Smartphone-PD: Preliminary results of an mHealth application to track and quantify characteristics of Parkinson disease in real-time

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Objective: Using a Parkinson disease (PD)-specific application (app) to: (1) assess the feasibility of remote, online recruitment and completion of app installations, (2) objectively measure and quantify five factors of PD (voice, balance, dexterity, gait, and reaction time), (3) measure daily variability of these and other factors including mobility and socialization, and (4) correlate Android app sensor data and clinical assessments from the Unified Parkinson Disease Rating Scale (UPDRS) in a subset of participants.

Background: Most clinical data on PD is low frequency and recorded during periodic assessments. An Android app in a recent pilot study has been shown to measure and quantify key characteristics of PD, including daily variability, with a strong correlation to the UPDRS.

Methods We are conducting a 6 month study of approximately 2,000 unpaid individuals (1,500 with PD and 500 controls) globally to use an Android application that prompts tests of voice, postural sway, dexterity, gait, and reaction time twice each day for the study duration. The app also uses embedded phone sensors to passively track characteristics of PD such as movement. Online surveys are used to obtain information on demographics, familiarity with technology, PD status and history, and current medications. Participants are identified and recruited using an email database of the Parkinson's Voice Initiative, online media, and patient registries such as the Michael J. Fox Foundation's Fox Trial Finder.

Results To date, 457 individuals have enrolled in the Smartphone-PD study: 232 PD (51%) and 224 control participants. Individuals considered "active" (i.e., those who have submitted at least one instance of testing and have not exited the study) currently number 375 (82%): 190 PD and 184 controls. Participants are 18-79 years of age with predominant male representation. Over 46,000 hours of unstructured streaming sensor data and 8,000 structured tests of voice, gait, posture, and dexterity have been collected over 6 months.

Conclusions Smartphone-PD has produced a large repository of PD-specific, raw smartphone sensor data. This ongoing, large-scale global study continues to show that study recruitment can be conducted entirely remotely, compliance with the study protocol can be monitored in real time, and use of the application can allow for exploration of daily fluctuations in patient symptoms.

Global Smartphone App users

*Blue stars – Active participants   ***White stars – Withdrawn participants**

Table 1. Baseline Characteristics		
Characteristic	PD (N = 232) N (%) or mean (SD)	Control (N = 224) N (%) or mean (SD)
Demographic Information		
Gender (% male)	107 (46)	80 (36)
Age (years)	57.2 (14.2)	44.6 (14.1)
Race (% white)	163 (70)	137 (61)
High school graduate	174 (75)	154 (69)
Previous participation in PD study? (% yes)	77 (33)	18 (8)
Technology Information		
Duration of smartphone ownership (> 1 year)	158 (68)	145 (65)
Downloaded other apps previously? (% yes)	166 (72)	153 (68)
Search for health information using phone? (% yes)	135 (58)	120 (54)
Internet or email use at home? (% yes)	177 (76)	157 (70)
Clinical Information		
Care from PD specialist (% yes)	112 (48)	N/A
Years since symptoms began	8 (6.2)	N/A
Years since diagnosis	8 (6.2)	N/A
Years on PD medication(s)	6 (4.4)	N/A