Feasibility and Preliminary Effects of using a Music-based, Rhythm-modulating Wearable Sensor System in the Community in Persons With Parkinson Disease

Study Protocol

NCT Number: NCT04891107

Date of Document: April 29, 2023

IRB Office use only Date submitted_____ FB_____ Exp. ____

BU Charles River IRB
Application Form (Full Board and Expedited Review)

SECTION A: PROTOCOL AND CONTACT INFORMATION

Protocol Number (To be assigned by IRB Office):	
Protocol Title:	Feasibility and preliminary effects of using a music-based, rhythm-modulating wearable sensor system in the community in persons with Parkinson disease
Principal Investigator (Name, degrees, licenses, etc.): ☐ Mr. ☐ Ms.	Terry Ellis PhD, PT
Department/School:	Department of Physical Therapy & Athletic Training; College of Health & Rehabilitation Sciences: Sargent College
BU Mailing Address:	635 Commonwealth Ave, Boston, MA 02215
Email:	tellis@bu.edu
Telephone:	617-353-7571
Additional Contact Person:	Jenna Zajac PT, DPT, Research Physical Therapist
Email:	zajacj@bu.edu
Telephone:	617-419-0704

☒ YES **(REQUIRED)**	I confirm that I qualify to serve as the Principal Investigator of this study and am in compliance with the following policies: • http://www.bu.edu/researchsupport/compliance/human-subjects/

SECTION B: FUNDING

Provide information regarding **ALL** funding sources in this section. This includes **ANY EXISTING FUNDING, PENDING FUNDING, OR FUNDING THAT HAS BEEN APPLIED FOR TO SUPPORT THIS RESEARCH**.

Please check all that apply:	
☒	This research is funded Have you received Just In Time (JIT) Notification? ☐ Yes ☐ No
☐	Funding has been requested Have you received Just In Time (JIT) Notification? ☐ Yes ☒ No

	NOTE: Once the funding has been awarded, submit an amendment to the IRB to add the funding source
☐	Research is not funded

If the research is funded or funding has been requested, it is REQUIRED that you complete the box below. The Sponsor Award # must be included in the box below. If you don't have an award #, please state that in the box below. If you have multiple funding sources, add additional boxes as necessary.

Sponsor Name			MedRhythms, Inc.
Title of Grant/Proposal			Feasibility and preliminary effects of using a music-based, rhythm-modulating wearable sensor system in the community in persons with Parkinson disease
Sponsor Award # **(REQUIRED)*** ***If Award # is pending, put pending. Once the funding has been awarded, submit an amendment to the IRB to add the funding source**			Pending
YES	**NO**		
☒	☐		Is Boston University the Prime Awardee of the grant?
☐	☒		Is Boston University receiving a sub-award? Name of Prime Recipient:

***NOTE:** Provide a copy of the grant application, funding proposal, scope of work, or sub-award agreement. The University is required to verify that all funding proposals and grants have been reviewed by the IRB before funds are awarded.

If this research study is for your dissertation, provide a copy of your prospectus (if available).

SECTION C: CONFLICT OF INTEREST

☒ YES **(REQUIRED)**	I confirm that **ALL** those responsible for the design, conduct, or reporting of the proposed program, including at minimum, all Senior/key personnel in the grant application, have completed the financial interest disclosure forms, submitted them to the COI office, and completed training as dictated at: http://www.bu.edu/researchsupport/compliance/conflicts-of-interest/, and as provided under *the Boston University Investigator Conflicts of Interest Policy for Research.* **NOTE: You must attach a copy of the PI's COI submission confirmation email. COI submission confirmation emails for all other study staff should be maintained at the research site.**
Of the financial interest disclosure forms submitted, did you check "yes" to any of the questions on either the FIND1 or NONFIND1 form? ☐ Yes* ☒ No	

***If you checked "yes" to any of the questions on either the FIND1 or NONFIND1 form, the IRB Director will contact the COI office to obtain the disclosure information.**

SECTION D: TYPE OF REVIEW

For Guidance regarding Type of Review please refer to the following website:
http://www.bu.edu/researchsupport/compliance/human-subjects/submitting-an-irb-protocol/

I. **FULL BOARD** ☒

Please refer to the IRB website for Full Board submission deadlines and meeting dates:
http://www.bu.edu/researchsupport/compliance/human-subjects/dates-and-timing-of-the-irb-committee/

II. **EXPEDITED** ☐

In order to qualify for expedited review, the study must be no more than minimal risk* **AND** must fall into one of the categories below. Check all that apply:

1. ☐ Clinical studies of drugs and medical devices only when an investigational new drug application (IND) or investigational device exemption application (IDE) is not required

2. ☐ Collection of blood samples by finger stick, heel stick, ear stick, or venipuncture as follows:
    a. From healthy, nonpregnant adults who weigh at least 110 pounds. For these subjects, the amounts drawn may not exceed 550 ml in an 8 week period and collection may not occur more frequently than 2 times per week; or

b. From other adults and children, considering the age, weight, and health of the subjects, the collection procedure, the amount of blood to be collected, and the frequency with which it will be collected. For these subjects, the amount drawn may not exceed the lesser of 50 ml or 3 ml per kg in an 8 week period and collection may not occur more frequently than 2 times per week.

3. ☐ Prospective collection of biological specimens for research purposes by noninvasive means. Examples include hair and nail clippings, saliva or cheek swabs, sweat, etc.

4. ☐ Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing.

   Examples:
   1. Physical sensors that are applied either to the surface of the body or at a distance and do not involve input of significant amounts of energy into the subject or an invasion of the subject's privacy
   2. Weighing or testing sensory acuity
   3. Magnetic resonance imaging
   4. Electrocardiography, electroencephalography, thermography, detection of naturally occurring radioactivity, electroretinography, ultrasound, diagnostic infrared imaging, doppler blood flow, and echocardiography
   5. Moderate exercise, muscular strength testing, body composition assessment, and flexibility testing where appropriate given the age, weight, and health of the individual

5. ☐ Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment or diagnosis)

6. ☐ Collection of data from voice, video, digital, or image recordings made for research purposes.

7. ☐ Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Note: The IRB will make the final determination on the Type of Review

***Minimal risk** means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

SECTION E: STUDY STAFF AND HUMAN SUBJECTS TRAINING

List **ALL** current members of the research team in the table below. Add more rows as necessary.

STUDENT RESEARCH:
The Faculty Advisor must be listed as a co-investigator in this section and must complete the Human Subjects training requirements. Faculty Advisors are responsible for reviewing the IRB application, agreeing to serve as the Co-PI for this study with the student and are responsible for the ethical conduct of this student's human subjects research. Faculty Advisors must sign this Application prior to it being submitted to the IRB.

BU CHARLES RIVER CAMPUS (CRC) INVESTIGATORS/STUDY STAFF

Note: Boston University Medical Campus (BUMC) investigators/study staff should be listed in the NON-BU INVESTIGATOR/STUDY STAFF section

Name, Degree, & Department/School	Study Role (e.g. co-investigator, research coordinator, research assistant, project manager, lab manager)	Human Subjects Training*
Terry Ellis, PhD, PT Department of Physical Therapy and Athletic Training, College of Health & Rehabilitation Science: Sargent College, Boston University	Principal Investigator	☒ CITI ☐ Other**: HIPAA training completed 09-02-2015 Most Recent Date Completed: 07-19-2019
Louis Awad, PT, DPT, PhD Department of Physical Therapy and Athletic Training, College of Health & Rehabilitation Science: Sargent College, Boston University	Co-Investigator	☒ CITI Most Recent Date Completed: 01-02-2017
Lillian Ribeirinha-Braga Neuromotor Recovery Laboratory	Research Assistant	☒ CITI Most Recent Date Completed: 07-08-2019
Jenna Zajac, PT, DPT Center for Neurorehabilitation Boston University	Research Physical Therapist	☒ CITI ☐ Other**: Most Recent Date Completed: 07-26-2019
Steven Zachariadis Student, Boston University	Research Assistant	☒ CITI ☐ Other**: Most Recent Date Completed: 08-07-2020

Aaron Gu DPT Student, Boston University	Research Assistant	☒ CITI ☐ Other**: Most Recent Date Completed: 08-07-2020

*For more information regarding the Human Subjects Training Policy, refer to the 'Training' section of the Policies & Guidance section IRB website: http://www.bu.edu/researchsupport/training-how-to/human-subjects-training/. This site includes a Study Personnel Training List. You can search this list by name to obtain the completion and expiration dates of training for investigators and study staff.

**If the investigator/study staff did not complete CITI, you must submit a copy of his/her training certificate.

NON-BU INVESTIGATORS/STUDY STAFF* ☒ **N/A**

Note: BUMC and BMC staff are considered to be non-BU staff and should be listed in this section. Add more rows as necessary. All the columns in the box below must be completed. In addition, you must complete the box that follows with a description of the activities for each staff member.

Name, Degree, & Affiliate Institution	Study Role	Staff Information	Will IRB Approval be Obtained from Affiliate?
		1. Will this staff interact with subjects? ☐ Yes ☐ No 2.Will this staff have access to identifiable information? ☐ Yes ☐ No 3.Is the work that the staff will complete related to his/her role or coursework at his/her affiliate institution.? ☐ Yes ☐ No	☐ Yes: Provide copy of IRB approval letter when available: ☐ No (provide reason): _____

		1. Will this staff interact with subjects? ☐ Yes ☐ No 2.Will this staff have access to identifiable information? ☐ Yes ☐ No 3.Is the work that the staff will complete related to his/her role or coursework at his/her affiliate institution.? ☐ Yes ☐ No	☐ Yes: Provide copy of IRB approval letter when available: ☐ No (provide reason): _____

*If IRB approval will be obtained from the affiliate site, only list the lead investigator from the affiliate on this form.

The box below must be completed. Include a summary for each staff listed in the above box. If any of the investigators listed on this form are not affiliated with BU, provide a summary of the study activities that he/she will conduct. If IRB approval is not being obtained at the affiliate institution, provide an explanation. **NOTE: Non-BU staff may be required to complete an Individual Investigator Agreement (IIA). The IRB will notify you if this form is required.**

REQUIRED GOOD CLINICAL PRACTICE TRAINING FOR NIH-FUNDED CLINICAL TRIALS

YES*	NO	NIH-FUNDED CLINICAL TRIALS
☐	☒	Is your study NIH-Funded AND meet the definition of a clinical trial as defined below: **Clinical Trial**: A research study in which one or more human subjects are prospectively assigned to one or more interventions (which may include placebo or other control) to evaluate the effects of those intervention on health-related biomedical or behavioral outcomes. This definition encompasses phase 1 trials of FDA-regulated drug and biological products, small feasibility studies of FDA-regulated device products, and studies of any intervention not regulated by the FDA, e.g. behavioral interventions. Of note, this requirement for GCP training applies to both biomedical and behavioral clinical trials funded by the NIH. On January 1, 2017, a new policy of the National Institutes of Health (NIH) goes into effect that requires all NIH-funded investigators and staff who are involved in the conduct, oversight, or management of clinical trials to be trained in Good Clinical Practice (GCP). The policy applies to all active grants and contracts, no matter what point they are in the life cycle of the trial. Currently, there is a GCP course available in our CITI training program (https://www.citiprogram.org/). This current course does have a focus on FDA-regulated research. Please note that online social-behavioral GCP courses are under development and we expect to have a social-behavioral focused GCP course available in the near future. If this study meets the definition, all staff must complete GCP training. For more information on this policy please refer to: • NIH definition of a Clinical Trial: http://osp.od.nih.gov/sites/default/files/NIH%20Definition%20of%20Clinical%20Trial%2010-23-2014-UPDATED_0.pdf • Policy on Good Clinical Practice Training for NIH Awardees Involved in NIH-funded Clinical Trials: https://grants.nih.gov/grants/guide/notice-files/NOT-OD-16-148.html • Frequently Asked Questions: http://osp.od.nih.gov/sites/default/files/FAQs_on_NIH_GCP_Policy.pdf

SECTION F: LOCATION OF THE RESEARCH

YES*	NO	
☐	☒	Will this research take place at sites/locations other than Boston University? Note: If the research will take place at Boston University, state the location (Center for Neurorehabilitation, Sargent College (6th floor, room 610)):

*If **YES,** please complete the boxes below

NOTE: You are responsible for obtaining permission/letters of support for research conducted off-site. This may include locations such as schools, workplaces, community organizations, etc. You must submit the letters/documentation of support with this application.

Institution Name and Address (if known)	**Describe Involvement (recruiting, consenting, data analysis, etc.) of the site. If the site or the site staff is not involved (engaged)[1] in research procedures, state NONE.**	**IRB/Ethics Approval/Site Permission Attached? If no[2], explain the plan to obtain this approval. If the site is not engaged in the research, you do not need to complete the box.**

[1]Guidance on Engagement of Institutions in Human Subjects Research: http://www.hhs.gov/ohrp/regulations-and-policy/guidance/guidance-on-engagement-of-institutions/index.html

[2]If IRB approval will not be obtained at the site, describe the IRB oversight arrangements here:

YES*	NO	
☐	☒ N/A	Is the off-site location requesting that the Boston University IRB review the protocol in place of local IRB review? *If **YES**, complete the Single IRB Review Form "Boston University is Institution A": http://www.bu.edu/researchsupport/compliance/human-subjects/.

YES*	NO	
☐	☐ N/A	Is the BU PI the lead investigator **OR** is BU the lead site for this research? **Note: This box only needs to be completed if the off-site location is engaged in the research.**

*If **YES**, provide the following information in this box:

- The plan for collection and management of data from all the sites
- The plan for reporting and evaluating:
  - Unanticipated problems
  - Serious and/or continuing non-compliance
  - Suspensions and terminations of research
  - Interim results
  - Protocol modifications
- The name of the Principal Investigator from each site
- If IRB approval will be obtained at the site, confirmation that you have a copy (or will obtain a copy) of the IRB approval letters and the IRB-approved protocols from each site
- If IRB approval will be obtained at the site, confirmation that the site IRB has a federal wide assurance (FWA)

YES*	NO	
☐	☒	Will this research be conducted outside of the United States?*

*If **YES**, complete the International Research Form at http://www.bu.edu/researchsupport/compliance/human-subjects/

SECTION G: STUDY SUMMARY

Summarize the study in lay language (do not copy from the grant/scope of work/proposal, etc.). This summary should include the research design, purpose, objectives, research question, hypothesis, and any relevant background information.

Note: Do not include a list of citations in this section. Please limit this section to no more than 300 words.

Parkinson disease (PD) is a chronic progressive health condition affecting older adults. Of particular concern is walking decline, which is a marker of emerging disability. Pathophysiologic changes in the basal ganglia result in a high expenditure of cognitive resources for once automatic movements, such as walking. Auditory cueing has been shown to compensate for impairments in the basal ganglia by harnessing the human capacity for rhythm perception through a mechanism called entrainment. Entrainment refers to the activation of motor-related centers of the brain in response to an external rhythmic stimulus. Direct sensorimotor connections between the auditory and motor system demonstrate the capacity for the auditory system to drive motor movement patterns. Music-based auditory cueing has demonstrated immediate and potent effects on walking, as reflected clinically by improvements in speed, stride length, and step frequency. Improvements

observed in the quality and thus, quantity, of walking make a music-based device a promising rehabilitation adjunct for persons with PD.

Study Objectives: The purpose of this study is to evaluate the effects of music, tailored to the participant's cadence, on adherence, quality of life, gait speed, functional mobility, and walking activity in individuals with Parkinson disease when used in the home and community environment.

Primary and Secondary Endpoints:
Primary Study Endpoints:

- Observed adherence to therapy schedule (feasibility)
- Mobility impact as assessed by PDQ-39 mobility dimension

Secondary Study Endpoints:

- Change in gait speed at baseline as compared to end of study participation (or earlier if the participant withdraws) as determined by the 10MWT
- Overall quality of life impact as assessed by PDQ-39
- Improvements in functional mobility as measured by the Five Times Sit to Stand test
- Change in amount (steps/day) and intensity (moderate intensity minutes; >100 steps/min) of walking activity as measured by the StepWatch Activity Monitor (SAM)

SECTION H: RESEARCH METHODS AND ACTIVITIES (Check all that apply)

☐	Collection of audio, video, digital, or image recordings
☐	Biological samples → **Complete Biological Samples Form:** http://www.bu.edu/researchsupport/compliance/human-subjects/ Examples: blood, hair, cheek swab, urine, tears, saliva, etc.
☐	Collection of data that may be sensitive and if disclosed could put subjects at risk for legal or social harms. Examples: Illegal behaviors, HIV status, psychiatric illness, information related to sexual behaviors, etc.
☐	Coordinating Center/Lead Site
☐	Deception
☒	Devices → **Complete Devices Form:** http://www.bu.edu/researchsupport/compliance/human-subjects/
☐	Drugs → **Complete Drugs Form:** http://www.bu.edu/researchsupport/compliance/human-subjects/
☐	Ethnographic:

	The study of people in their own environment through the use of methods such as participant observation and face-to-face interviewing
☐	Focus Groups
☐	Genetics Testing → **Complete Genetics Form:** http://www.bu.edu/researchsupport/compliance/human-subjects/
☐	MRI
☐	Placebo
☐	Pregnancy Testing
☐	Randomization
☐	Surveys, interviews, questionnaires
☐	Secondary Data Analysis
☒	Other (please describe): Clinical assessments that occur as part of standard clinical practice will be administered (e.g., cognition, walking).

SECTION I: SUBJECT POPULATION

Number of Subjects to be Enrolled: If you have sub-groups or more than one arm, please separate out these enrollment numbers. **Note: Please account for subjects who may drop out or be withdrawn from the study. Any subject who signs a consent form is considered to be enrolled regardless of whether they complete any study procedures**	• Up to 20 individuals with Parkinson Disease will be included in this protocol

Check all categories that apply to your target population:	
☒	Adults
☐	Children (< 18 years of age)
☐	Cognitively-Impaired Adults

☐	Non-English Speaking
☐	Prisoners
☐	BU Employees
☐	BU Students
☐	Wards of the state
☐	Other (please describe):

If Categories other than 'Adult' are checked, describe the additional safeguards that have been put in place to protect that subject population. For Cognitively-Impaired Subjects, provide the rationale for including this population in this research study.
N/A; Persons with PD with significant cognitive impairment will be excluded from the study. Persons with PD with any mild cognitive impairments are capable of providing consent.

Eligibility Criteria
Inclusion Criteria: Based on our experience conducting exercise trials in PD, the following criteria have been established to ensure participants can safely engage in a home/community walking program. 1. Diagnosis of idiopathic, typical Parkinson disease provided by a physician per participant report. 2. Modified Hoehn and Yahr stages 1-3 per physical exam by a licensed physical therapist. 3. Able to walk independently without physical assistance or an assistive device. 4. Willing and able to provide informed consent. 5. Provide HIPAA Authorization to allow communication with the primary healthcare provider for communication (as needed) during the study period.
Exclusion Criteria: Exclusion criteria are the specific criteria which would disqualify an individual from participating in the study not simply the opposite of the inclusion criteria. 1. < 18 years of age; 2. diagnosis of atypical Parkinsonism; 3. Modified Hoehn & Yahr stages 4-5; 4. moderately or significantly disturbing freezing episodes during daily walking; 4.1 moderate freezing episodes = freezing episodes that disrupt continuous walking 4.2 significant freezing episodes = freezing episodes that prevent continuous walking 5. cognitive impairment (i.e., MoCA score <24); 6. unable to walk at a comfortable speed of ≥0.4 m/s (i.e., 10-meter walk test (10MWT)); 7. unable to walk independently (i.e., requires physical assistance or assistive device);

8. unable to independently use the music-based device following training;
9. significant hearing impairment (unable to hear the music on the device);
10. currently participating in physical therapy;
11. self-reported cardiac problems that interfere with the ability to safely exercise (e.g., congestive heart failure, uncontrolled cardiac arrhythmias, chest pain; resting tachycardia (>100 beats/min) or uncontrolled BP (resting systolic BP >160 mmHg or diastolic BP >100 mmHg)) as measured by the physical therapist;
12. orthopedic problems in the lower extremities or spine that may limit walking distance (e.g., severe arthritis, spinal stenosis, or significant pain);
13. any other medical conditions that would preclude successful participation, as determined by a physical therapist

If participants meet one or more of the exclusion criteria, they will be informed that they are not eligible to participate in this study. Participants will not be informed which categories were not met (i.e., cognitive impairment), simply that they did not meet the collective criteria.

SECTION J: RECRUITMENT

Provide a summary of the recruitment process, including who will recruit, when and where recruitment will occur, and how subjects will be identified

Note: Submit any recruitment materials such as advertisements, brochures, flyers, letters/e-mails, scripts, etc. Please submit these materials as separate documents in either Word or PDF format.

Twenty persons with Parkinson disease will be recruited to participate in this study.

At BU, recruitment will occur primarily through the PD and Movement Disorders Center at the School of Medicine/Boston Medical Center and the Center for Neurorehabilitation (CNR) serving more than 2000 people with PD. Recruitment will occur in the following ways: 1) potential participants from the CNR patient registry are contacted by study personnel; 2) potential participants are informed of the study by their neurologist or physical therapist and provide their contact information to a member of the research team who initiates contact; 3) IRB-approved flyers are distributed to PD support groups throughout MA; 4) IRB-approved flyers are distributed to physicians and physical therapists in the community; 5) IRB-approved recruitment materials are included in the American Parkinson Disease Information and Referral Center newsletter in MA sent out regularly (via US mail or e-mail) to the Parkinson's community (5000-9500 contacts); 6) study information will be posted on Clinical Trials.gov and Fox Trial Finder, online services; 7) IRB-approved recruitment materials are posted on the CNR website; 9) IRB-approved recruitment materials are posted on the APDA's Facebook page, newsletter and other relevant social media sites (see Appendix IV: Recruitment Flyer; see Appendix V: Recruitment Posting Information).

SECTION K: CONSENT AND ASSENT

NOTE: Please refer to the consent and assent form templates on the IRB website when creating your consent/assent documents. The templates include the required elements of consent and will

help to ensure that your consent/assent form meets the requirements of the federal regulations and the BU CRC IRB. The consent templates can be located at: http://www.bu.edu/researchsupport/compliance/human-subjects/.

Note: STUDENT RESEARCHERS must: 1) indicate in the consent form/information sheet/script that he/she is a student and 2) list the Faculty Advisor as a contact in the form/sheet/script.

Provide a summary of the consent process, including who will consent, and when and where consent will occur. The summary should include, as appropriate, any waiting period between informing the prospective participant and obtaining consent, that the prospective participant or the legally authorized representative has sufficient opportunity to consider whether to participate, and steps taken to minimize coercion or undue influence. **Note: Submit copies of all consent forms and scripts. Please submit these materials as separate documents in Word format.**
Potential participants will be screened via phone to determine initial eligibility for the study (see Appendix I: Phone Screen). This screen will take approximately ten minutes and will be conducted by one of the trained personnel on the research team. The potential participant will be asked questions to ascertain whether they meet the study's initial inclusion/exclusion criteria. If the participant meets the study criteria and remains interested in participating, they will be scheduled for an in-person screening / baseline assessment visit to confirm eligibility and perform baseline clinical outcome measures. Testing will take place at the Center for Neurorehabilitation located at 635 Commonwealth Avenue (6th floor), Boston, MA 02215. At the in-person screening, a trained study personnel (listed in section E) will begin the face-to-face interview by explaining the study in detail and reviewing the informed consent document (see Appendix II: Informed Consent) with each potential study participant. The potential participant will be informed that participation in the study is entirely voluntary and will have no effect on any present or future medical or rehabilitation care. The potential participant will be encouraged to ask questions about the study to ensure complete understanding of all study elements. Potential participants will be provided with as much time as they request to review the informed consent and ask questions. All questions will be answered thoroughly by the trained study personnel. Only when the study participant has provided full written informed consent will the trained study personnel proceed to the in-person screening and subsequent study procedures.

Indicate the consent and/or assent process and document(s) to be used in this study. Check all that apply

Consent: Adults (≥18 years of age)	**N/A ☐**
One of the following MUST apply	
☒	Consent Form/Information Sheet

☐	Verbal Consent (Script) **Note: If written consent will not be obtained, complete the 'Waiver of Written Documentation Consent' box (Box 1) located further down in this section**
☐	Consent will not be obtained **Note: If consent will not be obtained, complete the 'Waiver or Alteration of Consent' box (Box 2) located further down in this section**

Assent of Children (≤ 18 years of age) **N/A ☒** **One of the following MUST apply**	
☐	Assent Form OR Parent Consent Form/Information Sheet (older children may sign the parent consent form along with their parents as long as the consent form is written at the grade level of the subjects)
☐	Verbal Assent (Script)
☐	Assent will not be obtained **If assent will not be obtained, one of the following conditions must exist:** 1. ☐ The capability of some or all of the children is so limited that they cannot reasonably be consulted 2. ☐ The children are too young to provide assent 3. ☐ The intervention or procedure involved in the research holds out the prospect of direct benefit to the health or well-being of the children and is available only in the context of the research 4. ☐ The research meets the same conditions as those for waiver or alteration of informed consent in research involving adults, as specified in the regulations at 45 CFR 46.116(d)*. **(Complete the 'Waiver or Alteration of Consent' box (Box 2) located further down in this section)** ***45 CFR 46.116(d):** **http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html**
Guidance on age requirements for obtaining assent:	

- **Parental Permission for minors under 6 years of age**
- **Verbal assent for minors 6-11 years of age**
- **Written assent from minors ages 12-17 (unless verbal consent is approved for the parents/adult subjects**

Parental Permission **N/A ☒** **One of the following MUST apply**	
☐	Parental Consent Form
☐	Parental Verbal Consent (Script) **Note: If written consent will not be obtained, complete the 'Waiver of Written Documentation of Consent' box (Box 1) located further down in this section**
☐	Parental permission will not be obtained **If parental permission will not be obtained, one of the following conditions must exist:** 1. ☐ The research protocol is designed to study conditions in children or a subject population for which parental or guardian permission is not a reasonable requirement to protect the subjects (for example, neglected or abused children). **2.** ☐ The research meets the same conditions as those for waiver or alteration of informed consent in research involving adults, as specified in the regulations at 45 CFR 46.116(d)*. **(Complete the 'Waiver or Alteration of Consent' box (Box 2) located further down in this section)** ***45 CFR 46.116(d):** **http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html**

Consent: Cognitively Impaired Adults (≥18 years of age) **N/A ☒** **Describe the process for the consent and/or assent process for enrolling cognitively impaired adult subjects including how capacity to consent is determined and if there is continual assessment of capacity**
Assent will be obtained from: ☐ All Subjects ☐ Some Subjects, specify: ☐ No Subjects

☐	Consent will be obtained from the subject's Legally Authorized Representative **(REQUIRED)**

CONSENT OF NON-ENGLISH SPEAKING SUBJECTS N/A ☒ **Describe the process for obtaining consent from non-English speaking subjects. List the individual who will serve as the interpreter and his/her qualifications.** **NOTE: A copy of the translated consent along with the Attestation Form for Translation of Consent must be submitted. The Attestation Form can be located at:** http://www.bu.edu/researchsupport/compliance/human-subjects/.

BOX 1—WAIVER OF WRITTEN DOCUMENTATION OF CONSENT

WAIVER OF WRITTEN DOCUMENTATION OF CONSENT N/A ☒ **Either Criteria 1 or 2 must be met in order to qualify**	**Yes**	**No**
☐ **Criteria 1**		
The research is **NOT** FDA Regulated	☐	☐
The only record linking the subject and the research would be the consent document	☐	☐
The principal risk would be potential harm resulting from a breach of confidentiality	☐	☐
Each subject will be asked whether the subject wants documentation linking the subject to the research and the subject's wishes will govern	☐	☐
A written statement/information sheet will be provided to subjects. If **NO**, provide rationale for not providing this information	☐	☐
☐ **Criteria 2**		
The research is **NOT** FDA Regulated	☐	☐
The research presents no more than minimal risk of harm to subjects	☐	☐
The research involves no procedures for which written consent is normally required outside of the research context	☐	☐
A written statement/information sheet will be provided to subjects. If **NO**, provide rationale for not providing this information	☐	☐

BOX 2—WAIVE OR ALTERATION OF CONSENT

WAIVER OR ALTERATION OF CONSENT N/A ☒ **All of the criteria below must be met in order to qualify**	**Yes**	**No**
The research is **NOT** FDA Regulated	☐	☐
The research involves no more than minimal risk to the subjects	☐	☐
The waiver or alteration will not adversely affect the rights and welfare of the subjects	☐	☐
The research could not practicably be carried out without the waiver or alteration	☐	☐
Whenever appropriate, the subjects will be provided with additional pertinent information after participation. If **NO**, provide rationale for not providing this information:	☐	☐
Provide the justification/rationale for why this study meets the above criteria for waiving or altering consent (REQUIRED):		

SECTION L: STUDY PROCEDURES

In the box below provide a detailed description of the study procedures to be performed (preferably in sequential order). Be sure to specify which procedures are for research purposes versus which procedures are part of standard of care, if applicable. Be sure to include the following information:

- **Methods of data collection**
- **Details regarding research activities/procedures/interventions**
- **Number, frequency, duration and types of subject contacts (visits, phone calls, internet surveys, mailings, etc.)**
- **Time required from each subject**
- **Use of equipment (eye-tracker, treadmill, sensors, etc.). Provide a brief description of equipment that will be used in the study.***

***Note: The IRB may request more information about the equipment (including equipment manuals) and/or request that you submit Appendix C: Device Form.**

Submit copies of all surveys, interview questions, assessments, screening scripts, etc. that will be used during the conduct of this study. Please submit these materials as separate documents in either Word or PDF format.

Note: If subjects will have standard of care procedures in addition to research procedures, clearly state which procedures are standard of care and which are for research purposes only.

Study Design:

The proposed study is a pilot investigation in which the study evaluations will take place at the Center of Neurorehabilitation (CNR) at Sargent College, Boston University. Twenty persons with

Parkinson disease will be enrolled to determine the effects of a community walking program with a music-based device on adherence, quality of life, walking speed and walking activity. The walking program will be carried out independently by participants in their home/community environment. Noninvasive functional assessments commonly administered in clinical practice (described below) will be used to measure the variables of interest.

Study Procedures

Preliminary Phone Screen (approximately 10 minutes):
A phone screen will be conducted to make a preliminary determination if potential participants meet the initial inclusion / exclusion criteria prior to scheduling a more in-depth, in-person screening assessment. During the phone screen (see Appendix I: Phone Screen), potential participants will be asked their age (exclude if <18 years of age), if they are currently participating in physical therapy (exclude if yes), and if a medical doctor diagnosed them with Parkinson disease (exclude if no). Potential participants will be asked about their ability to walk independently without physical assistance or an assistive device (exclude if no) and whether they experience freezing episodes during daily walking (exclude if moderately or significantly disturbing – see operational definition under exclusion criteria). Lastly, a brief medical history from the participant will be reviewed to determine the following:

- Those with a history of cardiac problems that interfere with the ability to safely exercise (e.g., congestive heart failure, uncontrolled cardiac arrhythmias, chest pain) will be excluded.
- Those with orthopedic conditions in the lower extremities or spine that may limit walking distance (e.g., severe arthritis, spinal stenosis, significant pain) will be excluded.
- Those with any other medical conditions that would preclude successful participation, as determined by a physical therapist, will be excluded.

Data on the screening form will be entered into REDCap to allow investigators to monitor the number of persons screened and pass/failure rate.

Potential participants who are deemed eligible based on the preliminary phone screen will be scheduled for an in-person screening and baseline assessment visit at Boston University.

In-Person Screening & Baseline Assessment Visit (approximately 2 hours):
The in-person screening and baseline assessment visit will take place at the Center for Neurorehabilitation at Boston University. All participants will be guided through the informed consent process upon arrival (see Appendix II: Informed Consent; see section K). After consenting, participants will be asked to sign a HIPAA Authorization to Disclose Protected Health Information for Research Purposes (see Appendix III: HIPAA Authorization). This will allow our team to communicate directly with the participant's healthcare provider during the study if needed.

In-Person Screening*:* After consenting, potential participants will be screened in-person to determine if they meet all study inclusion/exclusion criteria. The elements included in the screening process are part of routine physical therapy evaluation.

A physical exam will be conducted to assess cognitive status, Parkinson's symptoms and walking capacity.

- A diagnosis of Parkinson disease will be confirmed per participant report.
- The Montreal Cognitive Assessment (MoCA) will be administered by a licensed physical therapist (exclude MoCA score <24) (see Appendix VI: Screening Tools). The MoCA is a rapid screen of cognitive abilities to detect mild cognitive dysfunction. Participants are tested on 16 items that cover multiple cognitive domains. The score ranges from 0-30, with higher scores indicating less cognitive impairment.
- Disease severity will be assessed by a licensed physical therapist using the Modified Hoehn & Yahr Scale (only H&Y 1-3 will be included) (see Appendix VI: Screening Tools). The Modified H&Y Scale includes additional criteria to rate Parkinson disease symptoms on a scale from 1 to 5. Higher scores indicate increased disease progression.
- The 10-meter walk test (10MWT) will be administered by a licensed physical therapist (comfortable walking speed <0.4 m/s excluded based on the average of 2 trials at comfortable walking speed) (see Appendix VI: Screening Tools). The 10MWT is an assessment of gait speed over a short distance (2 meters ramp up, 6 meters walking, 2 meters ramp down). The aforementioned distances will be pre-measured for accuracy and only the middle 6 meters will be timed. Participants will be asked to walk at a comfortable pace for 2 trials and a fast pace for 2 trials. The physical therapist conducting the test will be guarding the participant as necessary to optimize safety.
- Walking capacity will be measured via the six-minute walk test (6MWT) (see Appendix VI: Screening Tools). The 6MWT assesses how far a person can walk over a 6-minute period. The test will be performed along a pre-measured (30-meter), level, obstacle-free hallway. Participants will be instructed to walk as far as possible in 6-minutes. The physical therapist conducting the test will be guarding the participant as necessary to optimize safety. Physiological measurements (e.g., heart rate, blood pressure) will be taken prior to initiation of the walking test to determine whether the participant is safe to participate in the walking program. The participant will be excluded based on the following: resting heart rate >100 beats/min; resting systolic BP >160 mmHg, resting diastolic BP >100 mmHg. The same physiological measurements will be taken upon completion of the walking test to assess hemodynamic response to exercise.
- Based on clinical expertise and judgement, the physical therapist conducting the in-person screening will determine if a participant requires additional guarding and/or assistance during walking activities (i.e., occasional hand contact to maintain balance or dynamic stability and/or an assistive device). If guarding is needed, the participant will be excluded.

Baseline Assessment: Participants who are deemed eligible through the in-person screen will continue on to complete the remainder of the baseline assessment measures, including:

- Demographic questionnaire consisting of age, gender, education level, living situation, employment, ethnicity, race, and PD-specific questions (see Appendix VII: Outcome Measures). This form will be completed interview-style by the physical therapist.
- Medication form pertaining to PD and non-PD medications (see Appendix VII: Outcome Measures). Participants will be asked during the phone screen to bring their medication list to this first evaluation visit. The physical therapist will transcribe the medications

onto the designated form. Medication lists that contain identifiable information will be given back to the participant and not be kept by the research team.

- Motor & Functional Measures:
    - Motor symptoms will be assessed using the Movement Disorder Society Unified Parkinson Disease Rating Scale (MDS-UPDRS)-III (see Appendix VII: Outcome Measures). The MDS UPDRS is the most widely used clinical rating scale for Parkinson disease. Part III is a motor examination (33 scores summed from 18 questions) conducted by the rater. Total scores can range from 0 to 141, with higher scores indicating worse disease severity.
    - Functional Mobility will be measured via the Five Times Sit to Stand (5xSTS) (see Appendix VII: Outcome Measures). The 5xSTS objectively assesses the time it takes to complete 5 sit-to-stands and is a method to observe movement strategies or compensations. The test will be performed in a standard chair with participants instructed to stand up and sit down 5 times as quickly as possible. The physical therapist conducting the test will be guarding the participant as necessary to optimize safety.
- Self-report/Interview Measures:
    - Section I and II of the Movement Disorder Society Unified Parkinson Disease Rating Scale (MDS-UPDRS) will be utilized to assess non-motor and motor signs. Section IA includes 6 items related to non-motor experiences such as cognition, mood, and motivation which are assessed by the examiner (see Appendix VII: Outcome Measures). Section IB consists of 7 items related to non-motor aspects of experiences of daily living such as sleep and fatigue which are filled out by the participant (with or without the help of a caregiver), but independent of the examiner (see Appendix VII: Outcome Measures). Section II is a self-administered questionnaire consisting of 13 items related to motor aspects of experiences of daily living (see Appendix VII: Outcome Measures).
    - Health-related quality of life will be measured by the Parkinson's Disease Questionnaire – 39 (PDQ-39)(see Appendix VII: Outcome Measures). The PDQ-39 is a self-report questionnaire that assesses quality of life over the past month across 8 different dimensions. Items are scored based on a 5-point ordinal system with lower scores reflecting better quality of life.
- Walking Activity: Walking activity will be measured over a 4-day period prior to initiating the intervention and continuously measured for an additional 4 days upon intervention initiation (total of 8 days of data). The purpose of this sequence is to be able detect changes in walking activity that may occur with initiation of a structured walking program. For example, once the walking program is initiated, do participants appear to increase their walking activity compared to baseline (before initiating the walking program)? Is the increase in walking activity isolated to during the individual sessions, or is there an overall increase noted throughout the day? Walking activity will be measured using the StepWatch 4 Activity Monitor (SAM; Orthocare Innovations, Mountlake Terrace, Washington). The SAM is a self-contained, maintenance-free device that combines acceleration, position and timing information to count complete gait cycles (strides) of the user; it is the size of a pager, weighs 38g, and will be attached with self-adhesive straps above the lateral malleolus (where the shin meets the foot) of the participants' less impaired lower extremity. Participants will be instructed to wear the

SAM for 8 consecutive days during all waking hours, expect when bathing, showering, or swimming. The physical therapist will fill out the SAM researcher form to appropriately document the SAM calibration process for each participant (see Appendix VII: Outcome Measures). Participants will be given instructions on how to don/doff the device and will be provided with a form to record times the SAM is removed over the 8-day period (see Appendix VII: Outcome Measures). The SAM requires no maintenance by the user besides remembering to keep it on. The physical therapist will provide strategies to help the participant remember to put the SAM back on if they do take it off at any time (e.g., if the SAM is taken off at night, place it on a nightstand next to the bed so it is seen in the morning). Using the manufacturer's software, the SAM will be calibrated by a physical therapist to each participant's gait pattern based on height, typical walking speed, and leg motion. The validity and reliability of the SAM for capturing stride counts has been demonstrated in persons with various neurological disorders including PD (Shepard 1999, Coleman 1999, Macko 2002, Salarian 2004, Gaines 2005, Manns 2009, Speelman 2011). Collected data will be downloaded to a computerized tablet, with which manufacturer's software will convert stride counts to step counts and calculate daily step count values. No identifiable information is collected by the SAM. Participants will return the SAM to study personnel via a pre-labeled, addressed envelope to mail following the 8-day monitoring period. Participants will be contacted via phone within 24-48 hours following the evaluation session to ensure that they are comfortable with the device and to address any questions or concerns.

Training Procedures / Instruction to Participants:

- Music-Based Device Training: During the 2 hour evaluation visit, a physical therapist will train the participant on how to use the music-based device and independently conduct the remote walking program. To ensure that the participant is able to hear the music, the physical therapist will have the participant put on the headphones while music is played. The participant will then practice donning/doffing, setting up, and using the device (i.e., walk for 5 minutes) to demonstrate comprehension and independent use. A team member will provide the participant with the necessary equipment (i.e., smartphone, shoe sensors, headphones, study diary). The physical therapist will discuss the space and location in which the participant plans to conduct the walking program, and review space adequacy and safety considerations. A safe environment will be considered to be the following: *indoor spaces* – level surfaces, obstacle-free, no slippery surfaces, no unsecure area rugs; *outdoor* spaces – avoid auto or bike traffic, obstructive tree roots, divots in the asphalt and concrete. These environments could include, but are not limited to: home, apartment building hallway, neighborhood sidewalks, local track or park, office environments, and community/recreation centers. Ideally the space is at least 50 feet in length that meet the above indoor and outdoor space criteria. This will decrease the amount of pivot turns thereby optimizing the amount of continuous walking.
  The purpose of the music-based device is to help participants entrain to a musical beat to improve the quality of their walking. The device monitors a participant's cadence using the sensor placed on the shoe. The musical tempo is matched to the baseline walking cadence of the participant. As the quality of a participant's walking improves and the participant accurately "entrains" to the tempo of the music, the tempo will adapt and increase cadence by 5%. For example, if the participant starts off walking 100

steps/minute, once considered entrained, the tempo will increase to 105 steps/minute. This increase is very small and will most likely not be noticed by the participant. If the participant is unable to increase their cadence to match this tempo, the tempo is reduced back to baseline. The algorithm used to set the tempo is dynamic and adjusts to the cadence of the participant. If a participant feels that they cannot keep up with the faster cadence, they can continue walking at their comfortable pace. Participants will also be instructed to stop the intervention if they feel uncomfortable or anxious at any time. Following this training, it is expected that participants will be able to independently set-up (including donning/doffing the device), perform and conclude a walking session independently. Participants will have access to Instructions for Use (IFU) that will detail all procedures required for proper operation of the system. However, participants will be encouraged to contact the research team if they have any additional questions, issues or concerns. Participants will be excluded from the study if unable to demonstrate how to use the device independently as determined by the physical therapist. Please note, participants will be provided with a pre-established username and password. No personally identifiable information will be recorded or stored in the device application.

<u>Remote Walking Program Description (10 hours total over four weeks + concurrent use of SAM device over 4 walking days)</u>

Overview: Following enrollment, participants will wear the SAM for a 4-day period prior to initiating the intervention (to collect baseline walking activity). After approximately 4 days, participants will initiate the walking program while continuing to wear the SAM for the first 4 days of the walking program. As the sensor for the music-based device is hooked onto the shoe and the SAM is worn on the lower leg (just above the ankle), both can be worn simultaneously on the same side of the body without interfering with a participant's walking and/or increasing the risk for trips/falls. Participants will be instructed to complete five home-based walking sessions per week (approximately 30-40 minutes in duration) for four weeks. Participants will be able to carry out their five (5) sessions a week on any days of the week according to their needs. Participant engagement in the walking program will be monitored remotely by the study team at the end of each week via a phone call. This phone call will last approximately 5-10 minutes (depending on whether the participant has questions/concerns and/or any medical/technical issues). During the evaluation visit, the research team will ask you at which time each week you would like to have this check-in call. If participants are unable to carry out the walking program 5-days per week, a study staff member will discuss the barriers to implementation (by phone) and suggest ways to optimize adherence to the program (e.g., setting a schedule). A study staff member will also inquire about adverse events during the weekly phone call and ensure that the participant is comfortable with the walking program.

Description of Walking Sessions: Using the music-based device, participants will conduct the walking sessions at their self-selected pace in a home/community environment that limits the amount of stops and/or pivot turns in order to optimize continuous walking. For the purposes of this study, home/community environment is considered any environment outside a professional healthcare facility. This includes but is not limited to the home, apartment building, independent living retirement homes, outdoor environments (tracks, parks, sidewalks), office environments and community/recreation centers. Participants will be asked to record in a study diary their schedule (dates and times) of walking, location, record of any falls they experience and any

comments/issues they experience while using the device (see Appendix VII: Outcome Measures). The entire session will take approximately 30-40 minutes, including 5-10 minutes to allow for a warm-up and cool-down period. The goal is for 30 minutes of continuous walking with music to be completed, however, rest periods are allowed as needed. The participant will be reminded that it is ok if they are not able to achieve 30 minutes of walking. Each individual walking session should be completed in one bout (i.e., should not be split up throughout the day). Participants will be instructed to terminate any walking session in the event of technical or medical issues to allow for adequate resolution. Participants will be informed of the potential risk of falls that can occur as part of the walking program in the community. Determination of a safe environment (as described in the *Music-Based Device Training* section above) will be discussed with the participant to mitigate external risk factors that could lead to a fall. Participants will be instructed to reach out to their healthcare provider if experiencing dizziness, chest pain, or other serious symptoms and will be asked to notify the study team following the episode. If participants experience a fall while using the device, they are advised to seek medical attention and record the incident in their study diary. In addition, participants will be asked to contact the research team following the event to determine whether it is safe for them to continue.

Participants will be contacted by a member of the study team weekly to see if they have any questions or concerns with the walking program. However, participants will be encouraged to reach out to the research team at any point if they do not feel comfortable using the device.

Post-Intervention Assessment Visit (approximately 1 hour):
The post-intervention assessment visit will be scheduled within approximately 7 days of completion of the walking program and take place at the Center for Neurorehabilitation at Boston University. This visit will entail the same battery of assessments performed at baseline including: 10MWT, 6MWT, MDS-UPDRS I/II/III, 5xSTS, and PDQ-39. In addition, post-intervention self-report questionnaires will be completed regarding the usability of the music-based device (Usability Scale), perceptions of change in walking abilities (Global Rating of Change Scale), and overall experience with the device (Post-training Questions)(Appendix VII: Outcome Measures). The music-based device and study diary will be returned to study personnel at this visit. The study team then will send back the music-based device to MedRhythms to be cleared of the data. Participants will be given the SAM again to wear for 4-days following the post-intervention visit. Following the 4-day monitoring period, participants will return the SAM to study personnel via mail using a pre-labeled, stamped addressed envelope. Participants who withdraw or are withdrawn prior to completing their last walking session may be asked to complete closing visit activities, if feasible.

Circumstances under which participants will be withdrawn without their consent:

- If a change in medical/functional status occurs that makes a participant ineligible for the study, the participant will be withdrawn.
- If a participant is unable to follow verbal instructions to ensure their safety during the study, he/she may be withdrawn from the study.

SECTION M: RISKS

Describe any expected risks to subjects. Consider physical, psychological, social, political, legal, economic, or other risks that are related to the study.
There are no identifiable social, political, legal, or economic risks associated with the study. There are some potential physical and psychological risks to participating in this study. The potential risks to participants include the following: (a) musculoskeletal injuries and/or cardiopulmonary complications, (b) injury or falls during assessments of physical function, (c) falls during the walking program in the community, (d) fatigue, (e) loss of confidentiality.

Describe the plan to minimize risks. Include in the description the availability of any medical or psychological resources.
The PI and co-investigators have extensive experience with clinical research involving individuals with Parkinson disease. Many of the investigators are licensed physical therapists and most study personnel and students have training in CPR and first aid. The risks of participating in this trial are minimal because the walking program is conducted at low to moderate intensity, which has been found to be safe in other studies of people with PD. In addition, a physical therapist will be instructing the participant on the use of the music-based device and be available via phone to answer any questions concerning set-up, use, and/or technological difficulties throughout the study. Furthermore, as the music-based device is dynamic in nature, the musical tempo will be adapted to the participant's specific needs and walking cadence. The following procedures will be implemented to minimize risk: • Musculoskeletal injuries and cardiopulmonary complications are minimized as persons with pre-existing orthopedic and cardiac conditions that may interfere with and/or compromise participant safety are excluded from the study. In addition, the musical tempo produced by the device is gradually progressed and accommodates to the participant's walking cadence, tailoring individually to each participant. This allows each person to acclimate gradually to the increased cadence thereby reducing the risk of musculoskeletal and cardiopulmonary complications. During the remote walking program, vitals will not be monitored, but vital signs will be examined during walking as part of the screening to ensure appropriate hemodynamic responses to walking. Participants will be instructed to reach out to their healthcare provider if they are experiencing any dizziness, chest pain, or other serious symptoms. • Falling during in-person assessments is minimized as licensed physical therapists are conducting all assessments and are well-trained in safe guarding procedures and implementation of all assessment procedures. During community walking, falls are minimized as the physical therapist provides instruction on safe walking in the community (e.g., safe location, level surfaces, proper shoes). Prior studies that have been done in persons with mild to moderate PD (Modified Hoehn & Yahr 1-3) that participated in community walking programs found that increased physical activity levels did not result in an increase in falls (Penko et al., 2019; Shen et al., 2015). If participants experience a fall while using the device, they are advised to seek medical attention and record the incident in their study diary. In addition, participants will be

asked to contact the research team following the event to determine whether it is safe for them to continue.

- Participants with freezing of gait that moderately or significantly impacts daily walking are excluded to minimize the risk of falling.
- Fatigue will be minimized due to the gradual progression of the musical tempo delivered by the device based on each individual participant. This increase is minimal (5%) and will most likely not be detected by the participant. In addition, participants walk to a self-selected pace and are allowed to rest during the approximately 30-40 minute walking session. Participants will be educated on the potential for the device to increase in speed beyond their usual pace. The participant will be instructed to reduce their speed or stop the walking session if they feel uncomfortable or anxious.
- Loss of confidentiality is unlikely as data with ID numbers only will be entered, password protected, into the REDCap database. All forms completed in-person on paper will be de-identified (ID number only) and kept in a locked filing cabinet in a locked office. A master list that links participant information with ID number will be kept in a password protected file in the REDCap database. Access to the REDCap database will be restricted to the PI and selected study staff only.

SECTION N: BENEFITS

Describe the potential benefits to subjects related to the study. State if there are no direct benefits. **NOTE: Compensation and/or course credit are not considered benefits.**
This study will provide multiple, structured walking sessions using a music-based device. This walking program will provide participants with an opportunity to practice walking while entraining to the beat of the music. Participants may or may not experience improvements in the quality and quantity of walking as a result of the program.

Describe the potential benefits to society and/or others related to the study
This project will facilitate the development and clinical translation of targeted interventions that can improve the quality and quantity of walking in persons with PD through specific action on the impairments most likely to be limiting mobility. In addition, the study will contribute to the application of new technology that extends the abilities of clinicians.

SECTION O: COSTS/PAYMENTS

YES*	**NO**	

☒	☐	Are there any costs to subjects as a result of participating in this study? *If YES, provide a description of the costs: Participants will be responsible for transportation costs; however, parking costs will be covered by the study.
☒	☐	Will subjects be compensated for participating in the study? Compensation may include cash, checks, gift cards, lotteries, course credit, etc. *If YES, provide a description of the compensation: $50 amazon gift cards will be given to participants at the in-person screening/baseline assessment visit and at the post-intervention visit ($100 total) **NOTE:** Payments should be prorated to compensate subjects for time and procedures completed
☐	☒	Will identifiable information be sent to Central University departments (Accounts Payable, Post Award Financial Operations, etc.) for payment purposes? *If YES, this information must be disclosed in the consent form.

SECTION P: CONFIDENTIALITY OF DATA

Describe how data will be stored (e.g. paper, electronic database, etc.)
Data Management: Step Activity Monitor (SAM) data is coded (de-identified) and will be downloaded to a BU personal protected computer for data reduction and analysis using the manufacturer's software. Other data from outcome measures will be collected on paper versions (coded, de-identified) and entered into **REDCap** ® - a cross-platform, secure and accessible data collection application that allows for multiple concurrent users to enter data directly into pre-specified fields. The REDCap database will be housed at Boston University. Our team has experience using REDCap in other trials. Each participant will be provided with an ID from the research team at Boston University that will be used to begin each walking session with the MedRhythms' music-based device. The device collects walking session data and uploads it to the secured cloud-based drive, with the data attached to this ID. A master list of participants connecting them to an ID will be stored on the REDCap database housed at Boston University and only select study personnel will have access. The MedRhythms company will not have access to this master list linking ID to participant. The data collected by the device are not study outcome data, but are device performance data. From this performance data, MedRhythms can extract secondary outcomes data for the research team at Boston University (e.g., entrainment data).

Per Boston University (BU) Record Retention Policy, records concerning human subjects must be retained for 7 years. Please refer to the policy at: http://www.bu.edu/policies/finance/record-retention/. As the investigator, you must also adhere to all applicable requirements as defined by regulatory agencies (e.g. FDA, etc.) or Sponsors.

YES*	NO	
☒	☐	Will you collect identifiable information? (e.g. names, social security numbers, addresses, telephone numbers, etc.) *If YES, complete the box below
Describe the coding system* that will be used to protect the information including who will have access to the code ***Coding system: Coding systems are used to: 1) protect the confidentiality of the research data and 2) allow the investigator to link subjects to their responses. Each subject is assigned a unique study ID at the beginning of the study. A separate document (key) should be maintained that links the names of the subjects to the study ID numbers.**		
To ensure confidentiality of all data collected, each subject will be assigned a unique alphanumeric code determined by the PI, Terry Ellis. Only the PI and designated research personnel associated with the project will have access to the master-code with the corresponding identifiers. The master-code will be housed on a password protected file within the REDCap database, requiring a two-factor authentication to login.		
YES*	**NO**	
☐	☒	Will you share data with others outside of the study? *If YES, complete the box below
Describe how data will be transferred and how confidentiality will be maintained (e.g. identifying information will not be sent outside, etc.)		

Describe how you will maintain the confidentiality of the data (e.g. locked cabinet, password-protected files, encryption, etc.)

Note: Confidentiality refers to the researcher's agreement with the participant about how the subject's identifiable private information will be handled, managed, and disseminated

For further assistance and/or access to resources regarding information security, please refer to the BU Information Security website: http://www.bu.edu/tech/security/

Only data that is de-identified will be entered on paper forms. Paper forms will be stored behind 2 locks. The de-identified data will be entered and stored in the REDCap database housed at Boston University. Two-factor authentication is required to login. A master code will contain a link to identifiable information. The master code will be housed in a file within the REDCap database with access restricted to essential study staff who will login using a 2-factor authentication process. The PI will approve any access to the master code. Data collected through the MedRhythms music-based device will be uploaded to a secure cloud-based drive owned by MedRhythms. A de-identified ID will be given to each participant to begin walking sessions with the device. A master list linking the unique ID to the participant will be stored in the REDCap database housed at Boston University with only essential study staff having access. The MedRhythms company will not have access to this master list.

SECTION Q: CERTIFICATE OF CONFIDENTIALITY

Complete this box if the study is UNFUNDED or FUNDED by any entity (e.g department, foundation, NSF, or other federal agencies) other than the NIH

On October 1, 2017 the NIH updated its policy for issuing Certificates of Confidentiality. The updated policy is located at: https://grants.nih.gov/grants/guide/notice-files/NOT-OD-17-109.html

Additional information regarding the policy can be found on the NIH FAQ's website at: https://humansubjects.nih.gov/coc/faqs. Note: Sections C and D describe the process for obtaining a Certificate for studies not funded by NIH

YES	NO	
☐	☒	Will you obtain a Certificate of Confidentiality? The NIH has updated the required consent form language. The language is at the following website: https://humansubjects.nih.gov/coc/suggested-consent-language. **Note:** A consent form with the applicable language must be included with this submission. Certificates of Confidentiality are issued by the National Institutes of Health (NIH). A Certificate of Confidentiality (Certificate) protects the privacy of research participants enrolled in biomedical, behavioral, clinical or other research. With limited exceptions, researchers may not disclose names or any information, documents or biospecimens containing identifiable, sensitive information. The Certificate prohibits disclosure in response to legal demands, such as a subpoena.

Complete this box if the study is FUNDED by the NIH

On October 1, 2017 the NIH updated its policy for issuing Certificates of Confidentiality. The updated policy is located at: https://grants.nih.gov/grants/guide/notice-files/NOT-OD-17-109.html

Note: Under the new policy, the investigator will not need to apply for a Certificate. All eligible research studies that are funded by NIH are automatically issued a certificate under the NIH Policy on Certificates of Confidentiality

Additional information regarding the policy can be found on the NIH FAQ's website at: https://humansubjects.nih.gov/coc/faqs

YES	NO	
☐	☐ N/A	Does this study qualify for a Certificate of Confidentiality under the NIH Policy or Issuing Certificates of Confidentiality? To determine if this study (which is conducted or supported by NIH) qualifies for a Certificate of Confidentiality, please answer the following question: • Is the activity biomedical, behavioral, clinical, or other research? ☐ YES ☐ NO If the answer to the above question is "NO", then this study will not be issued a Certificate of Confidentiality by the NIH. If the answer is "YES", please consider the questions below: ▪ Does the research involve Human Subjects as defined by 45 CFR 46? ▪ Are you collecting or using biospecimens that are identifiable to an individual as part of the research? ▪ If collecting or using biospecimens as part of the research, is there a small risk that some combination of the biospecimen, a request for the biospecimen, and other available data sources could be used to deduce the identity of an individual? ▪ Does the research involve the generation of individual level, human genomic data? If the answer to any one of the four questions above is "YES", then this NIH policy will apply and will be considered to have a Certificate of Confidentiality by the NIH.

		If this study is covered under this policy, the consent form must include language about the protections and exceptions allowed with the Certificate. The NIH has updated the required consent form language. The language is at the following website: https://humansubjects.nih.gov/coc/suggested-consent-language. **Note:** A consent form with the applicable language must be included with this submission. Certificates of Confidentiality are issued by the National Institutes of Health (NIH). A Certificate of Confidentiality (Certificate) protects the privacy of research participants enrolled in biomedical, behavioral, clinical or other research. With limited exceptions, researchers may not disclose names or any information, documents or biospecimens containing identifiable, sensitive information. The Certificate prohibits disclosure in response to legal demands, such as a subpoena

SECTION R: PRIVACY

Describe how you will protect the privacy of subjects. Include the following information: location of data storage, who will have access to study information, and location of study visits **Note: Privacy can be defined in terms of having control over the extent, timing, and circumstances of sharing oneself (physically, behaviorally, or intellectually) with others**
Privacy of subjects will be protected by conducting all in-person interactions and assessments in a semi-private or private space within the Center for Neurorehabilitation and sixth floor hallway of Sargent College, Boston University. While outside these spaces, no personally identifiable information will be discussed. All study personnel have completed training and undergo regular re-training to ensure their understanding of the steps taken to maintain confidentiality of data and privacy of subjects. Only the study PI's and necessary research personnel will have access to identifiable research data. The master-code will be housed at site specific secure data storage sites (Sharepoint at Boston University) with 2 factor authentication required for access. Access will be limited to specific personnel, approved by the PI's at each site. Only data that is de-identified will be entered on paper forms and into the REDCap database. Paper forms with linked name and ID will be stored behind 2 locks. The PI and all study personnel (listed in section E) will have access to all coded data on paper forms and data housed in the REDCap database.

No identifiable or coded data will be shared with non-study personnel including students, professional colleagues, outside institutions or study sponsors. No identifiable data will be used in scholarly presentations, in future research projects and in publications.

We will store study information for future research related to Parkinson disease. We will store only a limited data set which will include the data collected and dates collected. No identifiable information will be used for future research (see Appendix III: HIPAA Authorization).

SECTION S: MONITORING STUDY DATA

How will data be monitored?: **Note: The Data and Safety Monitoring Plan should be tailored to the nature, size, and complexity of the research protocol, the expected risks of the research, and the type of subject population being studied**	
☒	Principal Investigator
☐	Monitor/Monitoring Group
☐	Data and Safety Monitoring Board (DSMB) Note: The DSMB Charter must be submitted with this Application For more information regarding a DSMB, please refer to the following website: http://www.nidcr.nih.gov/Research/ToolsforResearchers/Toolkit/DSMBGuidelines.htm

Describe the plan for monitoring study data. This should include a description of how data will be collected and analyzed as the project progresses to assure the appropriateness of the research, its design, and subject protections.

Data will be collected and de-identified (using participant ID number only). This de-identified data will be processed and analyzed by the PI and research team (Section E).

Research staff will inquire about adverse events during a weekly phone call. Occurrences of adverse events will be described and recorded and any medical attention sought will be documented. If a deviation in data collection/usage, adverse or unanticipated event involving risks to participants or others, or a breach in confidentiality is suspected or found, the study will be halted until a resolution is determined in accordance with the IRB. The following definitions will be applied to the present study to monitor adverse events:

Adverse Event: Any untoward or unfavorable physical or psychological occurrence in a participant, including any abnormal sign (e.g., abnormal physical exam or laboratory finding), symptom, or disease temporally associated with participation in the research, whether or not considered related to participation in the research. The PI will be notified when any adverse event is identified and will report this to the IRB.

Serious Adverse Event: Any adverse event that:

i. results in death
ii. is life-threatening (places the participant at immediate risk of death)
iii. results in hospitalization
iv. results in a persistent or significant disability/incapacity
v. results in a congenital anomaly/birth defect
vi. may jeopardize the participant's health and may require medical or surgical intervention to prevent one of the other outcomes listed in this definition.

Unexpected Adverse Event: Any adverse event occurring in one or more participants, the nature, severity, or frequency of which is not consistent with either:

i. the known or foreseeable risk of adverse events associated with the procedures involved in the research that are described in (a) the protocol-related documents, such as the IRB-approved protocol, any applicable investigator brochure, and the current IRB-approved informed consent document, and (b) other relevant sources of information, such as product labeling and package inserts or the expected natural progression of any underlying disease, disorder, or condition of the subject(s) experiencing the adverse event and the subject's predisposing risk factor profile for the adverse event.

SECTION T: HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT (HIPAA)

YES*	NO	

X		Is this research being conducted in a covered entity?
		
		The following components have been determined to be covered entities on the Boston University Charles River Campus:
		
		• Sargent College Rehabilitation Services
		  o Physical Therapy Center at the Ryan Center for Sports Medicine and Rehabilitation
		  o Sargent Choice Nutrition Center
		• The Danielsen Institute
		• Boston University Health Plan
		
		*If YES, contact the IRB office for assistance.

SECTION U: FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA):

FERPA is the federal law that protects the privacy of student education records. Research funded by the Department of Education or research conducted in educational

institutions that receive funds from the Department of Education (for research or other purposes) must comply with FERPA.

YES*	NO	
☐	☒	Does this study involve collection of information from student school/university records? *If YES, refer to the following websites for guidance on FERPA: • http://www.bu.edu/researchsupport/compliance/human-subjects/ • http://www.bu.edu/reg/general-information/ferpa/ • http://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html **If FERPA applies, you must complete the box below:**
In accordance with FERPA, written consent must be obtained to access student records. The consent must: • Specify the records that may be disclosed • State the purpose of the disclosure • Identify the person or class of parties to whom the disclosure can be made		
☐ YES **(REQUIRED)**	I confirm that I will comply with the FERPA policy that is in place at the educational institution where I am conducting my research. This includes, if applicable, the requirements for written agreement when requesting a waiver of consent for personally identifiable information. **If an agreement is required, this agreement must be submitted to the IRB.**	

SECTION V: PROTECTION OF PUPIL RIGHTS AMENDMENT (PPRA):

PPRA is a federal law that affords certain rights to parents of minor students with regard to surveys that ask questions of a personal nature. Research funded by the Department of Education or research conducted in educational institutions that receive funds (for research or other purposes) from the Department of Education must comply with the PPRA.

YES*	NO	
☐	☒	Does PPRA apply to this study? *If YES, refer to the following websites for guidance: • http://www2.ed.gov/policy/gen/guid/fpco/ppra/index.html • http://www.bu.edu/researchsupport/compliance/human-subjects/

		If PPRA applies, you must complete the box below:
In accordance with PPRA, written parental consent must be obtained prior to subjects participation in the study.		
☐ YES **(REQUIRED)**		I confirm that I will comply with the PPRA policy that is in place at the educational institution where I am conducting my research.

SECTION W: CLINICAL TRIALS REGISTRATION:

The Food Drug and Administration Amendments Act (known as FDAAA 801) requires that "applicable clinical trials" be registered and have results reported on clinicaltrials.gov. The Responsible Party for a clinical trial must register the trial and submit results information. In addition, the International Committee of Medical Journal Editors (ICJME) and the National Institutes of Health (NIH) also have requirements for registration. Please see box below to determine if your study requires registration in accordance with either FDAAA 801, ICJME, or NIH.

YES	NO	FDAAA 801 Requirements
☐	☒	Does your study meet the definition of an applicable clinical trial and require registration **AND** results submission in accordance with FDAAA 801? Applicable Clinical Trials include the following: • Trials of drugs and biologics: Controlled clinical investigations, other than phase 1 clinical investigations, of drugs or biological products subject to Food and Drug Administration (FDA) regulation • Trials of devices (see note): 1) Controlled trials with health outcomes of devices subject to FDA regulation, other than small feasibility studies, and 2) pediatric postmarket surveillance required by FDA The Responsible Party is defined as: • The sponsor of the clinical trial or • The principal investigator (PI) of such clinical trial if so designated by a sponsor, grantee, contractor, or awardee, so long as the PI is responsible for conducting the trial, has access to and control over the data from the clinical trial, has the right to publish the results of the trial, and has the ability to meet all of FDAAA's requirements for the submission of clinical trial information Refer to the following website for guidance:

		• FDAA 801 Requirements: https://clinicaltrials.gov/ct2/manage-recs/fdaaa **Note: If your study meets the requirement for registration and reporting, you must submit the National Clinical Trial (NCT) Identifier # to the IRB prior to IRB approval.** NCT #:_____
YES	**NO**	**ICMJE Requirements**
☒	☐	Does your study meet the definition of a clinical trial and require registration in accordance with ICMJE? ICMJE definition of clinical trial: Any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects on health outcomes. Health-related interventions include any intervention used to modify a biomedical or health-related outcome (for example, drugs, surgical procedures, devices, behavioral treatments, dietary interventions, and process-of-care changes). Health outcomes include any biomedical or health-related measures obtained in patients or participants, including pharmacokinetic measures and adverse events. Purely observational studies (those in which the assignment of the medical intervention is not at the discretion of the investigator) will not require registration. Refer to the following websites for guidance: • ICMJE Clinical Trials Registration: http://www.icmje.org/about-icmje/faqs/clinical-trials-registration/ **Note: If your study meets the requirement for registration, you must submit the National Clinical Trial (NCT) Identifier # to the IRB prior to IRB approval.** NCT #:__pending_____ ****this is a small feasibility study of a new gait training approach. Moreover, outcomes assessed are the transient, single-session effects of this training approach.*
YES	**NO**	**NIH Requirements**

☐	☒	Does your study meet the definition of an applicable clinical trial and require registration **AND** results submission in accordance with NIH? As of January 18, 2017, NIH is requiring that clinical trials be registered at ClinicalTrials.gov. Confirm whether this study meets the registration requirements for clinical trial registration in accordance with the definition of a clinical trial as defined by NIH. See definition below. **Clinical Trial**: A research study in which one or more human subjects are prospectively assigned to one or more interventions (which may include placebo or other control) to evaluate the effects of those intervention on health-related biomedical or behavioral outcomes". This definition encompasses phase 1 trials of FDA-regulated drug and biological products, small feasibility studies of FDA-regulated device products, and studies of any intervention not regulated by the FDA, e.g. behavioral interventions. Of note, this requirement for registering and results reporting includes clinical trials beyond those already required by the FDA. The requirements are expanded to include to Phase I drug studies and NIH-funded clinical trials of social-behavioral interventions. For more information on this policy please refer to: • NIH Policy on the Dissemination of NIH-Funded Clinical Trial Information: https://s3.amazonaws.com/public-inspection.federalregister.gov/2016-22379.pdf • Checklist: https://prsinfo.clinicaltrials.gov/ACT_Checklist.pdf • NIH Definition of Clinical Trial: http://osp.od.nih.gov/sites/default/files/NIH%20Definition%20of%20Clinical%20Trial%2010-23-2014-UPDATED_0.pdf **Note: If your study meets the requirement for registration and reporting, you must submit the National Clinical Trial (NCT) Identifier # to the IRB prior to IRB approval.** NCT #:_____

Certification / Signatures

- By submitting this protocol I attest to the fact that all research activities to be implemented related to human subjects have been completely and accurately described herein.

- I agree to conduct the describe research in an ethical manner.

- I agree to comply with all institutional policies and procedures related to human subjects research and will not begin any human subjects research activities until I have obtained full approval from the IRB.

- I agree to conduct the research as described in this protocol and not to make any changes (except to eliminate immediate harm to subjects) without first obtaining approval for the changes from the IRB.

- I agree to immediately report any unanticipated problems involving risks to subjects or others, any subject complaints, and any incidents of non-compliance with the requirements of this protocol as soon as I become aware of them.

- I agree to comply with any relevant HIPAA and FERPA regulations if applicable.

- I verify that all those responsible for the design, conduct, or reporting of the proposed program, including at minimum, all Senior/key personnel in the grant application, have completed the financial interest disclosure forms and completed training as dictated at http://www.bu.edu/orc/coi/forms/, and returned the forms to the Office for Research Compliance COI Unit. **NOTE: If anyone checked "yes" to any of the questions on either the FIND1 or NONFIND1 form, the IRB Director will contact the COI office to obtain the disclosure information.**

PI printed name: Terry Ellis, PhD, PT

PI Signature:  Date: 04-05-2021

Submission
This form can be completed, signed, scanned and submitted to the IRB at irb@bu.edu. Faxed documents and handwritten materials are not accepted. Be sure to include all relevant attachments.

FACULTY Research:

The Department Chair signature is required: This application must be signed by the Department Chair for all faculty researchers. If the PI is the Department Chair then signature by the appropriate Dean is required. Department Chair signature is not required for student research. **By signing this form you are indicating that you have reviewed the application, the faculty/staff person listed as PI on this protocol is a member of your department, that he/she is qualified to serve as the PI for this study, he/she has the adequate resources, and the research utilizes acceptable practice for the discipline.**

Department Chair (print name): Gael Orsmond

Signature: 

Date: 4-11-2021

STUDENT Research

Student research: Student research must be signed by the faculty advisor AND the designated School IRB pre-reviewer (if applicable) PRIOR TO submission to the IRB. Students should check with their School to determine if School IRB pre-review is required. Students must submit a copy of their dissertation with the IRB Application

By signing this form you are indicating that you have reviewed the application, that you agree to serve as the Co-PI for this study with the student and that you will be responsible for the ethical conduct of this student's human subjects research.

Faculty Advisor (print name):

Signature:

Date:

IRB School Reviewer, if applicable (print name):

Signature:

Date: