The Precision Medicine Initiative Cohort Program

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NIH Deputy Director for Science, Outreach, and Policy
The Challenges …

- Many diseases lack effective prevention strategies, diagnostics, or treatments
  - Options fail to consider key differences among individuals: genes, lifestyle, environment
- Participants in biomedical research often treated as “subjects,” not partners
- Research findings take too long to be implemented into clinical practice
### Precision Medicine Initiative: The Time Is Now

<table>
<thead>
<tr>
<th></th>
<th>Ten Years Ago</th>
<th>Now – 2014 (most recent data)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of sequencing a human genome</td>
<td>$22,000,000</td>
<td>$1000 - $5000</td>
</tr>
<tr>
<td>Amount of Time to Sequence a Human Genome</td>
<td>2 years</td>
<td>&lt;1 day</td>
</tr>
<tr>
<td>Number of smart phones in the United States</td>
<td>1 million (&lt;2%)</td>
<td>160 million (58%)</td>
</tr>
<tr>
<td>EHR Adoption (% hospitals)</td>
<td>20-30%</td>
<td>&gt;90%</td>
</tr>
<tr>
<td>Computing Power</td>
<td>n</td>
<td>n x 16</td>
</tr>
</tbody>
</table>
# Proposed FY16 Budget for PMI

<table>
<thead>
<tr>
<th>Agency</th>
<th>$ Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Institutes of Health</td>
<td></td>
</tr>
<tr>
<td>• <em>PMI for Oncology</em></td>
<td>$200</td>
</tr>
<tr>
<td>• <em>PMI Cohort Program</em></td>
<td>$70</td>
</tr>
<tr>
<td></td>
<td>$130</td>
</tr>
<tr>
<td>Food and Drug Administration</td>
<td>$10</td>
</tr>
<tr>
<td>Office of the National Coordinator for Health Information Technology</td>
<td>$5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$215</strong></td>
</tr>
</tbody>
</table>
PMI Cohort Program Background

**Working Group Charge**: develop a vision for the PMI Cohort Program (PMI-CP) and advise on the design of a longitudinal national research cohort of ≥1 million volunteers

- Leverage existing cohorts, start from scratch, or hybrid?
- How to capture the rich diversity in the U.S. population?
- What data types should be included?
- What policies need to be in place for maximal benefit?
Advisory Committee to the NIH Director
Precision Medicine Initiative Working Group

Co-Chairs:
Richard Lifton, MD, PhD, Yale University School of Medicine, New Haven, CT
Bray Patrick-Lake, MFS, Duke University, Durham, NC
Kathy Hudson, PhD, National Institutes of Health, Bethesda, MD

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  Yumanity Therapeutics, Cambridge, MA

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  University of Oxford, UK

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  Google X, Mountain View, CA

• Josh Denny, MD
  Vanderbilt University, Nashville, TN

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  Gates Foundation, Seattle, WA

• Eric Dishman
  Intel, Santa Clara, CA

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  Multiple Myeloma Res Foundation, Norwalk, CT

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  Harvard Medical School, Boston, MA

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  University of Michigan Medical School, Ann Arbor

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  U Penn Perelman School of Medicine, Philadelphia

• Spero M. Manson, PhD
  University of Colorado, Denver

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  Partners Health Care System, Inc., Boston, MA

• Richard Platt, MD, MSc
  Harvard Pilgrim Health Care Institute, Boston, MA

• Jay Shendure, MD, PhD
  University of Washington, Seattle

• Sue Siegel
  GE Ventures & Healthymagination, Menlo Park, CA
Inputs

- **Workshops**
  - Unique Scientific Opportunities for the National Research Cohort (April 28-29, NIH, Bethesda, MD)
  - Digital Health Data in a Million-Person Precision Medicine Initiative (May 28-29, Vanderbilt University, Nashville, TN)
  - Participant Engagement and Health Equity (July 1-2, NIH, Bethesda, MD)
  - Mobile and Personal Technologies in Precision Medicine (July 27-28, Intel Corp., Santa Clara, CA)

- **Requests for Information**
  - Building the cohort
  - Strategies to address community engagement and health disparities

- FNIH Survey of public perceptions of precision medicine cohort
- White House Privacy and Trust Principles
Scientific Opportunities in the PMI-CP

- Develop quantitative estimates of risk for a range of diseases by integrating environmental exposures, genetic factors and gene-environment interactions
- Identify the causes of individual variation in response to commonly used therapeutics (pharmacogenomics)
- Discover biological markers that signal increased or decreased risk of developing common diseases
- Use mobile health (mHealth) technologies to correlate activity, physiological measures and environmental exposures with health outcomes
- Develop new disease classifications and relationships
- Empower study participants with data and information to improve their own health
- Create a platform to enable trials of targeted therapies
Assembling the PMI Cohort

- One million or more volunteers who agree to provide health data and a biospecimen
- Longitudinal cohort with continuing interactions
- Two methods of recruitment
  - Direct volunteers
    - Anyone can sign up
  - Healthcare provider organizations (incl. FQHCs)
    - Consider diversity of HPO participants, robustness of EHR, participant follow-up
Assembling the PMI Cohort

Broadly reflect the diversity of the U.S.

- Groups that are underrepresented
- All states of health and disease
- All areas of the U.S.
- All life-stages
- Special policy considerations about enrollment/retention of:
  - children
  - decisionally impaired
  - participants who become incarcerated
79% agree cohort probably/definitely should be done
54% would probably/definitely participate in the cohort

What motivates participation?
- 82% interested in receiving results of study
- 62% wish to help advance health research

71% said participants should be partners with researchers
“...I’m proud we have so many patients’ rights advocates with us here today. They’re not going to be on the sidelines. It’s not going to be an afterthought. They’ll help us design this initiative from the ground up, making sure that we harness new technologies and opportunities in a responsible way.”

President Barack Obama
January 30, 2015
PMI-CP Focus on Engagement

- Highly interactive participant model
  - Participant representation in governance, design, conduct, dissemination, evaluation
  - Build a strong foundation of trust
- Participant engagement and communication activities should be centrally coordinated
- Consent is with PMI Cohort Program
  - Basic consent to be part of the cohort
  - Broad consent for secondary use
  - Consent is adaptable over time for new components
- Return of results and access to data
Information Flow In

Direct Volunteers

Self-report Measures
- mHealth Data
- Consent
- EHR Data
- Baseline Exam
- Biological Samples

HPO Volunteers

15
**Initial Core Data Set**

- Centrally collected and stored in a Coordinating Center
- Align with other data sets when possible
- Leverage existing data standards and common data models when possible

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Data Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self report measures</td>
<td>Diet, substance use, self-report of disease and symptoms (e.g., cognitive or mood assessment)</td>
</tr>
<tr>
<td>Baseline health exam</td>
<td>Vitals (e.g., pulse, blood pressure, height, weight), medical history, physical exam</td>
</tr>
<tr>
<td>Structured clinical data (EHR)</td>
<td>ICD and CPT codes, medication history, select laboratory results, vitals, encounter records</td>
</tr>
<tr>
<td>Biospecimens</td>
<td>Blood sample</td>
</tr>
<tr>
<td>mHealth data</td>
<td>Passively-collected data (e.g., location, movement, social connections) from smartphones, wearable sensor data (activity, hours and quality of sleep, time sedentary).</td>
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</tbody>
</table>
Biospecimen Collections

- PMI-CP would collect biospecimens
  - Anticipate what future uses may be
  - Collect initially from everyone and at subsequent intervals
  - Start with blood, but should accommodate samples for exposure studies, metabolites, microbiome, etc.
- Quickly establish a central PMI-CP biobank
- CLIA-compliant specimen collection and testing where possible
Information Flow Out

Volunteers

Public

Results

Data

Researchers

Data
Return of results and data

- Participants may receive, depending on their preferences:
  - Individual data
  - Individual health information
  - Ongoing study updates
  - Aggregated results
### Possible data sources for the PMI Cohort

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<tr>
<th>Data Source</th>
<th>Example Data Provided</th>
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<tr>
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<td>Diet, substance use, self-report of disease and symptoms (e.g., cognitive or mood assessment)</td>
</tr>
<tr>
<td>Structured clinical data (EHR)</td>
<td>ICD and CPD codes, medication history, laboratory results, vitals, encounter records</td>
</tr>
<tr>
<td>Unstructured clinical data (EHR)</td>
<td>Narrative documents, images, EKG and EEG waveform data</td>
</tr>
<tr>
<td>Biospecimens</td>
<td>Blood sample, microbiome, nail and hair for environmental exposures over time</td>
</tr>
<tr>
<td>mHealth and sensor data</td>
<td>Passively-collected data (e.g., location, movement, social connections), wearable sensor data (activity, calories expended, hours and quality of sleep, time sedentary).</td>
</tr>
<tr>
<td>Healthcare claims data</td>
<td>Billing codes as received by public and private payors, outpatient pharmacy dispensing</td>
</tr>
<tr>
<td>Geospatial and environmental data</td>
<td>Weather, air quality, environmental pollutant levels, food deserts, walkability, population density, climate change</td>
</tr>
<tr>
<td>Other data</td>
<td>Social networking e.g., Twitter feeds, over-the-counter medication purchases</td>
</tr>
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</table>
Policy for the PMI-CP

Policy needs for PMI-CP:

– Single Institutional Review Board (IRB)
– Privacy and security
  • Standards for data security
  • Safeguards against unintended data release
  • Penalties for unauthorized re-identification
– Share results and provide access to data
  • Clarify CLIA and HIPAA

Special considerations for certain populations
PMI-CP Governance

- Governance structure
  - PMI-CP director
  - Independent Advisory Board
  - Executive Committee
  - Steering Committee with five subcommittees
    - Return of results and information
    - Data
    - Biobanking
    - Resource Access
    - Security

- Maintain interagency coordination
Implementation

- Communications/Outreach/Engagement
  - Web portal
  - Exams Biobank
- Direct volunteer enrollment
- Government HPO enrollment
- Non-gov’t HPO enrollment
- Coordinating Center
- Lab stuff (SNPs, etc.)

You are here

PMI Staff Governance

Protocol

IRB

Time
Thank you!