PARKINSON

National Centre of Excellence in Research

Device-based Assessment in the Luxembourg Parkinson's Cohort

Dr Christian Stallinger

Luxembourg Center for Systems Biomedicine

Centre Hospitalier de Luxembourg

Fonds National de la Recherche Luxembourg

THE NATIONAL CENTRE OF EXCELLENCE IN RESEARCH (NCER)
IS AN INITIATIVE OF THE LUXEMBOURG NATIONAL RESEARCH FUND

What exactly is Parkinsonism?

Parkinsonism

is the combination of

Motor symptoms

- **Bradykinesia**
- Rigidity
- Tremor
- (postural instability)

Non-motor symptoms

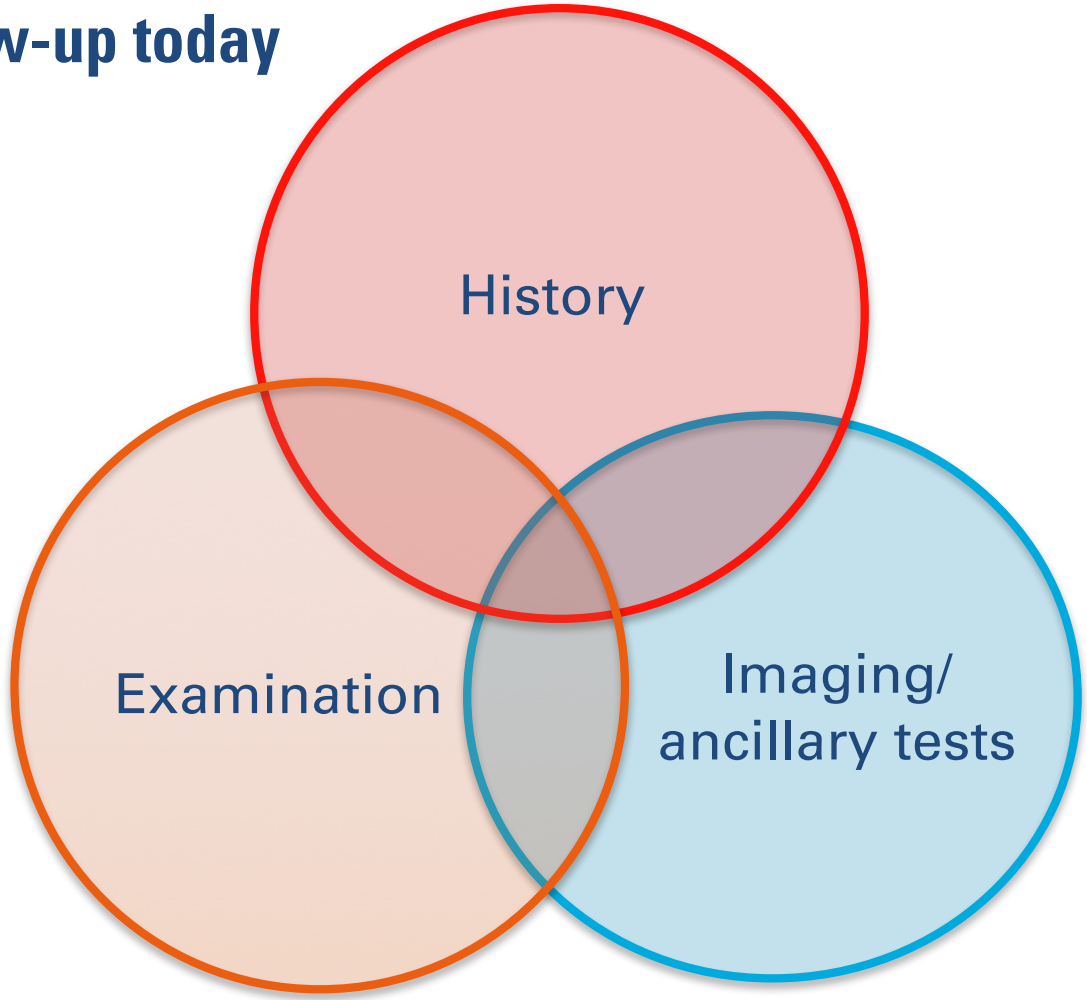
- Obstipation
- Orthostatic hypotension
- Hyp-/anosmia
- Bladder dysfunction
- Paraesthesia/pain
- Depression
- Hallucinations
- Sleep disorders
- Bradyphrenia
- ... ff.

Parkinsonism IS NOT JUST Parkinson's Disease

- **PD: many names for one disesase**
  - Idiopathic Parkinson's Syndrome
  - Typical Parkinson's Disease
  - Sporadic Parkinson's Disease

- **Some rare diseases look like „Parkinson's" (but aren't)**
  - Atypical Parkinson syndromes
    - MSA, PSP, CBD, ….
- **symptomatic Parkinson's syndromes**

Diagnosis and follow-up today



→ No "Parkinson's-Test" available

→ Diagnosis is made rather **late**

→Clinical diagnosis !

From a doctor's point of view...

- Early and correct diagnosis remain challenges
- Generally helpful, but current clinical scales have limitations
  - Subjective
  - Not receptive to short term/gradual changes
    (… related to disease stage and progression)
  - Not very good at prediction (e.g. OFF, freezing)
  - Discriminating forms of Parkinsonism

Our goals in the Luxembourg Parkinson's Cohort

- **Better understanding of PD causes and progression**

- **Earlier diagnosis**
  - Today, at the time of diagnosis, **more than half of the cells in the substantia nigra are already dead**

- **Finding causal treatment options**
  - Today, the symptoms of PD **can be treated well** with drugs and deep brain stimulation
  - **BUT**: so far, no treatment has slowed down progression

- **Stratification of PD patients will help making personalized medicine possible**

The Luxembourg Parkinson's Cohort

- Parkinson's patients in **all disease stages**
- Patients with **atypical Parkinson** syndromes

+

- **People without Parkinson's** as healthy controls

Our approach: deep phenotyping

Clinical data collection

Level A

- Anamnestic data
- Epidemiological data
- Standardised neurological examination
- Global cognition data
- Sensory data
- Non-motor symptoms

mandatory

Level B

- Neuropsychology
- Vision
- Gait
- PSP

optional

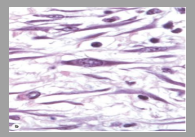
Each collection can be performed independently depending on defined criteria

Biological data collection

Blood

Urine

Saliva



Stool

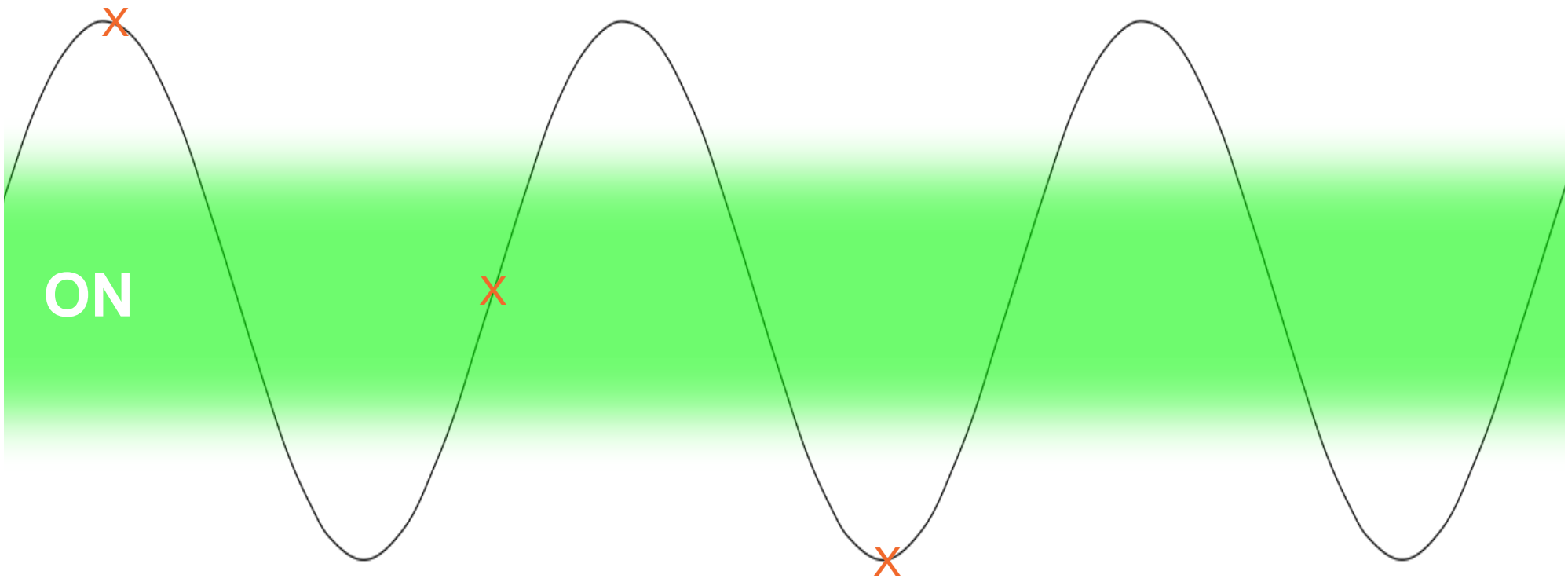
Fibroblasts

CSF

Colon biopsy

Fluctuations as an example for a clinical challenge

Hyperkinesia



Hypokinesia (OFF)

X = clinical visit

time

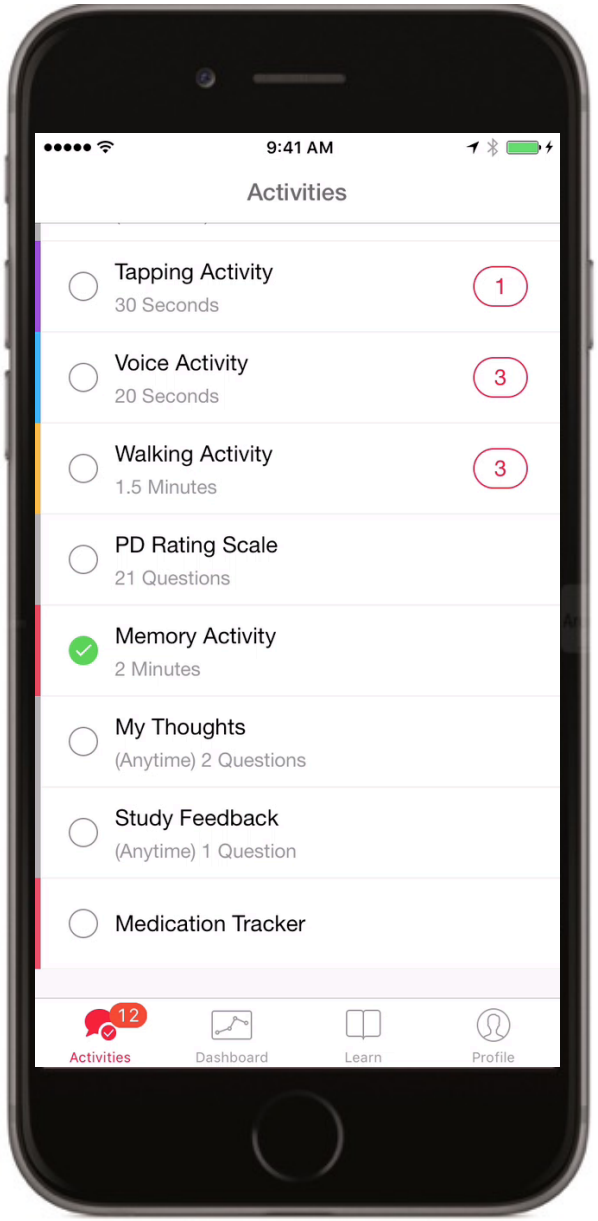
Device-based assessment in Luxembourg

mPower

eGaIT

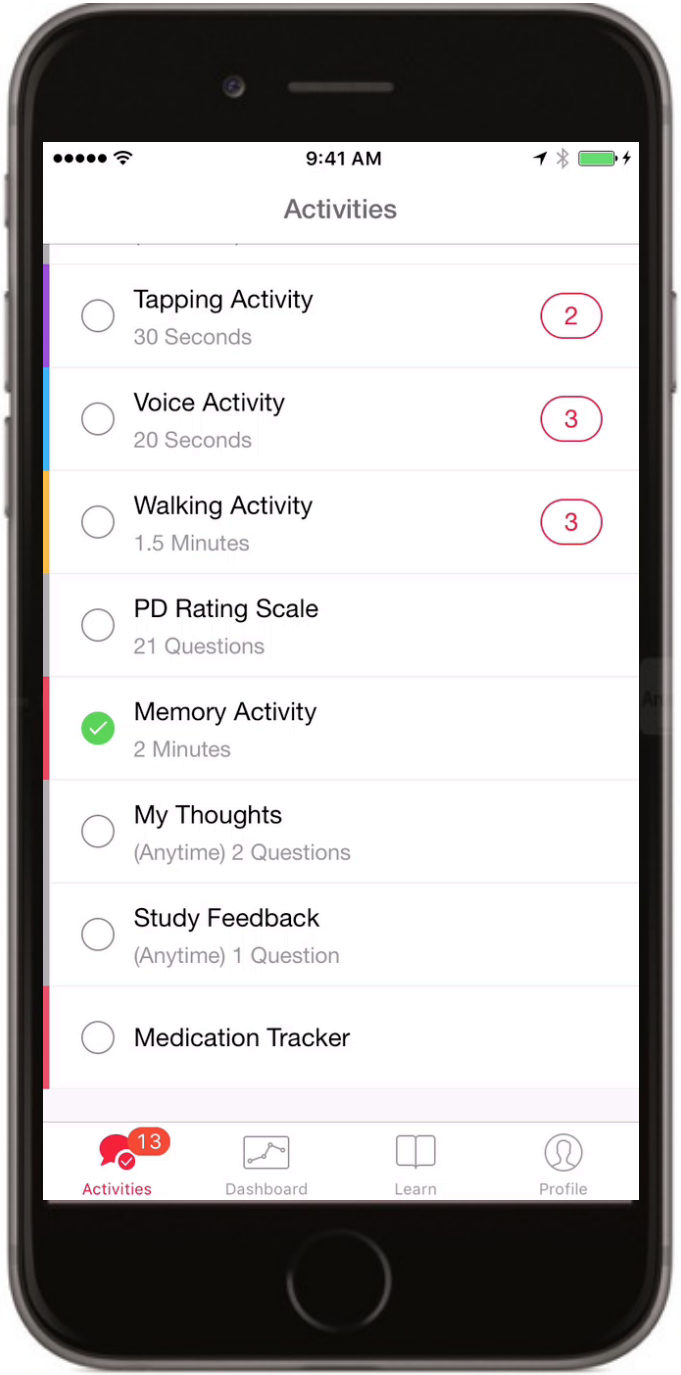
Sensor-based Movement Analysis

mPower

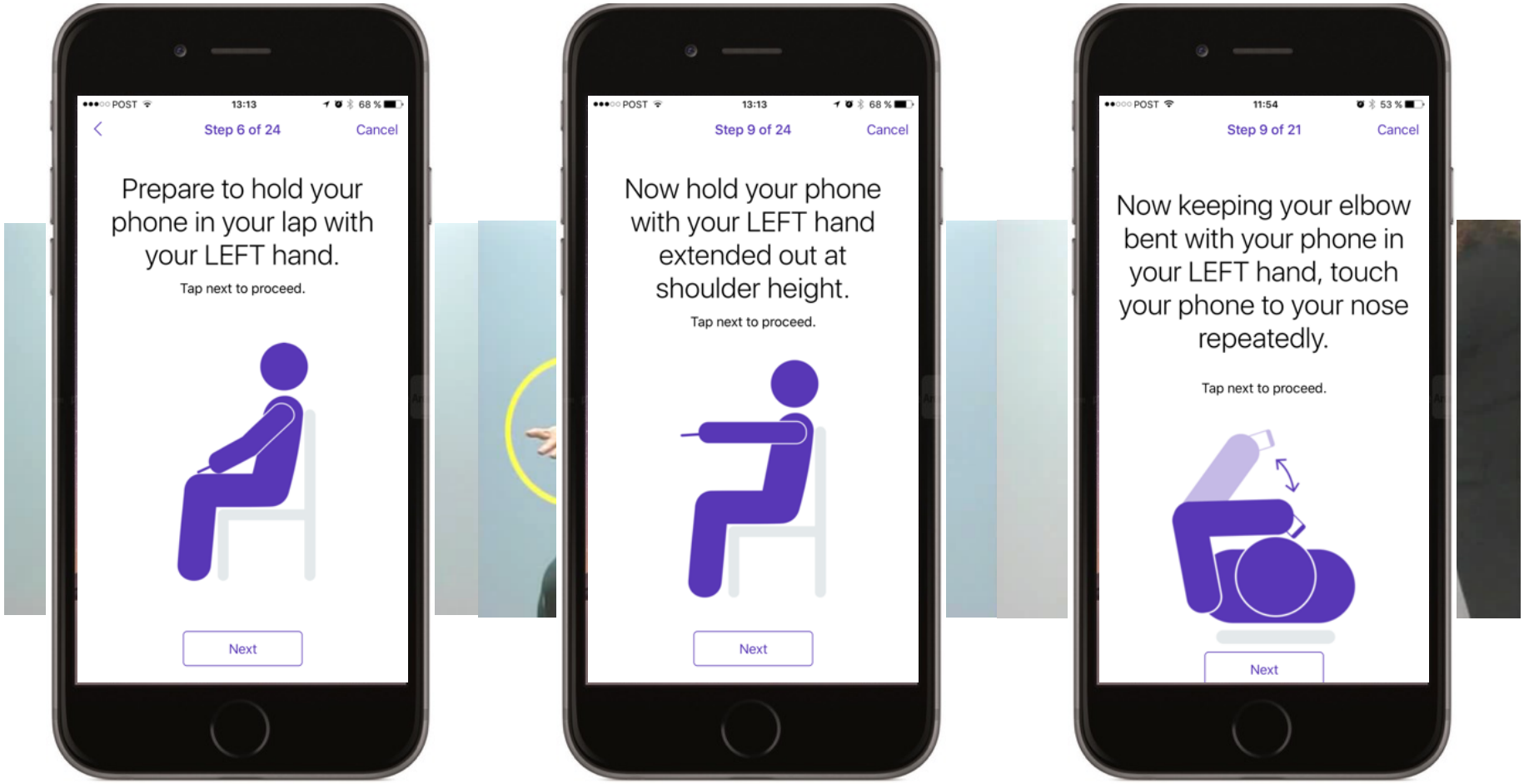

9:41 AM
Activities
Tapping Activity
30 Seconds
1
Voice Activity
20 Seconds
3
Walking Activity
1.5 Minutes
3
PD Rating Scale
21 Questions
Memory Activity
2 Minutes
My Thoughts
(Anytime) 2 Questions
Study Feedback
(Anytime) 1 Question
Medication Tracker
12
Activities
Dashboard
Learn
Profile

mPower – Bradykinesia

Finger tapping



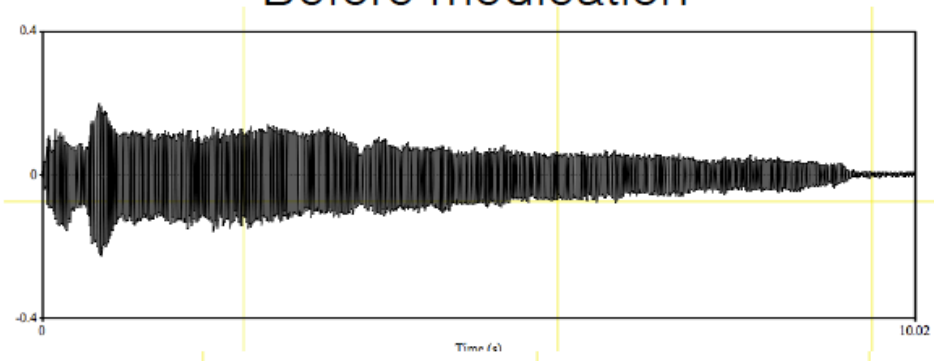
mPower – Tremor analysis



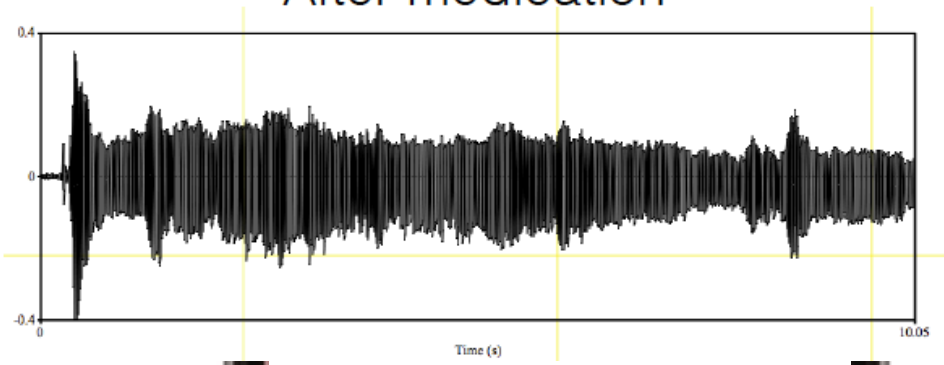
Resting tremor | **Postural tremor** | **Action tremor**

mPower – Voice analysis

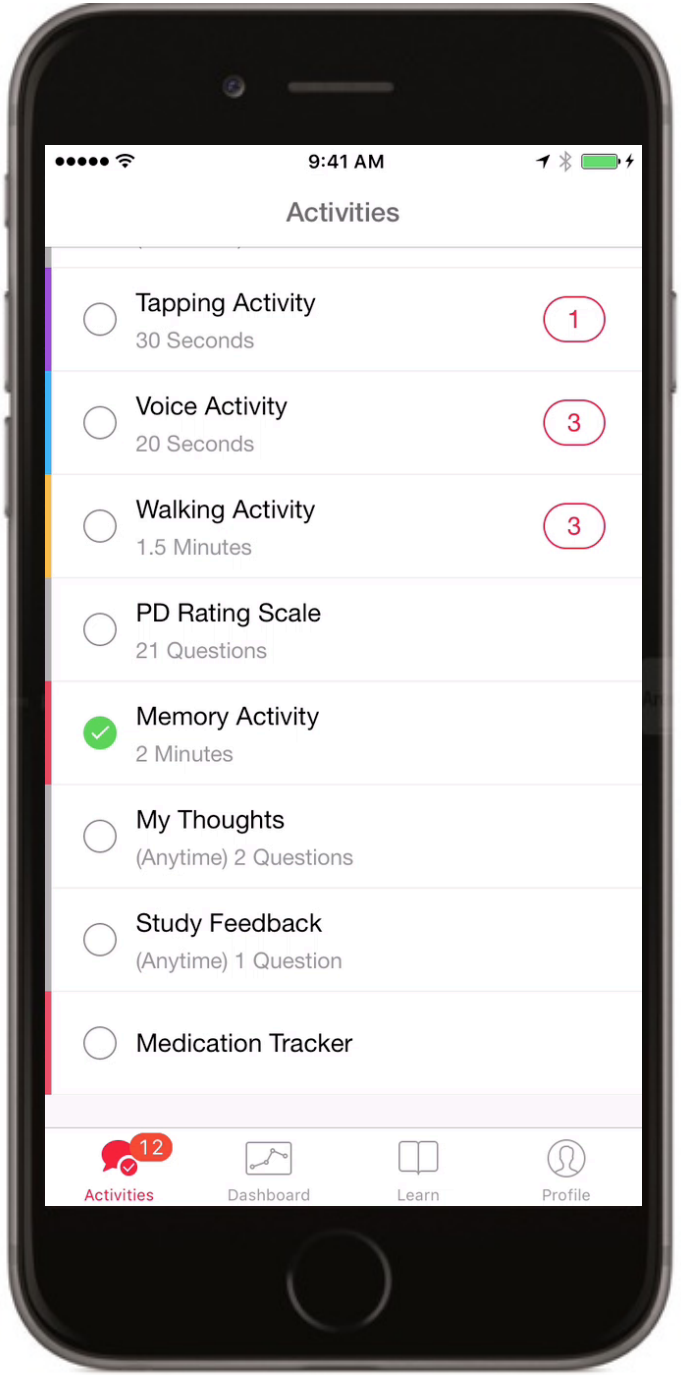
Before medication



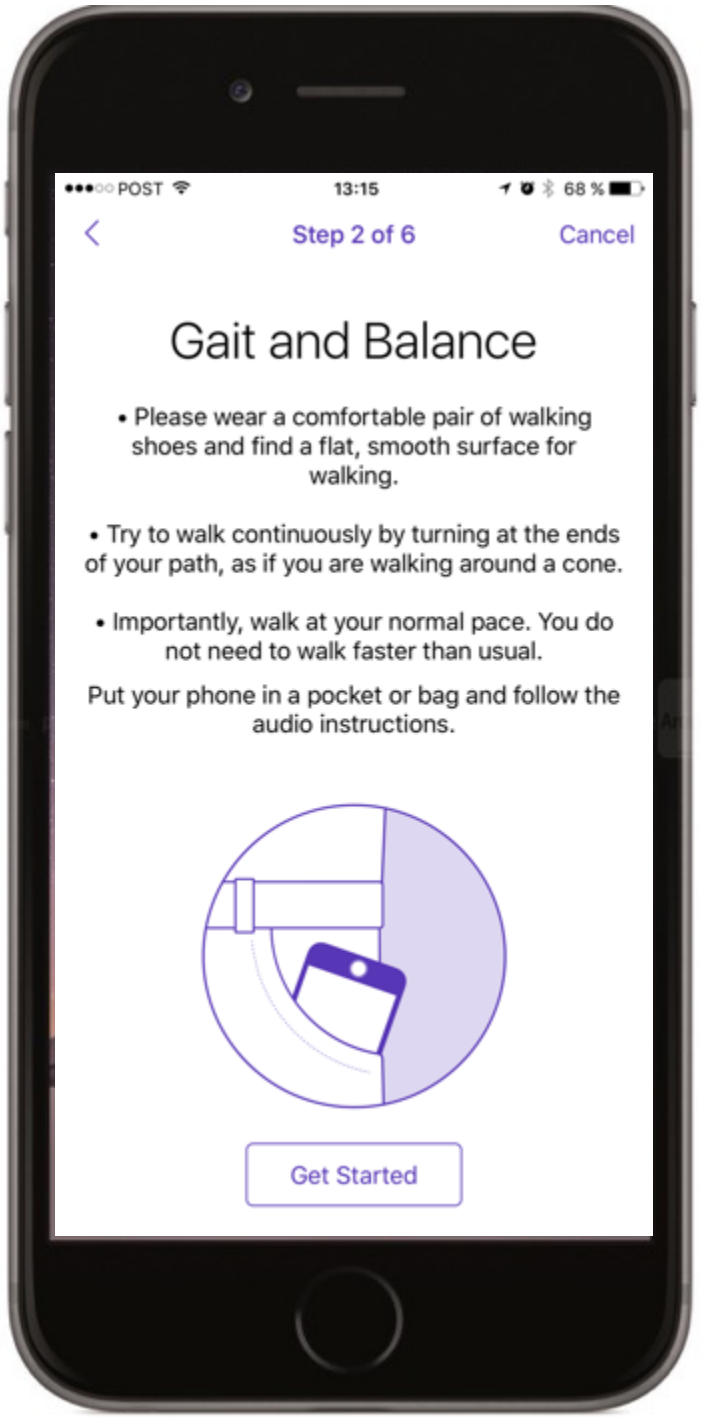
After medication



mPower – memory test



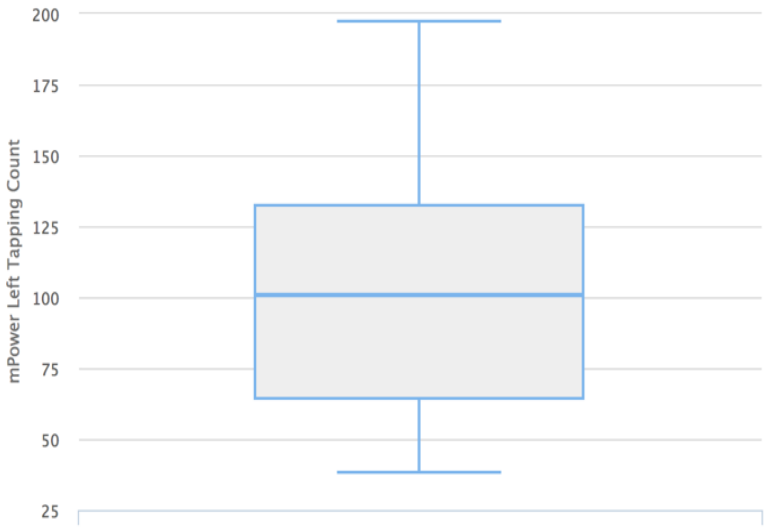
mPower – gait analysis



mPower – first findings...

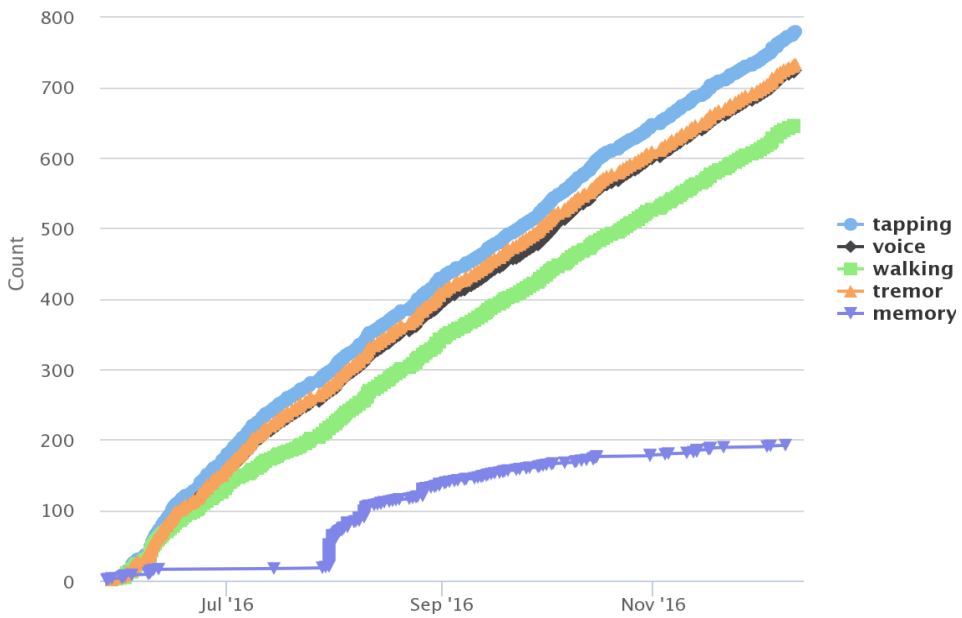
Before medication

After medication

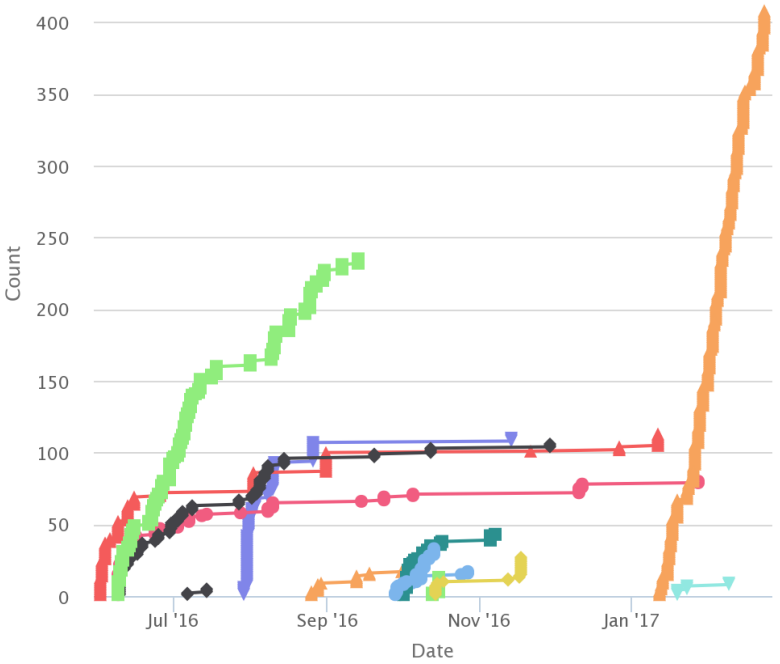


Tapping count, male PD patient, left hand

mPower – adherence



Overall count for mPower activities



Cumulative task count for individual participants

mPower – adherence

SCIENTIFIC DATA

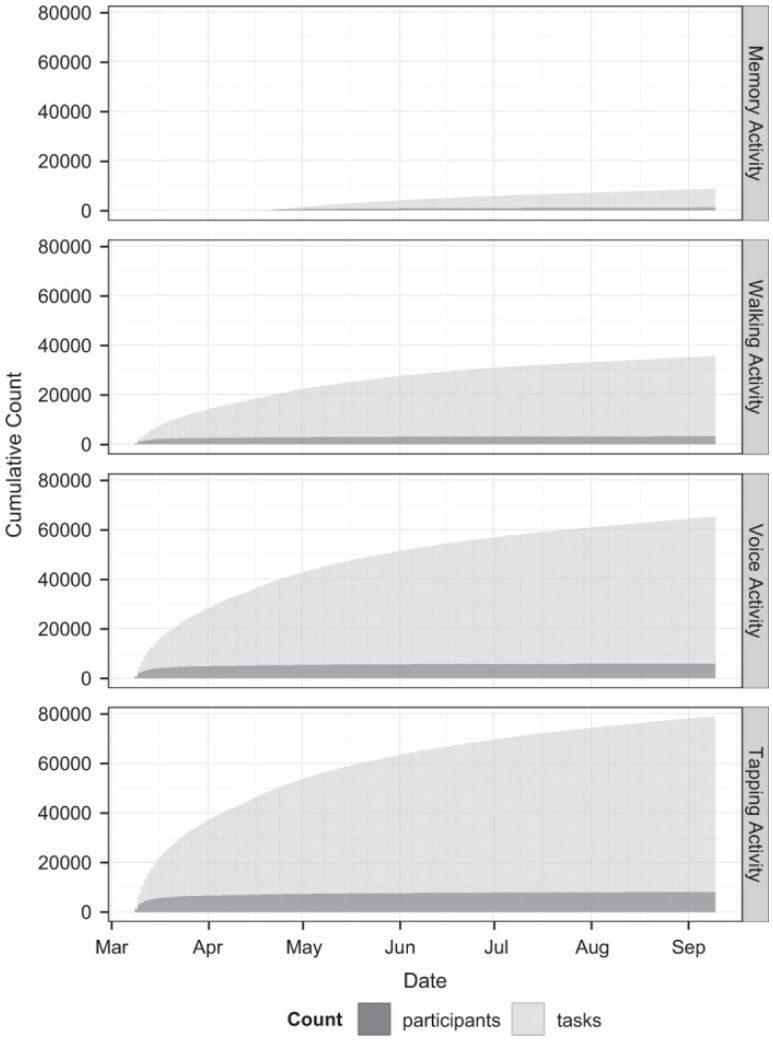
Sci Data. 2016; 3: 160011. PMCID: PMC4776701
Published online 2016 Mar 3. doi: 10.1038/sdata.2016.11
Data Descriptor

The mPower study, Parkinson disease mobile data collected using ResearchKit

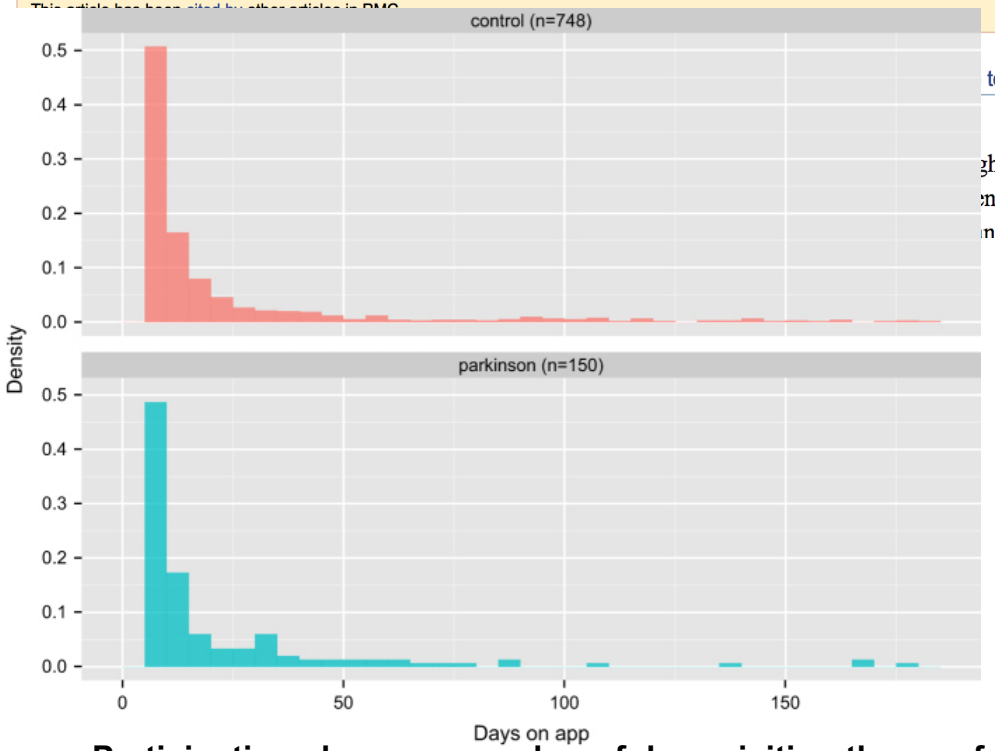
Brian M. Bot,[1] Christine Suver,[1] Elias Chaibub Neto,[1] Michael Kellen,[1] Arno Klein,[1] Christopher Bare,[1] Megan Doerr,[1] Abhishek Pratap,[1] John Wilbanks,[1] E. Ray Dorsey,[2] Stephen H. Friend,[1] and Andrew D. Trister[a,1]

Author information ▶ Article notes ▶ Copyright and License information ▶

See the article with doi: 10.1038/npjparkd.2016.6.



Cumulative participation for activities over time



Participation shown as number of days visiting the app for all participants who completed at least one task on five separate days.

eGaIT

Sensor-based Movement Analysis

Gait assessment in the Luxembourg Parkinson's Cohort

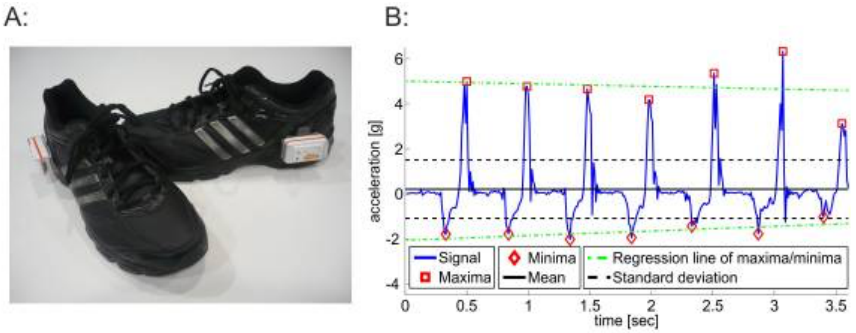
Timed up-and-go-test

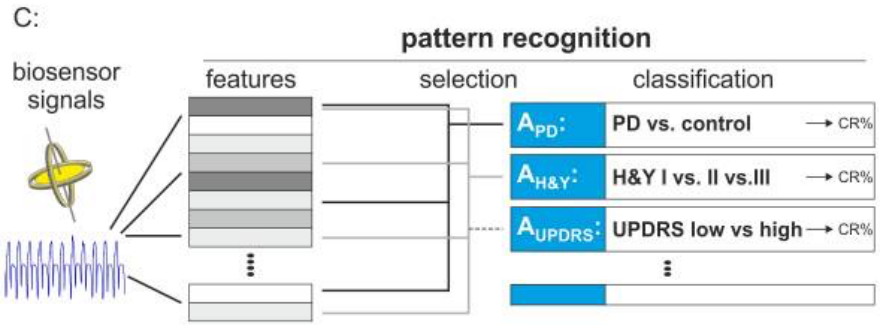
Gait assessment in the Luxembourg Parkinson's Cohort

Freezing of Gait Assessment Course (Ziegler Score) Mov Disord. 2010 Jun 15;25(8)

Sensor read-out

Feature extraction





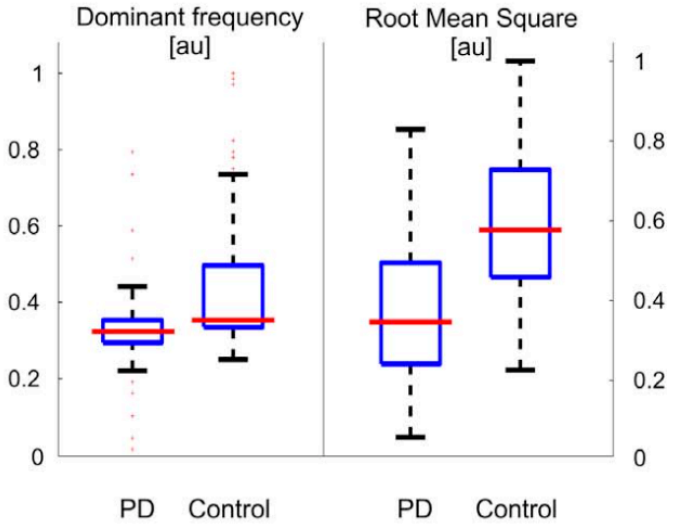
OPEN ACCESS Freely available online

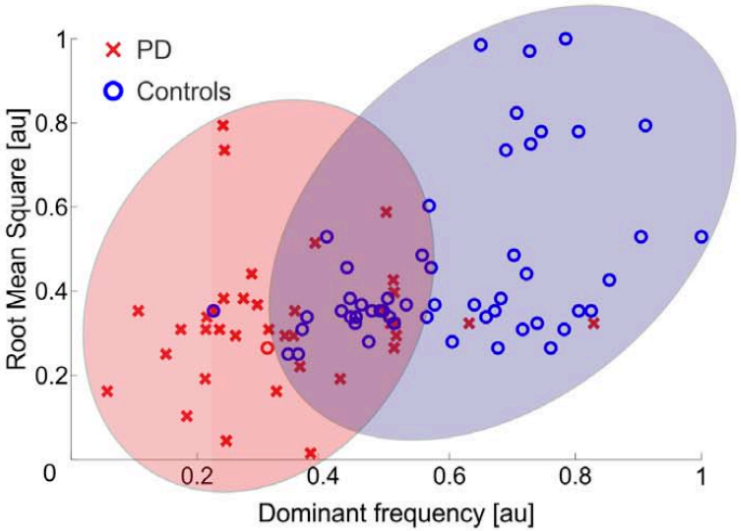
PLOS

Unbiased and Mobile Gait Analysis Detects Motor Impairment in Parkinson's Disease

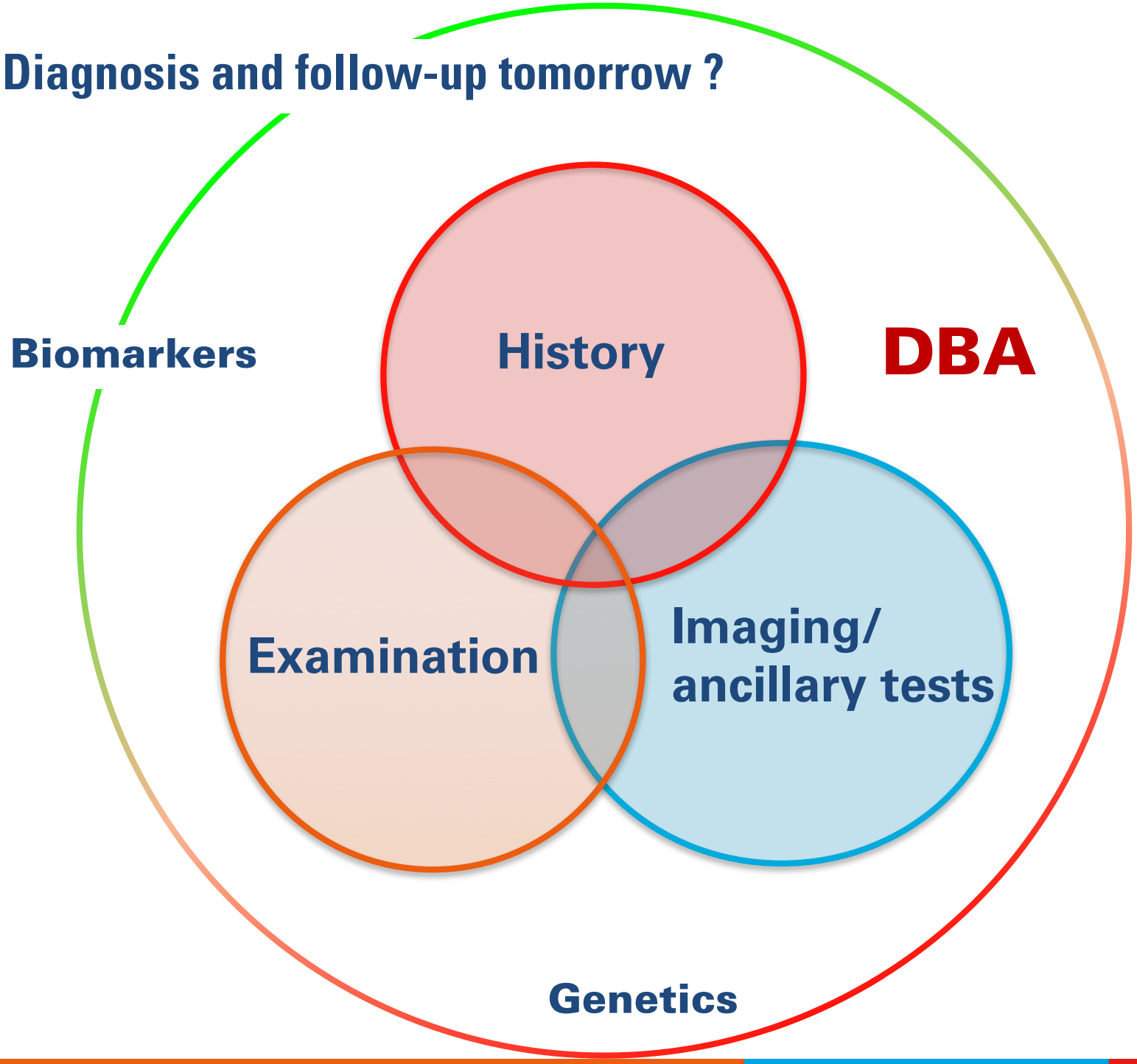
Jochen Klucken[1], Jens Barth[1,2,3], Patrick Kugler[2], Johannes Schlachetzki[1], Thore Henze[1], Franz Marxreiter[1], Zacharias Kohl[1], Ralph Steidl[3], Joachim Hornegger[2], Bjoern Eskofier[2], Juergen Winkler[1]*

1 Department of Molecular Neurology, University Hospital Erlangen, Erlangen, Germany, **2** Pattern Recognition Lab, Department of Computer Science, Frie Alexander-University of Erlangen-Nuremberg, Erlangen, Germany, **3** ASTRUM IT GmbH, Erlangen, Germany





Diagnosis and follow-up tomorrow ?



Requirements for clinical management of PD with DBA

1. It provides a **valid and accurate** parameter of a clinically relevant feature of the disease

2. there is confirmed evidence that the parameter has an ecologically **relevant** effect on the specific clinical application

3. a target range can be defined wherein the parameter **reflects the adequate treatment response**

4. implementation is **simple** to allow repetitive use

Movement Disorders

Official Journal of the International Parkinson and Movement Disorder So

Explore this jou

Advances in Technologies for PD Series: Review

A clinical view on the development of technology-based tools in managing Parkinson's disease

Walter Maetzler MD, Jochen Klucken MD, Malcolm Horne

First published: 7 June 2016 Full publication history

DOI: 10.1002/mds.26673 View/save citation

Cited by (CrossRef): 5 articles Check for updates | Citation tools

Am score 5

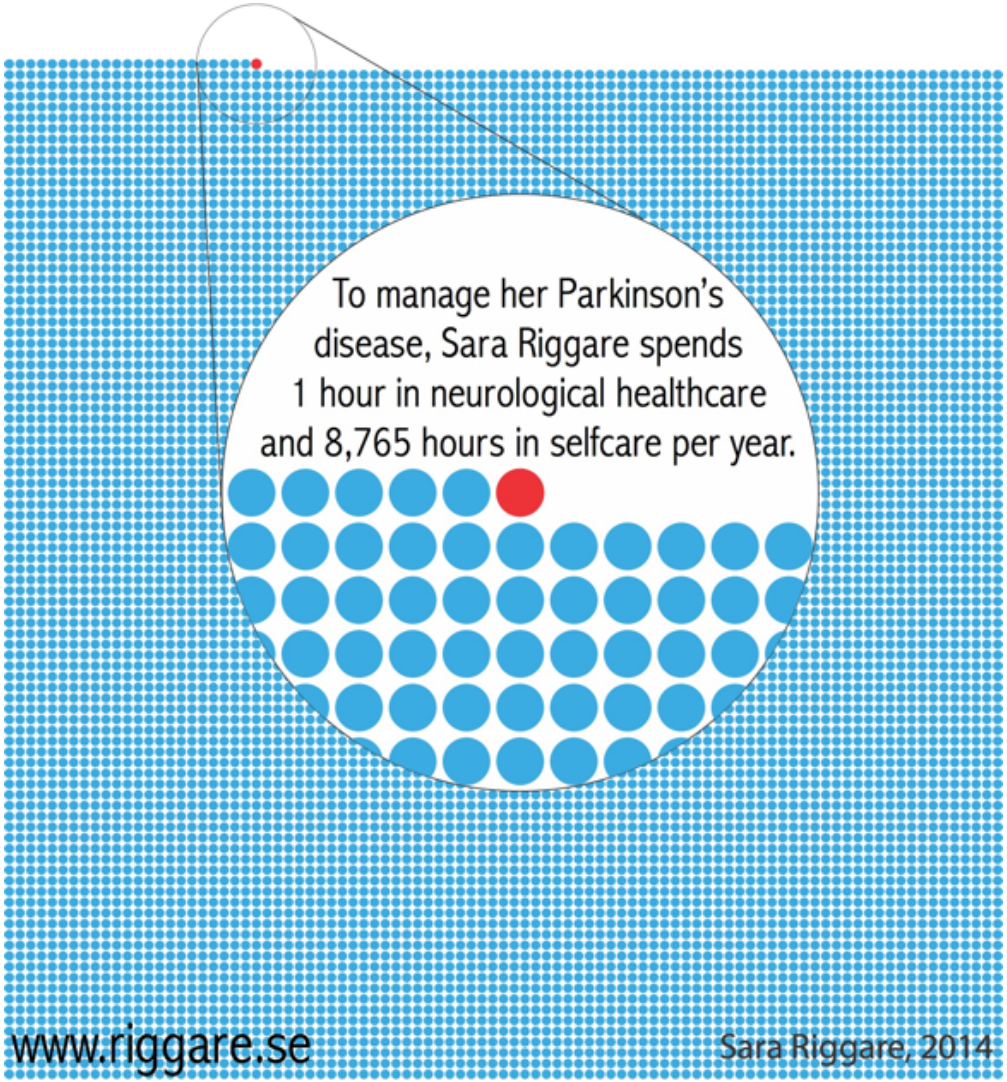
Relevant conflicts of interest/financial disclosures: Nothing to report.

Full financial disclosures and author roles may be found in the online version

The future

Application in

- Integrated care
- Clinical studies
- „Disease companion“
- Closed loop



Thanks!
© Bruno Santos | LCSB 2016