The Precision Medicine Initiative Cohort Program

Kathy Hudson, PhD
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

State of the Union Address
January 20, 2015

Precision Medicine Initiative: The Time Is Now

	Ten Years Ago	Now – 2014 (most recent data)
Cost of sequencing a human genome	$22,000,000	$1000 - $5000
Amount of Time to Sequence a Human Genome	2 years	<1 day
Number of smart phones in the United States	1 million (<2%)	160 million (58%)
EHR Adoption (% hospitals)	20-30%	>90%
Computing Power	n	n x 16

Proposed FY16 Budget for PMI

Agency	$ Million
National Institutes of Health • *PMI for Oncology* • ***PMI Cohort Program***	$200 $70 **$130**
Food and Drug Administration	$10
Office of the National Coordinator for Health Information Technology	$5
TOTAL	$215

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

Members:

- **Esteban Gonzalez Burchard, MD, MPH**
  University of California, San Francisco
- **Tony Coles, MD, MPH**
  Yumanity Therapeutics, Cambridge, MA
- **Rory Collins, FMedSci**
  University of Oxford, UK
- **Andrew Conrad, PhD**
  Google X, Mountain View, CA
- **Josh Denny, MD**
  Vanderbilt University, Nashville, TN
- **Susan Desmond-Hellmann, MD, MPH**
  Gates Foundation, Seattle, WA
- **Eric Dishman**
  Intel, Santa Clara, CA
- **Kathy Giusti, MBA**
  Multiple Myeloma Res Foundation, Norwalk, CT
- **Sekar Kathiresan, MD**
  Harvard Medical School, Boston, MA
- **Sachin Kheterpal, MD, MBA**
  University of Michigan Medical School, Ann Arbor
- **Shiriki Kumanyika, PhD, MPH**
  U Penn Perelman School of Medicine, Philadelphia
- **Spero M. Manson, PhD**
  University of Colorado, Denver
- **P. Pearl O'Rourke, MD**
  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

FNIH Survey of public opinion on a large US cohort study

- 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."

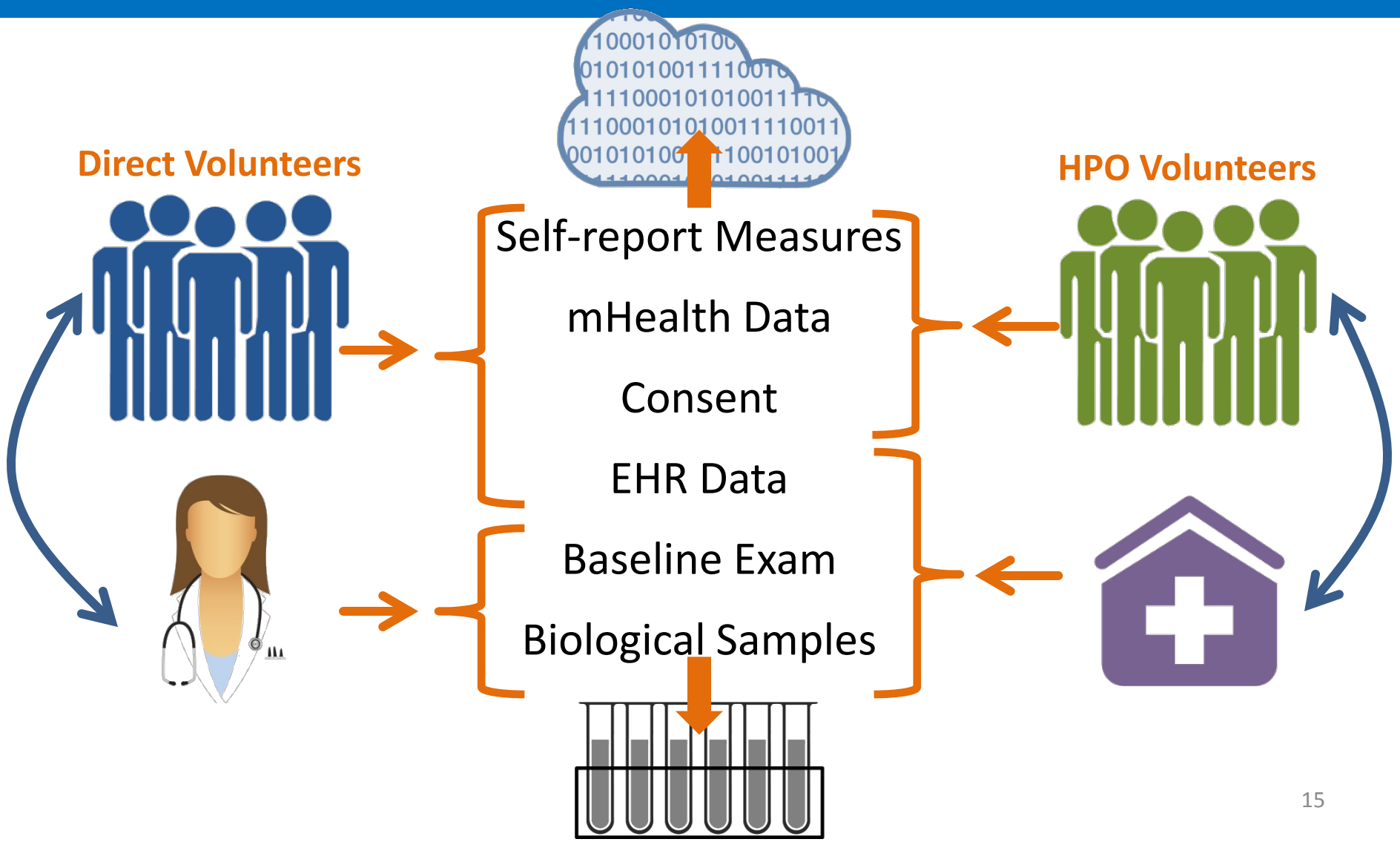
President Barack Obama

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



Initial Core Data Set

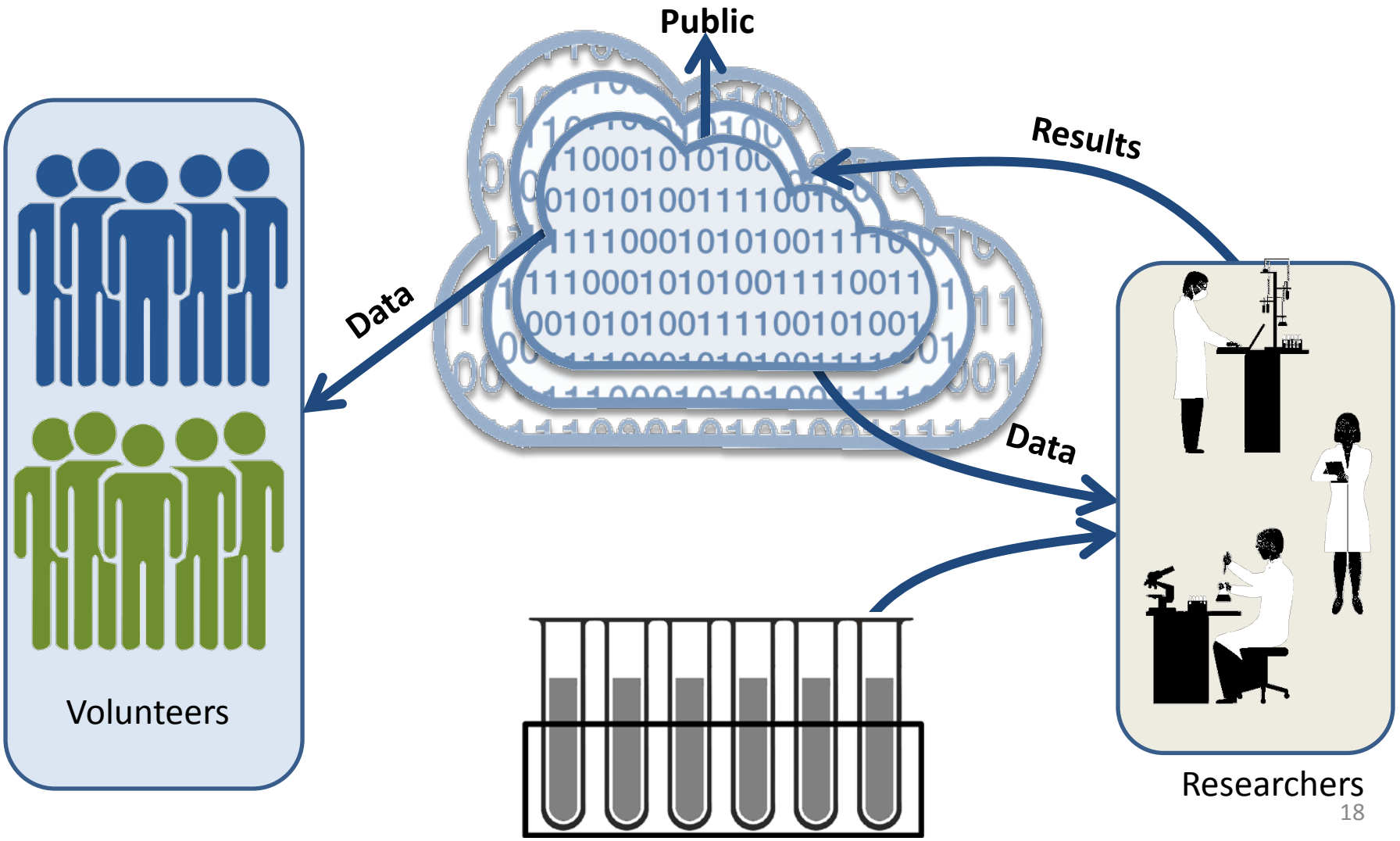
- Centrally collected and stored in a Coordinating Center
- Align with other data sets when possible
- Leverage existing data standards and common data models when possible

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

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



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

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

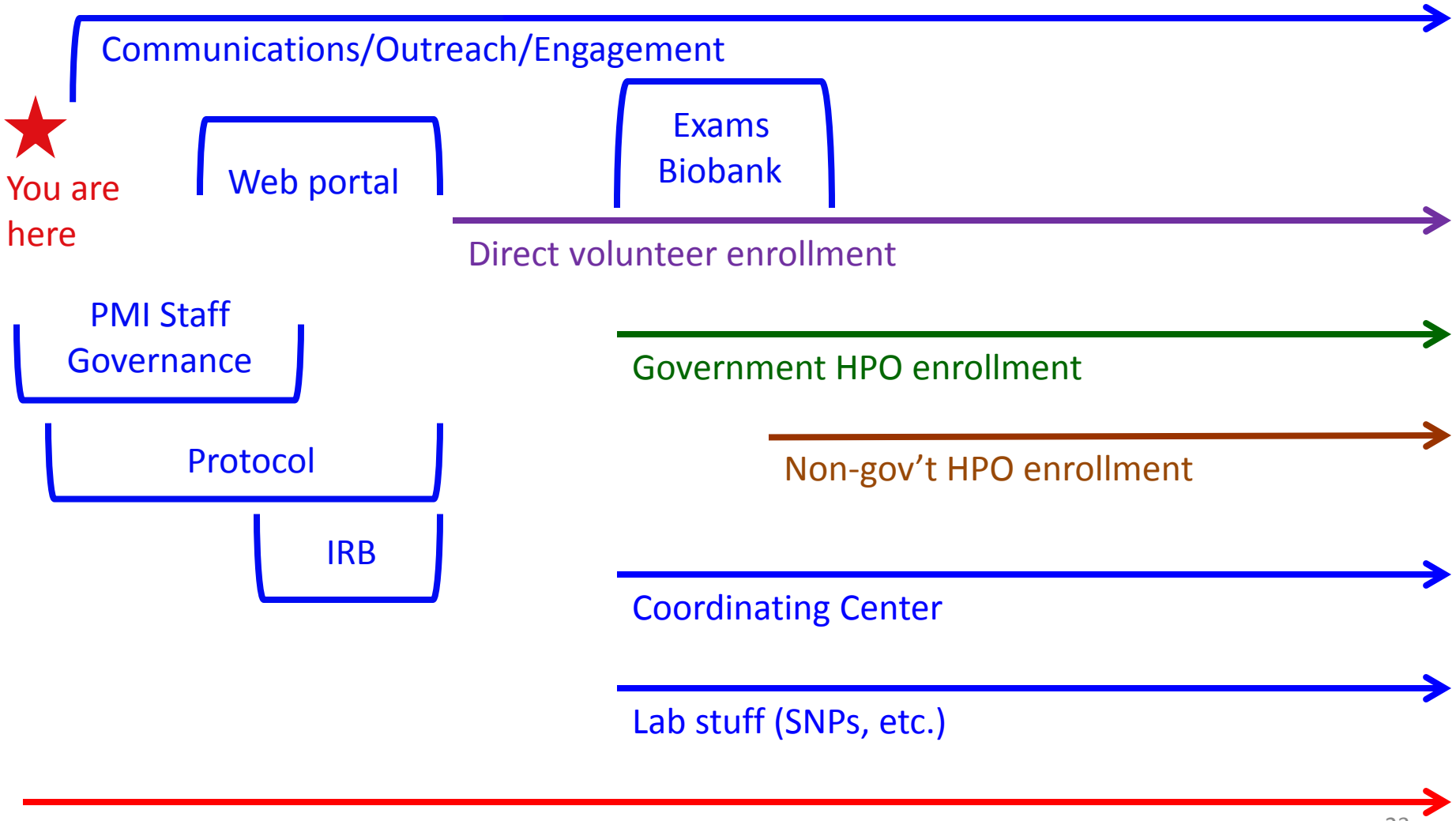
Policy for the PMI-CP

- 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



Thank you!