and nearly half were over age 70. 64 Respondents were female (48.5%). 58 responses (43.9%) were from people age 70 or older. 39 had been diagnosed with PD in the past two years (29.5%) 42 between 2-5 years (31.8%) and 51 more than 5 years (38.6%). 29 respondents (22%) reported not regularly participating in exercise, and 103 reported regular exercise habits. Non-exercisers were more commonly over age 70 (14/29; 48.3%) and with more than 5 years since diagnosis (16/29; 55.2%) or 2-5 years (8/29; 27.6%). Both exercisers and non-exercisers reported barriers to regularly exercising. From open ended responses we identified common response themes including motor symptoms (e.g. stiffness, dystonia, unsteadiness, imbalance; 41), practical issues (time and travel required, facility access, fluctuations and unpredictable function; 38) nonmotor symptoms (e.g. amotivation/apathy, fatigue, sleepiness; 37), comorbidities limiting activity (arthritis or other causes of pain;13) and safety concerns (e.g. fall risk; 10).

Exercisers employed a variety of exercise types which we classified as aerobic exercise (132), balance training (70), flexibility (61), strength / resistance (56), and 71 other responses including group activities and exercise as part of activities of daily life. Common responses within these groups were used to develop example exercise snacks (aerobic, some strength/resistance options) or movement breaks (flexibility). Examples are shown in Appendix B.
Though we expect responses were affected by selection bias, 82% of respondents had discussed exercise with their healthcare provider as part of their treatment. 93% endorsed interest in using a platform to guide them brief exercise techniques and 86% would consider participating in a pilot study of such a system.

Appendix B- Intervention Detail

The Seven Movements platform will be reviewed with participants during initial onboarding and participants can tailor and customize a schedule of reminders for movements. Note: We will combine our clinical expertise in

PD (Wile) with exercise snacks physiology (Little and Gibala) and Seven Movements surveys of pwPD to develop accessible standing and seated exercise snacks that are appropriate yet challenging for pwPD.

Instructional videos are available in the app alongside movement options:

Examples include an Exercise Snack (march in place) and Active Movement Break (teapot).

Participants will log the daily exercise snacks completed, their perceived effort (Borg CR-10 scale), and enjoyment (Exercise Enjoyment Scale) in the platform: