## All of Us Research Program

### Josh Denny, M.D., M.S. **Chief Executive Officer**







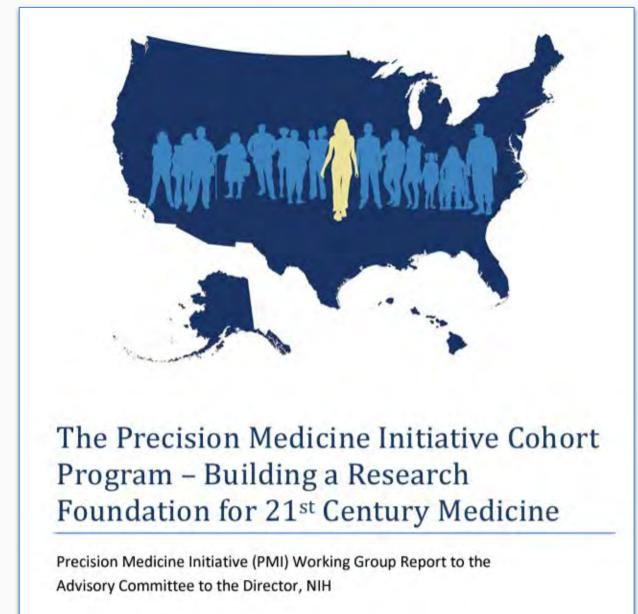






## What is the NIH All of Us Research Program?

The All of Us Research Program is a historic, longitudinal effort to gather data from one million or more people living in the United States to accelerate research and improve health. By taking into account individual differences in lifestyle, socioeconomics, environment, and biology, we hope that researchers will one day uncover paths toward delivering precision medicine – or individualized prevention, treatment, and care – for all of us.

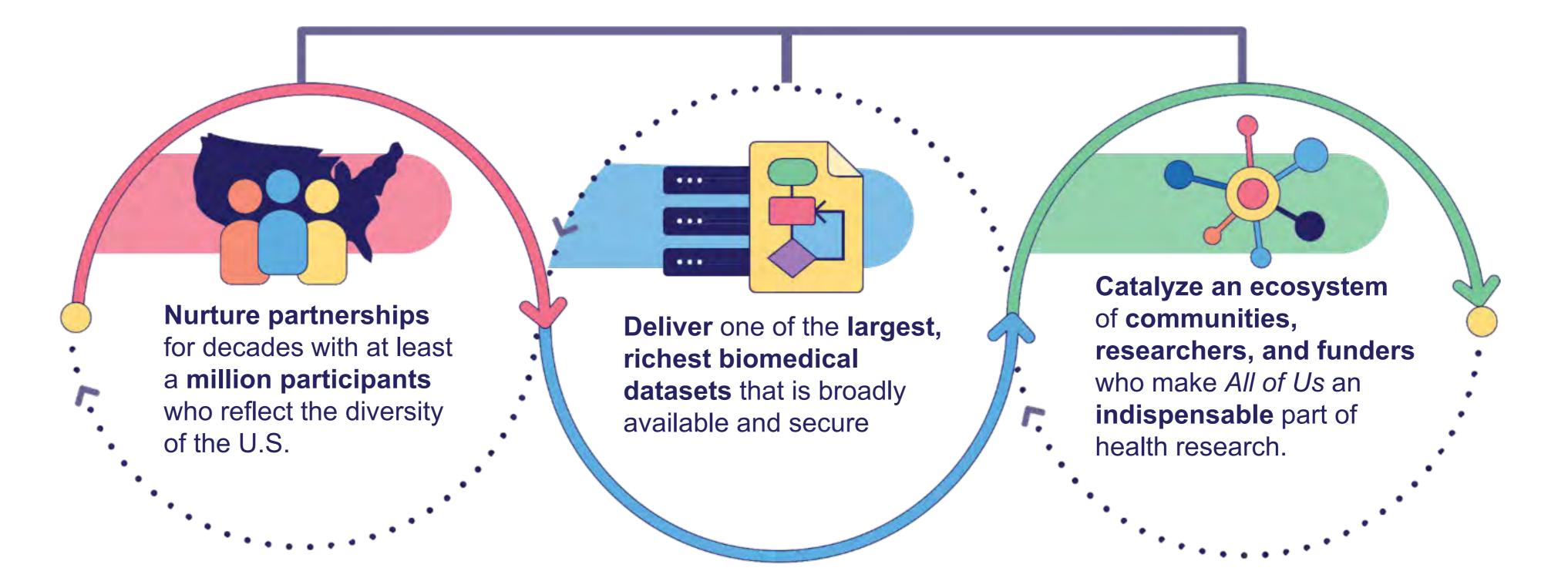


September 17, 2015



## The All of Us Research Program Mission

## Accelerate health research and medical breakthroughs, enabling individualized prevention, treatment, and care for all of us.



Made possible by a team that maintains a culture built around the program's core values



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## All of Us Research Program Core Values

Participation is **open** to all.

Participants reflect the rich diversity of the U.S.

Participants are **partners**.

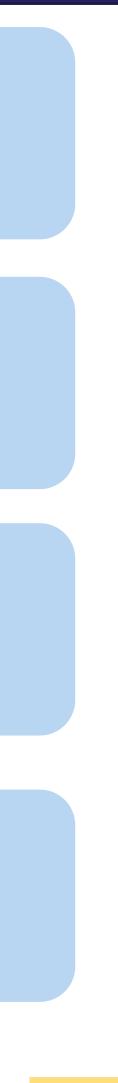
Trust will be earned through transparency.



Data will be accessed **broadly** for research purposes.

Security and privacy will be of highest importance.

The program will be a catalyst for positive change in research.



## All of Us Research Program Core Values

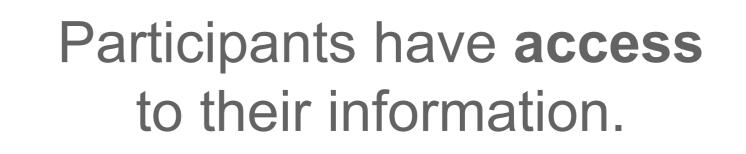
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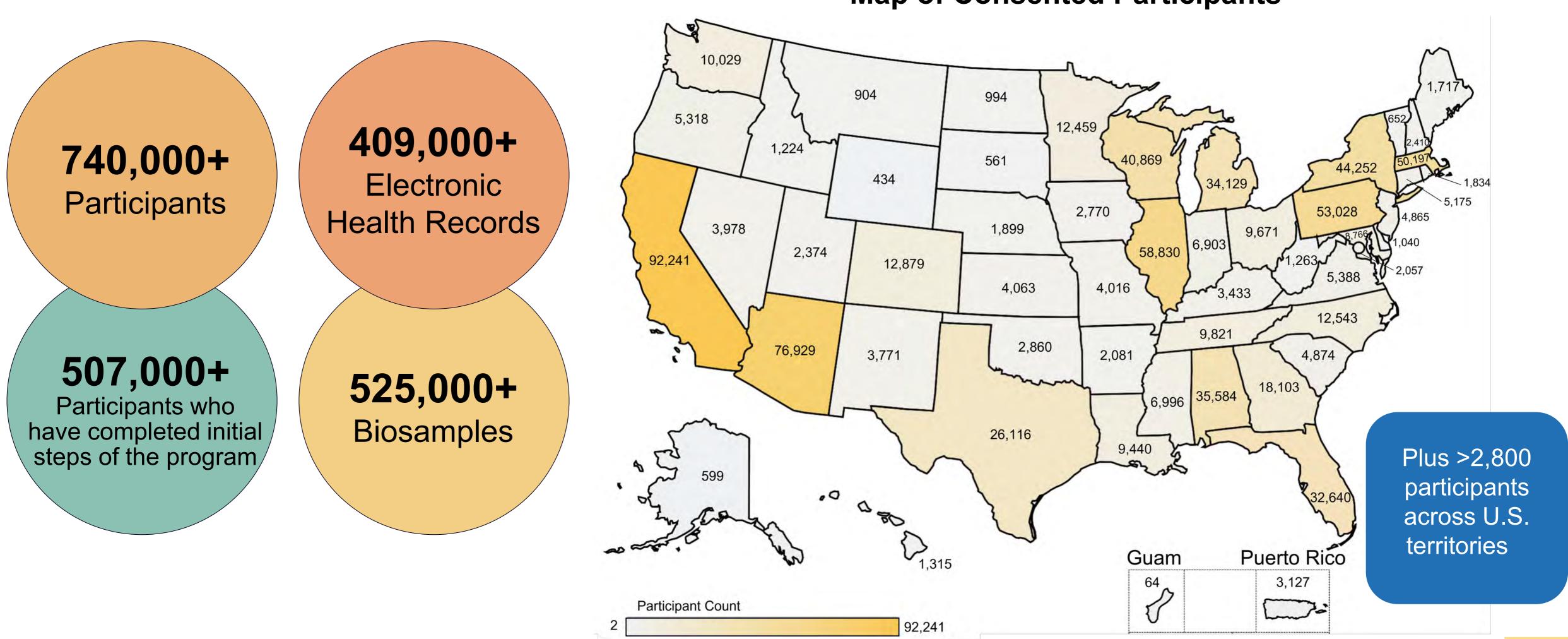
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## **Consented 740K+ Participants With Continued Growth**



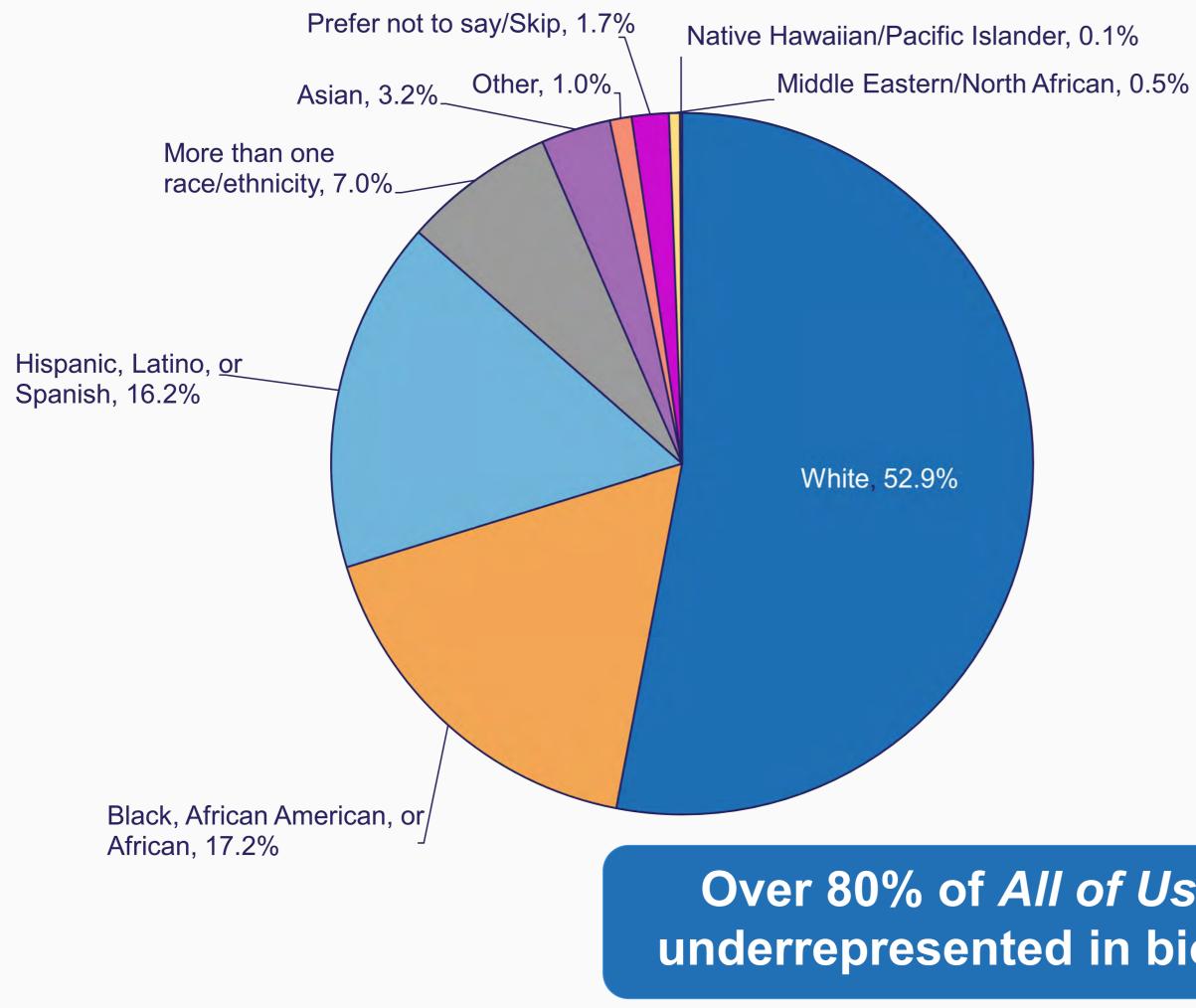
### Map of Consented Participants

### Numbers current as of November 29, 2023

6

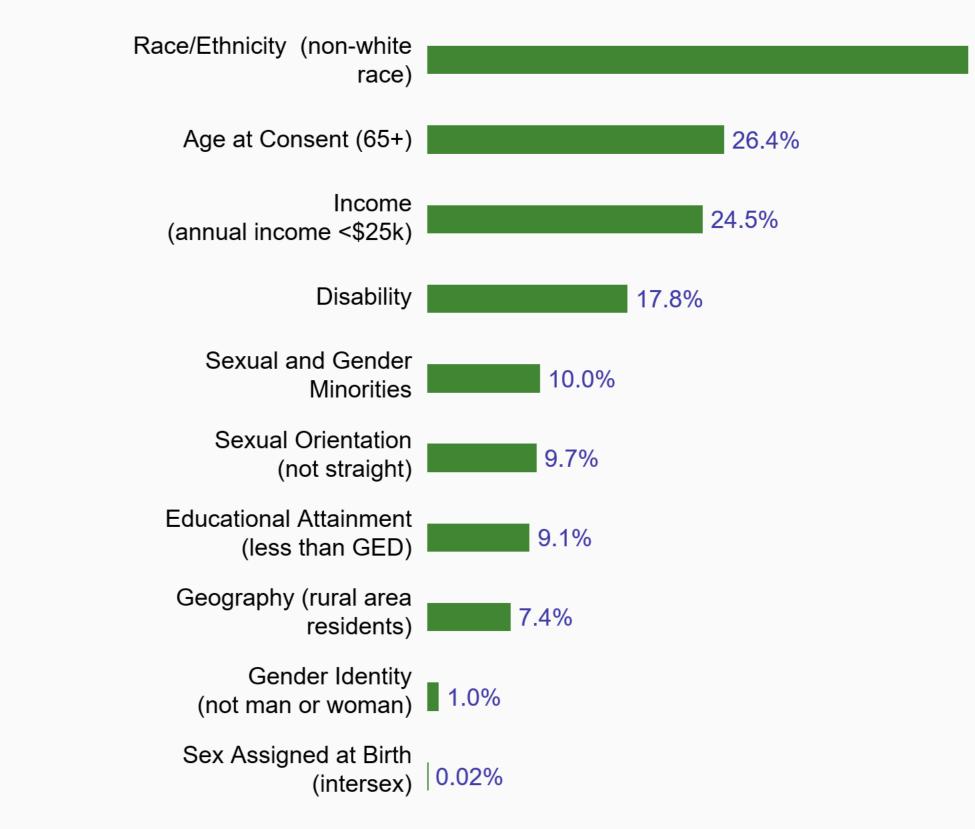
## **Participant Diversity**

### **Race & Ethnicity of Participants**



### Numbers current as of November 29, 2023

### **UBR Category**



### **Over 80% of All of Us participants are** underrepresented in biomedical research



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## All of Us Research Program Core Values

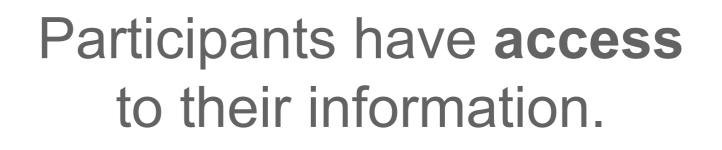
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## All of Us Consortium Members (as of November 2023)



Note: These are not approved lockups and should not be repurposed on assets.



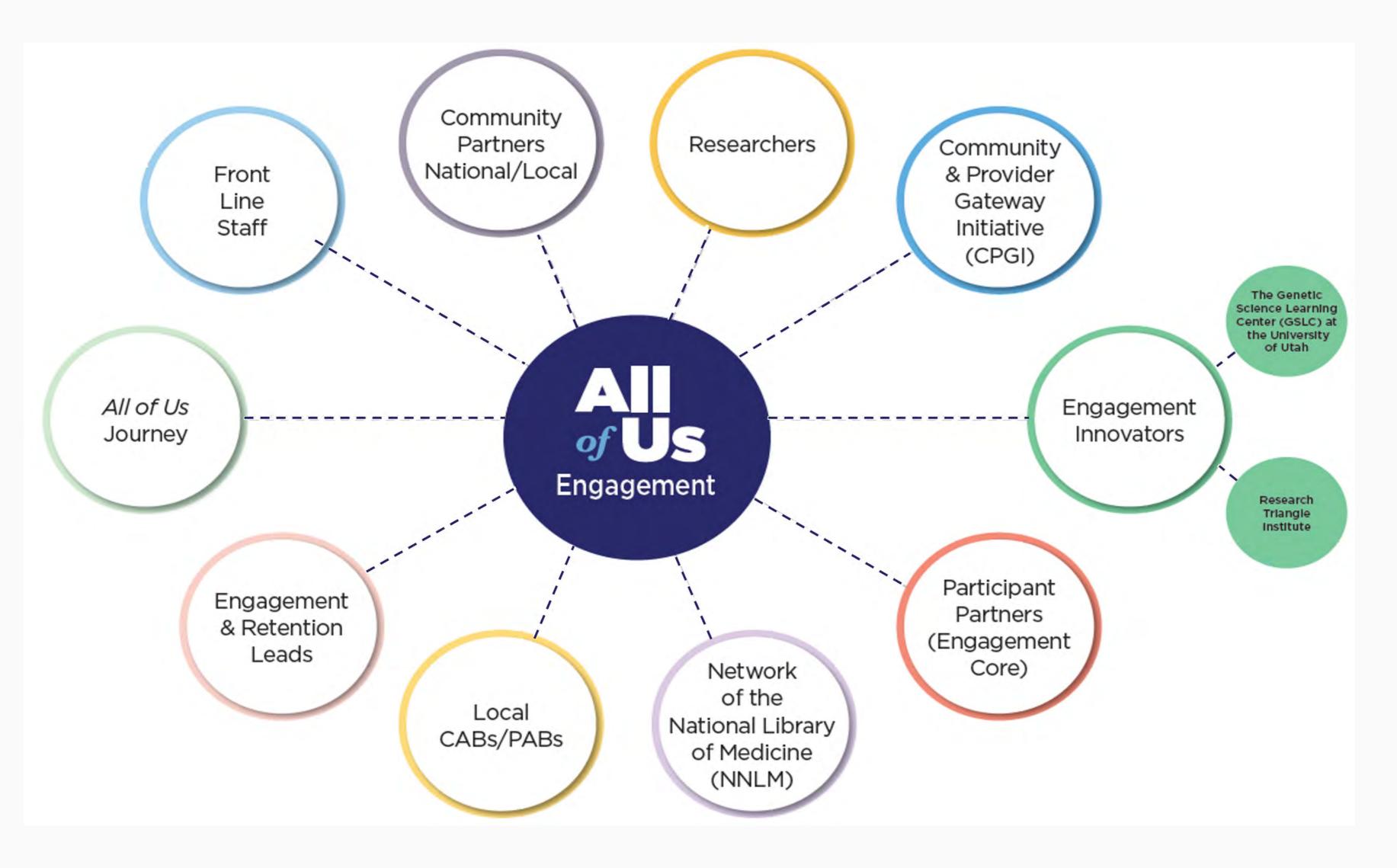


## All of Us Community and Provider Partner Network (as of April 2023)



Note: These are not approved lockups and should not be repurposed on assets.

## All of Us Engagement Ecosystem



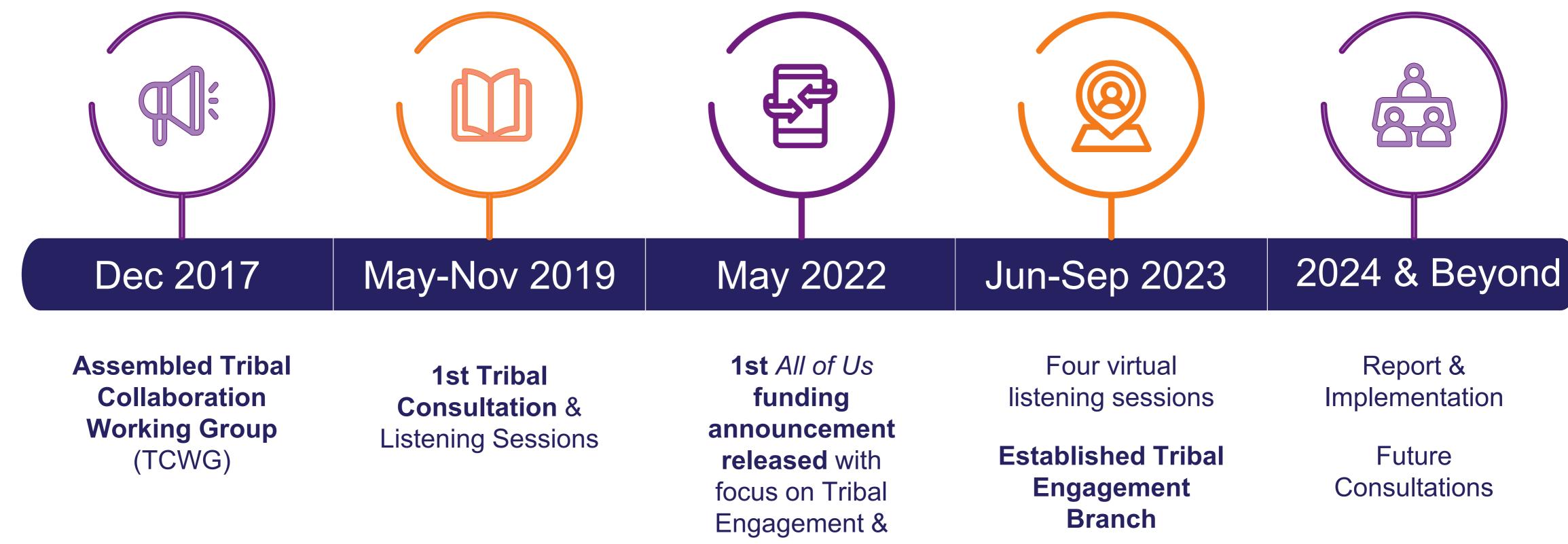
Today, the program includes 35 Participant Ambassadors and 10 Participant Partners who serve on the Steering Committee, the Executive Committee, and the Advisory Panel.







## All of Us Tribal Engagement



Partnership

Tribal **Consultation** 





## All of Us Research Program Core Values

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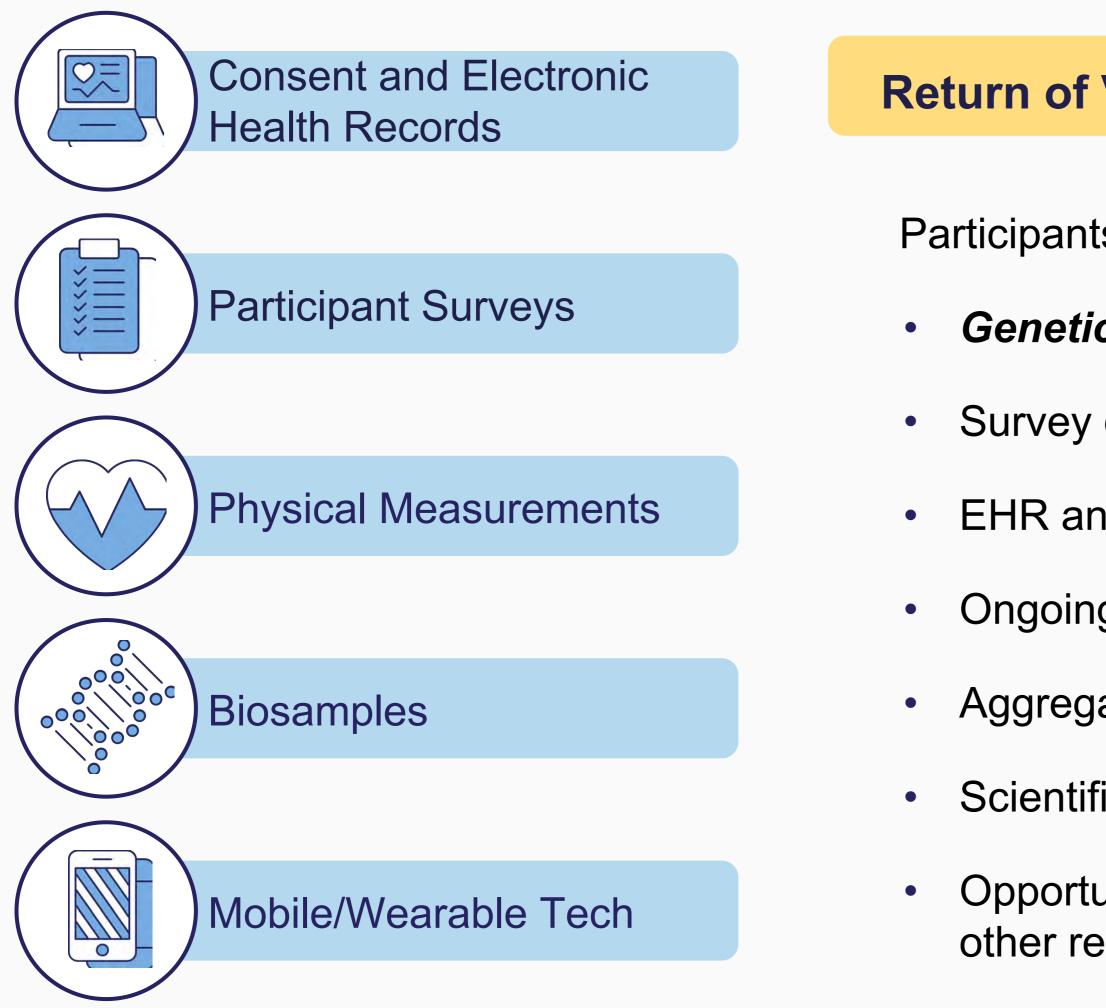








## Data Collected and Return of Value to All of Us Participants



### **Return of Value for Participants**

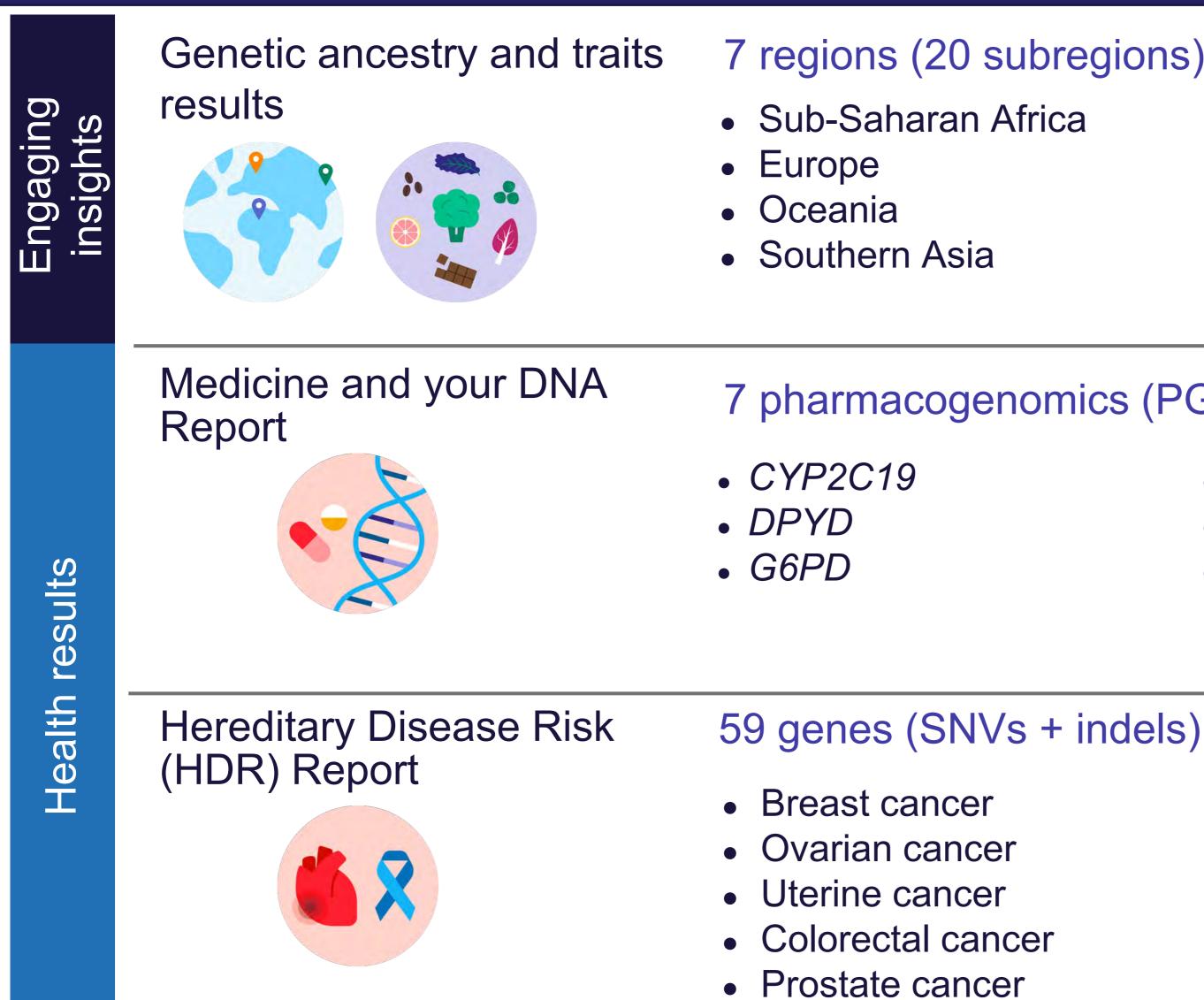
- Participants may receive:
  - Genetic information
  - Survey data (comparative)
  - EHR and claims data
  - Ongoing study updates
  - Aggregate results
  - Scientific findings
  - Opportunities to be contacted for other research opportunities

! _	Your result: Something very important for your health was found in your BRCA1 gene.	<u></u> <u></u> <del></del> <del></del> <del></del> <del></del> <del></del> <del></del> <del></del> <del></del> <del></del> <del></del>	Medicine and your DNA
What does this mean IMPORTANT! Share this re with your do	<ul> <li>that you are more likely to get some types of cancers than other people.</li> <li>It does not mean that you have some types of cancers.</li> <li>It does not mean that you will definitely get some types of cancers.</li> <li>This result is important and should not be ignored.</li> <li>This report comes from a research program, so it is a research result. Your doctor will need to confirm these results with a clinical DNA test before using</li> </ul>	Our genes affect how we respond to medicine. What is this kind of information used for?	They do that in many different ways, Some genes help move medicines to the right part of the body. This test looked at a few of the genes in your DNA that of affect how medicines are used. The technical term for th kind of information is "pharmacogenetics." Doctors and pharmacists use this kind of information wh they consider why medicines work differently for differe people. But doctors and pharmacists don't make decisions base on just DNA. Some other important considerations con to age, weight, health, diet, and other medicines you are taking at the same time.
		Pharmacogenetics: Redicine and your	
All US	Insurgitary Essanse Evel Angore: One and the new to some attacker	Genema Greier, Brouz Instalio ef MT Laberatory Director: Hind L. Bern, Int	NA I HONG NOUTICATIONS
Labouring Operation into All // US Dishboard Dishboard My Data Parements Dishboard Agreements Dishboard Conternation	My Data           Wight DNA Results           View the DNA results you have chosen to get from the All of Us Research		
Labouring Devicements	My Data	irch Program.	





## Participants Can Receive Four Types of Genetic Research Results



### 7 regions (20 subregions) and 4 traits

- Eastern and northern Asia Ear wax
- The Middle East and North Africa
- The Americas

- Bitter taste perception
- Cilantro preference
- Lactose intolerance

## 7 pharmacogenomics (PGx) genes and 50+ medications

- SLCO1B1
- NUDT15
- TPMT

• UGT1A1

- Melanoma
  - Brain cancer
  - Pancreatic cancer
  - Stomach cancer

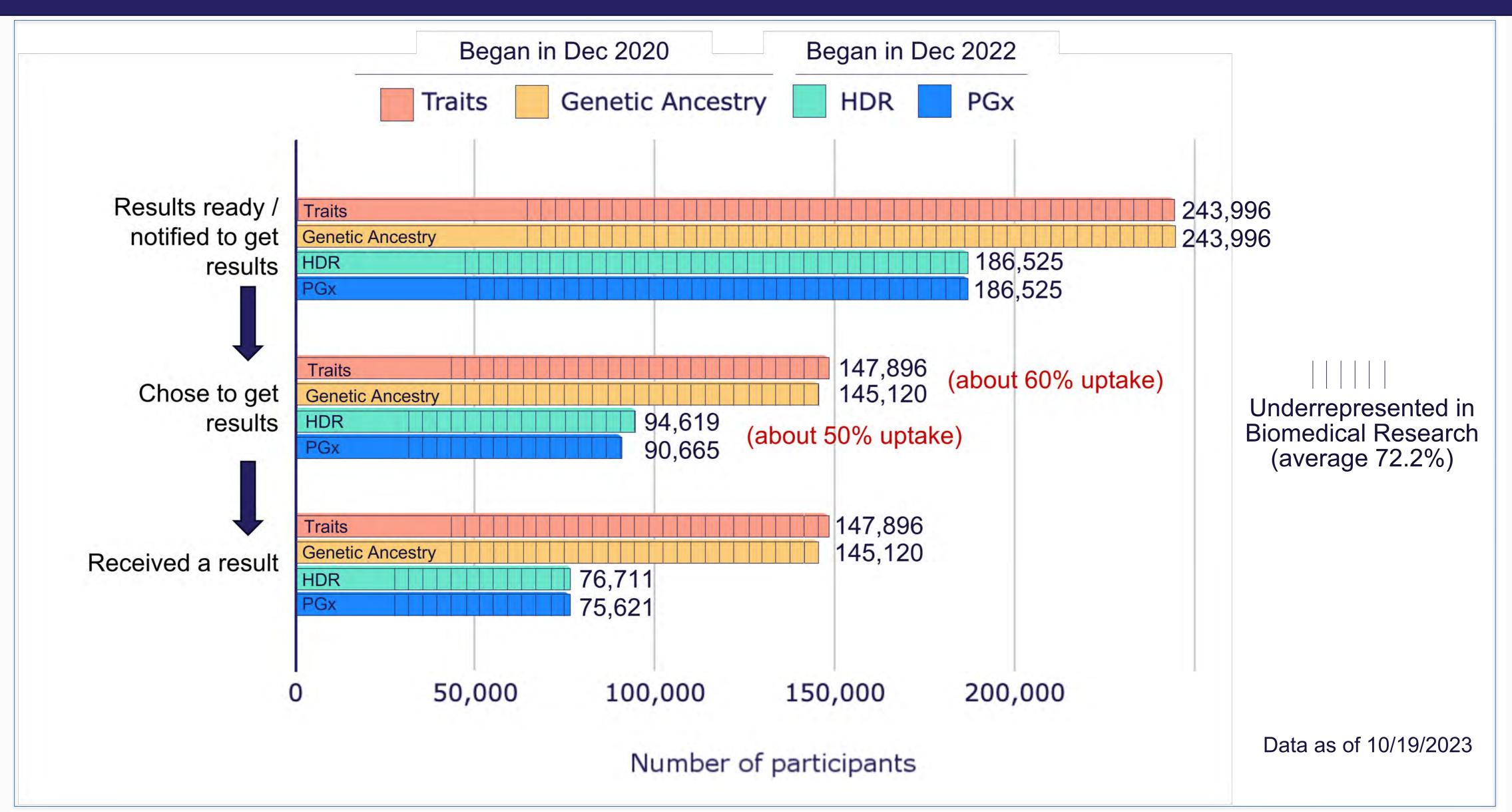
- Familial hypercholesterolemia
- Cardiomyopathies
- Arrhythmias
- Arteriopathies







## 240,000+ Participants are Currently Eligible to Receive Genetic Results







## Returning Genetic Ancestry and Traits (as of November 29, 2023)

### **DNA Results**

You'll see all of your DNA results here when they're ready. See options for your DNA results.

#### **Genetic ancestry and trait results**



#### **Genetic ancestry**

Genetic ancestry can be very interesting, but you may also learn information y Learn more



#### Bitter taste perception

Learn what your genes can tell you about how you taste bitter things.



#### **Cilantro preference**

Your genes play a role in whether you love cilantro or think it tastes like soap.



#### Earwax type

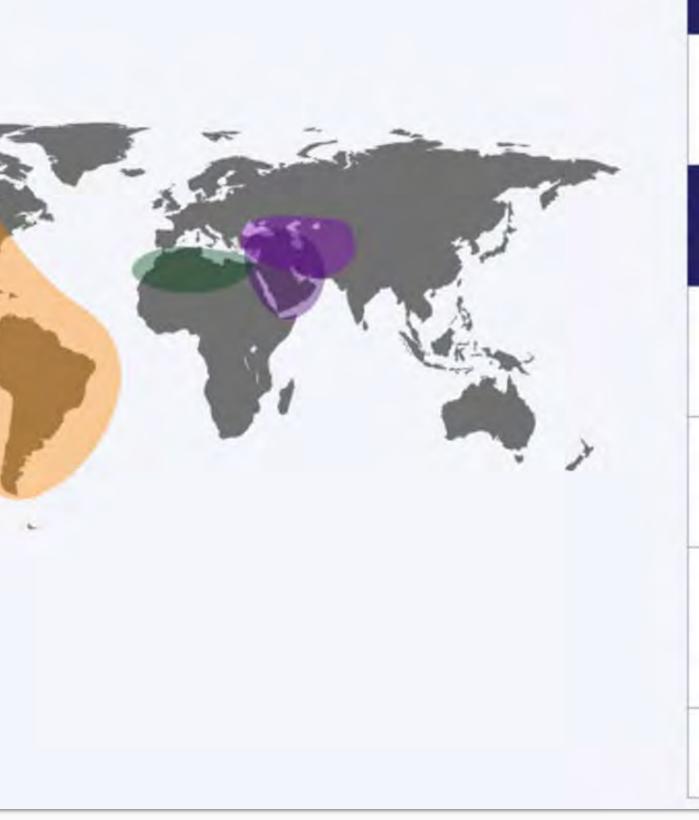
Flaky or sticky? Earwax type is in your genes.



#### Lactose intolerance

Your genes have a say in how well you digest lactose products like milk.

5 results

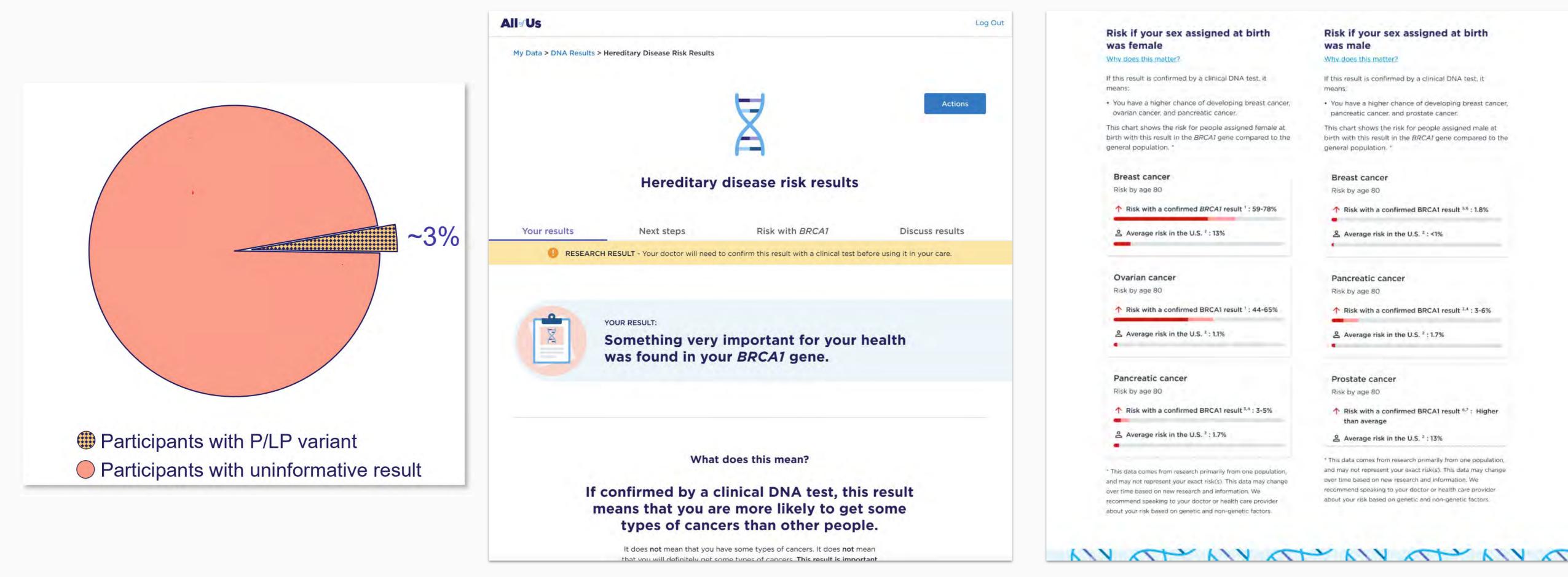


The Americas	50% ~
The Americas	100%
Such as North, Central, and South	America
The Middle East and	50% ~
North Africa	
Northern Africa	10%
Such as Morocco, Algeria, and Egy	ypt
The Middle East	40%
Such as the Arabian Peninsula and	d Egypt
Western Asia and the Caucasus	50%
restern Asia and the cadeasas	



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## **Returned 76,000+ Hereditary Disease Risk (HDR) Results;** Identified 2,200+ Participants with P/LP Variants

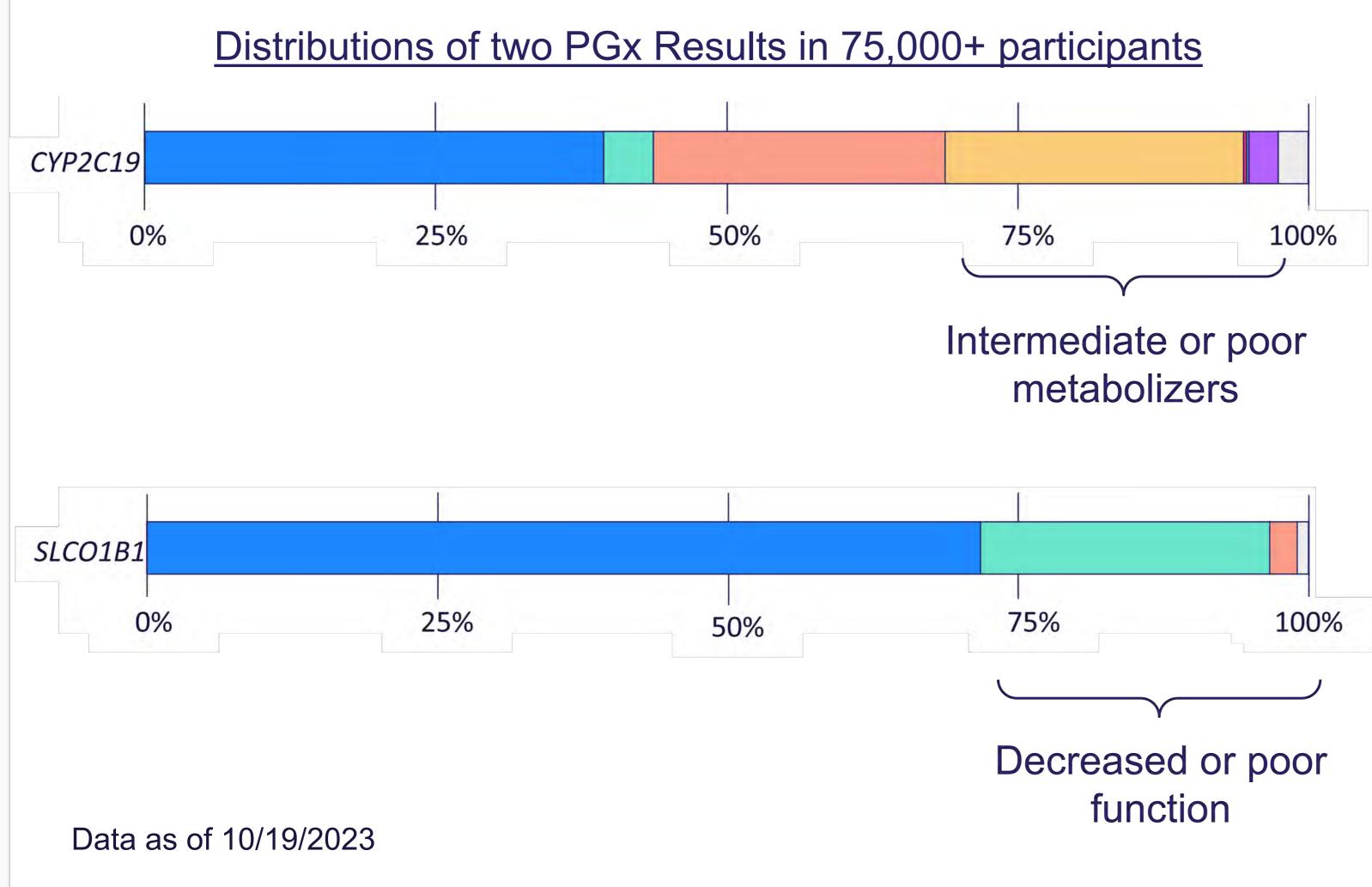


### Data as of 10/20/2023





## Returned 75,000+ PGx Results, with 68,000+ (>90%) Participants with a **Result That Could Impact How the Body Processes Certain Medications**







GENETICS AND MEDICINE

**DNA and medicine** 

#### This table points out some medicines that may be affected by your genetic results.

If you are taking one of these medicines, talk with your doctor or pharmacist about whether ordering a clinical pharmacogenetic test is right for you.

#### These medicines MAY BE impacted by your genetics.

In some cases, pharmacogenetic information may help doctors and pharmacists choose medicines and doses.

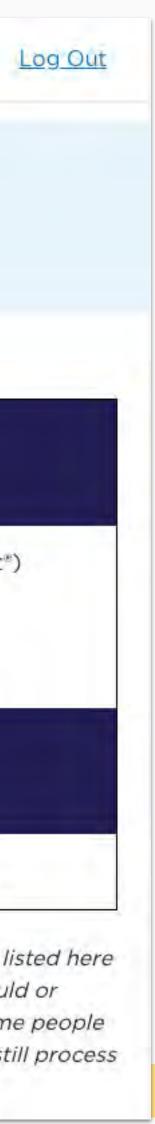
#### Gene <u>CYP2C19</u>

- brivaracetam (Briviact<sup>\*</sup>)
- clobazam (Onfi<sup>\*</sup>)
- clopidogrel (Plavix<sup>®</sup>)

#### Gene SLCO1B1

simvastatin (Zocor<sup>®</sup>)

Just because a medicine is listed here doesn't mean that you should or should not be taking it. Some people with these genetic results still process these medicines normally.



## New Surveys on Mental Health and Well-Being Launched July 2023

## **Emotional Health History** and Well-Being

#### **Emotional Health** History and Well-Being

8 minutes

Start

### **Topics Assessed:**

- Generalized and lifetime anxiety
- Present and past depression
- Suicidal behavior
- Childhood and adult adversity/trauma
- General well-being

Behavioral Heal and Personality	27 C
5 minutes	
Start	

### **Topics Assessed:**

- Adult ADHD
- Bipolar disorder
- Psychosis
- Panic disorder

- Personality

**Over 100,000 participants** have completed both surveys to date

## **Behavioral Health** and Personality



Obsessive compulsive disorder Social phobia and agoraphobia

#### What do your responses say about your personality?

The "Big 5" is a mindel of personality that includes five key tracts. The Big 5 personality inddel has been very wait. studied and confirmed as valid. The five key traits include:

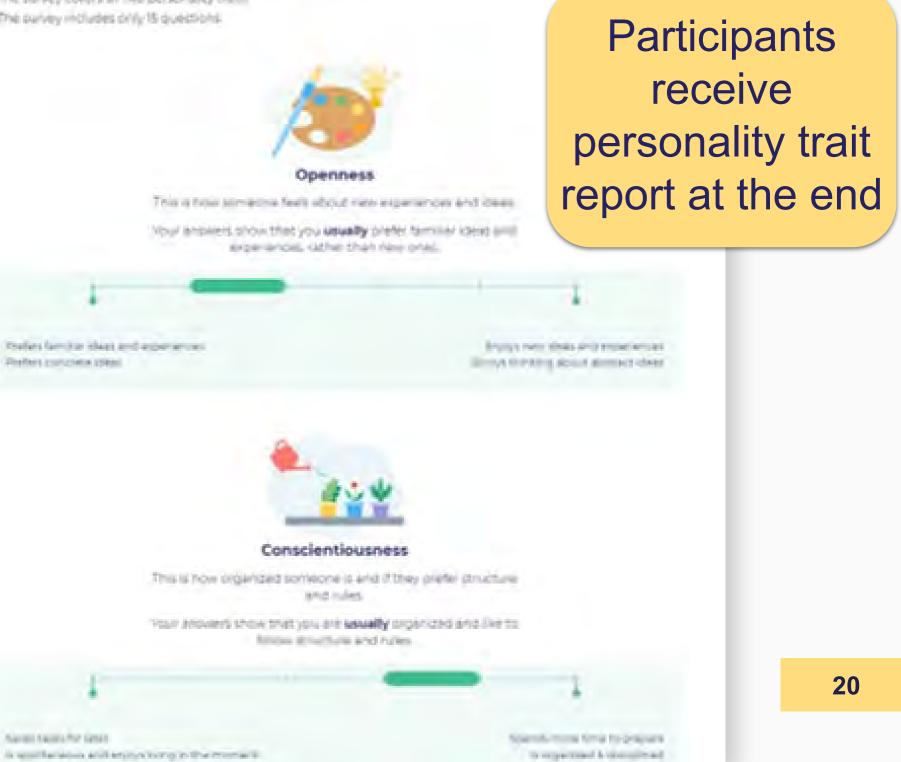
- Openness to experience: How you feel adduit new experiences and cleas
- Conscientiousness How councils during and Fursh pieles structure and rules
- Estreversion: How secal and energetic you are around others.
- Agreesblenest: How much you consider the needs and feelings of others in velation to your own needs.
- Emotional resilience: How you may repond to stress/u experiences or negative emotions, we ensety in sadness. The Big S Inventory calls this tract Neuroboom

Each of the tracts really fails on a spectrum or a scale. For example, the extrinversion tract has entraversion on one end of the scale and inclusion on the other end. Nost people In somewhere in between these

These results report on only five personality tracts so they do not fully reflect who you are four tracts indicate how you may respond in different situations. How you actually respond will depend on more than just your tracts

Several different survey tools measure the Big Epersonality traits. The expert group assigned to develop the Mental Health and Well-Being survey shoose this tool for Several reasons

- The equivey is a velocated bird?
- The survey covers all five personality train
- The burvey includes of ity 15 quections



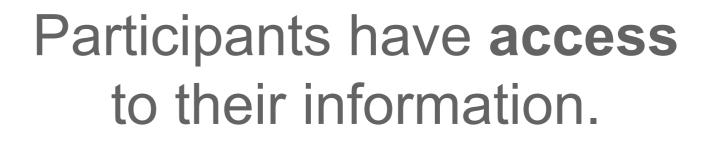
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## All of Us Research Hub: Public Data Browser

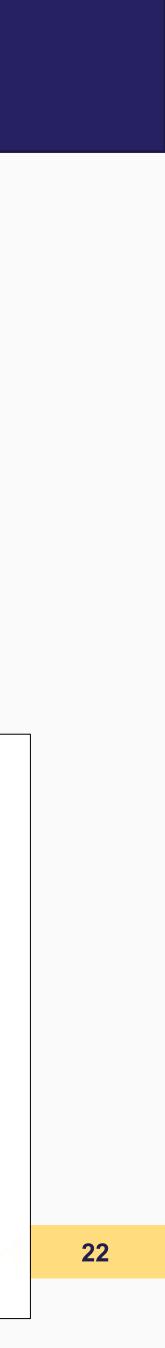
## Summary statistics of:

- EHR Data (Conditions, Drug Exposures, Lab & Measurements, Procedures)
- **Genomic Variants**
- Survey Questions (including COVID-19 surveys)
- **Physical Measurements**
- **Open Access (no login** required)

### **Data Browser**



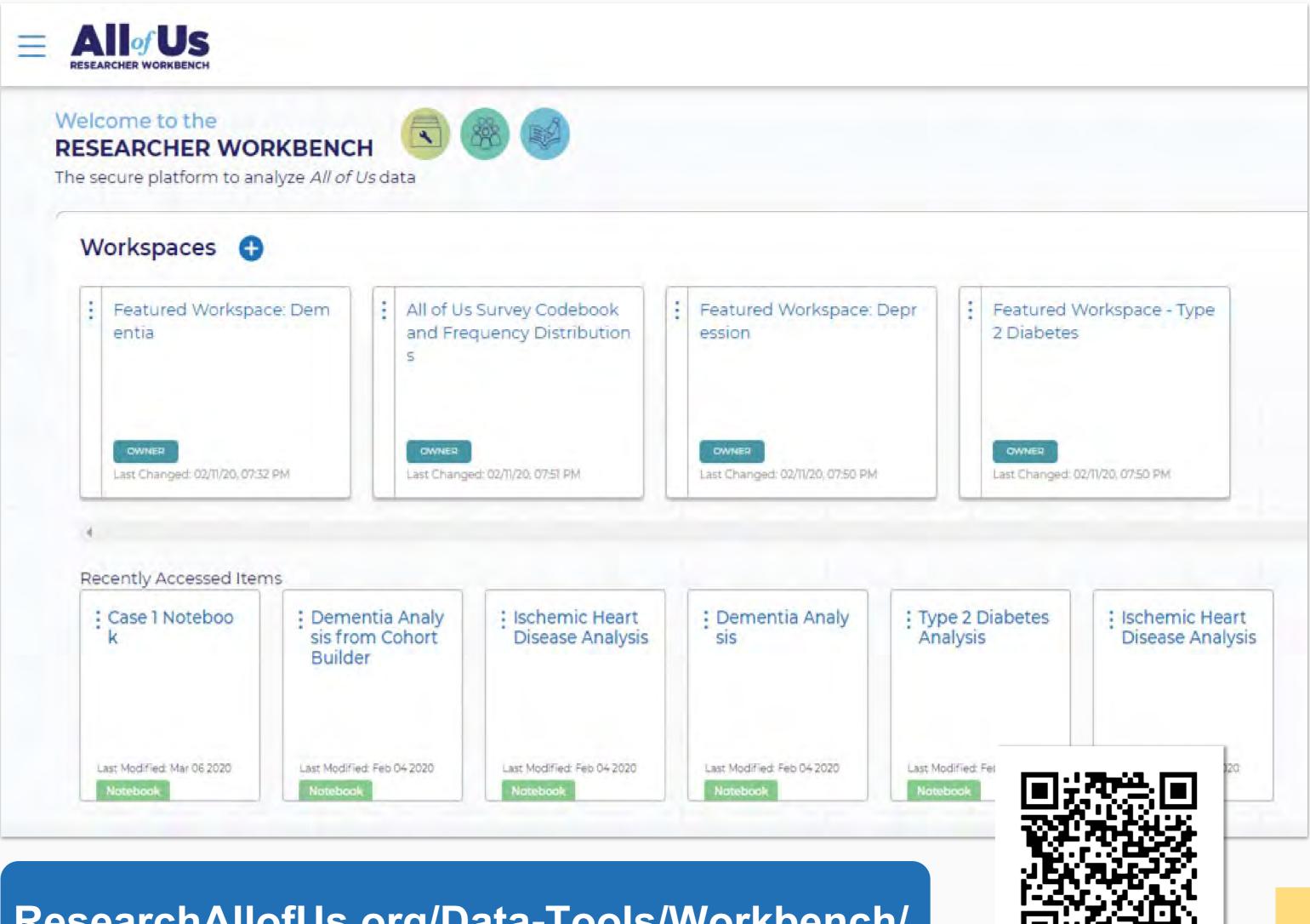


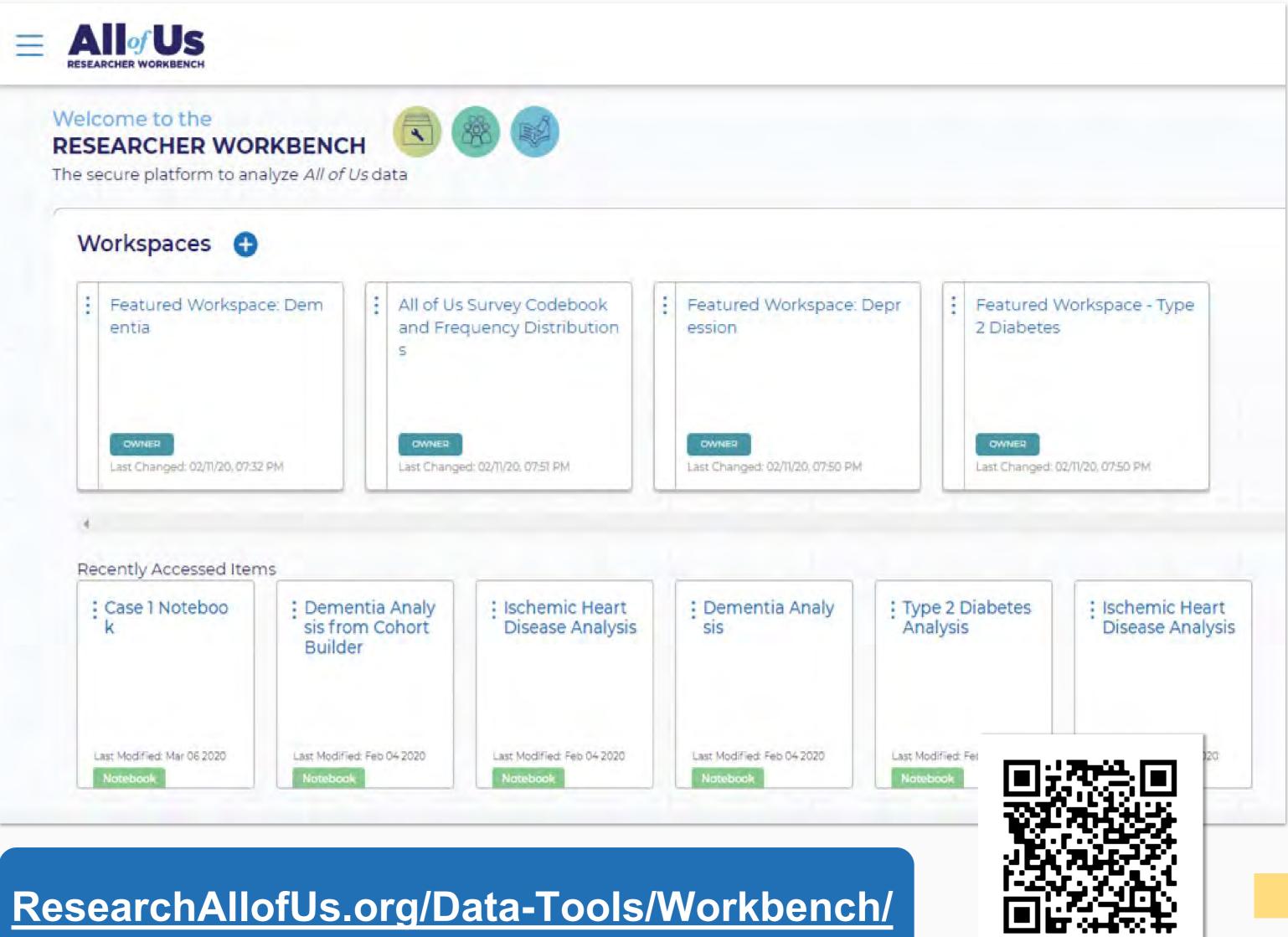


## All of Us Researcher Workbench: Access to Row-Level Data for Analysis

### **Researcher Workbench**

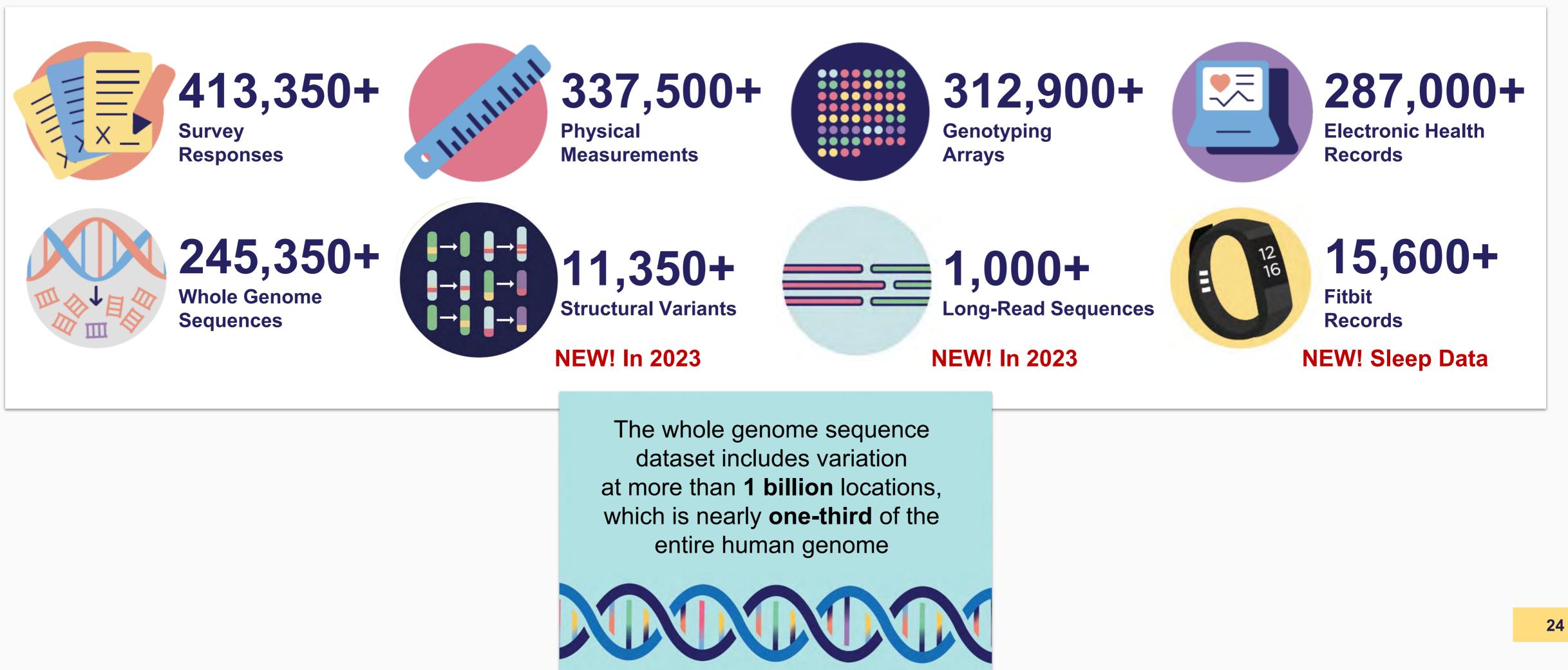
- Cloud-based central resource for broad data accessibility
- R and Python, soon SAS will be available also
- **Passport access model for** approved researchers - just create, describe your workspace, and get to work! No separate IRB approval needed.
- Currently open to academic, health care and not-for-profit organizations







## Nearly 250,000 Whole Genome Sequences Available to Advance Precision Medicine



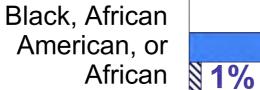
## All of Us is Enhancing Diversity of Genomic Studies



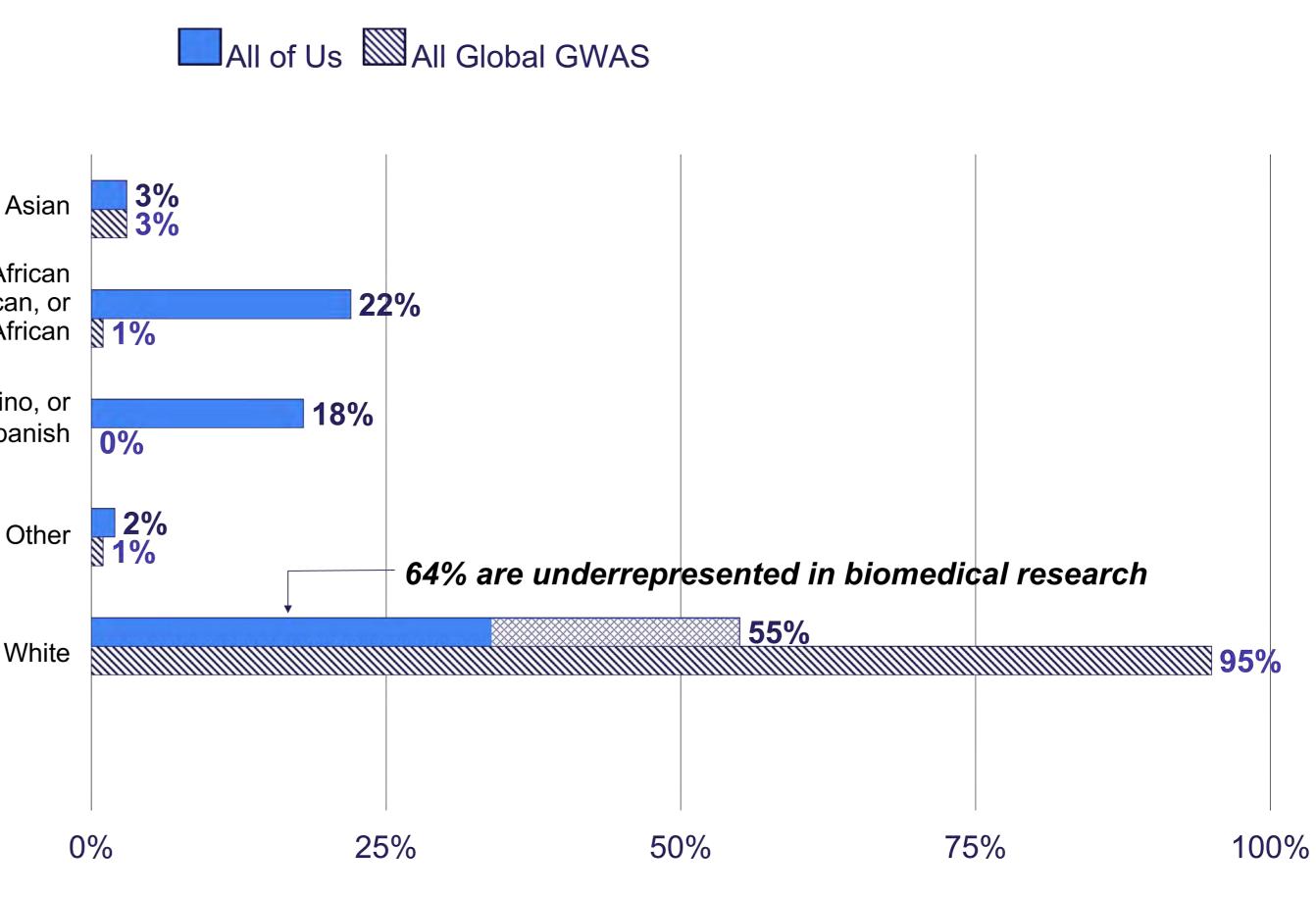
~45% diverse by race/ethnicity

77% underrepresented in biomedical research

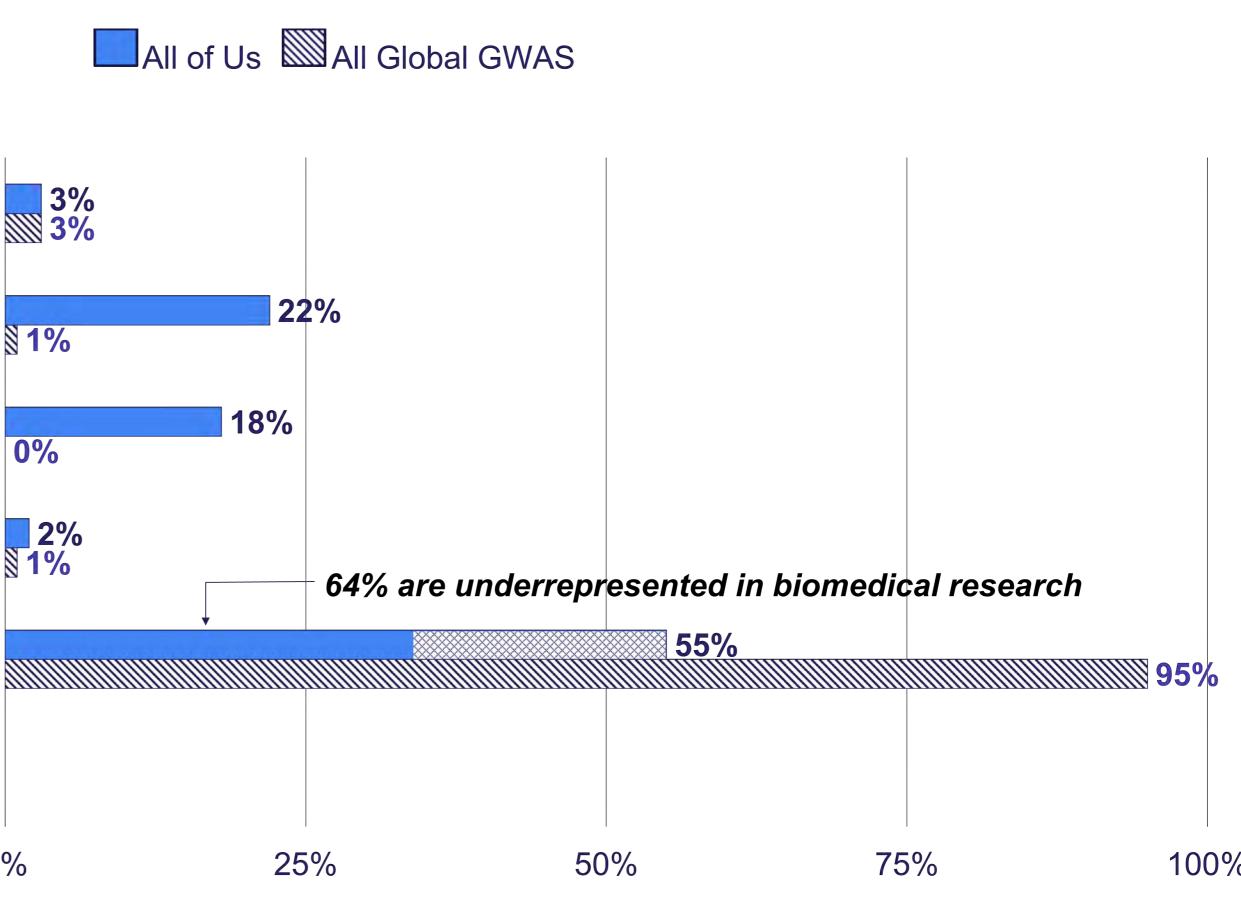
Asian



Hispanic, Latino, or Spanish 0%



White



All Global GWAS values from <u>www.gwasdiversitymonitor.com</u>. Values current as of November 2023



## Researcher Workbench Usage and Diversity (data as of November 29, 2023)

## **Our Researchers**

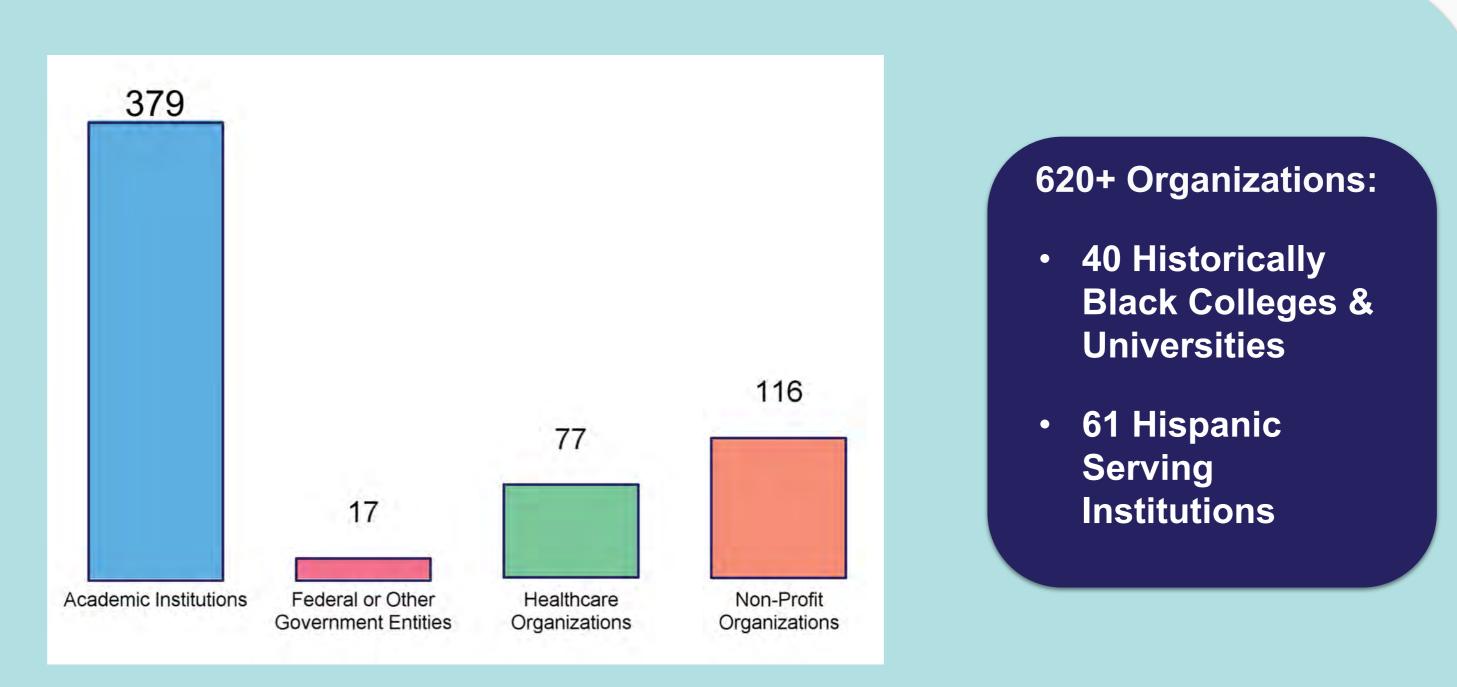


**8,120+** Registered Researchers



620+ Institutions

Over 74% of our researchers are underrepresented in the biomedical workforce — including over 33% diverse by race and ethnicity (other than Non-Hispanic White or Asian)



Research Currently Underway





### **Top conditions being studied**

- Cardiovascular disease
- Hypertension
- Mental Health
- Cancer
- Diabetes



## **Publications are Growing**



#### Family and personal history of cancer in the All of Us research program for precision medicine

Lauryn Keeler Bruce 🔟, Paulina Paul, Katherine K. Kim, Jihoon Kim, Theresa H. M. Keegan, Robert A. Hiatt, Lucila Ohno-Machado, On behalf of the All of Us Research Program Investigators 📷

Published: July 17, 2023 • https://doi.org/10.1371/journal.pone.0288496

Originally published 22 May 2023 https://doi.org/10.1161/STROKEAHA.122.041891 Stroke. 2023;54:1538-1547

Charles C. Matouk

Article Open Access Published: 10 October 2022

#### Association of step counts over time with the risk of chronic disease in the All of Us Research Program

Hiral Master, Jeffrey Annis, Shi Huang, Joshua A. Beckman, Francis Ratsimbazafy, Kayla Marginean, Robert Carroll, Karthik Natarajan, Frank E. Harrell, Dan M. Roden, Paul Harris & Evan L. Brittain



Daniela Renedo, Julián N. Acosta, Andrew B. Koo, Cyprien Rivier, Nanthiya Sujijantarat, Adam de Havenon, Richa Sharma, Thomas M. Gill, Kevin N. Sheth, Guido J. Falcone and

**Brief Communication** 

#### Quantifying physical activity needed to mitigate genetic risk for obesity

lide Han, Jeffrey Annis, Hiral Master, Andrew Hughes, Dan Roden, and 3 more

**Pre-Print** 

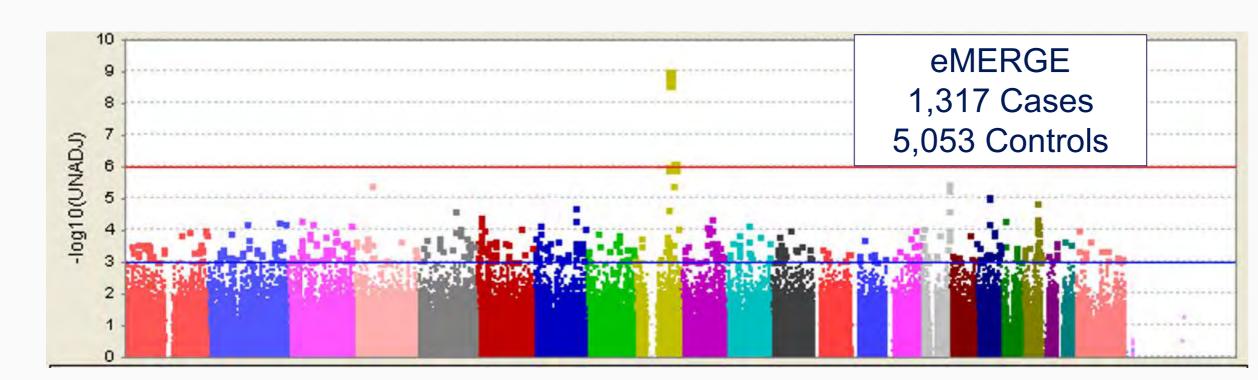


## One example of GWAS in All of Us

## The Genetic Basis of Primary Hypothyroidism

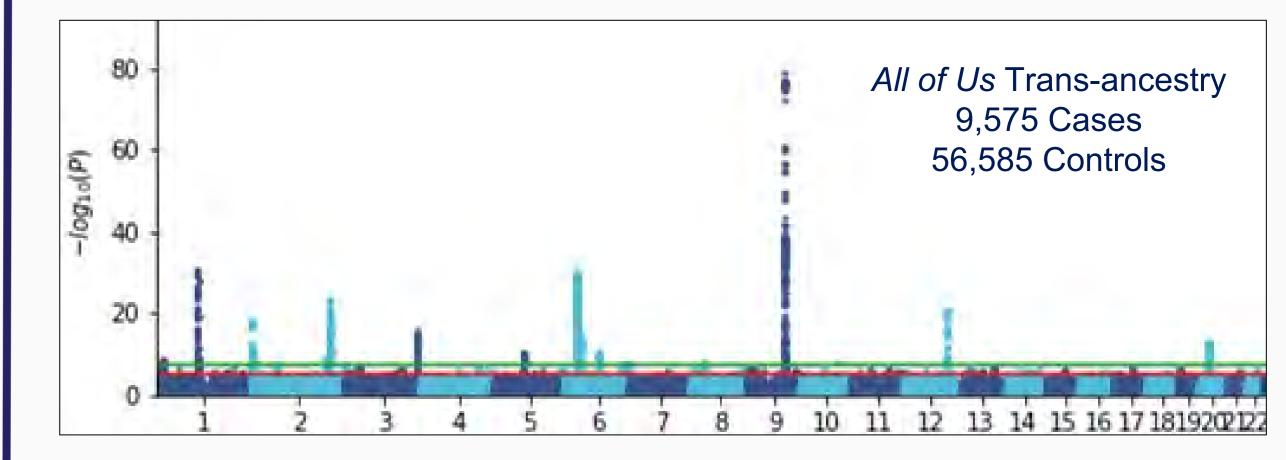
2011 - eMERGE Network analysis

- 5 sites worked together to find autoimmune hypothyroidism in EHRs
- Discovered one genetic loci in European ancestry individuals
- Took ~2.5 years and ~40 people



### 2023

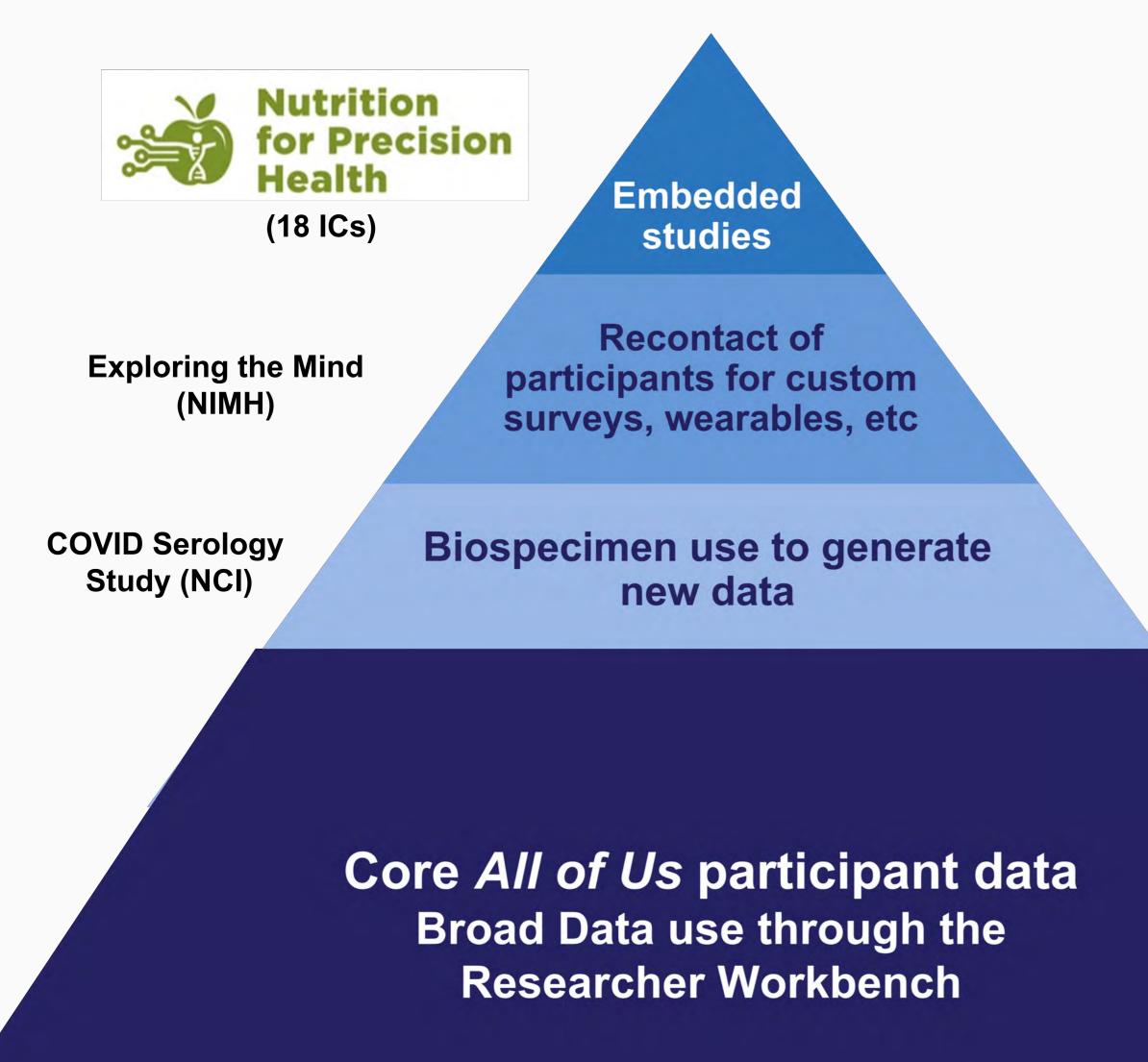
- All of Us Researcher Workbench
- >10 genetic loci in diverse population
- Took one postbaccaulareate student about 6 weeks for initial analysis







# Ancillary Studies Will Have a Positive Impact on Increasing Access to a Research-Ready, Diverse National Cohort



### **Example Ancillary Studies:**

Randomized controlled trials Observational trials Devices New biospecimen collection Deploying questionnaires/tasks in portal Biospecimen access



## Nutrition for Precision Health Powered by the All of Us Research Program

## **Goal**: To develop algorithms to predict individual responses to foods and dietary patterns



Examine baseline diet and physiological responses to meal challenges

Examine responses to 3 short-term intervention diets in free-living controlled feeding studies

10,000 All of Us participants

1,500-2,000 Module 1 participants



Examine responses to 3 short-term intervention diets in domiciled controlled feeding studies

500-1,000 Module 1 participants

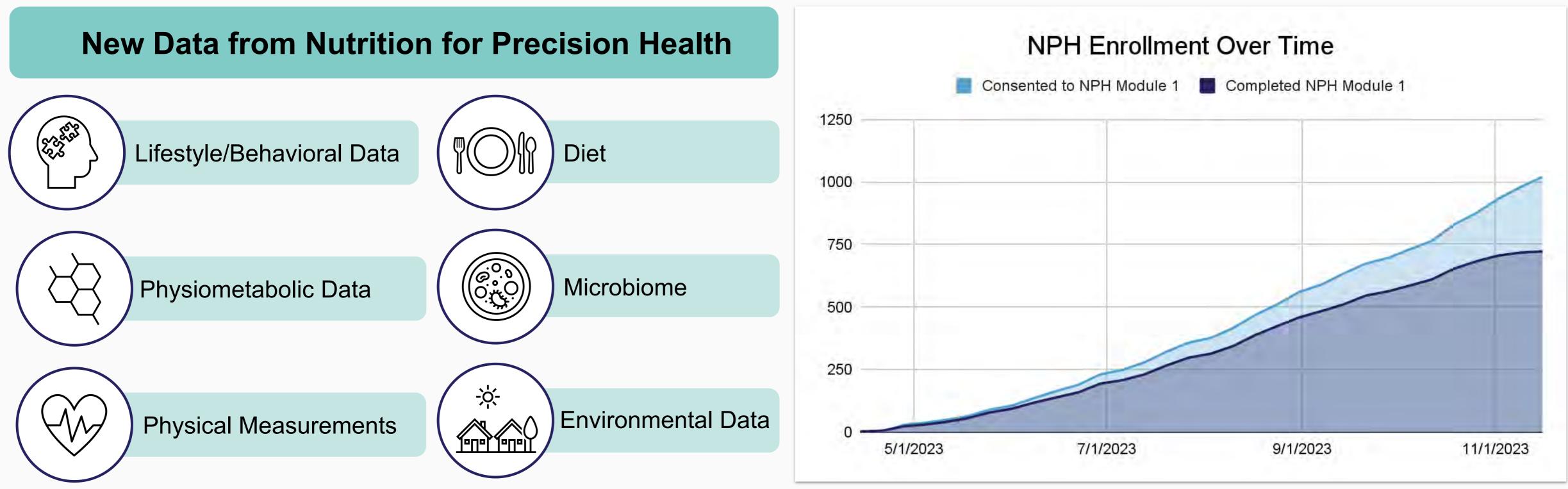








## **Ancillary Studies: Nutrition for Precision Health**







## **Recent All of Us Funding Announcements**



- NIMHD, NLM, OBSSR, and ODSS



### All of Us Awards \$1.5 Million to Institutions Collaborating with Tribal Communities

- Engineering Society



### All of Us Establishes New Center for Linkage and Acquisition of Data (CLAD)

- partners.
- mortality data, environmental data).

NIH Awards \$9.7 Million to Advance the Use of All of Us Research Program Dataset • All of Us and 10 partner ICOs are funding 26 research projects using All of Us data. • Funding for awards provided by All of Us, NEI, NHLBI, NHGRI, NIAMS, NIDA, NIMH,

 Funding will support outreach and engagement with Tribal and Indigenous communities, strengthen the research infrastructure supporting AI/AN researchers, and broaden the base of researchers conducting cultural and ethical research with Tribal communities Awardees are the University of Arizona, Marshfield Clinic, American Indian Science and

• Awarded \$30 million to the University of Colorado Anschutz Medical Campus and its

• CLAD will connect new types of information to All of Us participant data to help researchers better understand the drivers of health and disease (e.g., health care claims,

### Program Announcements



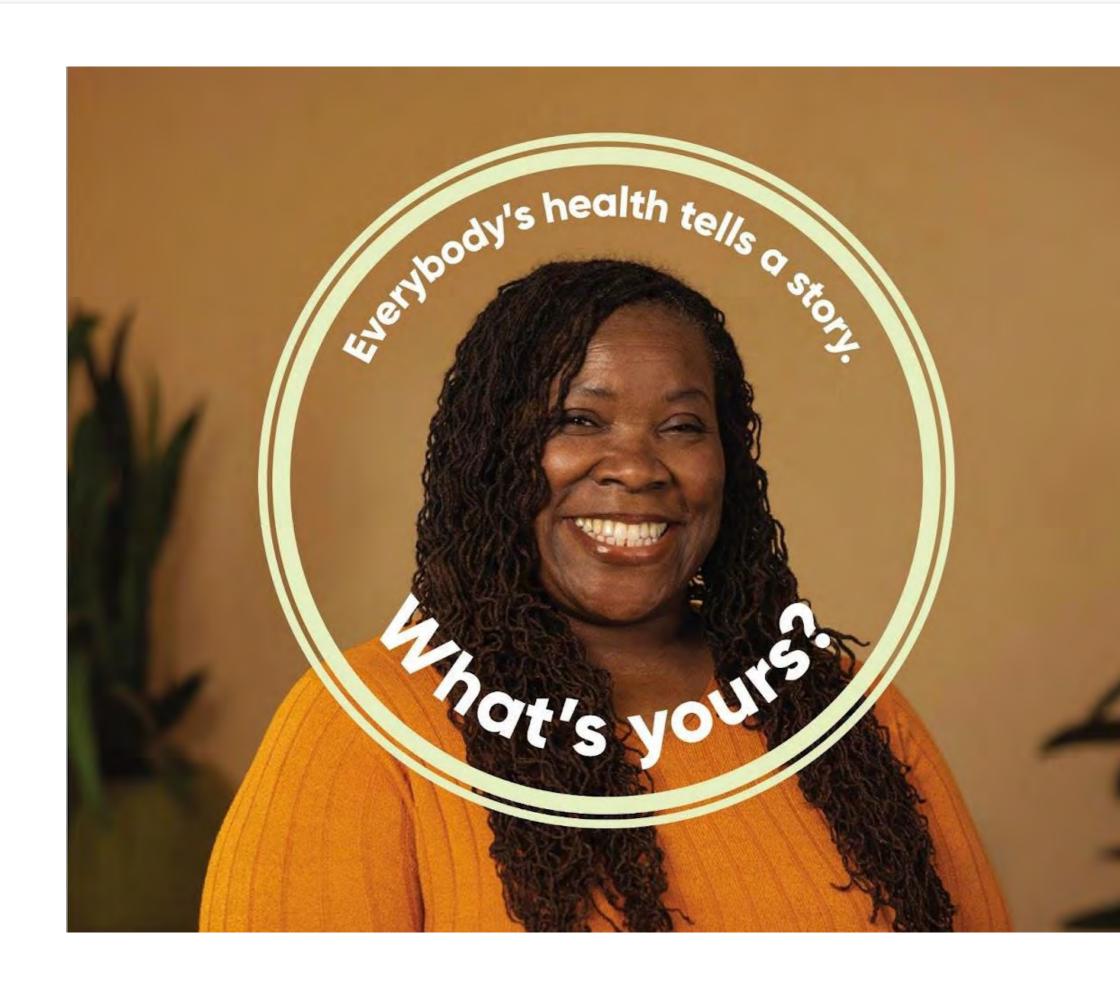








## Changing the Health Landscape: Bringing the NIH Close to Home



"By Participating in the All of Us Research Program, I am helping to shape health research. By providing my health information to All of Us, I am learning things about myself, like how my body responds to certain medications. This information empowers me to work with my doctor to find the right dose. Health research hasn't always included people like me, but All of Us is changing that. I'm ready for it."

— Michelle Anderson, Former *All of Us* Participant Ambassador

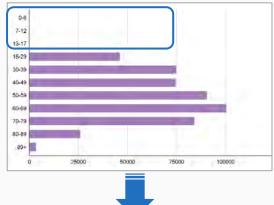
Learn More: USA Today Article



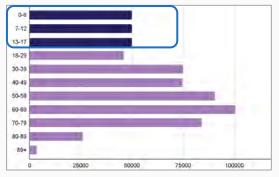


#### **Supporting Health Research Across the Lifespan**

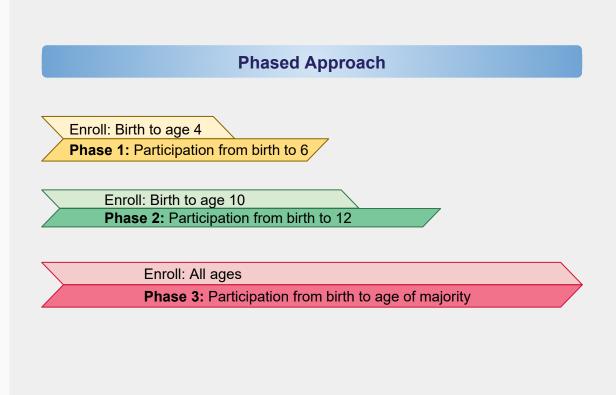
#### Age at Enrollment: Current State



Age at Enrollment: Future State



https://www.researchallofus.org/data-tools/data-snapshots/





AII of US



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## Thank you to our 740,000+ participants!



## <u>AllofUs.NIH.gov</u>

## JoinAllofUs.org

## **ResearchAllofUs.org**



