Using Technology to Transform Care and Research
Outline

• Access challenge
• Using technology to transform care
• Using technology to transform research
• Future
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Parkinson disease is a common chronic condition

Parkinson disease – overview

• **Clinical features** – Presence of two of the following: asymmetric rest tremor, slowness in movements (bradykinesia), rigidity, and gait imbalance
• **Cause** – Uncertain. Approximately 10% have an underlying genetic cause; balance are thought to be due to environmental exposures. Pathology shows loss of dopamine-producing neurons in the substantia nigra
• **Treatment** – Primarily medications although surgery is an option for some
• **Prognosis** – Modest increase in mortality; average duration of illness is ~14 years

The burden of chronic conditions such as Parkinson disease is growing globally

Distribution of individuals with Parkinson disease by country from 2005 to 2030*

*Among individuals over 50 in the world’s ten most and Western Europe’s five most populous nations

Source: Neurology 2007;68:384-6
Access to care is limited in the United States

Proportion of Medicare beneficiaries with PD who do not see a neurologist

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We are using simple, inexpensive technology to reach patients around the world

Novel application of existing technology

**Equipment**
- Internet-enabled device
- Web cam, microphone
- Encrypted software

**Personalized care**
- In-home care
- Remote patient monitoring
- Remote study participation

**Global reach**
We completed a randomized, controlled trial of virtual house calls for Parkinson disease

20 patients with PD at two centers

11 patients receive 3 in-person visits over 6 months

9 patients receive 3 telemedicine visits over 6 months in home

Outcomes:
1. Feasibility
2. Clinical outcomes
3. Economic value

Sponsors: Google, Excellus

Source: JAMA Neurol 2013;70:565-70
Virtual visits flip the care paradigm

Patient time spent on in-person versus telemedicine visits

Door-to-door
100% = 255 minutes

Time spent traveling and waiting: 78%
Time spent with physician: 22%

On-to-off
100% = 53 minutes

Time spent connecting: 28%
Time spent with physician: 72%

A case series of one-time virtual visits for Parkinson disease demonstrated satisfaction

Patient satisfaction with virtual visits (n=33)

- Specialist's ability to understand and explain condition
- Ability to convey feelings, symptoms, and information to specialist
- Specialist's ability to provide recommendations to improve quality of life
- Specialist's ability to gather relevant information
- Using web-based videoconferencing to receive care from a PD specialist
- Quality of the connection

Special thanks to the Verizon Foundation for support of the study

Virtual visits offer patients care, convenience, and comfort

Feedback from patients and families

Care
• “We had a good family crying moment after the appointment from just pure joy of finally having the opportunity for him to see a (Parkinson disease) specialist”
• “The (Parkinson disease) literacy was amazing”

Convenience
• “It’s great not having to drive the 2 hours ... having the added expense of my wife missing an entire day of work, [and] saving on gas for the car, tolls, [and] parking”
• “I could have access to a movement specialist, which I currently don’t where I live”

Comfort
• “I liked the interaction being personal despite the 3000 mile distance...it felt somehow protected by the veil of technology, which enabled the exchange to be more honest”
• “I am more relaxed in my home setting”

The Connect.Parkinson study is a national randomized controlled trial of telemedicine for Parkinson disease patients.

In collaboration with:

- National Parkinson Foundation
- PCORI
- Deliver Care Anywhere
- Vidyo

If interested, visit us at Connect.Parkinson.org
Individuals have visited the Connect.Parkinson website from all over the US and even from abroad.

Source: Google Analytics, accessed 3/13/2014
Physicians are generally satisfied but have concerns about the quality of the connection

Initial physician feedback on satisfaction with different aspects of the virtual visit

N= 58 visits

The care provided

The technical quality of the virtual visit

The virtual visit overall

Selected physician feedback

- “Visit interaction was great, but it was very difficult to determine actual ratings for rapidly alternating movements.”
- “Video quality, particularly for rating UPDRS is frustrating.”
- “I think it is fine for the interview part, and maybe for clinical follow-ups.”

Source: Connect.Parkinson study
Patients are very satisfied with the telemedicine visits

Initial patient feedback on satisfaction with different aspects of the virtual visit
N= 56 respondents

Selected patient feedback
• “I learned more in one visit than all the information provided by other physicians over a period of years!!!”
• “I felt it was a great doctor’s visit. Better than many I’ve had face to face.”
• “It was so good to not have to ride 45 minutes in a handicapped van each way to see a (movement disorder specialist).”
• “On a cold rainy day it was so nice not to have to worry about getting a ride and getting from the car to the office. I could concentrate on what I wanted to ask and the info the doctor provided.”

Source: Connect.Parkinson study
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    – Virtual research visits
    – Smartphones
• Future
Virtual research visits

**Methods**
- Fox Trial Finder participants provided consent by phone, completed baseline surveys, downloaded video conferencing software, and received a web camera.
- After a test connection, participants underwent a remotely assessed cognition and had a virtual research visit to:
  1. Review their history
  2. Perform MDS-UPDRS (modified to exclude assessments of rigidity and balance).
  3. Confirm whether PD was the most likely diagnosis,
  4. Solicit feedback on their experience.

**Results**
- 81.4% individuals from 39 states completed the visits
- On average, participants were:
  1. 61.6 years old
  2. Had Parkinson disease for 8.0 years
  3. Scored 26.5 on the Montreal Cognitive Assessment
  5. Parkinson disease was most likely diagnosis in 97.0% of cases.
- Overall satisfaction with the visits was 79% (satisfied or very satisfied) among neurologists and 93% among participants.
We connected remotely to over 160 participants in 39 states

Map of participants
Research participants were satisfied with the virtual visits

Over 80% of participants said they would be more willing and able to participate in future research studies if they could do so remotely.
In addition to virtual visits, mobile technologies can transform care for Parkinson disease

Pilot smartphone study in Parkinson disease

Figure 1. Picture of Android smartphone and software application.

Figure 2. Procedure for collecting voice recordings (sustained vowel ‘aaah’), finger tapping coordinates and the time of touch, acceleration time traces during gait, and postural sway tests along with the major steps in the data analysis.

Source: Arora S, Venkataraman V, Donohue S, Biglan KM, Dorsey ER, Little MA. Using smartphones to diagnose Parkinson disease: a pilot study (under review)
Smartphones can distinguish those with Parkinson disease from those without.

Gait and posture tests in Parkinson disease

Source: Arora S, Venkataraman V, Donohue S, Biglan KM, Dorsey ER, Little MA. Using smartphones to diagnose Parkinson disease: a pilot study (under review)
Smartphone-PD will enlist 2000 individuals to assess PD symptoms using an Android phone application

Map of current participant locations

- Active participant
- Withdrawn participant
In addition, smartphones empower patients and researchers alike to better understand Parkinson disease. Using Android and Apple smartphones, researchers and patients now have the tools to measure and track symptoms of Parkinson disease.
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Technology will reshape the way we deliver care

Office vs. Virtual Visits at Kaiser Permanente Northern California, 2008-2013

“I expect that by 2016, with the expanded use of video, the number of virtual visits—including secure email, telephone, and video encounters—in KPNC will surpass the number of in-person office visits.” – Robert M. Pearl, MD; Exec. Dir. & CEO – Permanente Medical Group

Source: Pearl R Health Aff 2014;33:251-257
Technology brings unprecedented access to care

Mayo Clinic Plans for 2020

“How can we help patients everywhere? ... Our board has approved our plan that by 2020 we will have meaningful interaction with 200 million people per year ... [Ultimately], why wouldn’t we at Mayo share what we know with people everywhere remotely.”

Dr. John Noseworthy

Technology will soon allow us to connect to almost anyone anywhere

The world in 2017

In 1796, Edward Jenner developed the smallpox vaccine.
In 1895, Wilhelm Conrad Röntgen took the first X-ray: an image of his wife’s hand
In 1928, Alexander Fleming discovered the first antibiotic.
In 2007, Steve Jobs introduced the smartphone

21st Century: Reach the Unreachable
Appendix
### Barriers to the adoption of telemedicine can be resolved

#### Major telemedicine barriers

| Reimbursement                                                                 | • 43 states and DC provide varying forms of Medicaid reimbursement for telehealth services  
|                                                                              | • 19 states and DC now require private insurance plans to cover telehealth services |
| Licensure                                                                   | • 11 state boards issue special purpose or telemedicine licenses, or licenses to practice medicine across state lines  
|                                                                              | • 57 state boards (incl. US territories and DO boards) and the DC Board of Medicine mandate licensure in patient’s state |
| Consent requirements                                                        | • States have varying requirements for consent (written vs. verbal consent) prior to telemedicine encounters |
| Quality of examination                                                      | • Limited ability to offer a complete and accurate evaluation of patients’ conditions  
|                                                                              | • Remote monitoring devices will likely offer a new window into assessing and measuring symptoms |

Medical centers can increase their reach through telemedicine

Increased reach of hospitals with telemedicine

Patient adoption is a function of:
1. Clinical feasibility
2. Differential cost between in-person care and telemedicine
3. Set-up costs for telemedicine
4. Travel costs

Legend
A’s Market coverage
B’s Market coverage
Untreated region
A’s Telemedicine Market coverage