AGING IN PLACE

Panel 3 - *Health transition trajectories: Data to action*
Jeff Kaye, Maureen Schmitter-Edgecomb,
Dan Siewiorek

OUTLINE

1. J. Kaye: Frameworks for Building Evidence for Technologies to Facilitate Independence
2. M. Schmitter-Edgecomb: Technologies to Support Independence Across the Continuum of Prevention for Cognitive Aging
3. D. Siewiorek: Technologies to Support Physical Health
4. Discussion

FRAMEWORKS FOR BUILDING EVIDENCE FOR TECHNOLOGIES THAT FACILITATE INDEPENDENCE

"This really is an innovative approach, but I'm afraid we can't consider it. It's never been done before."

Jeffrey Kaye, M.D.
Layton Professor of Neurology & Biomedical Engineering
Director, ORCATECH
Director, Layton Aging & Alzheimer's Disease Center
Oregon Health & Science University
Portland VA Medical Center

ORCATECH
SENSING LIFE KINETICS

OREGON HEALTH & SCIENCE UNIVERSITY
OHSU

Health Trajectory Framework

The use of particular technologies may be best framed by considering the point of application in the life or health course.
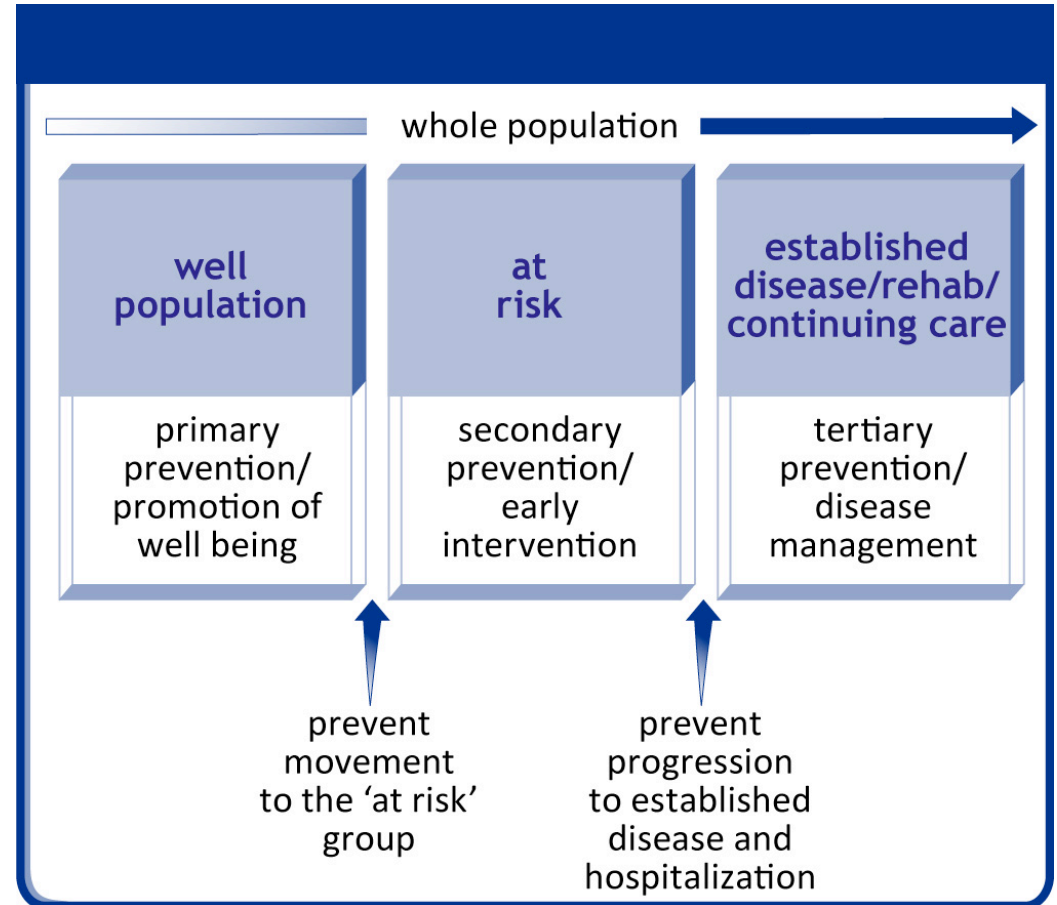

whole population

well population	at risk	established disease/rehab/ continuing care
primary prevention/ promotion of well being	secondary prevention/ early intervention	tertiary prevention/ disease management

prevent movement to the 'at risk' group

prevent progression to established disease and hospitalization

Figure adapted from: National Public Health Partnership, Preventing Chronic Disease: A Strategic Framework. (2006). Accessed May 26, 2010 at http://www.healthpromotion.act.gov.au/c/hp?

Research Trajectory (Process) Frameworks

UNDERSTAND THE STAKEHOLDERS/KEY QUESTIONS
ROI (Response Over Internet) surveys, Focus Groups
Participant/End-User Assessment

☎	☐ I only use a landline phone. I do *not* use a cell phone.
☎ 📱	☐ I use my landline often, but have a cell phone for emergencies.
☎ 📱	☐ I use both a landline phone and a cell phone, depending on which one is more convenient.
☎ 📱	☐ I use my cell phone most of the time, even at home, but I still have a landline that I use occasionally.
📱	☐ I don't have a landline phone, I *just* use a cell phone.

UNDERSTAND REAL WORLD USE
Life Lab: Large Scale Deployments Relevant Health
& Wellness Measures & Interventions in Everyday
Environments

Secure Internet
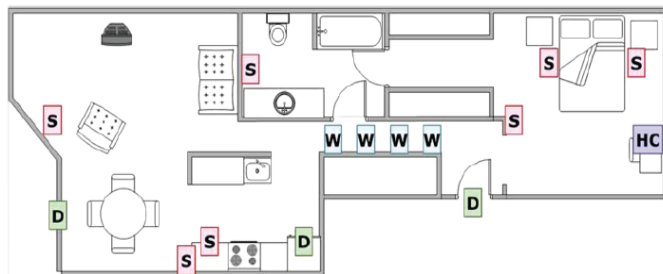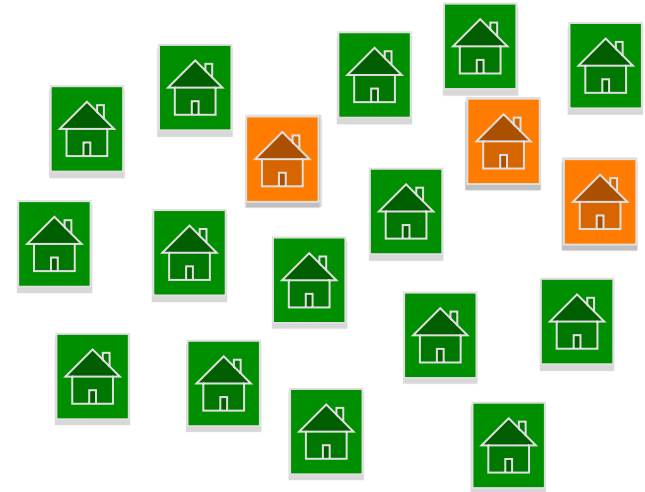
UNDERSTAND THE DATA
ORCATECH Data Repository, Data Aggregation,
Measurement Analytics & Outcomes
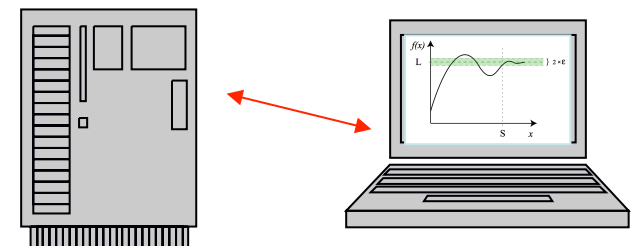
UNDERSTAND THE TECHNOLOGIES
Point of Care 'Smart Apartment' Lab:
Focused Sensor/Measurement Technology Development & Assessment

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Technology Trajectory Framework

1956

2006
(c)2007 Andrew Hall, PortlandBridges.com

Gartner Hype Cycle

expectations

2013

Consumer 3D Printing
Gamification
Big Data — Wearable User Interfaces
Natural-Language Question Answering — Complex-Event Processing
Internet of Things — Content Analytics
Speech-to-Speech Translation
Mobile Robots — In-Memory Database Management Systems
3D Scanners — Virtual Assistants
Neurobusiness
Biochips
Autonomous Vehicles

Prescriptive Analytics — Augmented Reality — Predictive Analytics
Affective Computing — Machine-to-Machine Communication Services — Speech Recognition
Electrovibration — Mobile Health Monitoring — Location Intelligence
Volumetric and Holographic Displays — NFC — Consumer Telematics
Human Augmentation — Mesh Networks: Sensor — Biometric Authentication Methods
Brain-Computer Interface
3D Bioprinting — Cloud Computing
Quantified Self — Enterprise 3D Printing
Quantum Computing — Activity Streams — Gesture Control
In-Memory Analytics
Smart Dust — Virtual Reality
Bioacoustic Sensing

As of July 2013

| Innovation Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity |

time

Plateau will be reached in:
○ less than 2 years ● 2 to 5 years ● 5 to 10 years ▲ more than 10 years
obsolete ⊗ before plateau
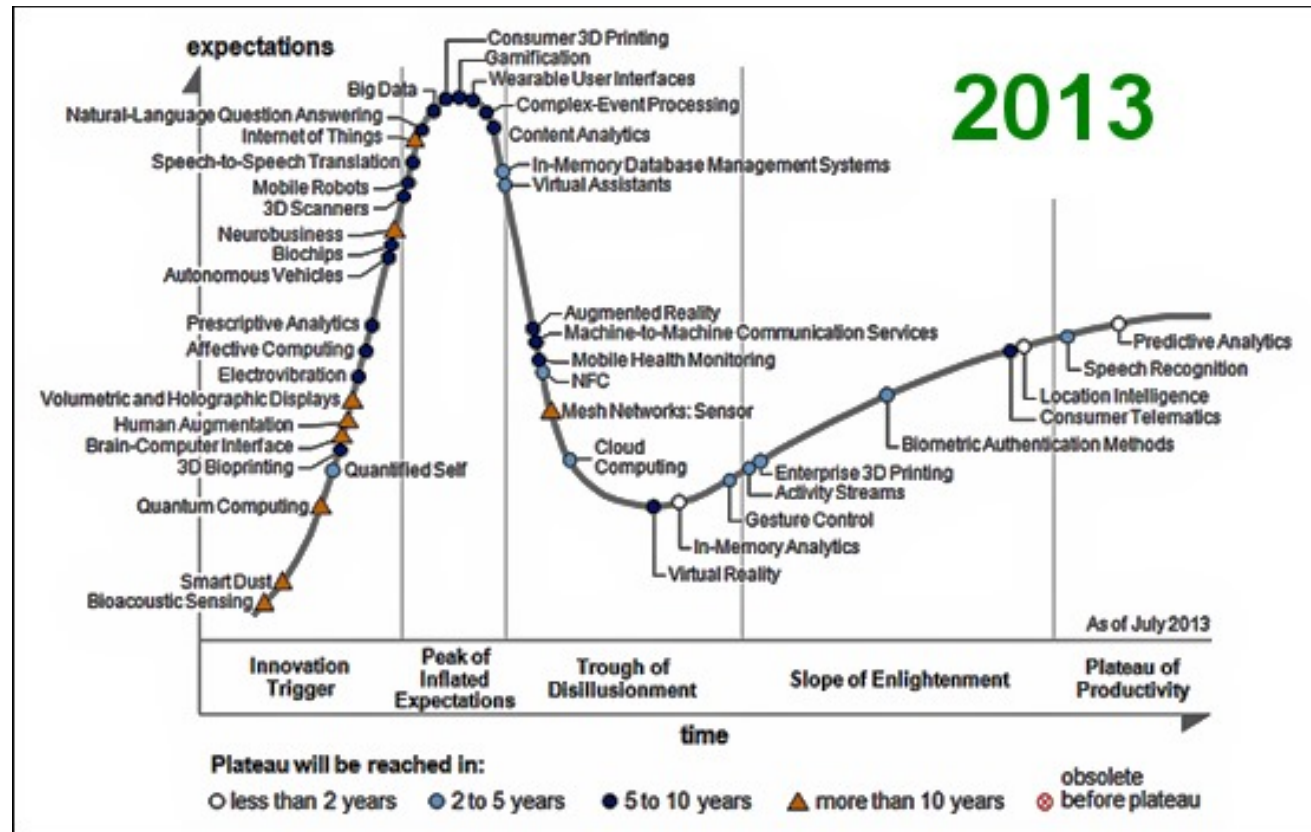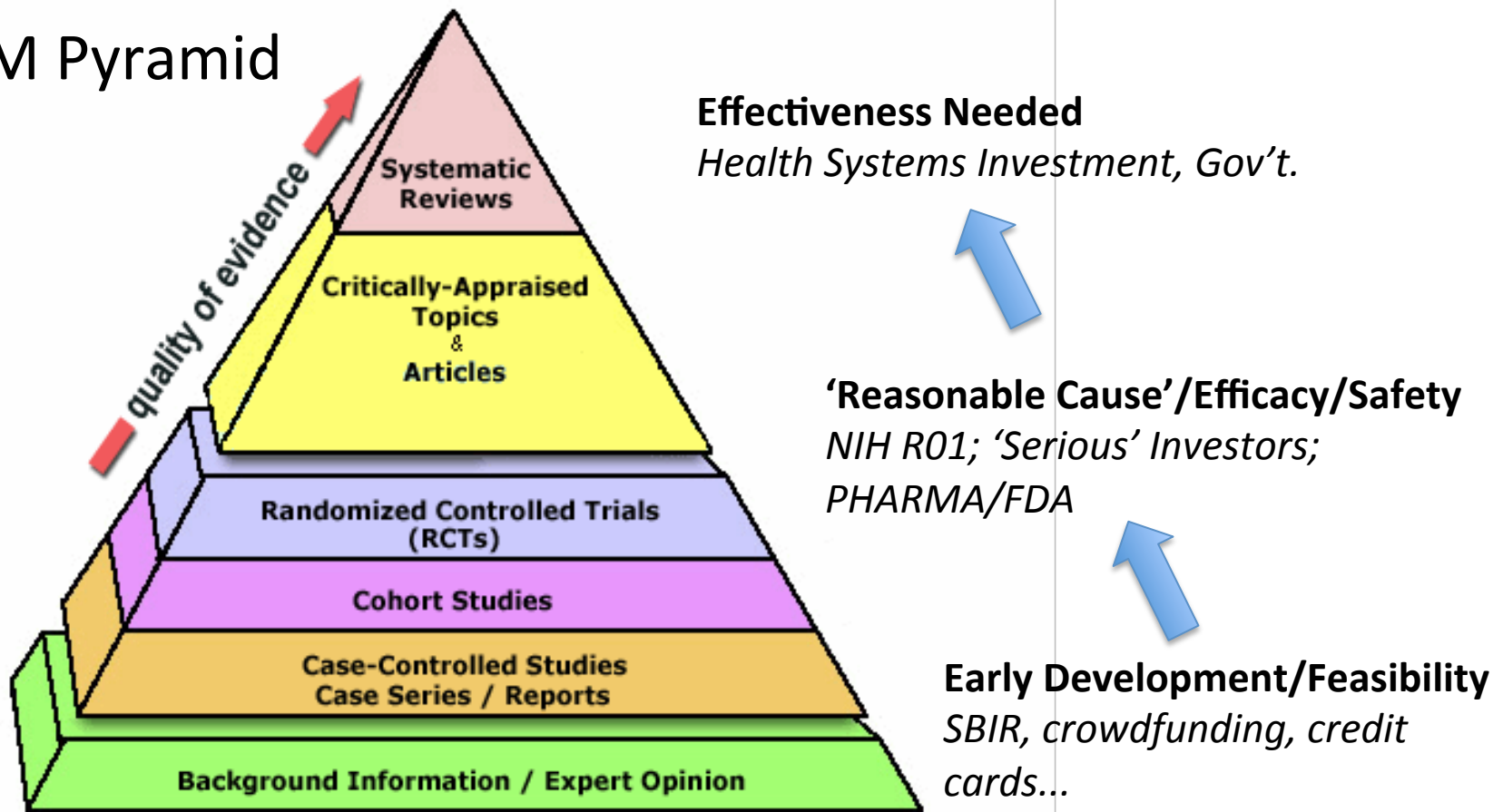
Evidence Trajectory: Setting a research agenda
What evidence is necessary? - The right evidence for the right time

EBM Pyramid

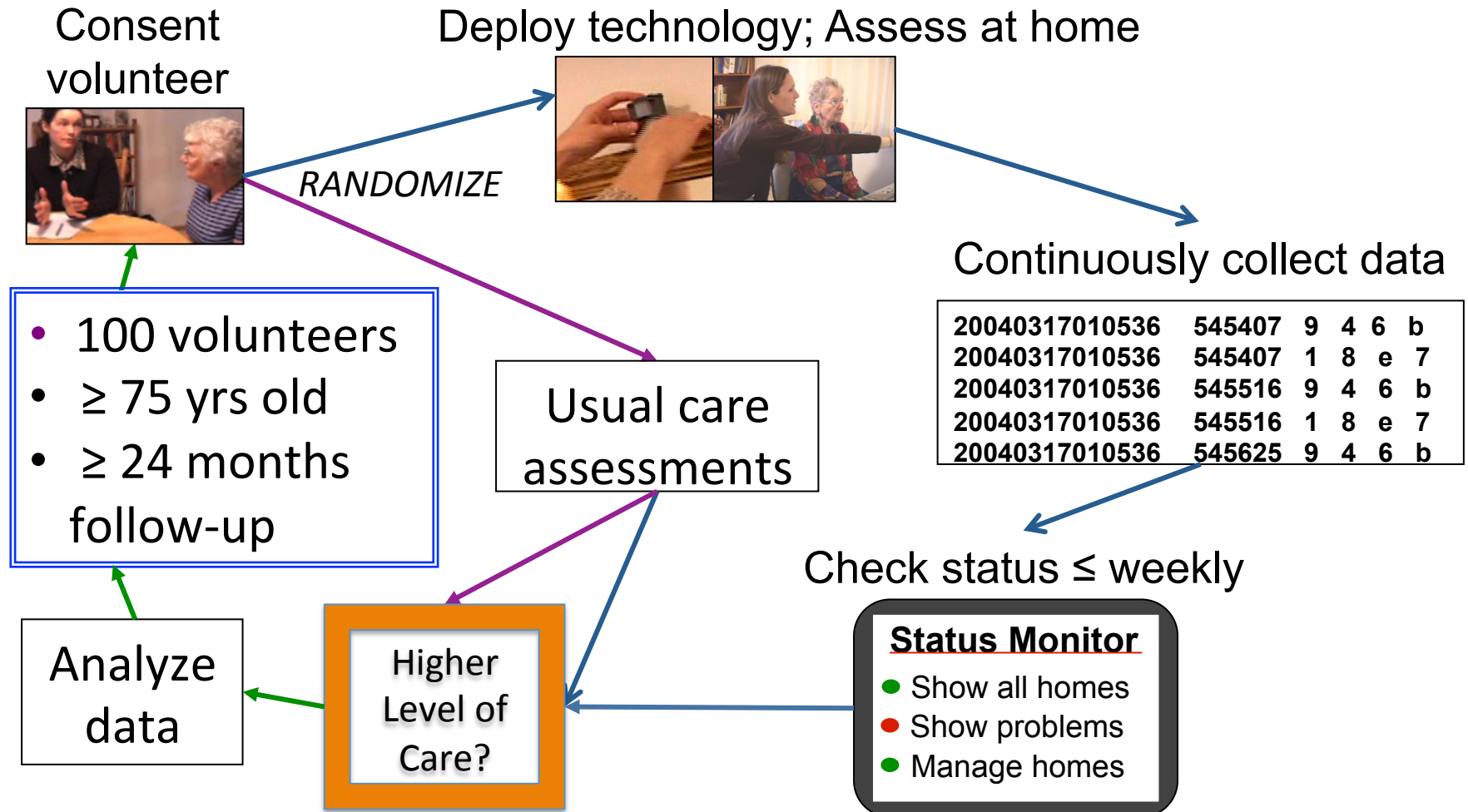**Effectiveness Needed**
Health Systems Investment, Gov't.

'Reasonable Cause'/Efficacy/Safety
NIH R01; 'Serious' Investors; PHARMA/FDA

Early Development/Feasibility
SBIR, crowdfunding, credit cards...

Example: 1^0 Prevention

Target - Utility of Technology in Preventing Transition

AIMS: RCT of sensed data to decrease care transitions

Consent volunteer

RANDOMIZE
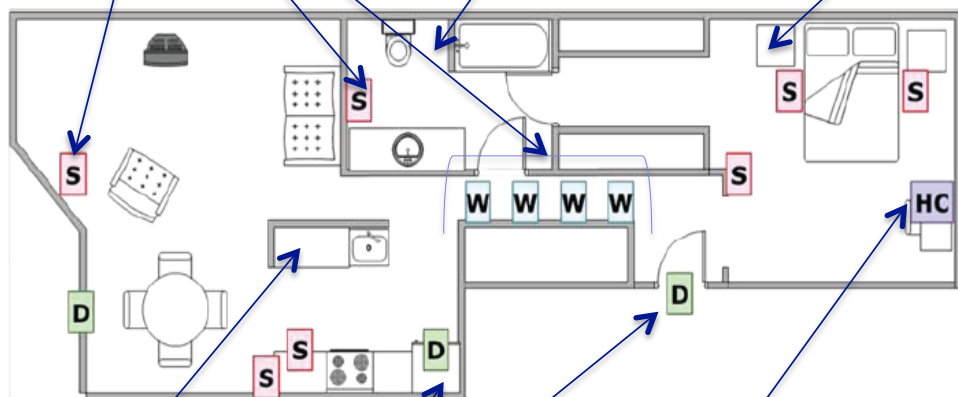
Deploy technology; Assess at home

Continuously collect data

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20040317010536	545516	9	4	6	b
20040317010536	545516	1	8	e	7
20040317010536	545625	9	4	6	b

- 100 volunteers
- ≥ 75 yrs old
- ≥ 24 months follow-up

Usual care assessments

Check status ≤ weekly

Status Monitor
- Show all homes
- Show problems
- Manage homes

Analyze data

Higher Level of Care?

AIMS Home-Based Assessments

Activity, Sleep, Mobility Time & Location

Body Composition Heart Rate, Temperature, CO_2

MedTracker

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M T W

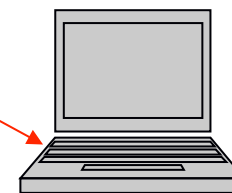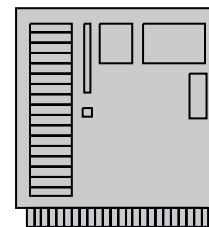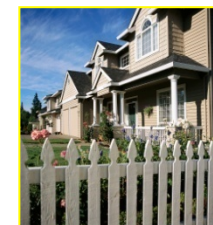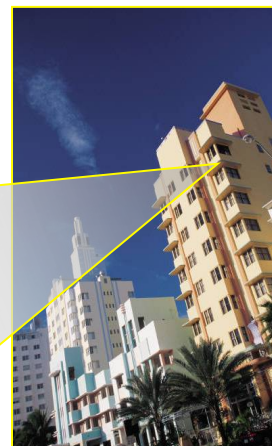S S S S S

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HC

D D D S S

Secure Internet

Phone Activity

Doors Opening/ Closing

Computer Activity

Charting a Research Agenda - Some Issues to Consider

- o Population:
  - Early Adopters (computer users)?
  - Diversity (cell use and low SES)?
  - 'Caregiving' Community (professional, family, none)?
- o The comparator condition(s) or control:
  - Technology without intervention?
  - Blinding?
  - Refusers?
- o Technologies:
  - What are the optimal sensed inputs (in this trial focus on established technologies, functional measures, informed by caring ecosystem)?

Example: 2^0 Prevention
Target: Feasibility and Acceptance of a Home Telepresence Robot

Device/technology characteristics:
- Appearance
- Efficiency
- Ease of use
- Reliability
- Control

User traits:
- Changes in vision, hearing, cognition
- Mobility issue
- Age, gender, education
- Previous experiences/ exposure to technology

Seelye, et al. 2012 Telemedicine & e-Health

Original Research

Reactions to a Remote-Controlled Video-Communication Robot in Seniors' Homes: A Pilot Study of Feasibility and Acceptance

VGo Applications

< >

Patient Monitoring

Finite expert healthcare staff instantly interacts with patients and move around as if they were there in person.

Read More...

Remote Student

Students with extended illness, injuries, disabilities and immune deficiencies attend school without leaving home.

Read More...

Remote Visiting

Visit with extended stay hospital patients and elderly in nursing homes or assisted living communities.

Read More...

capability in independently living, cogniti
Materials and Methods: A mobile remote
video-communication ability was placed i
and preferences of thes
ho communicated with them remotely via the

^aParticipant who progressed to mild cognitive impairment.

cially assistive robots[14,15] are examples of smart environment as-

Charting a Research Agenda – Some Issues to Consider

o Importance of collaborating with industry - *where technologies are developed into products and services*

o Rules of engagement - best approaches and practices for these collaborations

Example: 2^0 Prevention
Target: Feasibility Social Engagement RCT for MCI

Video Chat

- 83 MCI or Normal randomized to video chat or control group
- 6 week tx period consisting of daily 30 min video chats
- 89% of all possible sessions completed; Exceptional adherence – *no drop-out*
- Intervention group improved on executive/fluency compared to controls.
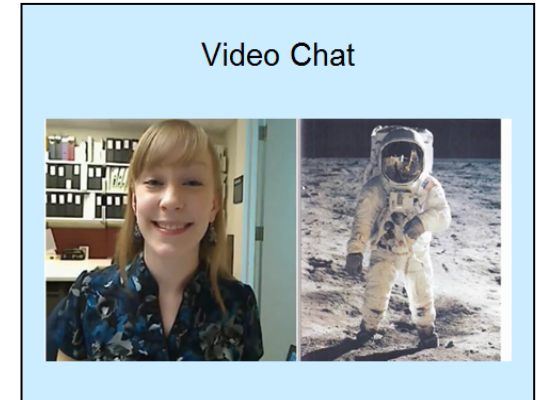
- MCI participants spoke 2985 words on average while intact spoke 2423 words during sessions.
- This measure discriminated MCI from cognitively intact subjects better than the traditional cognitive tests of Fluency and CERAD Delayed Recall.

H. Dodge, PI

Charting a Research Agenda – Some Issues to Consider

o Disrupting conventional wisdom and standards
- "Older persons won't do a video chat every day"
- "It must be expensive…"
- Automated measures may be *better*…

Example: 3⁰ Prevention
Target: Systematic Review of Telecare Effectiveness

Susannah McLean*, Aziz Sheikh, Kathrin Cresswell, Ulugbek Nurmatov, Mome Mukherjee, Akiko Hemmi, Claudia Pagliari

eHealth Research Group, Centre for Population Health Sciences, The University of Edinburgh, Edinburgh, United Kingdom

Abstract

Background: Telehealthcare involves the use of information and communication technologies to deliver healthcare at a distance and to support patient self-management through remote monitoring and personalised feedback. It is timely to scrutinise the evidence regarding the benefits, risks and costs of telehealthcare.

...studies showed no differences in outcomes between telehealthcare and usual care. ...reviews highlighted the large number of short-term (< 12 months) feasibility studies with under 20 participants. ...reported clinical effectiveness of telehealthcare interventions for patients with long-term conditions appeared to be greatest in those with more severe disease at high-risk of hospitalisation and death.

adequately describe the intervention makes it difficult to disentangle the contributions of technological and human/organisational factors on the outcomes reported. Evidence on the cost-effectiveness of telehealthcare remains sparse. Patient safety considerations were absent from the evaluative telehealthcare literature.

RCT 'Class 1' Evidence... *Whole System Demonstrator*

Crude (unadjusted) trends in emergency hospital admissions

- Assessed telehealth and telecare over 1 year (6,191 patients in 238 GP practices)

- Telehealth RCT (> 3,000 patients with COPD, DM or HF): significant reduction in deaths with telehealth; ED visits, elective admissions and costs NS.

- Telecare RCT (> 2,400 patients with social care needs): No reduction in health or social care use.

- Economic evaluation of telehealth RCT. Costs and outcomes were measured: telehealth not cost-effective at the scale implemented

- Cost: $51,391,800; four years

http://www.fastuk.org/research/projview.php?id=1436
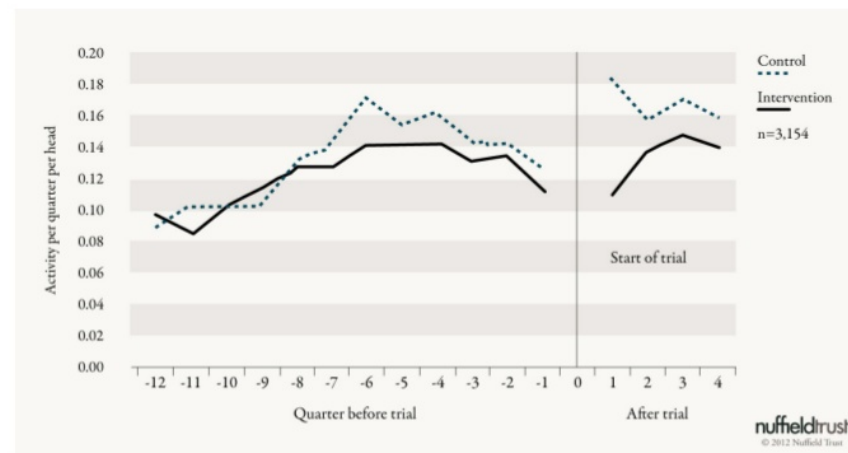
Charting a Research Agenda -
Health transition trajectories: Data to action

KEY QUESTIONS:
1. What are the top opportunities using technology among Primary, Secondary and Tertiary Preventions to ensure AiP?
2. What technologies across the spectrum may best facilitate AiP?
3. What are the levels of evidence and/or confidence that a system is effective and then scalable and generalizable?
4. What resources are needed to achieve the answers to these questions?
5. What are the timelines for reaching the answers to these questions?

NOISE TO SIGNAL
Rob Cottingham
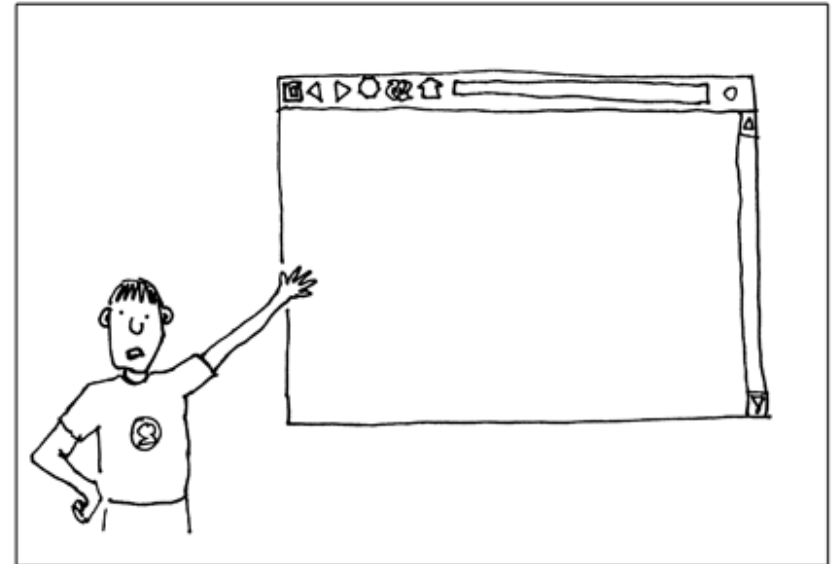
We still need to flesh out the concept, interface, content, feature set, information architecture, use cases and business model, but there's your wireframe. That'll be $38,000.

Thank You!

Many a calm river begins as a turbulent waterfall, yet none hurtles and foams all the way to the sea.

- Mikhail Lermontov

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Technology Attuned to Trajectories of Change

Technology/Services Sophistication/Complexity

End-to-End TeleCare
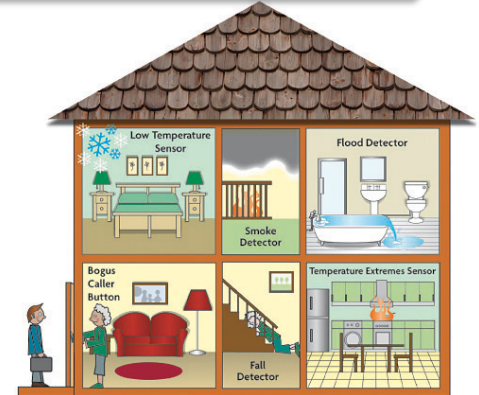
Integrated Wellness Promotion Program

Robot Assistant

Basic Telemedicine

PERS

Fitness/Lifestyle Apps

Healthy/Worried Well   At Risk/Mild Impairment   Chronic Disease

1^0 Prevention 2^0 Prevention 3^0 Prevention