Project Title

Smartphone-based Mobility Assessment in Parkinson's Disease: A validity study

Project Lead and Members

Project lead: Chloe Chung

Project members: Chua Yi Qian, Yee Zhirong, Dr Shermyn Neo Xiu Min

Organisation(s) Involved

Tan Tock Seng Hospital, National Neurosciences Institute, Taggle Pte. Ltd.

Healthcare Family Group Involved in this Project

Allied Health, Medical

Specialty or Discipline (if applicable)

Physiotherapy, Neurology

Aims

To create and test a smartphone application that enables self-administration of Timed-up-and-go (TUG) test, under both normal and dual-task conditions

Background

See poster appended / below

Methods

See poster appended / below

Results

See poster appended / below

Lessons Learnt

Validation study of a newly developed mHealth app and users' feedback are essential to determine its effectiveness and soundness.

Conclusion

See poster appended / below

Additional Information

This project attained Silver (Category: SHBC Best Poster Award (Allied Health)) at the Singapore Health & Biomedical Congress (SHBC) 2021

Project Category

Technology, Digital Health, Mobile Health, Digital Apps

Keywords

mHealth, Parkinson's Disease, Mobility Assessment, Self-Management

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Smartphone-based mobility assessment in Parkinson's disease: A validity study

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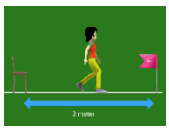
Background

Parkinson's disease (PD) is a progressive neurodegenerative disease, which has significant deleterious effects on gait and balance. Falls are common in PD, occurring up to 68% of people with PD.[1]

- The Timed up & Go (TUG): time to rise up from a seated chair position, walk 3m, turn, walk back, and sit down.



- Longer TUG test times are associated with decreased mobility and have moderate predictive ability for falls in people with PD.[2]
- Cognitive load has a negative effect on gait in people with PD.[3] The assessment of TUG under cognitive dual task condition (TUG-cognitive) further enhanced identification of fall risk in PD.[4]

Aim

- To create and test a smartphone app-based assessment of TUG during normal and dual-task conditions which would allow patients to monitor their functional mobility at home by themselves.

Methods

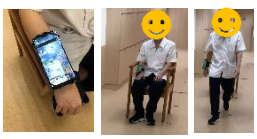


Figure 1. Data acquired with the smartphone strapped onto the wrist of the user

Figure 2. screenshot of the animated instruction for TUG

Figure 3. TUG-Cognitive. To count the frequency of even numbers being called out of a random presentation of numbers played from the app

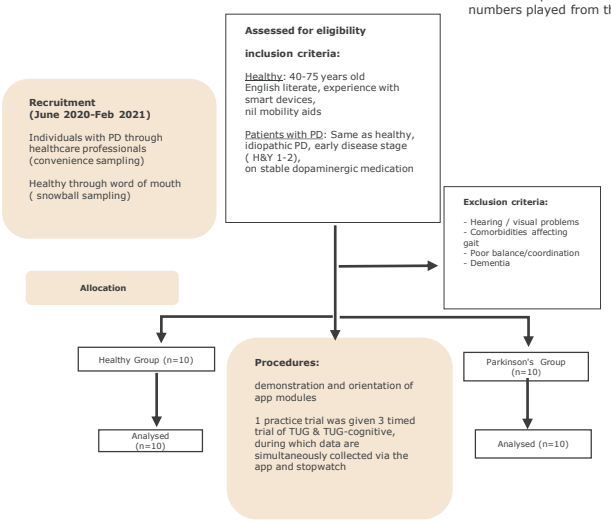


Figure 4: A flowchart of recruitment and method.

Statistical Analysis

- SPSS 26.0 (SPSS Inc., IBM)
- Test of normality: Shapiro-Wilk Test
- Spearman's coefficient for concurrent validity

Results

- All 20 participants' characteristics are shown in Table 1.

Table 1. Characteristics of participant's age, gender, smartphone usage and Hoehn & Yahr Stage.

Characteristics	Individuals with PD	Healthy individuals
Age, years; Mean (SD)	60.5 (9.1)	52.3 (9.4)
Gender (n)	Male: 8 Female: 2	Male: 4 Female: 6
Self-reported smart devices usage, hours/day Mean (SD)	2.5	4
Hoehn & Yahr Stage (I-IV)	Stage I: 1 Stage II: 9	NA
TUG (s), stopwatch vs .app	9.70(1.26) vs. 9.56(1,22)	8.29(1.38) vs. 7.92(1.41)
TUG-cognitive (s), stopwatch vs. app	11.0 (2.9) vs. 10.8 (2.6)	8.6 (1.7) vs. 8.4 (1.8)

Figures 1 (a-d). Results showings correlation of smartphone app against standard clinical measures and their corresponding correlations n healthy individual and individuals with PD.

Figures 2 (a-d). The Bland Altman plot of smartphone App timing against standard clinical measures in healthy individual and individuals with PD

References:

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Discussion & Conclusion

- Overall, there are moderate to strong associations between smartphone app and stopwatch timing for both TUG and TUG-cognitive, in healthy individuals and individuals with early PD.
- The smartphone app we created enable accurate assessment of TUG and dual-task TUG (TUG-cognitive) and it is feasible for patients with early PD to self-administer.
- Smartphone-based mobility assessment could possibly empower patients to track, monitor and manage their disease more proactively.
- Additional work is warranted to explore the feasibility in home-based setting and to validate this app in patients in moderate disease stage to increase generalizability.