Precision Medicine Initiative Working Group Update

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Timing Is Everything
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>
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<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 (% providers)</td>
<td>20-30%</td>
<td>&gt;90%</td>
</tr>
<tr>
<td>Computing Power</td>
<td>n</td>
<td>n x 16</td>
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Mission of the Precision Medicine Initiative

“Enable a new era of medicine through research and technology that empowers patients, researchers, and providers to work together toward development of individualized treatments.”
Elements of the PMI

- Research components
  - Expand genomics-based clinical and pre-clinical studies of cancer treatments
  - Form a national research cohort of 1M or more volunteers

- Policy needs
  - Privacy
  - Research participants protections (Common Rule)
  - Data sharing
### Proposed FY16 Budget for PMI

<table>
<thead>
<tr>
<th>Agency</th>
<th>$ Million</th>
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<tbody>
<tr>
<td>National Institutes of Health</td>
<td></td>
</tr>
<tr>
<td>• Cancer</td>
<td>$200</td>
</tr>
<tr>
<td>• Cohort</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>TOTAL</td>
<td>$215</td>
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</table>
What Is a Cohort?
What Is a Cohort?

A group of people with a shared experience
PMI National Research Cohort

- 1 million or more US volunteers
- New model for participant engagement
  - Individuals control use of their health information
    - Genomic data, lifestyle information, biological samples – all linked to electronic health records
  - Flexibility on how and when to participate
  - Participants can be made aware of research studies of interest to them
  - Open, responsible data sharing with privacy protections
Participant Partnerships

Technologies

EHRs

Genomics

Data Science
Planning the PMI National Research Cohort

- **February 11-12**  
  NIH Hosted first Workshop

- **March 30**  
  ACD PMI WG Established

- **April 28-29**  
  Unique Scientific Opportunities for the Nat’l Research Cohort Workshop (NIH)

- **May 28-29**  
  Digital Health Data in a Million-Person PMI Cohort Workshop (Vanderbilt)

- **July 1-2**  
  Participant Engagement and Health Equity Workshop (NIH)

- **July 27-28**  
  Mobile Technologies in a Precision Medicine Initiative Cohort (Intel)
PMI Working Group of the Advisory Committee to the NIH Director (ACD)

- Charge: develop a vision for PMI and advise on design national research cohort

- Sample of Key Questions
  - Leverage existing cohorts, recruit de novo, or hybrid
  - How to capture heterogeneity in US population
  - Minimum core data elements
    - “Omics”
    - Environmental exposures
    - Behavior and lifestyle factors
ACD PMI Working Group Members

- Tony Coles (Yumanity)
- Rory Collins (UK Biobank)
- Josh Denny (Vanderbilt)
- Susan Desmond-Hellmann (Gates Foundation)
- Eric Dishman (Intel)
- Kathy Giusti (Multiple Myeloma Research Foundation)
- Esteban Gonzalez Burchard (UCSF)
- Sachin Kheterpal (University of Michigan)
- Shiriki Kumanyika (University of Pennsylvania)
- Sekar Kathiresan (Mass General Hospital)
- Spero Manson (Colorado School of Public Health)
- Pearl O'Rourke (Partners Health Care System)
- Richard Platt (Harvard Pilgrim Health Care Institute)
- Jay Shendure (University of Washington)
- Sue Siegel (GE Ventures)
- Andrew Conrad (GoogleX)
Unique Scientific Opportunities Workshop (April 28-29)

- Visionary scientific questions that could be uniquely addressed by the PMI research cohort

- Principal workshop issues:
  - Unique opportunities presented by incorporating “omics,” environmental, and behavioral factors into cohort data collection
  - Possibilities of big health data
  - Near- and longer-term use cases for the cohort
Unique Scientific Opportunities – Takeaways

- Data standards and EHR interoperability are critical to success
- Cohort design must deliver near-term and long-term outcomes
- Cohort should include both disease and healthy populations
- Designing cohort around families increases “omic” possibilities
- “Triangulate” data to dissociate correlation from causation
- Data collection priorities – chemical exposures, physical activities, and geographic and time/date stamps on the data collected
- Returning individual results and information about how and when their data are being used will increase cohort participation
Results of Request for Information (RFI) on Building the PMI Cohort

- 1 million or more study diverse participants
- Existing studies/platforms & novel recruitment
- Maximum inclusiveness (age, ethnicity, SES, geography, rural/urban, sexual orientation)
- Follow up >5 years with varied exam interval, include core set of standardized data collection, incorporate EHR & mHealth-based strategies
- Consent with ability to re-contact
- 58 unique entities interested ... ~30 can identify & follow >10K participants
Principal workshop discussions

- Existing resources NIH can leverage to build the cohort
- Prospective ascertainment of health information
- Baseline information and samples to be collected
- Management of data generated by PMI

Special guests: Sen. Lamar Alexander (R-TN) and Rep. Marsha Blackburn (R-TN)
#PMINetwork for May 28-29

- 29,549,800 impressions
- 1,651 Tweets
- 483 people participating on Twitter

- Videocast
  - Day 1: 367 unique users
  - Day 2: 182 unique users
Digital Health Data in a Million-Person PMI Cohort – Takeaways

- Bipartisan support for PMI...it’s time to act!
- Health care delivery organizations on board
- Data sharing and consent must be addressed
- A diverse cohort stronger than a representative cohort
- Precision medicine or precision health?
  - Need more than just EHR records
- Data curation approach critical
- Core data elements are a small number of “needs” (not “wants”)
General Cohort Design Concepts – So Far

- **Scientific Opportunities**
  - “Early wins” will foster public interest and trust in PMI
  - Need strategies to collect a wide variety of biological and environmental data

- **Design Considerations**
  - Hybrid distributed and centralized data models
  - Many reasons to include children in the cohort, but may require different design considerations
  - For recruitment, balance ease of access to participants (e.g., through HC delivery organization) with diversity and inclusion
  - Healthy and disease populations must be represented
RFI on Strategies to Address Community Engagement and Health Disparities

- Strategies to enable broad and sustained participation from diverse communities (NOT-OD-15-107)
  - Building trust
  - Willingness to undergo biomedical research testing
  - Racial/ethnic differences in attitudes towards precision medicine

- Comments due June 19, 2015

- Presented at Participant Engagement and Health Equity Workshop (July 1-2)
Survey on Public Preferences for Participation in a National Research Cohort

- N = 2400 respondents
  - Broadly representative of the US population
  - Oversamples Hispanic and African Americans (500 each)
- Assesses public attitudes and willingness to participate in large-scale research cohort
  - Incentives to participate
  - Data sharing
  - Informed consent
  - Participant engagement
- Results presented at on Participant Engagement and Health Equity Workshop (July 1-2)
Participant Engagement and Health Equity Workshop (July 1-2, NIH)

- Principal workshop questions
  - Key design features of a participant-driven, inclusive and diverse cohort?
  - Inclusion and engagement goals and best practices for health equity?
  - How can PMI build and sustain public trust through governance, policy, and implementation?
  - What would a direct-from-participant cohort look like?
  - What should the cohort be called?
  - How to implement new models of engagement in existing cohorts?
Mobile Technologies in a Precision Medicine Initiative Cohort (July 27-28, Intel)

- Scientific, methodological, and practical considerations for incorporation of mobile technologies in a PMI cohort
  - Benefits and barriers to mobile technologies
  - Scaling up for 1M or more
  - Functionalities needed for PMI successes
  - Social and technological challenges in a diverse cohort
ACD PMI Working Group Report: September 2015
Questions?
Back Pocket Slides
Promise of PMI: New Treatments

- PMI will result in more therapies like Zelboraf™
  - Targeted to 60% of metastatic melanoma patients whose cancer contains a V600E mutation in the BRAF gene
  - Doubled the survival rates in this group
- Kalydeco™ treats cystic fibrosis (CF)
  - Targeted to mutations responsible for 5% of all CF cases
  - The first CF therapy to treat the underlying cause of CF rather than just treating its symptoms
- Benefits of precision medicine can be scaled up to help more people
Promise of PMI: Pharmacogenomics

• Imagine:
  • DNA Chip of all known variants of pharmacogenomic relevance
  • Provide information to both patients and clinicians
  • EHR for Rx – what Rx is written
  • Pharmacy records – what Rx is filled
  • Mine data for common genetic variants
  • Learn what works & what doesn’t
  • Mount an interventional trial if no one knows if the gene/drug info is really linked
  • Dramatically expand existing knowledge
    • FDA counts over one hundred labels with genetic info
  • Apply to widely used therapeutics
Participants at the Center

– Participants engaged in design and oversight
– Participant demands that data sharing include sharing data with THEM
– Participants pushing new consent models
– User centered approach that puts the participant first
– Partnership replacing paternalism
mHealth Advances

Mobile devices can track increasing amounts of health information

- Blood pressure, pulse rate, connect with devices such as inhalers and spirometers
- Mt. Sinai Asthma Mobile Health Study, together with Apple Healthkit measures:
  - Symptoms
  - Daily activities
  - Environmental triggers
  - Peak expiratory flow
  - Medications
  - Heath events
Electronic Health Records (EHRs)

- Now widely adopted
- Offers unique tools for researchers and data mining
- Research use requires agreements on data syntax, semantics, transmission methods, etc with multiple organizations who hold the EHRs
Electronic Health Records (EHRs)

- Can we put people, not institutions, in control of EHR data sharing?
- Blue-button technology promises to allow patients to download information from their electronic health record
- Promise not yet achieved but perhaps can be accelerated by leadership, resources, and patient demand
- Data could be centralized, truly enabling data science