NIH AND THE
BEHAVIORAL AND
SOCIAL SCIENCES

OFFICE OF BEHAVIORAL AND SOCIAL SCIENCES RESEARCH
NATIONAL INSTITUTES OF HEALTH

William Riley
Acting Director
Office of Behavioral and Social Sciences Research
YOU MAY HAVE HEARD THAT NIH FUNDS RESEARCH ON . . .

“child menus at restaurants”

• Actual Title: Introducing Child Menus in Restaurants to Improve Access to Healthier Foods (R21HD071324)

• Purpose: Observe menu ordering of children and their parents in restaurants. Based on these observations, develop a program using healthy child menus and training of restaurant staff to encourage healthier eating.

• Potential Impact: More frequent consumption of away-from-home foods is associated with higher intakes of calories, fat, and sugar. Systemic interventions like this can directly target an important contributor to childhood obesity, especially among underserved populations.
YOU MAY HAVE HEARD THAT NIH FUNDS RESEARCH ON . . .

“cigarette smoke detecting underwear”

- Actual Title: The Development of a Noninvasive Monitoring System for Cigarette Smoking (R21DA029222)
- Purpose: Develop and test a wearable respiratory and hand movement monitor that, via pattern recognition, can detect each smoking event in real time.
- Potential Impact: Ability to intensively monitor smoking patterns and the temporal relationship to environmental cues. Potentially could serve as the basis for smoking cessation interventions that preempt smoking events.
YOU MAY HAVE HEARD THAT NIH FUNDS RESEARCH ON . . .

“text messaging drunks at bars”

- Actual Title: Tailored Mobile Text Messaging to Reduce Problem Drinking (R34AA021502)
- Purpose: Develop and evaluate a personalized text-messaging intervention for problem drinking that can be delivered throughout the day and adapted to various drinking contexts.
- Potential Impact: Text messaging already shown effective for smoking cessation (Free et al., 2011). Comparable outcomes for reducing problem drinking would provide an inexpensive and easily scalable intervention that could reach anyone with access to cell phone.
THEIR REVIEW PROCESS

1. Access only to publicly available information: grant title and abstract
2. Reviewed by those who are unlikely to have expertise in that area of science
3. Decision about worthiness for funding filtered through a predetermined narrative
OUR REVIEW PROCESS

1. First level review by a panel of experts in the specific research area who:
   - read the entire grant application,
   - discuss the application with the full panel,
   - score the application on significance, approach, innovation, environment, and investigators, and
   - provide a detailed summary of their review

2. Programmatic evaluation for consistency with institute priorities, portfolio balance, etc.

3. Second level of review by Advisory Council

4. Decision to fund only about 14% of all grants submitted
CONTRIBUTION OF BEHAVIORAL AND ENVIRONMENTAL FACTORS TO DEATH

Schroeder et al. (2007, NEJM) after McGinnis (1993, JAMA)

A 7% weight reduction and 2.5 hrs/wk increase in activity led to a 58% reduction in the cumulative incidence of Type 2 diabetes in insulin-resistant individuals, and the reduction was 34% after 10 years (DPP, 2002; Knowler et al., 2009).
• To transform behavioral intervention designs by implementing an experimental medicine approach to behavior change intervention.

• To inform a mechanistic approach to medical regimen adherence interventions.
Causal Mechanisms & Behavior Change

Behavioral Assay

Neuroimaging Assay

Endocrine Assay

Gene Expression

Attentional Control

Attentional Bias Training (ABT)

Changed Behavior

Target Engaged?

Target Valid?

Efficacious?
Current SOBC FOAs
(Applications due March 20, 2015)

Science of Behavior Change: Assay Development and Target Validation (UH2/UH3)
- Interpersonal and Social Processes Targets
- Stress Reactivity and Stress Resilience Targets
- Self-regulation Targets

NIH Science of Behavior Change Resource & Coordinating Center (U24)

http://commonfund.nih.gov/behaviorchange/
~50% of heart attack survivors stop taking statins within two years even in a medical system that provides generous subsidies. (Jackevicius et al., 2002 JAMA)
## ADHERENCE RATES

Meta-analysis: 520 studies across 17 illnesses

<table>
<thead>
<tr>
<th>Treatment regimens</th>
<th>No. of Studies (percent of sample)*</th>
<th>Average Percent Adherence</th>
<th>Confidence Interval† (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication</td>
<td>328 (63.0)</td>
<td>79.4</td>
<td>(77.4, 81.4)</td>
</tr>
<tr>
<td>Screening</td>
<td>9 (1.7)</td>
<td>72.8</td>
<td>(49.9, 90.4)</td>
</tr>
<tr>
<td>Exercise</td>
<td>13 (2.5)</td>
<td>72.0</td>
<td>(60.5, 82.3)</td>
</tr>
<tr>
<td>Health behavior</td>
<td>88 (16.9)</td>
<td>69.7</td>
<td>(65.5, 73.5)</td>
</tr>
<tr>
<td>Appointment</td>
<td>57 (11.0)</td>
<td>65.9</td>
<td>(60.8, 70.7)</td>
</tr>
<tr>
<td>Diet</td>
<td>25 (4.8)</td>
<td>59.3</td>
<td>(49.6, 70.3)</td>
</tr>
</tbody>
</table>

*DiMatteo Med Care 2004*
NIH ADHERENCE RESEARCH NETWORK

Composed of 17 NIH Institutes, Offices & Centers

Mission
Advancing NIH-sponsored adherence research

Activities
• Monitor science
• Develop research grant funding opportunities
  • Hold workshops
  • Write publications
• Sponsor webinar series
Patients respond “Fine” or “Problem” & nurses call back those with problems.

RCT outcomes at 12 mos.
(N = 538 drug naïve ARV initiators in Kenya)

<table>
<thead>
<tr>
<th>Outcome (ITT)</th>
<th>SMS group</th>
<th>Control group</th>
<th>RR (95%CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported adherence (&gt; 95%)</td>
<td>62%</td>
<td>50%</td>
<td>0.81 (0.69 - 0.94)</td>
<td>0.006</td>
</tr>
<tr>
<td>Viral suppression (&lt;400 copies/ml)</td>
<td>57%</td>
<td>48%</td>
<td>0.85 (0.72 - 0.99)</td>
<td>0.040</td>
</tr>
</tbody>
</table>

Lester et al 2010 *Lancet*
Research on interventions to improve medication adherence
- For a single chronic condition (e.g., hypertension),
- To prevent disease recurrence (e.g., cancer), or
- For multiple comorbid conditions

Outcomes should include
- Patient self-report of medication adherence, AND
- At least one non-self-report adherence measure, AND
- A relevant health outcome or biomarker

Funding mechanisms
- PA-14-335 = R21 Exploratory/Developmental Research applications for determinant research and to develop/pilot interventions
- PA-14-334 = R01 Research Project Grant applications to test interventions
- Issued Sept 2014, active through 2017
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
WHO USES MOBILE?

EVERYONE

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>Cell Phone</th>
<th>Smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, Non-Hispanic</td>
<td>90</td>
<td>53</td>
</tr>
<tr>
<td>Black, Non-Hispanic</td>
<td>53</td>
<td>64</td>
</tr>
<tr>
<td>Hispanic</td>
<td>88</td>
<td>60</td>
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</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Cell Phone</th>
<th>Smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29 (n=404)</td>
<td>97</td>
<td>80</td>
</tr>
<tr>
<td>30-49 (n=577)</td>
<td>95</td>
<td>67</td>
</tr>
<tr>
<td>50-64 (n=641)</td>
<td>89</td>
<td>45</td>
</tr>
<tr>
<td>65+ (n=570)</td>
<td>76</td>
<td>18</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Education attainment</th>
<th>Cell Phone</th>
<th>Smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>No high school diploma (n=168)</td>
<td>83</td>
<td>36</td>
</tr>
<tr>
<td>High school grad (n=630)</td>
<td>88</td>
<td>46</td>
</tr>
<tr>
<td>Some College (n=588)</td>
<td>92</td>
<td>60</td>
</tr>
<tr>
<td>College+ (n=834)</td>
<td>95</td>
<td>70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household income</th>
<th>Cell Phone</th>
<th>Smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $30,000/yr (n=580)</td>
<td>86</td>
<td>43</td>
</tr>
<tr>
<td>$30,000-$45,999 (n=374)</td>
<td>90</td>
<td>52</td>
</tr>
<tr>
<td>$50,000-$74,999 (n=298)</td>
<td>96</td>
<td>61</td>
</tr>
<tr>
<td>$75,000+ (n=582)</td>
<td>98</td>
<td>78</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Urbanity</th>
<th>Cell Phone</th>
<th>Smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (n=763)</td>
<td>92</td>
<td>59</td>
</tr>
<tr>
<td>Suburban (n=1,037)</td>
<td>91</td>
<td>59</td>
</tr>
<tr>
<td>Rural (n=450)</td>
<td>85</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: Pew Internet Spring Tracking Survey, April 17 – May 19, 2013. N=2,252 adults ages 18+. Interviews were conducted in English and Spanish and on landline and cell phones. Margin of error is +/- 2.3 percentage points for results based on all adults.
SMARTMOVE: ACTIVITY TRACKING FOOTWEAR

- Footwear sensors provide mobile detection of specific activities.
- Feedback and encouragement through a smartphone interface targets increases in specific activity areas.
Problem: Remote monitoring of Parkinson’s disease motor symptoms will allow for better treatment and medication control.
**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
**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
• **Wireless Health 2015**
  - The Wireless Health 2015 Conference convenes the vanguard international research communities in wireless technologies and mobile health research. Wireless Health 2015, hosted at the NIH, invites cutting edge wireless, connected and mobile health research from engineering, computer science, biomedical and health disciplines.
SMART AND CONNECTED HEALTH INTER-AGENCY PROGRAM
NATIONAL SCIENCE FOUNDATION
NATIONAL INSTITUTES OF HEALTH

NSF Solicitation: NSF-13-543
NIH Notice Number: NOT-OD-13-041
Digital Health Infrastructure
*Informatics and Infrastructure*
- Integration of EHR, clinical and patient data
- Access to information, data harmonization
- Semantic representation, fusion, visualization

Data to Knowledge to Decision
*Reasoning under uncertainty*
- Data-mining and machine learning
- Inference, cognitive decision support system
- Bring raw image data to clinical practice

Empowered Individuals
*Energized, enabled, educated*
- Systems for empowering patient
- Models of readiness to change
- State assessment from images video

Sensors, Devices, and Robotics
*Sensor-based actuation*
- Assistive technologies embodying computational intelligence
- Medical devices, co-robots, cognitive orthotics, rehab coaches
• **Problem:** Agitation related to dementia often results in medication/sedation and out of home placements

• **Solution:** *Create a home and body network that uses sensing to predict agitation so that caregiver can intervene before a crisis*
  - Immediate access to data allows nimble reactions
  - User interface for health professionals and adult children
  - Automatic data (sensors, images, sound)
  - Real-time, personalized interventions

John Lach, University of Virginia
PRECISION MEDICINE: BUILDING A LARGE U.S. RESEARCH COHORT
A New Initiative on Precision Medicine

Francis S. Collins, M.D., Ph.D., and Harold Varmus, M.D.

“Tonight, I’m launching a new Precision Medicine Initiative to bring us closer to curing diseases like cancer and diabetes — and to give all of us access to the personalized information we need to keep ourselves and our families healthier.”

— President Barack Obama, State of the Union Address, January 20, 2015

The proposed initiative has two main components: a near-term focus on cancers and a longer-term aim to generate knowledge applicable to the whole range of health and disease. Both components are now within our reach because of advances in basic research, including molecular biology, genomics, and bioinformatics. Furthermore, the initiative
Precision Medicine Initiative

“The initiative will encourage and support the next generation of scientists to develop creative approaches for detecting, measuring, and analyzing a wide range of biomedical information – including molecular, genomic, cellular, clinical, behavioral, physiological, and environmental parameters.”
Collins and Varmus, NEJM, 2015

Behavioral and environmental measurement tools to:
• better characterize disease processes and treatment outcomes
• assess not only disease states but also the physical, mental, and social functional status
• monitor behavioral (e.g. smoking/diet) and environmental (e.g., particulate matter, social isolation) exposures that contribute to disease and that interact with genetic influences on disease and treatment, and
• provide potential behavioral and environmental predictors of treatment response beyond that obtained from genetics alone.
SOCIAL DETERMINANTS OF HEALTH
Social Conditions and Policies
- Culture, Norms, Racism, Sexism
- Discrimination, Public Policies, Poverty

Institutions
- Health Care System, Families, Churches, Community-based organizations, Legal System, Media, Political System

Social/Physical Context

Social Relationships
- Social Networks, Social Support, Social Influences, Social Engagement

Individual Risk Factors
- Age, SES, Education, Obesity, Tobacco Use, Acculturation, Diet, Race

Biologic/Genetic Pathways
- Allostatic Load, Metabolic Processes, Physiological Pathways, Genetic Mechanisms

Fundamental Causes
- Patterns of Social Organization
- Individual Characteristics
- Biology

Source: Warnecke et al., AJPH 2008
Life expectancy at age 50 for men and women in 10 industrialized nations since 1950.
Source: Glei, Mesle, and Vallin, 2009.
The Spread of Obesity in a Large Social Network over 32 Years

Nicholas A. Christakis, M.D., Ph.D., M.P.H., and James H. Fowler, Ph.D.
Body-Mass Index (BMI) and Glycated Hemoglobin at Follow-up*

- BMI ≥ 35
  - Control: 35.5
  - Low-Poverty Voucher (ITT): 31.1
  - Traditional Voucher (ITT): 30.8

- Glycated Hb ≥ 6.5%
  - Control: 20.0
  - Low-Poverty Voucher (ITT): 16.3
  - Traditional Voucher (ITT): 20.6

*95% C.I.
UNDERSTANDING THE RELATIONSHIP BETWEEN YEARS OF EDUCATION AND LONGEVITY: SUMMARY OF JUNE 4 MEETING
Life Expectancy At Birth, By Years Of Education At Age 25 For White Females

Olshansky S J et al. Health Aff 2012;31:1803-1813
QUALITY-ADJUSTED LIFE YEARS BY RISK GROUP

Data estimated from Whitehall 39 year follow-up: Clarke BMJ 2009;339:b3513
HAZARD OF PREMATURE DEATH BY YEARS OF EDUCATION

Hazard of Death 1997-2002

Adapted from Rogers et al Biodemography and Social Biology, 56:80–99, 2010
D&I: THE MAGIC PILL...

- Suppose a pill effectively preempts all forms of asthma when taken once a week...
- Only half of systems choose to adopt it
- Half of those systems choose to train clinicians to deliver it
- Half of the clinicians at those systems prescribe it
- Half of their patients receive it
(Assuming perfect access/adherence/dosage/maintenance)

Impact: \(0.5 \times 0.5 \times 0.5 \times 0.5 = 6\%\) benefit
DISSEMINATION AND IMPLEMENTATION STUDIES

- > 90 projects through trans-NIH announcements
- Effectiveness of implementation approach
  - Quality Improvement Interventions
  - Organizational change
  - Provider Training and Supervision
  - Financing/policy change
- Emerging approaches
  - Learning Collaboratives
  - Technology as dissemination driver
Matilda White Riley Lecture
- June 23, 2015
  - Jeanne Brooks-Gunn, Ph.D. and Kevin Volpp, MD, PH.D.

Futures in the Behavioral and Social Sciences.
- Panel discussion on training and careers (June 24)

20th Anniversary Symposium
- June 25th Day-long celebration of the behavioral and social sciences featuring:
  - Vanessa Hayes, Ph.D., Alan Leshner Ph.D., Henry Yin, Ph.D., Elissa Epel, Ph.D., Steve Ramirez, Santosh Kumar, Ph.D, Bonnie Spring, Ph.D., David Williams Ph.D., Julie Mennella, Ph.D., Allison Harvey, Ph.D., Scott Halpern, MD. Ph.D.