

**A Physician/Patient Hybrid
Perspective on
Biometric Monitoring Devices (BMD)**

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Outline

- Objectives
- Background
 - Demographic
 - As Physician/Clinical Researcher
 - As Patient/Research Subject
- Parkinson's Disease (PD) specific BMD considerations
- General BMD considerations
- Key Points for BMD development & utilization

Objectives

- Highlight key points for BMD development & use in clinical trials from my hybrid perspective
- Help ID and address “digital divides” & gaps in neurodegenerative disease research, care & support

Lessons Learned Violating the Golden Rules of Medicine & Clinical Research

- It is better to be providing care than receiving care
- It is better to be conducting clinical research than being the subject of research
- Having seen both sides of the care and research enterprises provides some perspectives you may find valuable

Demographic Background

Digital Evolution

- “Baby Boomer” or per my daughter an “Artifact”
- “Analog Artifact “Undergrad education predates digital revolution
- Slide rule
- First digital device purchased was a TI scientific calculator ~\$400 in 1975 dollars



**My digital pioneer classmates in the
Original Facebook circa 1973**

Digital Revolution Creeping Into Medicine by the End of Residency

- Pagers with dimes taped to clips to answer out of hospital calls from pay phones
- Department owned cell phone (“the brick”) for some senior on call residents
- Introduction of computerized hospital Rx ordering
- Early PP rare, 35 mm slides, dual synched projectors standard for presentations



Physician & Clinical Research background

- Orthopedist w/ clinical epidemiology fellowship
- Designed and conducted academic clinical outcome studies , registry and Biotech GCP Phase 2-4 clinical studies
- 10+ years experience biotech clinical research & development
- FDA, EMA studies & approvals
- Electronic Data Capture (EDC) in some studies

Patient/Clinical Research Subject Background

- PD diagnosis January 2006
- Clinical research subject in several trials including biomarker studies, 4 BMD studies
- DBS implant 2015, DBS study

PD Specific Considerations

- Multi-organ /system disease, not just a movement disorder
- Non-motor symptoms can be as important & disabling as movement symptoms, e.g. GI, speech, swallowing, sleep, cognition, mood, fatigue, pain syndromes, vision
- Disease progression generally involves increasing severity of symptoms in increasing number of systems, but extent /linkage/timing of co-morbidities variable

PD Specific Considerations

- Some of the non-motor symptoms challenging to measure with BMD's only
- That, plus need to measure how symptoms affect patient function, may require active patient input into standardized PRO instrument(s) as well as “passive”/automatic collection of BMD data
- Possible model example – Patient diary with outpatient Holter monitor

Paradox/Challenge of Using Digital Devices for PD Patient Data Input

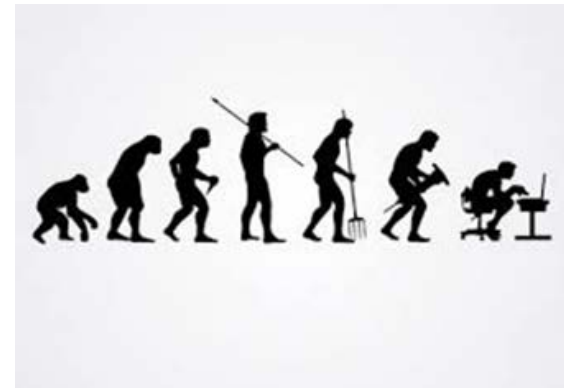
- Assessing traditional Activities of Daily Living (ADL's) (e.g. walking, bathing, eating) well developed in clinical medicine & research
- Computers/smart phone devices are now essential part of daily functional activities, I term these "Activities of Digital Living".
- PD markedly reduces ability & endurance to use digital devices
- Need better assessment, technology and support for PD patients & other patient populations to effectively use digital devices.

How Does PD Impact Use of Digital Devices?

- Tremors
- Dyskinesia
- Dystonia
- Bradykinesia
- Freezing
- Fatigue
- Posture – kyphosis
- Muscle & joint pain
- Speech difficulties , impair voice to text programs
- Vision, including reduced tears & blinking
- Standard touch screens & mice are problematic

Challenge of IT Development for PD Care and Research

- Breadth & progression of PD symptoms that affect digital tech use – “Digital Devolution”
- Under recognized in both clinical and IT communities
 - Center of Excellence example
- Pharma/Biotech ≠ Info tech
 - Need to bridge “Two Cultures”



BMD Opportunities & Challenges

Opportunities

- Real time, continuous data
- Automatic collection
- Overcome recall bias
- Some data collection independent of patient education/"clinical sophistication" background
- Reduce observer variability

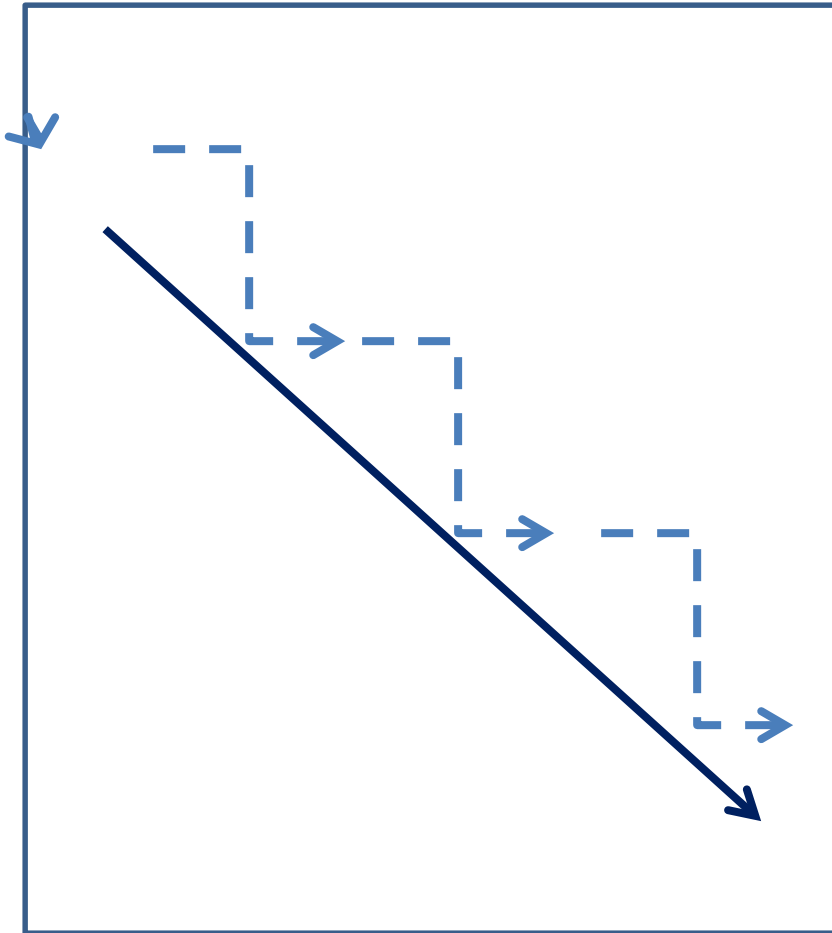
Challenges

- Noise to signal ratio, interpretation
- Establishing/validating clinical correlations
- Miss important symptoms/functional problems due to measurement or patient input difficulty
- Comfort/ease of use
- Device reliability

Is BMD a way to do traditional studies more efficiently or a way to do new types of studies?

- Both - potential to mitigate some operational and clinical risks
- Like EDC, has potential to make traditional types of studies more efficient , E.g. faster data collection, reduce missing data, reduce intra and inter observer variability, faster DB lock
- New types of data, potential for enhanced data analysis and interpretation, E.g. better measurement of progression rates, help identify rate predictors & sub-populations of “rapid progressives”, reduce false negative risks.

Conceptual Advantage of BMD



- Measure continuous change vs “step function”
- Capture disease progression/regression in real time vs. when patients come for scheduled visits or when become aware of symptom/functional changes
- Potential for “mapping/navigating” disease vs. static GPS coordinate like “point in time” description
- Help find “Holy Grail” – slow, stop, reverse disease progression

4 P's for BMD Development & Use

- Be Practical
 - Pragmatic feasibility vs. academic perfection
- Be Persistent
 - New tech can help speed success, but therapeutic breakthroughs still require tenacity, time and money. Stay the course.
- Be Prepared
 - Chance favors the prepared mind. Learn from failures and unexpected observations. The potential of DBS was initially discovered serendipitously !
- Be Patient-Centered

How to be truly “Patient Centric”



“Hold on, I’m going to conference in my wrist.”

The New Yorker, November 24, 2014

- Measure what is important to patient
- Adapt technology to patients’ needs & abilities
- Pragmatic vs. Perfect
- Clinical validation & correlations initially and periodically
- Correlations with historical/existing lit & data