NIH and mHealth

Wendy Nilsen, PhD
Office of Behavioral and Social Sciences Research
National Institutes of Health
The NIH Mission:

… science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability.
NIH Overview

- 27 Institutes and Centers (ICs)
- $31.2 billion in FY2010
- 80% of funds for grants and contracts supporting extramural research
Office of Behavioral and Social Sciences Research (OBSSR) Mission

...to stimulate behavioral and social science research throughout NIH and to integrate these areas of research more fully into others of the NIH health research enterprise, thereby improving our understanding, treatment, and prevention of disease.
What is mHealth?

- Diverse application of wireless and mobile technologies designed to improve health research, health care services and health outcomes
- **NOT JUST CELL PHONES**
Includes any wireless device carried by or on the person that is accepting or transmitting health data/information

• Sensors (e.g., implantable miniature sensors and “nanosensors”)

• Monitors (e.g., wireless accelerometers, blood pressure & glucose monitors)

• Mobile phones
Beyond Telemedicine

- **Portable**: Beyond POC Diagnostics
- **Scalable**: Economical to scale
- **Richer data input**: Continuous data sampling
- **Personal**: Patient can receive & input information
- **Real-time**: Data collection and feedback is in real-time using automated analyses and responses
Do it right or lose them

I think we can safely assume the promise of apps radically revolutionizing our health is heavily inflated. So, then, what good are health apps? Health apps are the equivalent of old school public health advertising. Just as I see an ad when I get on the subway telling me this soft drink has 40 packets of sugar, I whip out my iPhone and see the Livestrong app on my homescreen reminding me that I need to eat well. I don’t really want to use it because it’s such a drag.”

Jay Parkinson of Future Well, 2011
Leveraging the Ubiquity of Wireless
Moving “Hype” to Productivity

mHealth Hype Cycle

- Peak of Inflated Expectations
- Plateau of Productivity
- Slope of Enlightenment
- Trough of Disillusionment

Technology Trigger

TIME
Continuum of mHealth tools

**Measurement**
- Sensor sampling in real time
- Integration with health data

**Diagnostic**
- POC Diagnostics
- Portable imaging
- Biomarker sensing
- Clinical decision making

**Treatment**
- Chronic disease management
- Remote Clinical trials
- Disaster support/care

**Global**
- Service Access
- Remote treatment
- Dissemination of health information
- Disease surveillance
- Medication tracking and safety
- Prevention and wellness interventions
Measurement and Assessment
Implantable Biosensors

- **Problem:** Measurement of analytes (glucose, lactate O2 and CO2) that indicate metabolic abnormalities
- **Solution:** Miniaturized wireless implantable biosensor that continuously monitors metabolism
  - Inserted by needle subcutaneously
  - Operated remotely using a cell phone
  - Multi-analyte sensor
  - One month continuous monitoring

Diane J. Burgess, University of Connecticut
NHLBI, R21HL090458
Wearable Chemical Sensor System

**Problem:** Chemical exposure varies by context, need personal exposure

**Solution:** Selective detection of VOCs (hydrocarbon and acid vapors)
- Sensitive: ppb – ppm
- Real-time: sec. – min.
- Spatially resolved
- Wearable: cell phone size
- Cell phone based interface

http://www.airnow.gov

Nongjian Tao, Arizona State University, NIEHS, U01 ES016064
Problem: Detection of salivary stress hormones in real-time is expensive and not practical in clinical settings.

Solution: Develop wireless salivary biosensors
- Salivary α-amylase biosensor
- Salivary cortisol biosensor

Vivek Shetty, DDS, UCLA, NIDA U01DA023815
Population Scale Activity Measures

- **Problem:** Population-scale measurement of physical activity
- **Solution:** Miniature, low-cost devices that measure human motion using redesigned accelerometers in a user-friendly format

Stephen Intille, PhD, Northeastern University
NHLBI, U01HL091737
High Throughput Exposomics

NIH Genes, Environment and Health Initiative
Exposure Biology Program

Genes, Environment and Health Initiative: The Vision

EXPOSURE BIOLOGY PROGRAM
- Develop technology and biomarkers
  - Diet
  - Physical Activity
  - Environmental Exposures
  - Psychosocial Stress and Addictive Substances

GENETICS PROGRAM
- Identify genetic variants
  - GWA Studies
  - Data Analysis
  - Replication
  - Sequencing
  - Database
  - Function
  - Translation

GxE
Together these lead to whether disease occurs or health is promoted...

Kevin Patrick, UCSD, NCI U01 CA130771
Diagnostics
LUCAS- Mobile Microscope

**Problem:** Create a low-cost quality microscope to use in low resources settings.

**Solution:** A specially-developed lens fits to a cell phone to create a microscope

**Field testing:** Malawi, Mozambique and Brazil

LUCAS images of CD4+ and CD8+ T cells compared to a regular microscope image

Karin Nielsen, UCLA, FIC, R24TW008811
High-resolution fiber-optic microendoscope

- **Problem:** Methods to detect cancer from traditional biopsies are invasive for patients and require lab facilities.
- **Solution:** A scientific charge-coupled device camera and a laptop computer for under $4,000 (clinical trials in China, Botswana, Guatemala)
Treatment
Body Sensor Networks

**Problem:** Overweight and Obesity among urban, minority youth

**Solution:** KNOWME networks personalized tracking & feedback in Real-Time

- Immediate access to data allows nimble reactions to events, environments, & behavior
- User interface for health professionals, children & families
- User initiated data (SMS, speech notes, images/videos)
- Real-time, personalized, adaptive interventions to correct energy balance

Donna Spruijt-Metz, PHD, USC, NSF
Chronic Disease Management

- **Problem:** Chronic diseases are difficult and expensive to manage within traditional healthcare settings
- **Solution:** CHESS: Disease self-management programs for asthma, alcohol dependence and lung cancer
- Information provided the user needs it
- Intervene remotely with greater frequency than traditional care
  - Real-time management
  - More efficient triage
  - Reduces acute care

David Gustafson, University of Wisconsin, NIAAA R01 AA 017192-04
Cardiac Disease Management

**Problem:** Patients with CVD have symptoms that frequently bring them to emergency care where there is limited baseline data

**Solution:** Remote monitoring to create physiological cardiac activity “fingerprints” that alert professionals and patient when there are irregularities based on their own cardiac patterns

Vladimir Shusterman, PinMed, NHLBI, R43-44 HL0771160, R41HL093953
Wireless Pain Prevention Program

• **Problem:** Treatment of pain and quality of life improvement for youths with Sickle Cell Disease

• **Solution:** Wireless Pain Prevention Program
  - Cell phone with e-Ouch software (support and information for pain in real-time)
  - Web link connecting to educational materials, a psychologist, and a nurse practitioner
  - Peer social support network through cell phone

_Eufemia Jacob, UCLA, NHLBI, RC1HL100301_
Remote Clinical Trials

You’ve seen the signs. Now find out why.

Do you have Overactive Bladder (OAB)?

Find yourself rushing to the bathroom?

Wishing you could get there on time?

You may be eligible to participate in a 16-week clinical research study sponsored by Pfizer, conducted under FDA regulations and overseen by the University of California, San Francisco.

Why participate?

• Help advance research and potentially help others with OAB symptoms.
• You can participate in the privacy and comfort of your home!
• Get paid $25 for each online assessment and/or lab visit completed. Get paid up to $175.
Aging in Place: Smart Environment/Mobile Technologies

- **Problem:** Assessment of and intervention for everyday functional limitations of persons with early-stage dementia without need of assisted living (aging in place)
- **Solution:** Automated wireless and fixed monitoring and assistance to help people cope with age-related limitations

Diane J. Cook, Washington State NIBIB, R01EB009675
Necessity for Global Health

- Lack of providers in developing world
- No wired infrastructure
  - Well-developed and rapidly growing wireless
- Healthcare needs to be provided through low-cost and immediate, scalable services
- Potential for reverse technology transfer
  - Knowledge from developing world informs domestic research and practice
**Problem:** Adherence to chronic disease medications is poor. In resource-poor settings, getting people medication is only part of the solution

**Solution:** Wireless medication canisters that signal medication timing, transmit adherence data and allow resources to target the non-compliant

Jessica Haberer, Partners Healthcare NIMH K23MH087228
Adverse Event Monitoring (Peru)

**Problem:** Following at-risk patients for adverse events in low- to medium resource countries is expensive/impractical

**Solution:** Wireless adverse events reporting and database improves patient and community care

- **Real time data via IVR on cell phones**
- **Urban and rural areas of Peru**
- **Secure database**
- **Queries on demand via Internet**
- **Real time alerts via E-mail**
- **Real time alerts via SMS**
- **Communication back to the field via cell phones**

Walter Curiso, MD, University of Peruana
FIC R01TW007896
Research/Funding Challenges

- Technology development (rapid) versus NIH funding process (slow) timelines.
- Interdisciplinary research teams needed versus traditional academic model.
- Research methodology for data collection/analysis.
- NIH study sections – grant reviewers.
- IRBs/HIPAA.
- Getting to know who to talk to at NIH
Current NIH Research Support

- **PA-12-171** Pilot and Feasibility Studies in Preparation for Drug and Alcohol Abuse Prevention Trials (R34)
- **PA-11-330** mHealth Tools to Promote Effective Patient Provider Communication, Adherence to Treatment and Self Management of Chronic Diseases In Underserved Populations (R01, R21, R03)
- **PAR-11-020** Technologies for Healthy Independent Living (R01, R21)
- **PA-10-122** SHIFT Award: Small Businesses Helping Investigators to Fuel the Translation of Scientific Discoveries [SBIR: R43/R44]
- **PA-11-118** HIV/AIDS Testing and Follow-up Among the Underserved in the United States (R01)
- **PA-11-063** Translating Basic Behavioral and Social Science Discoveries into Interventions to Improve Health-Related Behaviors

*May be more that include mobile, but not target it directly*
Important NIH Websites

- NIH Office of Extramural Research:

- NIH Center for Scientific Review:
  - http://cms.csr.nih.gov/

- NIH RePORTer Database:
  - http://projectreporter.nih.gov/reporter.cfm
Workshop on mHealth Evidence

- Collaboration between Robert Wood Johnson, McKesson foundation, NSF and NIH
- Randomized control trials are challenging in the fast-paced world of technology. Need alternate methods
- Workshop to assess the design and analytic possibilities for developing evidence in mHealth
- August 16, 2011 at NIH
2012 NIH mHealth Training Institutes

Need

- Improved use of mHealth products in clinical and behavioral research
- Increased collaboration and cross-fertilization across disciplines

Plan

- 5-day training for 28 participants
- Develop skills to improve the design and research of mobile technologies
- July 30-August 3, 2012, Northeastern University
Join our Listserv

- **mHealth-Training@list.nih.gov**

  Join the electronic mailing list (LISTSERV) for forthcoming announcements by —
  Sending an e-mail message to listserv@list.nih.gov from the mailing address at which you want to receive announcements.

  The **body of the message** should read `SUBscribe mHealth-Training [your full name]`.

  The message is case sensitive; so capitalize as indicated!
  - Don't include the brackets.
  - The Subject line should be blank
  - For example, for Robin Smith to subscribe, the message would read
    - `SUBscribe mHealth-Training Robin Smith`.

  You will receive a confirmation of your subscription along with instructions on using the listserv.
Thank you!

- Thank you!
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