Using Technology to Transform Care and Research

Presentation for Public Health Grand Rounds
March 20, 2015

Outline

- Access challenge
- Using technology to transform care
- Using technology to transform research
- Future

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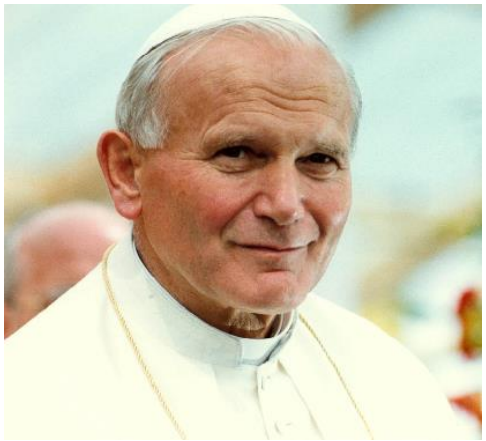
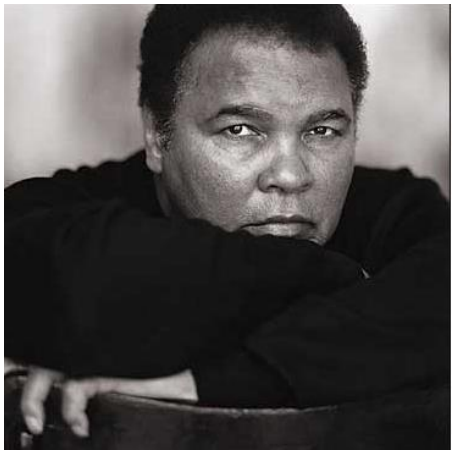
Parkinson disease is a common chronic condition

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

Faces of Parkinson disease

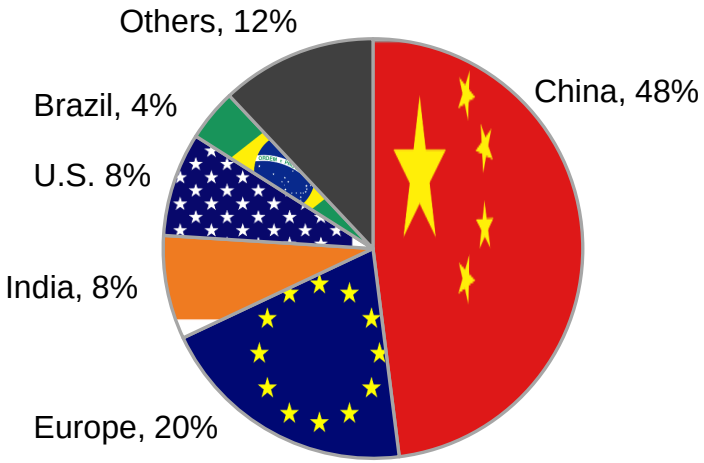




Sources: Neurology 2003;60:1756-1761; JAGS 2000;48(8):938-942; Mayo Clinic Proc 2002;77:918-925; BMJ 1991;303:741-743; Parkinsonism Rel Disord 2002;8:369-380; JAGS 1996;44(4):394-399

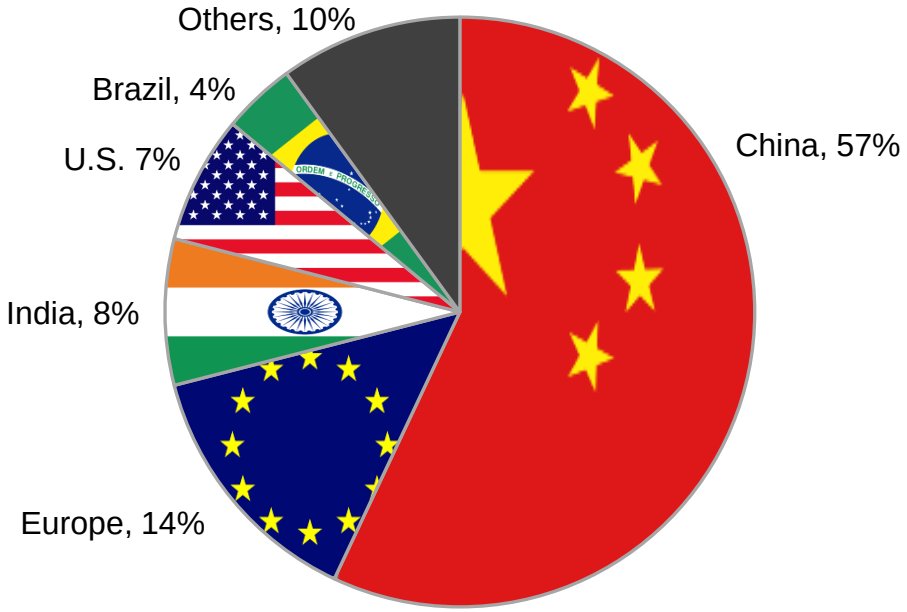
The burden of chronic conditions such as Parkinson disease is growing globally

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

2005
100% = 4.1 million individuals



2030
100% = 8.7 million individuals

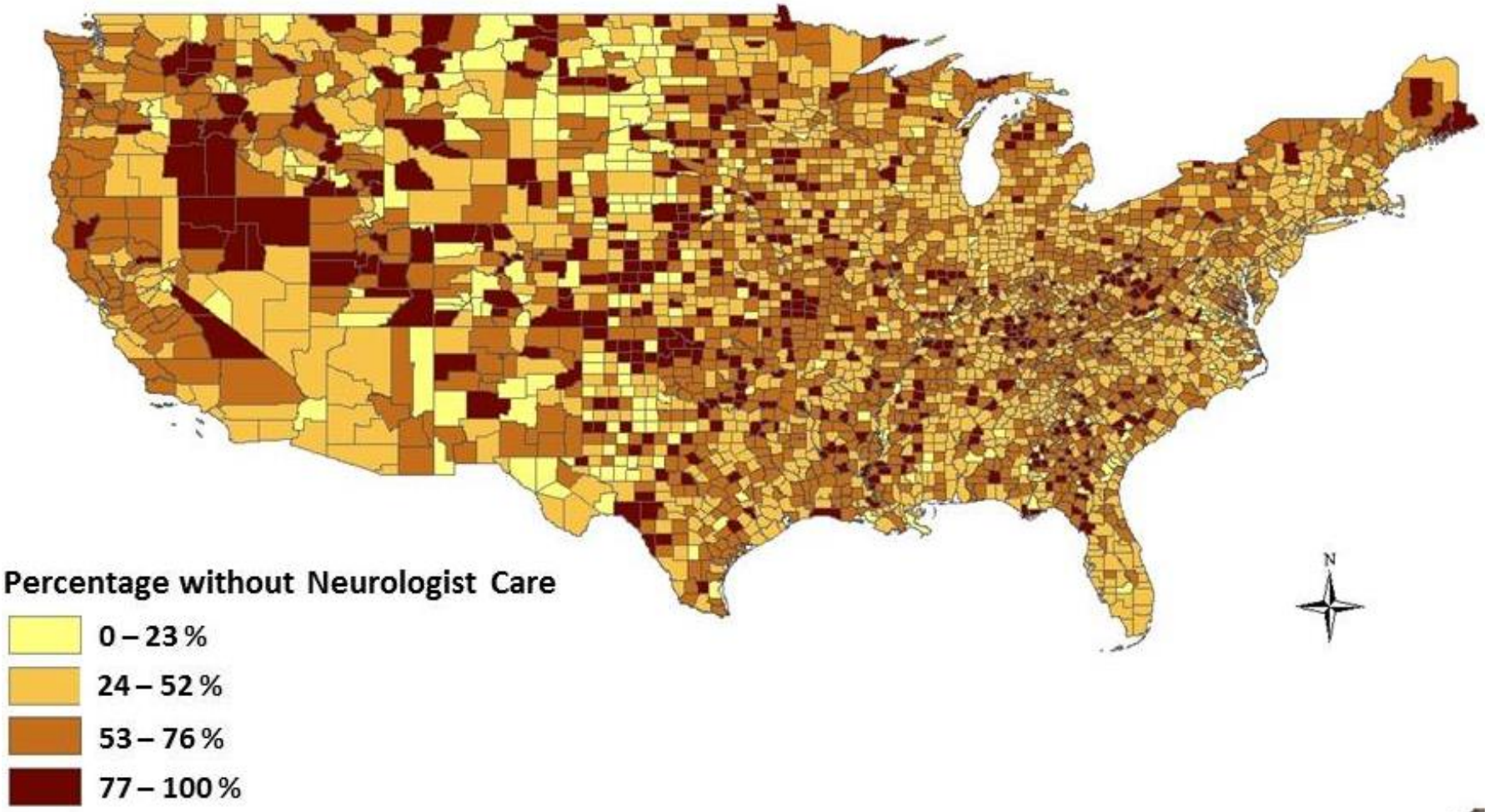


*Among individuals over 50 in the world's ten most and Western Europe's five most populous nations

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



Source: Neurology 2013; 80:1989-96.

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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

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

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

20 patients with PD at two centers

Randomized

- 11 patients receive 3 in-person visits over 6 months
- 9 patients receive 3 telemedicine visits over 6 months in home

Outcomes:

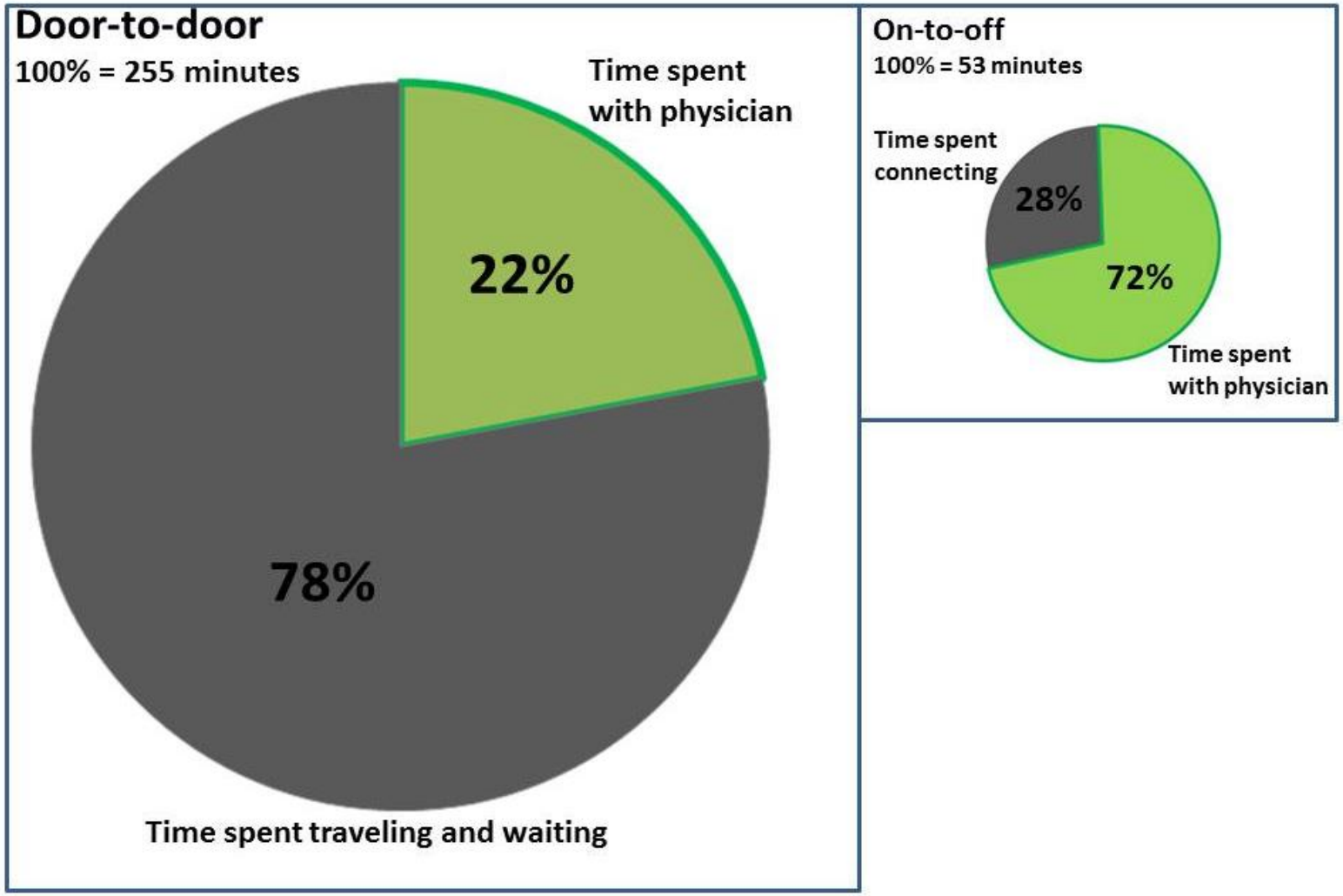
1. Feasibility
2. Clinical outcomes
3. Economic value

Sponsors: Google Excellus

Source: JAMA Neurol 2013;70:565-70

Virtual visits flip the care paradigm

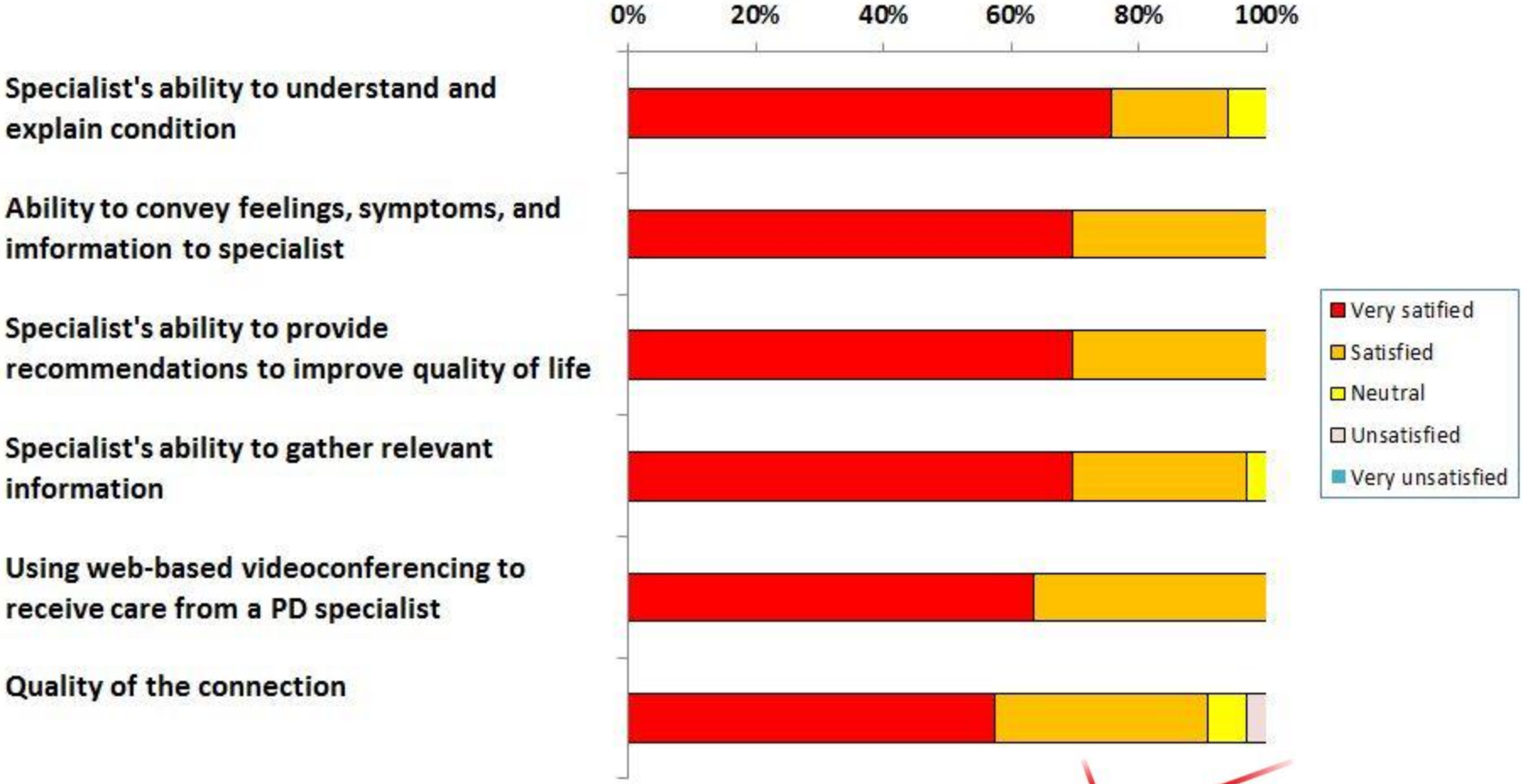
Patient time spent on in-person versus telemedicine visits



Source: JAMA Neurology 2013;70:565-70.

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

Patient satisfaction with virtual visits (n=33)



Special thanks to the Verizon Foundation for support of the study

Source: Neurol Clin Pract. 2014;4(2):146-152.

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"

Source: Neurol Clin Pract. 2014;4(2):146-152.

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

In collaboration with:

NATIONAL PARKINSON FOUNDATION

pcori PATIENT-CENTERED OUTCOMES RESEARCH INSTITUTE

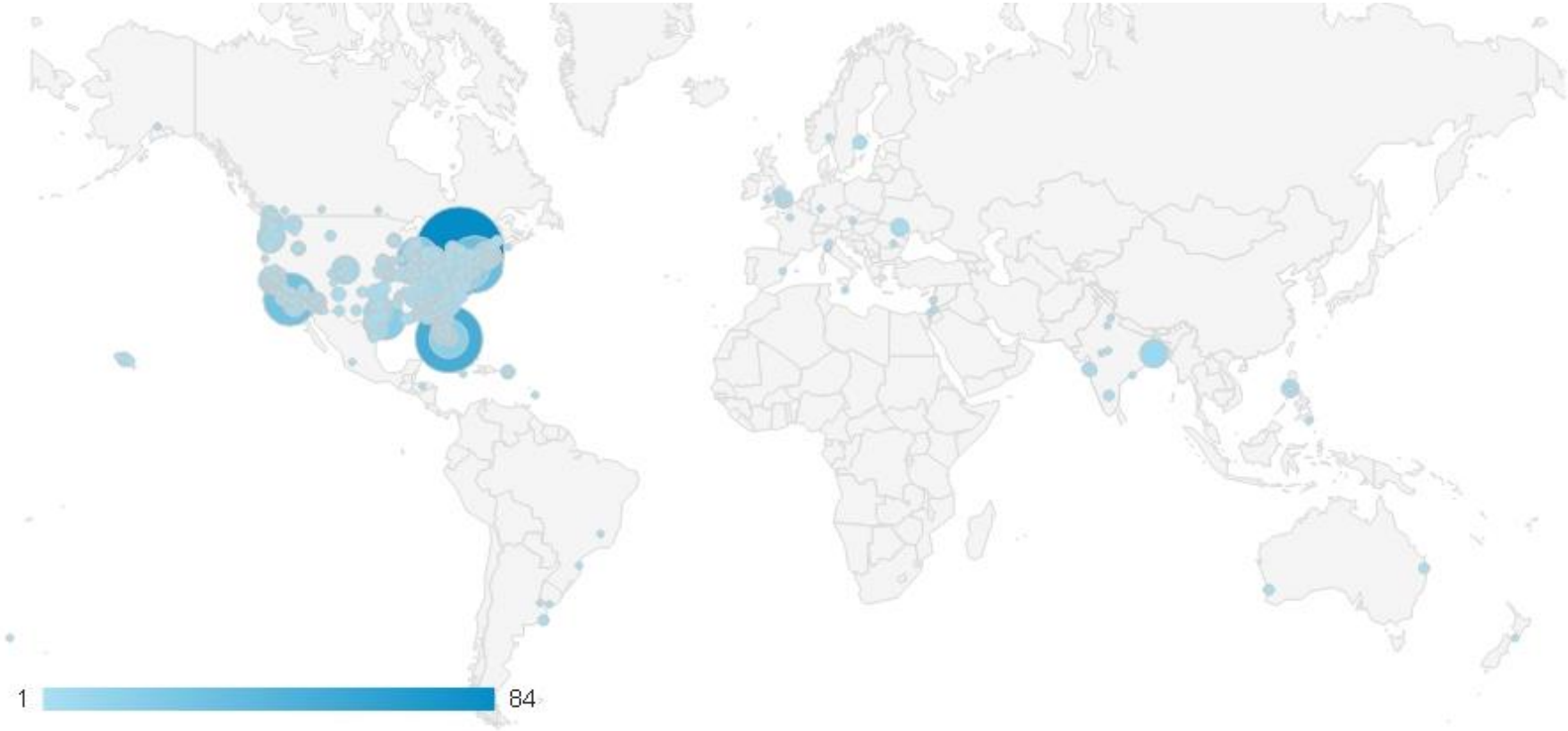
SBR HEALTH Deliver Care Anywhere

patientslikeme™

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



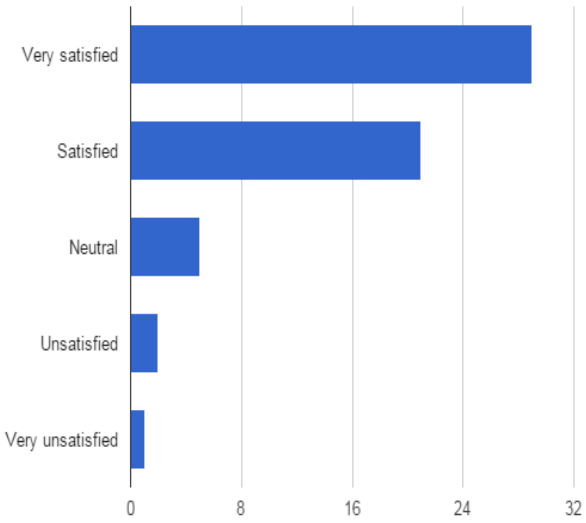
Source: Google Analytics, accessed 3/13/2014

Physicians are generally satisfied but have concerns about the quality of the connection

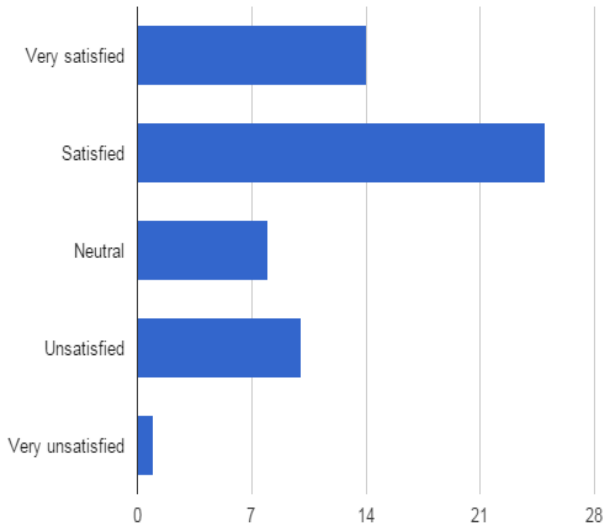
Initial physician feedback on satisfaction with different aspects of the virtual visit

N= 58 visits

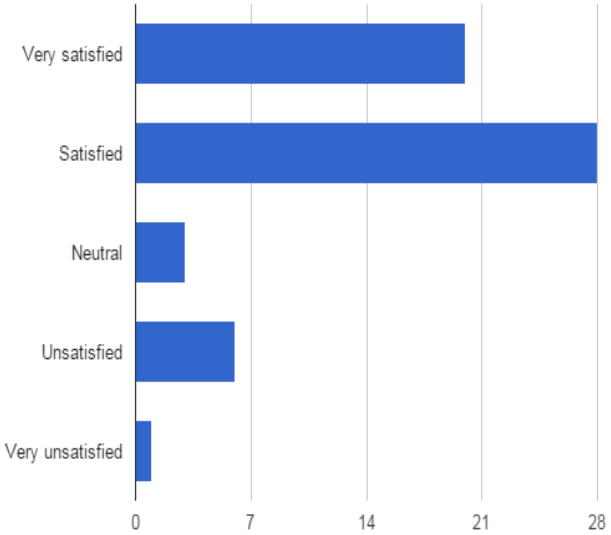
The care provided



The technical quality of the virtual visit



The virtual visit overall



Selected physician feedback

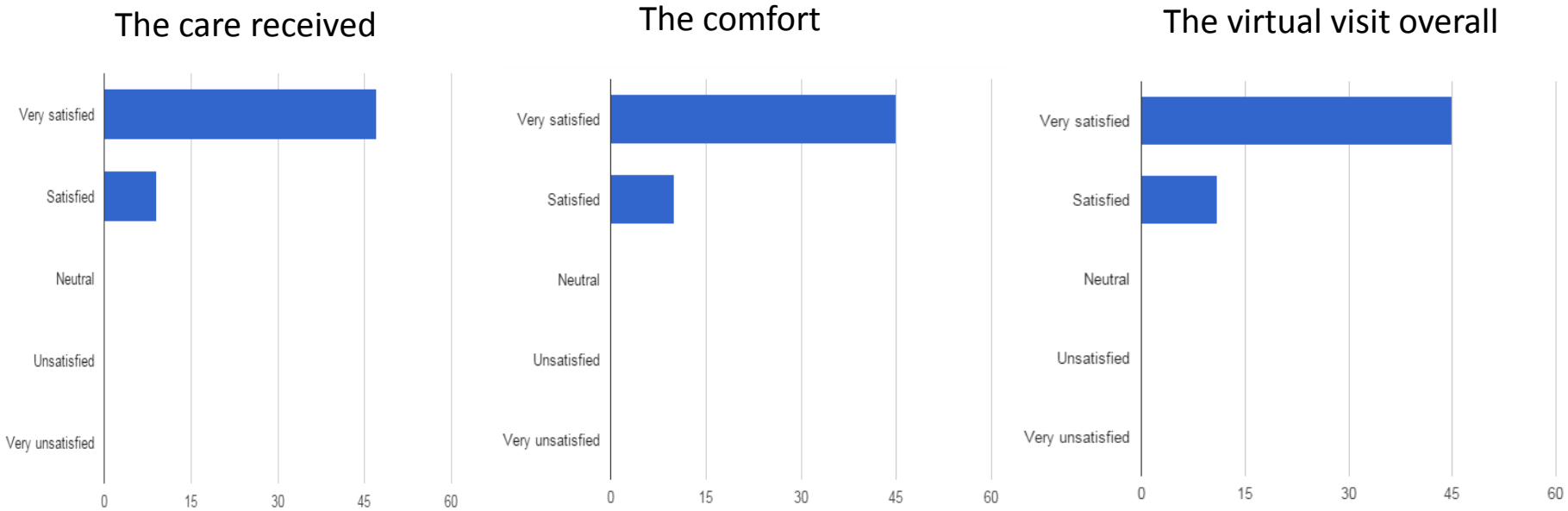
- "Visit interaction was great, but it was very difficult to determine actual ratings for rapidly alternating movements."
- "Video quality, particularly for rating UPDRS is frustrating."
- "I think it is fine for the interview part, and maybe for clinical follow-ups."

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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- **Using technology to transform research**
  - **Virtual research visits**
  - **Smartphones**
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Virtual visits can also be applied to research

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

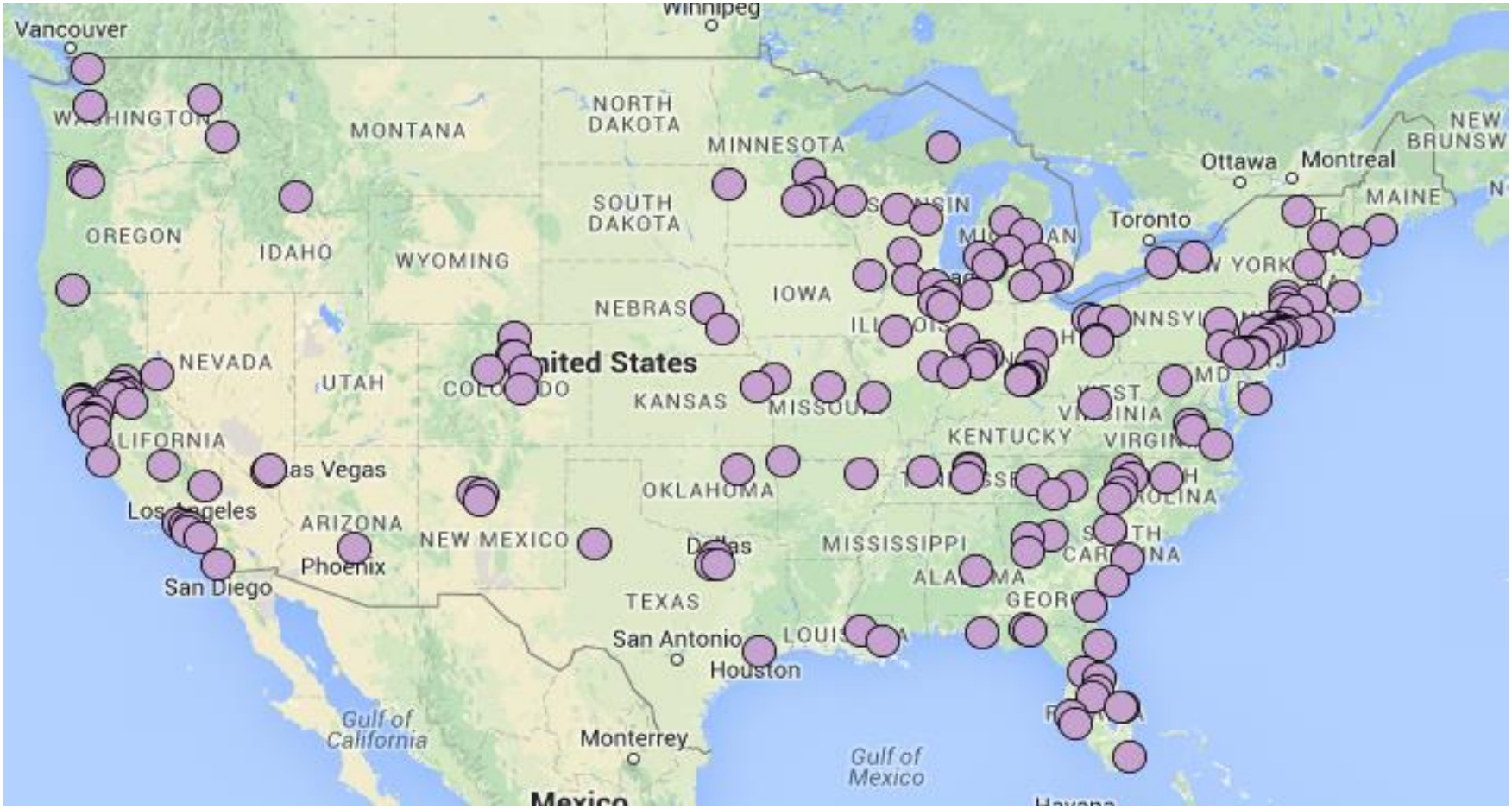
• On average, participants were:

(1) 61.6 years old
(2) Had Parkinson disease for 8.0 years
(3) Scored 26.5 on the Montreal Cognitive Assessment
(4) Had modified motor score of 22.8.
(5) Parkinson disease was most likely diagnosis in 97.0% of cases.

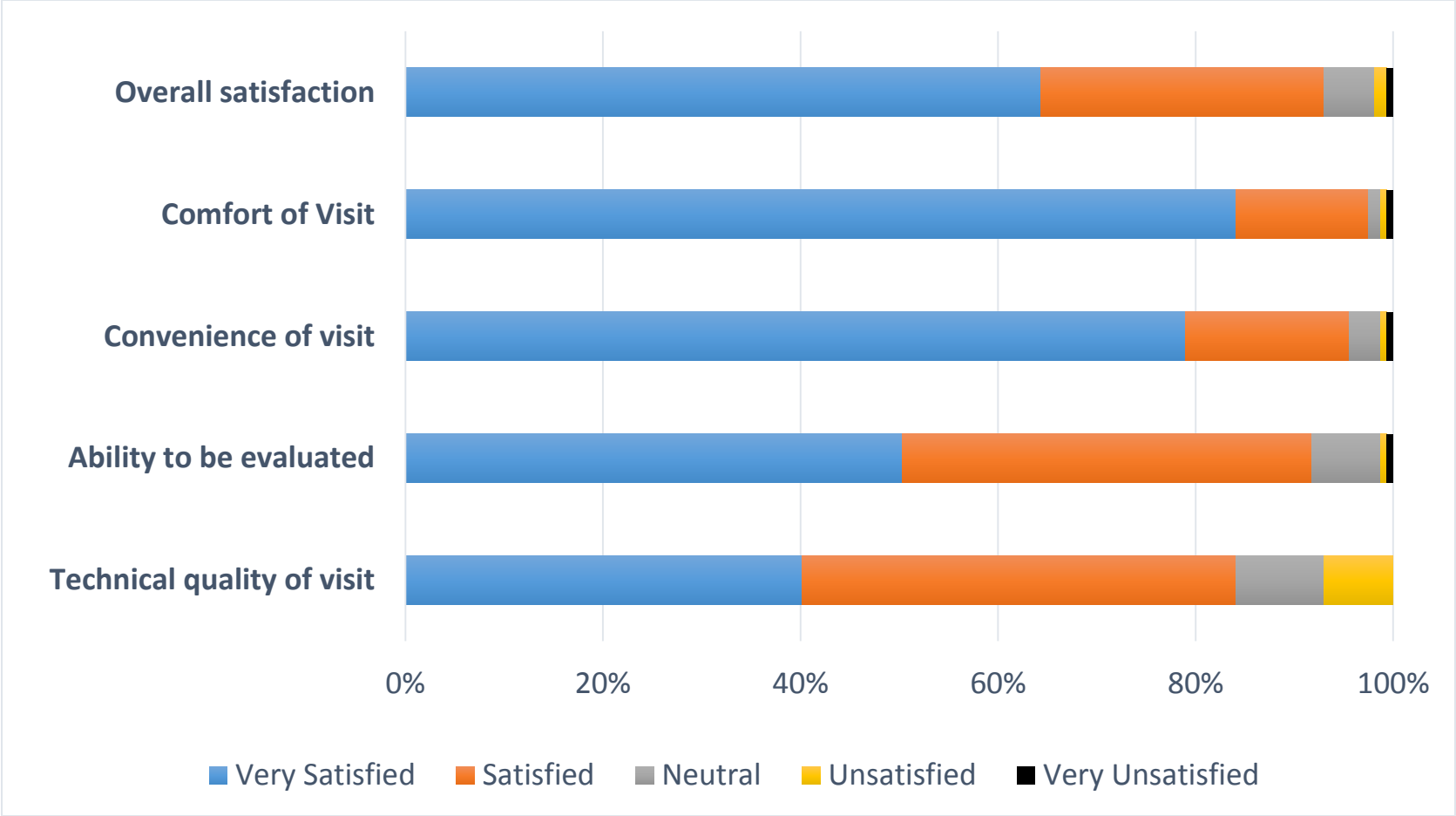
• Overall satisfaction with the visits was 79% (satisfied or very satisfied) among neurologists and 93% among participants.

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 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.

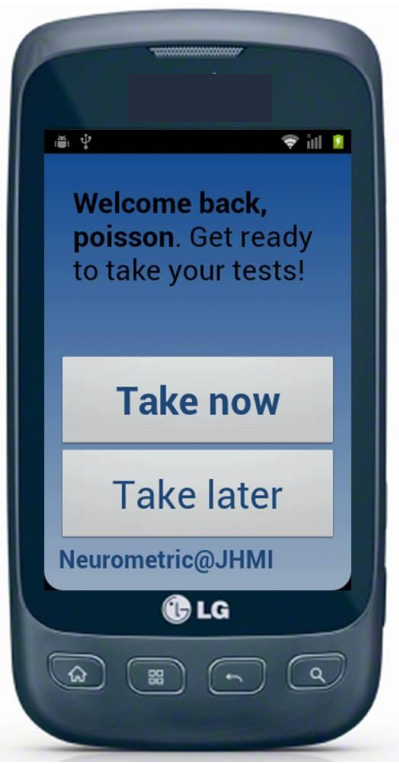
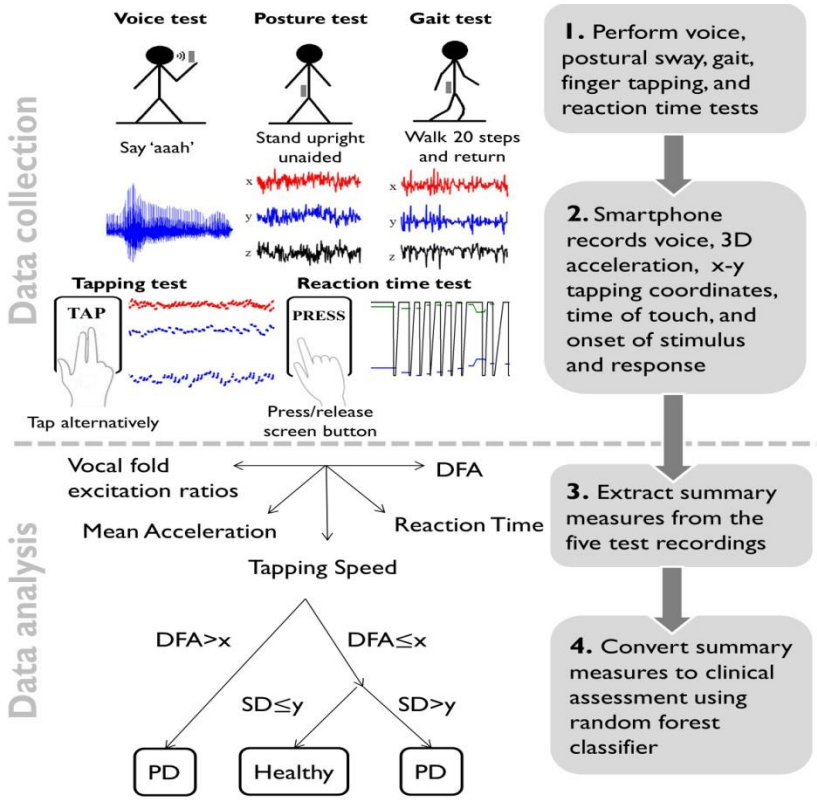


Figure 2. Procedure for collecting voice recordings (sustained vowel 'aaah'), finger tapping coordinates and the time of touch, acceleration time traces during gait, and postural sway tests along with the major steps in the data analysis.

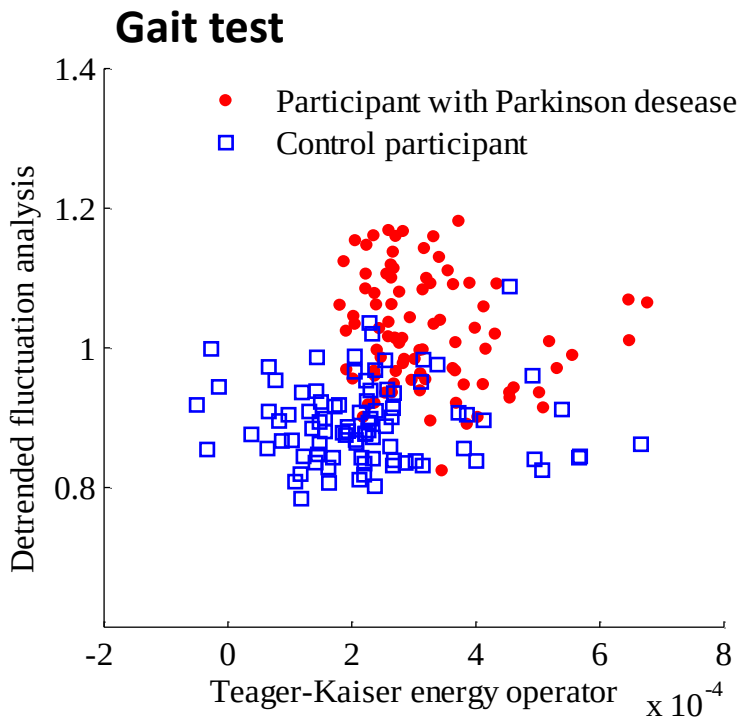


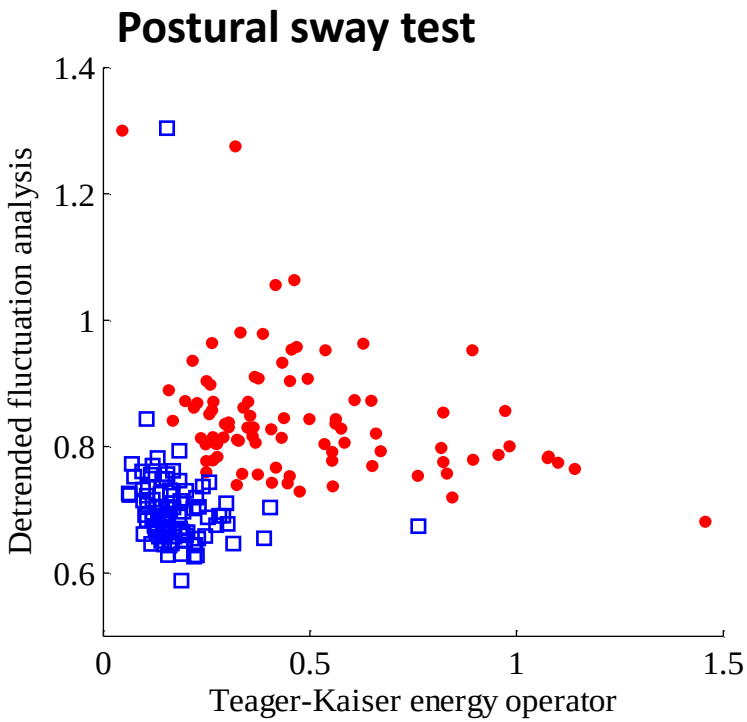
Abbreviations: 3D = three dimensional; DFA = detrended fluctuation analysis; PD = Parkinson disease; SD = standard deviation; TKEO = Teager-Kaiser energy operator

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

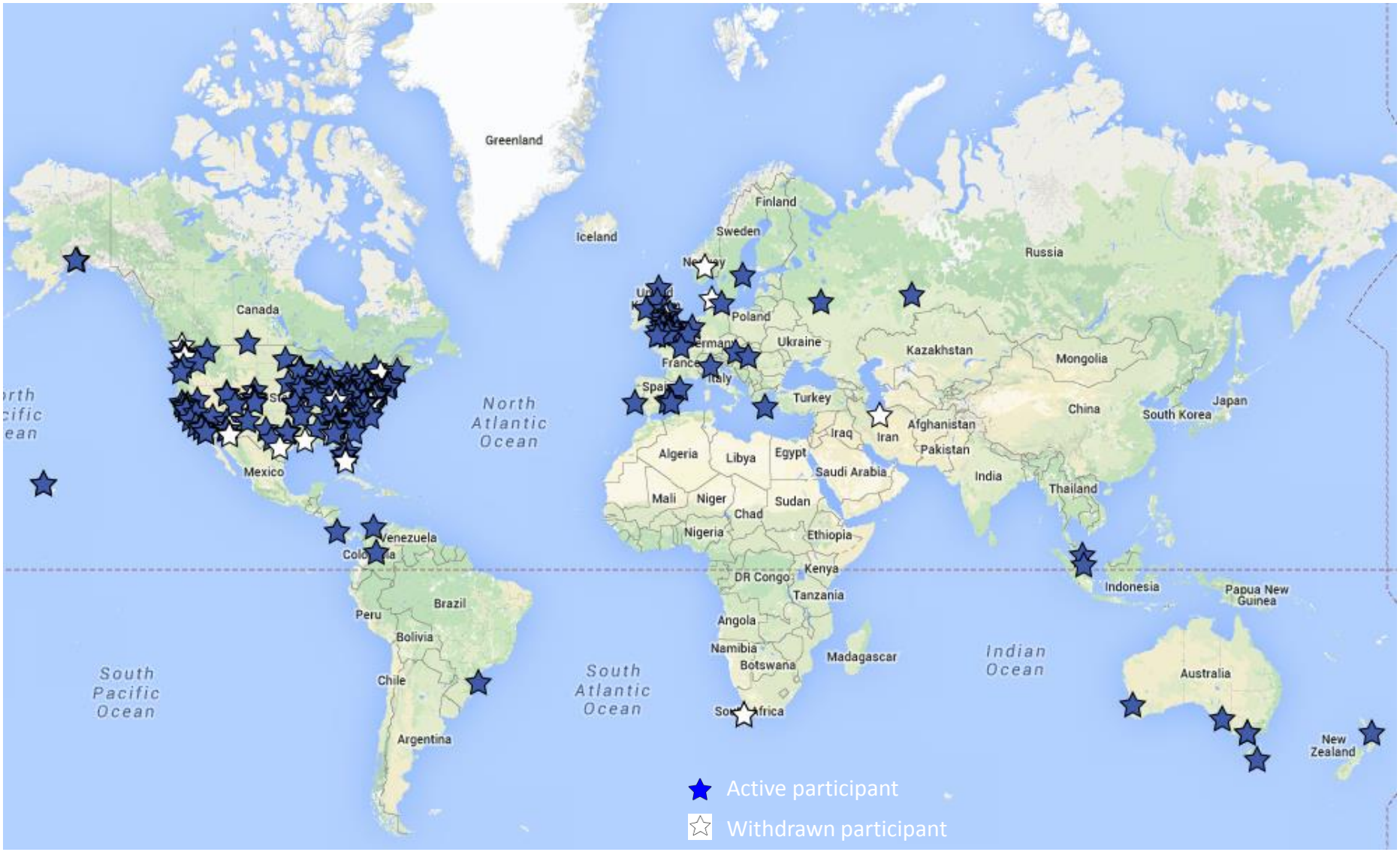




Source: Arora S, Venkataraman V, Donohue S, Biglan KM, Dorsey ER, Little MA. Using smartphones to diagnose Parkinson disease: a pilot study (under review)

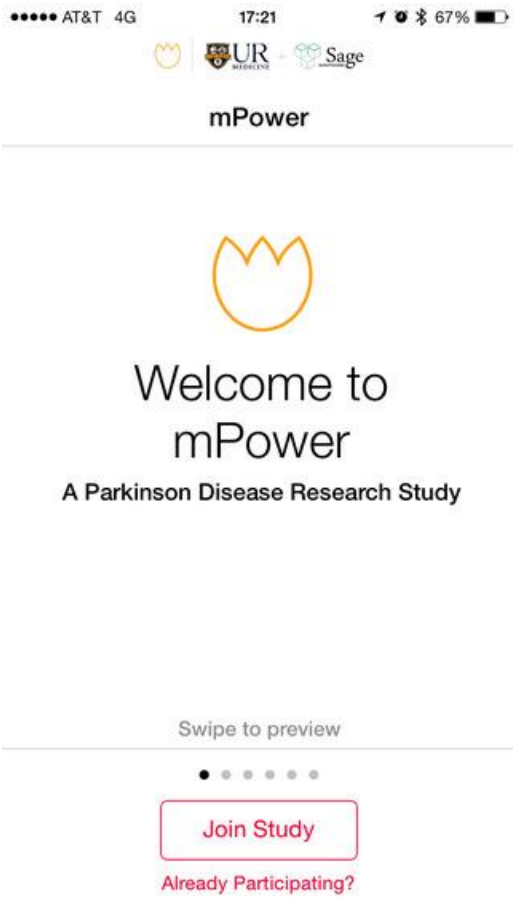
Smartphone-PD will enlist 2000 individuals to assess PD symptoms using an Android phone application

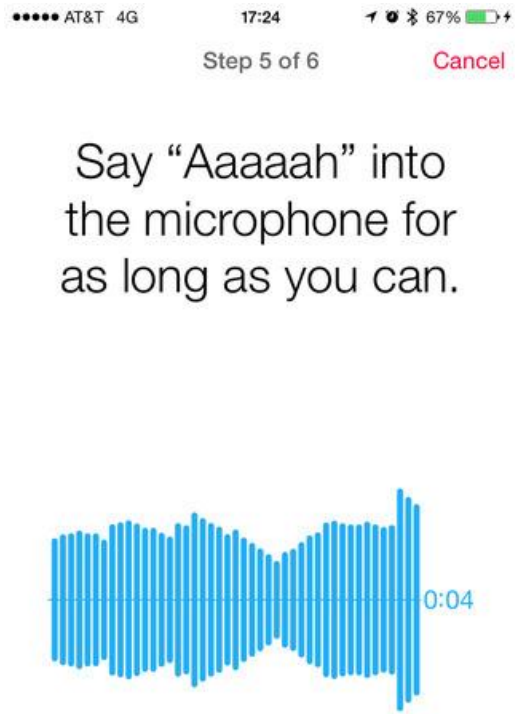
Map of current participant locations

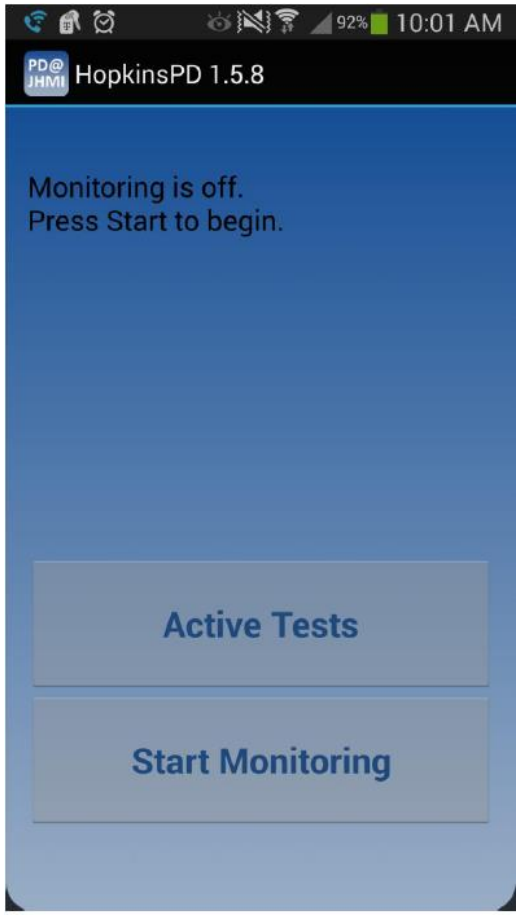


In addition, smartphones empower patients and researchers alike to better understand Parkinson disease

Using Android and Apple smartphones, researchers and patients now have the tools to measure and track symptoms of Parkinson disease







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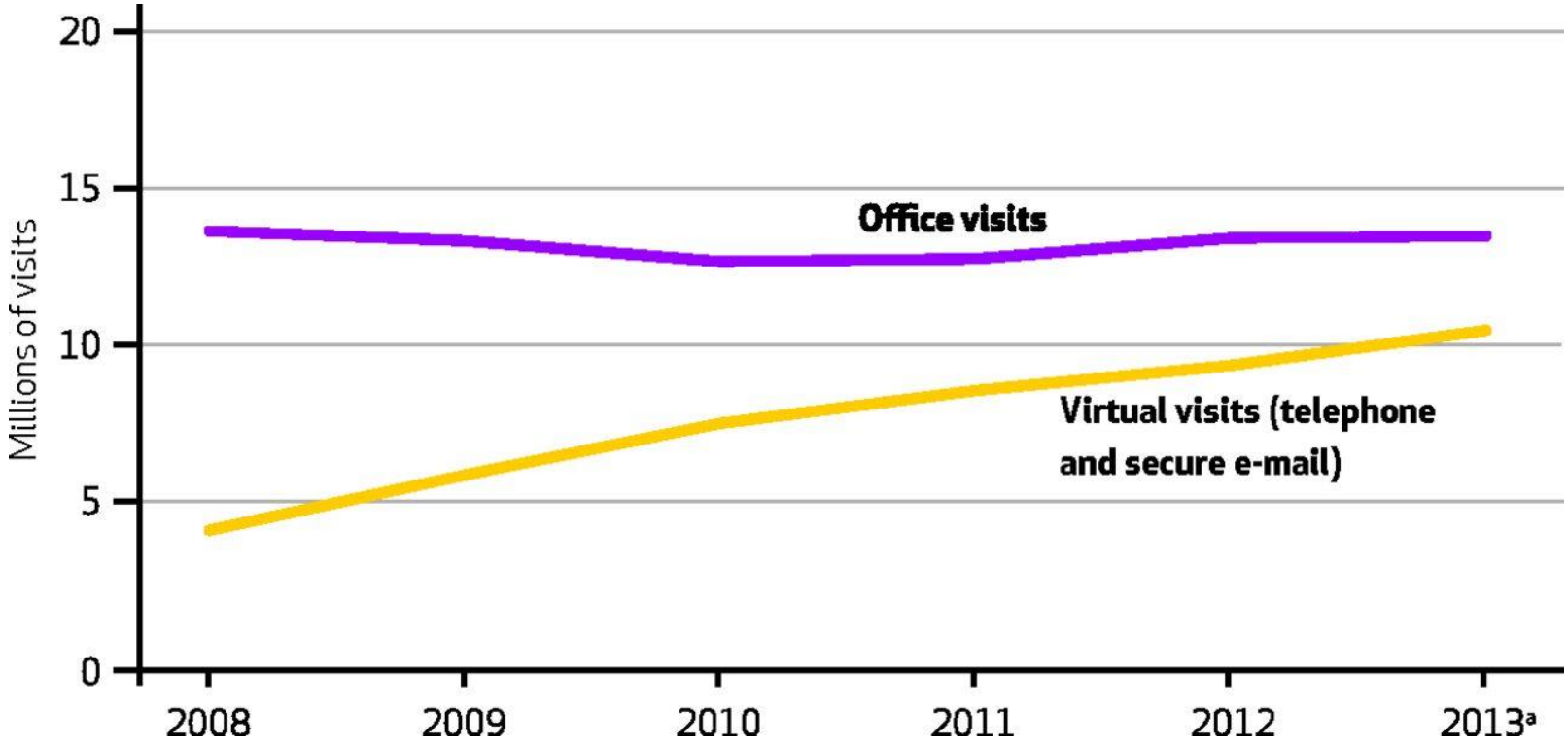
Technology will reshape the way we deliver care

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

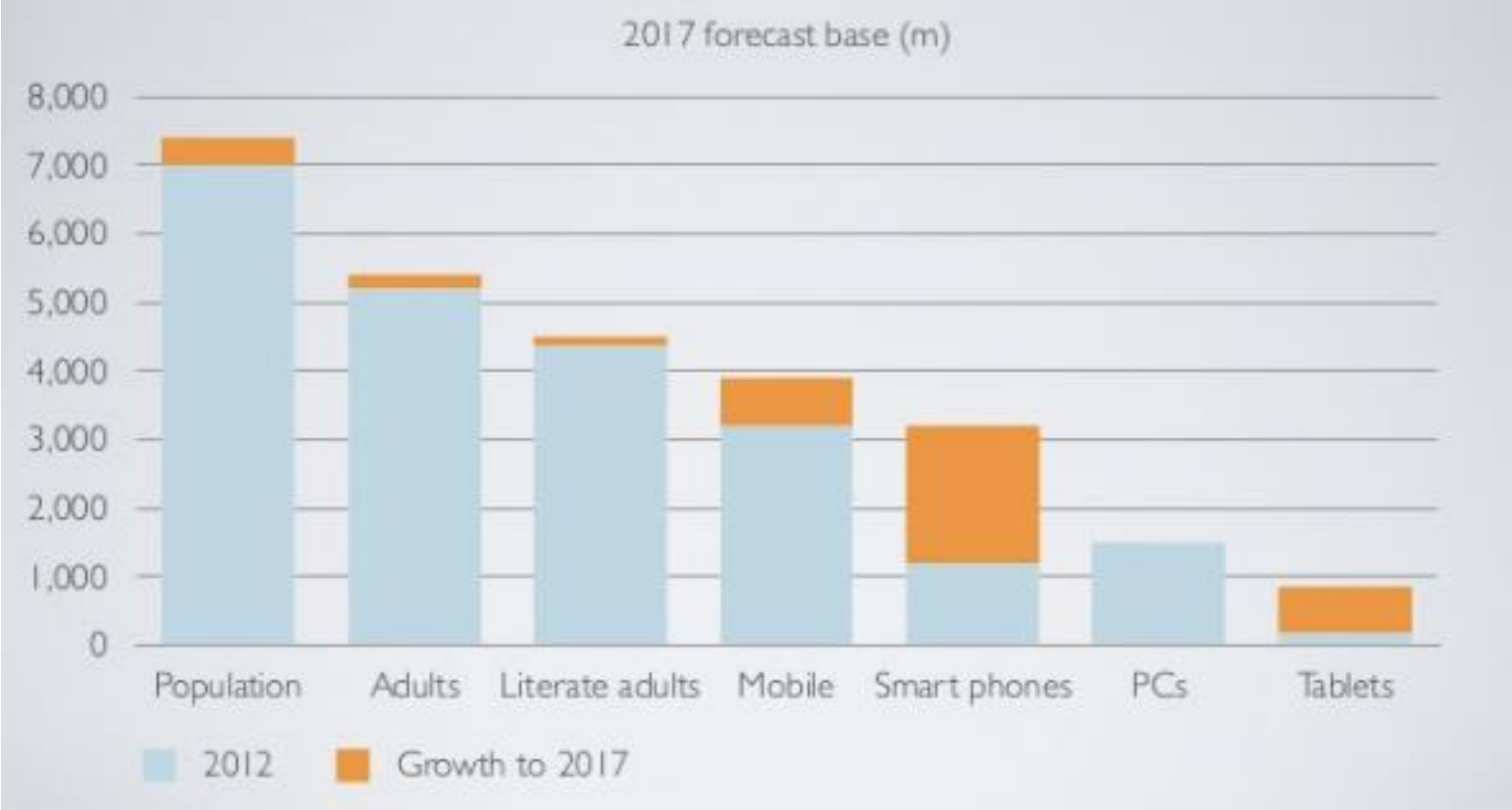
Dr. John Noseworthy

"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."

Source: Nisen M. Mayo Clinic has a radical plan to expand its reach across the world. Business Insider. February 13, 2013. Available at: http://www.businessinsider.com/mayo-clinic-ceo-future-of-healthcare-2013-2.

Technology will soon allow us to connect to almost anyone anywhere

The world in 2017



Source: Pramis J. By 2017 there will almost be as many smartphones as literate adults. Digital Trends. May 21, 2013. Read more: http://www.digitaltrends.com/mobile/2017-literate-adults-smartphones/#ixzz2d1dtkRDg

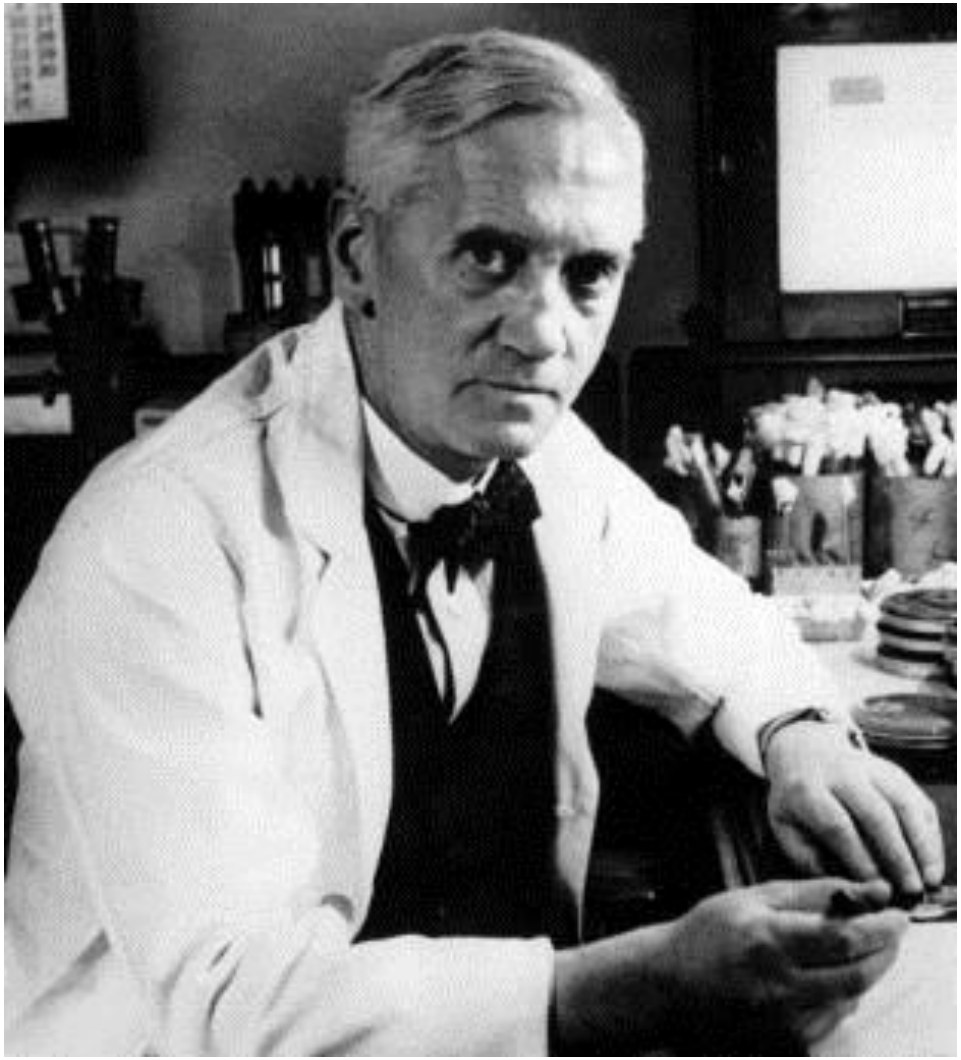
In 1796, Edward Jenner developed the small pox vaccine

18th Century: Prevent the Unpreventable

In 1895, Wilhelm Conrad Röntgen took the first X-ray: an image of his wife's hand

19th Century: See the Invisible

In 1928, Alexander Fleming discovered the first antibiotic



20th Century: Cure the Incurable

In 2007, Steve Jobs introduced the smartphone

Appendix

Barriers to the adoption of telemedicine can be resolved

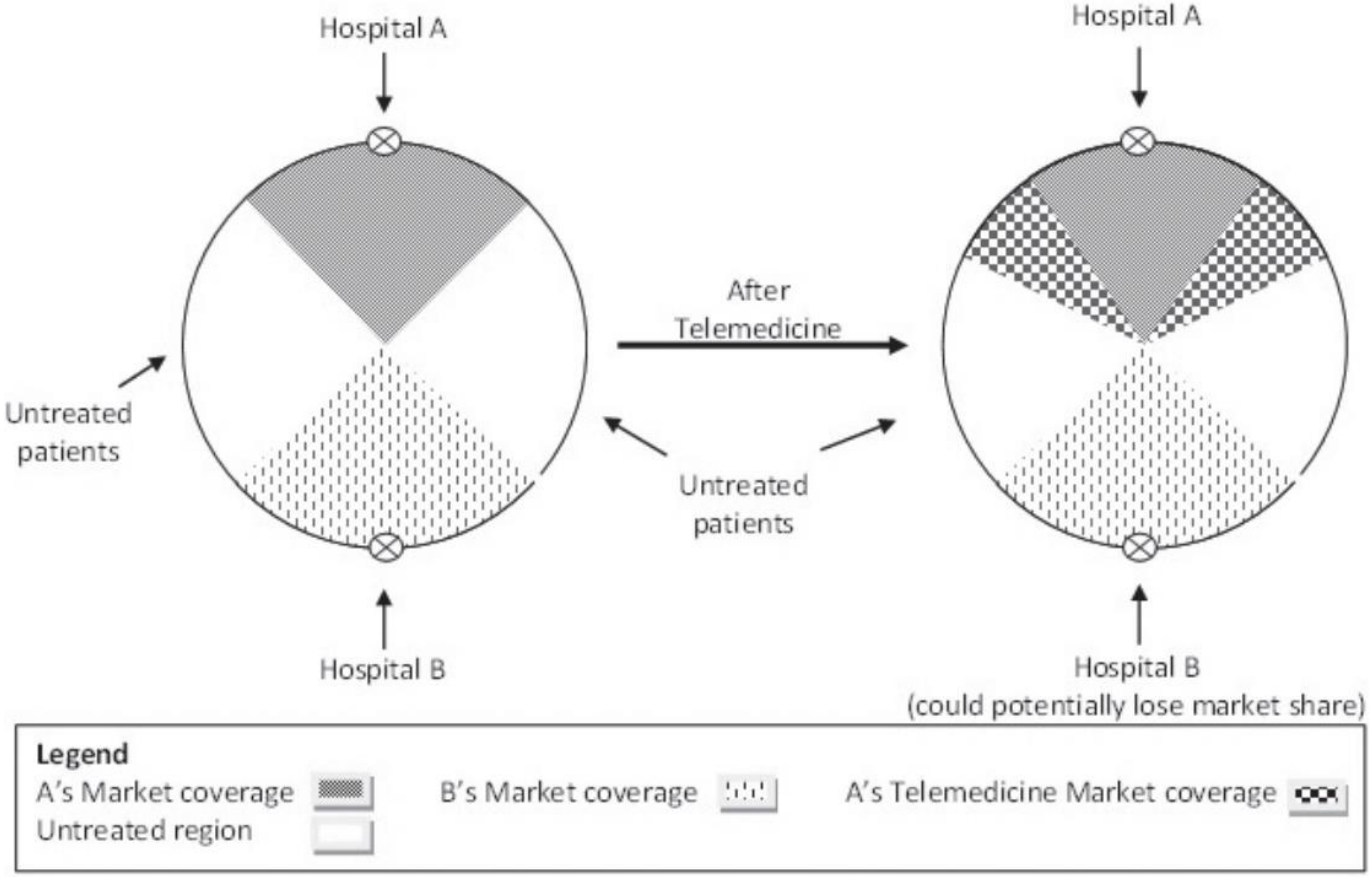
Major telemedicine barriers

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 an offer a new window into assessing and measuring symptoms

Source: http://www.ncsl.org/research/health/state-coverage-for-telehealth-services.aspx; http://www.fsmb.org/pdf/grpol_telemedicine_licensure.pdf; http://www.lexology.com/library/detail.aspx?g=a90e1cd6-8090-481b-90c0-7b19407a70a0

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

Source: Rajan B, Seidmann A, Dorsey ER. The Competitive Business Impact of Using Telemedicine for the Treatment of Patients with Chronic Conditions. *J Mange Inform Syst* 2013; **30**; 127-57.