Emerging Opportunities for Genomics to Improve Population Health

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May 22, 2024

Part 1: Brief Introduction to the National Academies and the Roundtable on Genomics and Precision Health

The National Academies of Sciences, Engineering, and Medicine

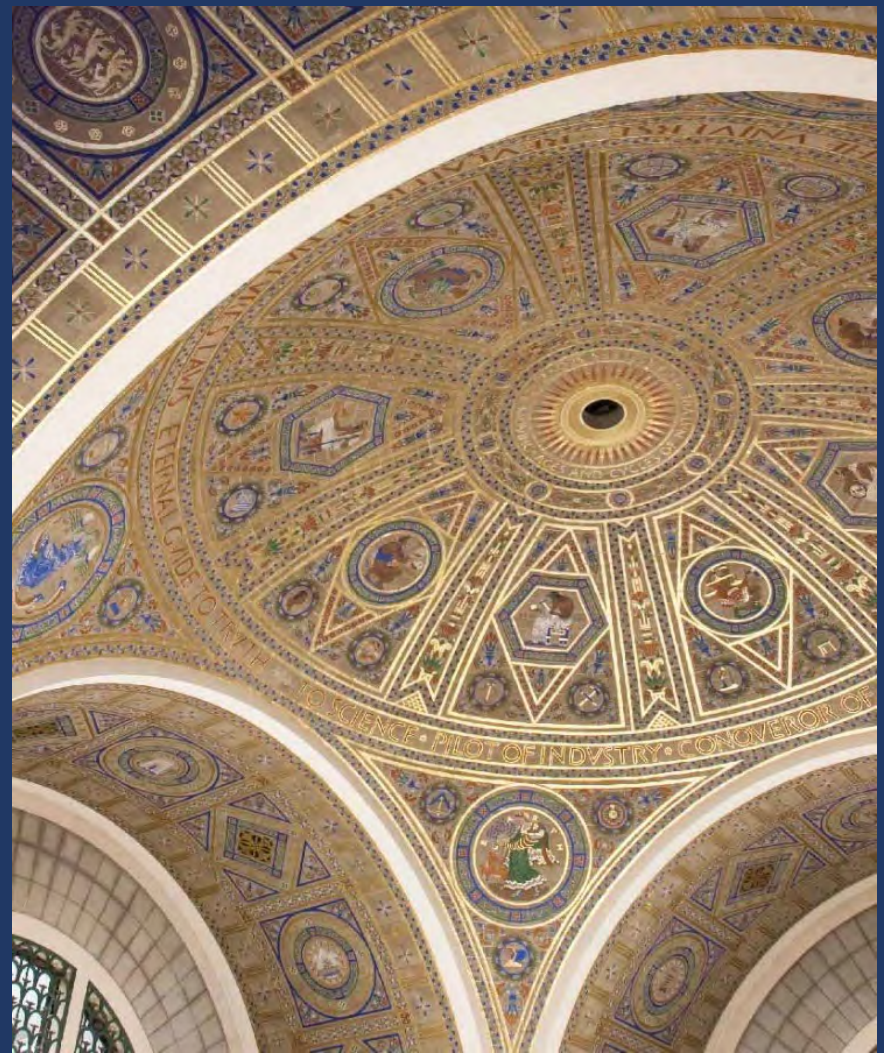
Advising the nation, advancing the discussion, and connecting new frontiers

- The National Academies are **private, nonprofit institutions** that provide independent, trustworthy advice and facilitate solutions to complex challenges by mobilizing expertise, practice, and knowledge in science, engineering, and medicine.
- The National Academies operate under an 1863 congressional charter to the National Academy of Sciences, signed by President Lincoln.
- Best known for our consensus studies, sponsors have several options to meet their needs. For example, these include workshops, standing committees, and **roundtables** that meet regularly.

NAS building, Constitution Avenue, Washington, DC

Roundtables at the National Academies

- Roundtables are convening activities (not aimed at arriving at consensus)
- They provide a venue for interested parties from academia, industry, government, and other interested groups to meet and discuss issues of mutual interest and concern in a neutral setting
- Facilitate attention, visibility, and discussion of critical and emerging issues
- Examine challenges and provide opportunities to explore new approaches to solutions



Impact of our Work

December 3, 2018

A Proposed Approach for Implementing Genomics-Based Screening Programs for Healthy Adults

FOSTER

Relationships and Collaboration

By bringing together a diverse group of participants around a particular topic, our activities foster new professional relationships, facilitate cross-sector collaborations, and enable professional development and networking, including the cultivation of new leaders.

Roundtable Membership

Co-Chairs:
W. Gregory Feero, *JAMA*
Catherine Wicklund, NSGC

Members:

Devin Absher, Kaiser Foundation Health Plan, Inc.

Aris Baras, Regeneron Pharmaceuticals

Vence Bonham, National Human Genome Research Institute

Jeffrey P. Brosco, Heath Resources and Services Administration

Bernice Coleman, American Academy of Nursing

Robert Darnell, The Rockefeller University / New York Genome Center

Jennifer Goldsack, Digital Medicine Society (DiMe)

Geoff Hollett, American Medical Association

Praduman Jain, Vibrent Health

Katie Johansen Taber, Myriad Genetics

Sekar Kathiresan, Massachusetts General Hospital

Muin Khoury, Center for Disease Control and Prevention

Susan Klugman, American College of Medical Genetics and Genomics

Bruce Korf, Global Genomic Medicine Collaborative (G2MC)

Charles Lee, The Jackson Laboratory for Genomic Medicine (JAX)

Christa Lese Martin, Geisinger

Molly McGinnis, Genome Medical, Inc.

Adele Mitchell, Biogen

Jennifer Moser, U.S. Department of Veteran Affairs

Judy Mouchawar, Blue Cross Blue Shield Association

David Nelson, American Society for Human Genetics

Roundtable Membership

Members (continued):

Kenneth Offit, American Society of Clinical Oncology

Michelle Penny, Genomics Consulting

Kathryn Phillips, University of California, San Francisco

Victoria Pratt, Association for Molecular Pathology

Nalini Raghavachi, National Institute on Aging

Sheri Schully, All of Us Research Program, NIH

TBD, National Institute of Mental Health

Anil Shanker, Meharry Medical College

Nonniekaye Shelburne, National Cancer Institute

Jacquelyn Taylor, Columbia University

Sharon Terry, Genetic Alliance

Joyce Tung, 23andMe, Inc.

Thierry Vilboux, U.S. Food and Drug Administration

Karen Weck, College of American Pathologists

Robert Wildin, University of Vermont Health Network Medical Group

Sarah Wordsworth, University of Oxford

National Academy of Medicine Fellow
Paule Joseph, *Inaugural American Academy of Nursing Fellow at NAM*

How to Connect with Us

Visit: nationalacademies.org/GenomicsRT
To sign up for our listserv, view our strategic plan, publications, and future events

Reach out: genomics@nas.edu
To suggest topics for workshops, possible speakers, and/or reviewers, or to just learn more about us

Participate: in the discussion with us today

#GenomicsRT
@NASEM_Health

Part 2: Intersection of the Roundtable and Public Health: Paradox or Paradigm Change?

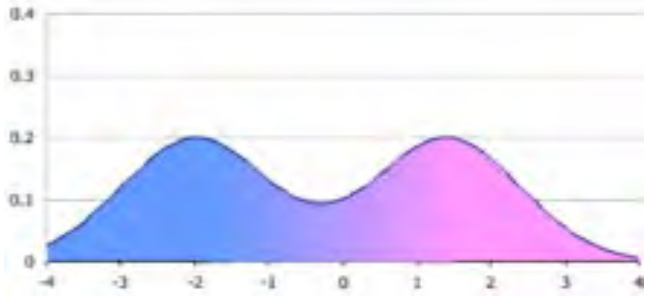
precision medicine

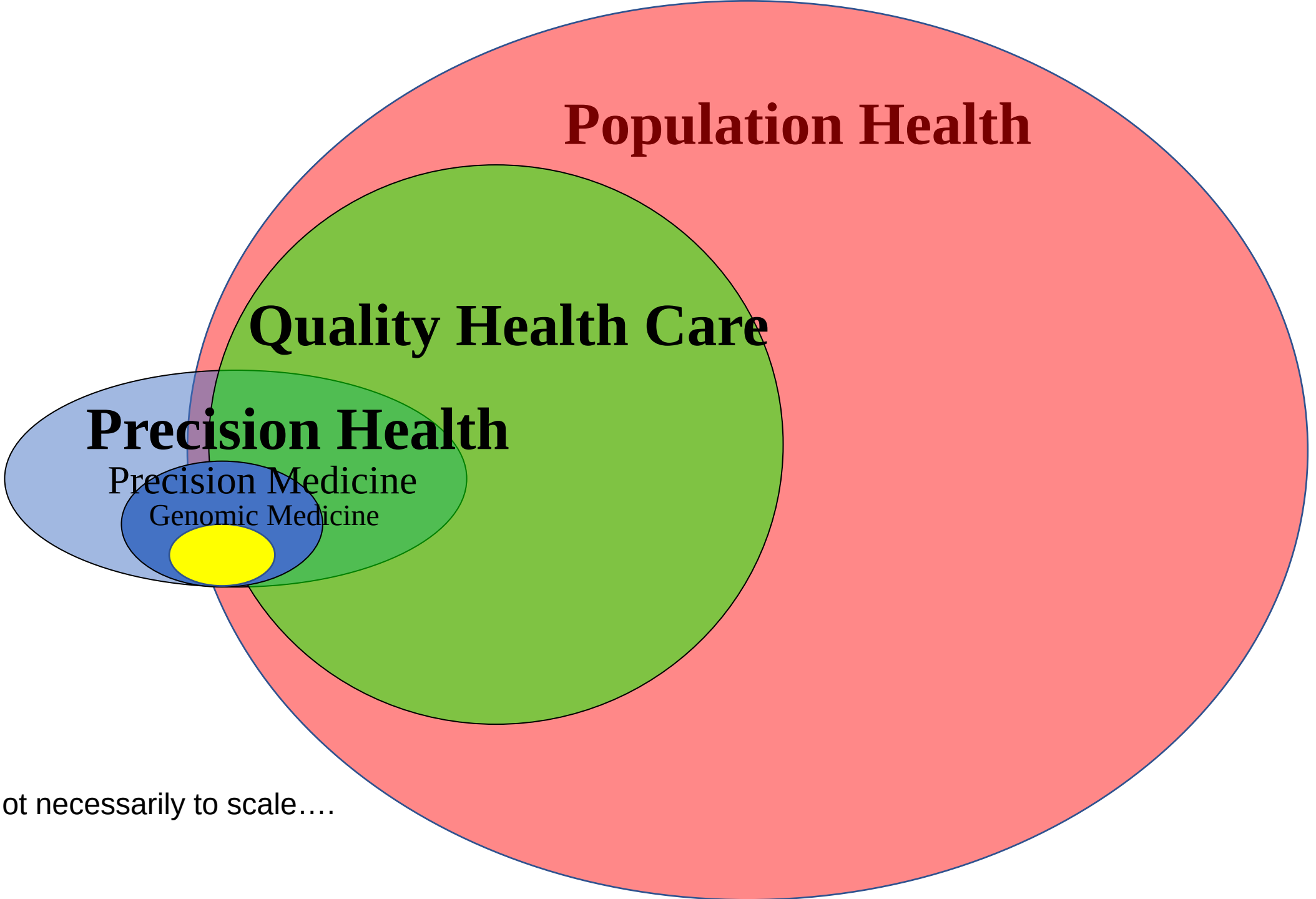
Medical care designed to optimize efficiency or therapeutic benefit for particular groups of patients, especially by using genetic or molecular profiling.

"current research is focused around precision medicine—classifying patients on their tumor's molecular changes"

Source: Google, definitions from Oxford Languages

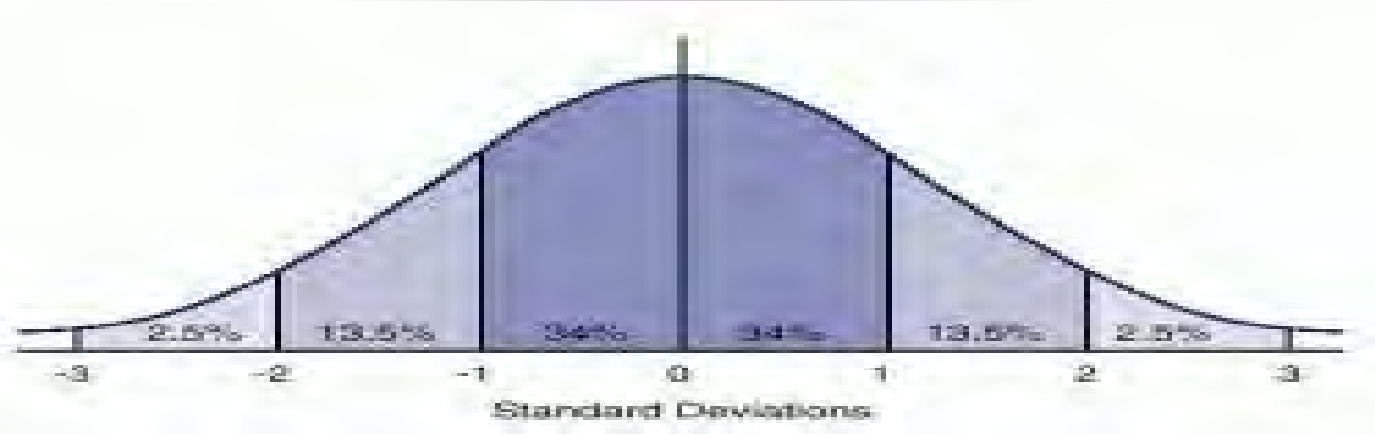
Treating the individual





Not necessarily to scale….

Treating the mean

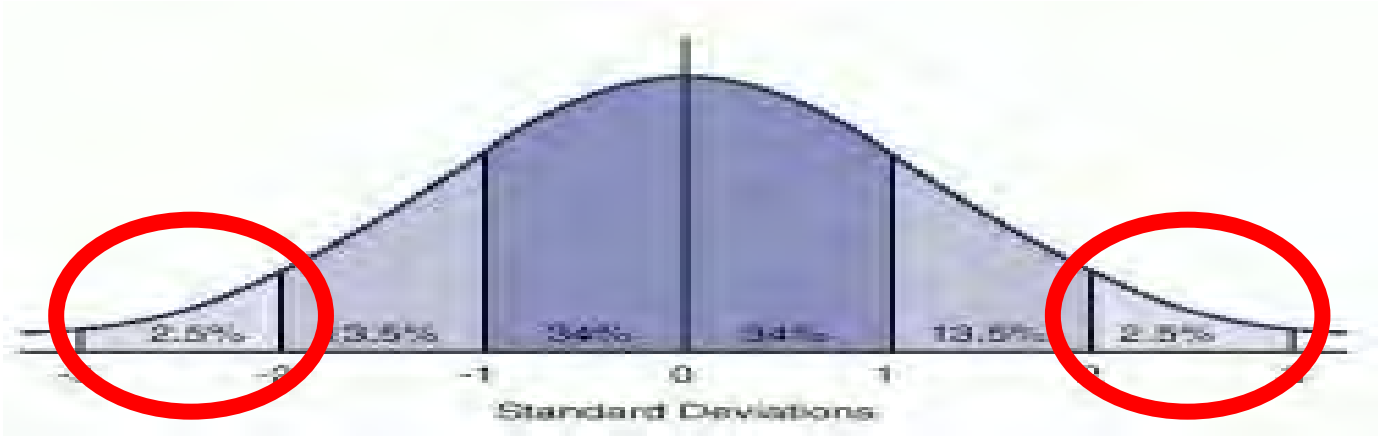


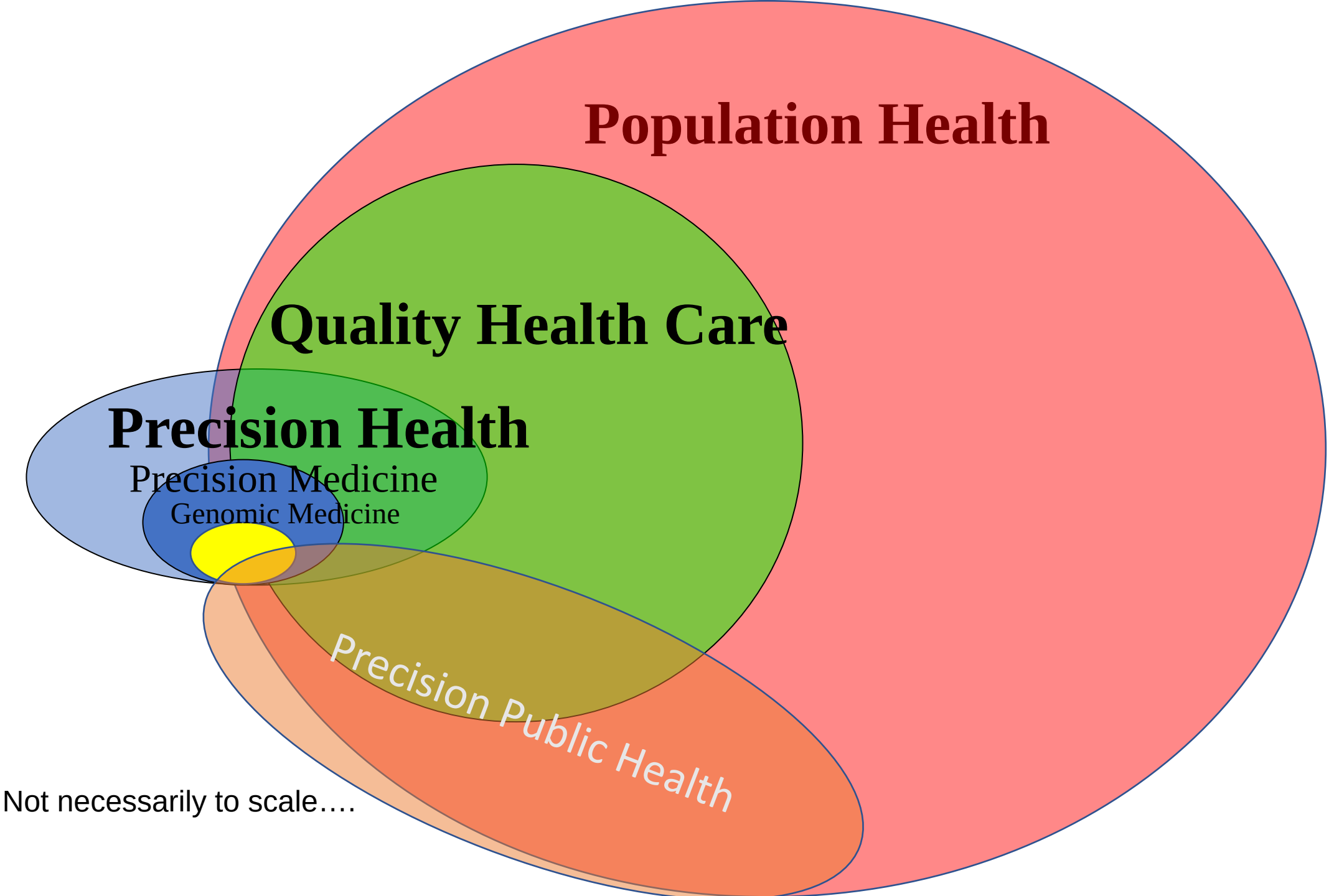
… if precision medicine is about the individual, precision public health is about populations. It is essentially about delivering "the right intervention at the right time, every time to the right population."

Muin Khoury MD, PhD

https://blogs.cdc.gov/genomics/2018/05/15/precision-public-health-2/

Would you offer these groups the same intervention?





Not necessarily to scale….

Genomics and Precision Health Scope of Impact?

- Diagnosis (Mendelian disease, cancer)
- Risk prediction (type 2 DM, carrier screening, NBS)
- Prevention (FH, HBOC, Lynch)
- Prognosis (breast cancer)
- Drug selection (non-small cell lung cancer)
- Harm avoidance (abacavir toxicity)
- Treatment monitoring (cell free DNA/CA)
- Novel therapies (gene editing/amyloidosis)

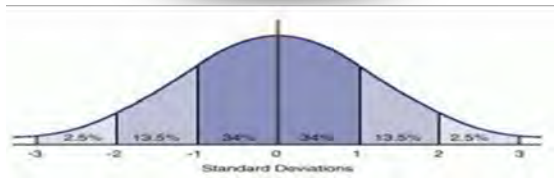
EQUITY????

Not a paradox!

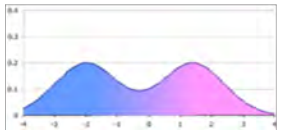
Next-Generation Screening - The Promise and Perils of DNA Sequencing of Newborns at Birth: A Workshop

Continuum of Population Health Interventions

Public Health Domain



Medical Domain

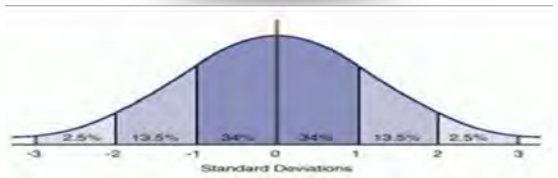


Not a paradox!

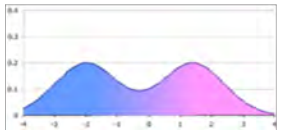
Exploring the Current Landscape of Consumer Genomics: A Workshop

Continuum of Population Health Interventions

Public Health Domain



Medical Domain



Genomics and Population Health Action Collaborative

The Genomics and Population Health Action Collaborative aimed to identify challenges and potential best practices for the widespread integration of evidence-based genomics applications in population health programs.

Provide feedback on this project

Description

About the Collaborative

Integrating genomics at the population health level has the potential to increase our understanding of disease, improve public health, reduce health disparities, and promote genomic literacy. Current evidence for certain genomic applications suggests that health could be improved if these were implemented in the recommended populations. The Genomics and Population Health Action Collaborative was formed in 2015 with the goal of identifying challenges and potential best practices for the widespread integration of evidence-based genomics applications in population health programs.

This collaborative was an *ad hoc* activity under the auspices of the Roundtable on Genomics and Precision Health at the National Academies of Sciences, Engineering, and Medicine (the National Academies). The products of the action collaborative do not necessarily represent the views of any one organization, the Roundtable, or the National Academies and have not been subjected to the review

PROJECT
Roundtable on Genomics and Precision Health

DIVISION
Health and Medicine Division

UNIT
Board on Health Sciences Policy

STATUS
Completed

Workshop Case Studies I:

- Consumer Genomics: c2019
- Genomics Across the Continuum of Health Care: c2022
- Guidelines for Genomic Testing: October 2024

Exploring the Current Landscape of Consumer Genomics: A Workshop (2019)

- Overarching goal of the workshop was to explore the current landscape of consumer genomics and implications for how genetic test information is used or may be used in research and clinical care.
- Discussions included topics such as:
  - Diversity of participant populations
  - Impact on health literacy and engagement
  - Knowledge gaps related to use in clinical care
  - Data privacy/security concerns

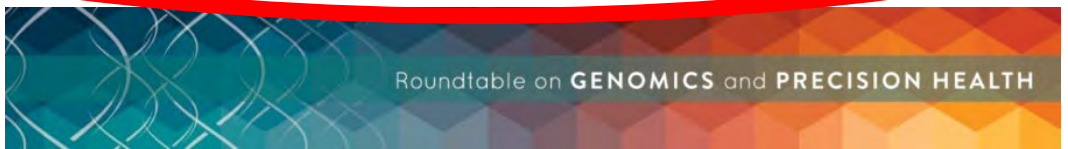
Key Takeaways Heard from Individual Speakers

- Research is needed to better understand what a particular genetic change means, how to annotate it, and how to interpret those variations.
- Direct-to-consumer (DTC) genomic services could provide more directive resources to consumers to help them determine the next steps they might take, given their family histories and the results.
- Offering pretest counseling, or a checklist for consumers outlining the limitations of certain testing and the appropriateness for them, to relieve tension between larger genetic testing panels and customized tests.
- Hybrid models could be a solution for bringing clinicians into the consumer genomics process.
- Companies should be incentivized to share their data, particularly for underrepresented populations, and deposit them in publicly accessible databases.
- The volume of data generated by consumer genomics companies could create incentives for electronic health record companies to develop standards for interoperability and maintenance of genomic data in the context of health care systems.
- Fund research that would use computer algorithms and AI to create automated systems that would perform some of the interpretation functions and help ameliorate the shortage of genetic counselors.
- Research is needed to determine which consumers will benefit the most from having genetic counseling services and how best to "tier" those individuals to allow genetic counselors to practice more efficiently.
- Consider an implementation science approach for defining the challenges (e.g., consumer and provider education) and other aspects of integrating consumer genomics into clinical practice.

Realizing the Potential of Genomics across the Continuum of Precision Health Care: A Workshop (2022)

- The overarching goal for the workshop was to examine strategies to ensure that genomic applications are responsibly and equitably adopted to benefit individuals, as well as populations, over time.

- The public workshop featured invited presentations and discussions to explore:
  - Examples of how genomic data are being used to assess health risk outside of traditional settings for clinical genetics (e.g., prenatal screening and testing, newborn screening, polygenic risk scores) and guide decision-making with an eye toward understanding challenges and opportunities related to equity of access to innovation in science and population level adoption of genomic applications;
  - How patients, clinicians, and payers assess and act upon the risks and benefits of genomic screening and diagnostic testing; and
  - Challenges of integrating genomic data from various sources into clinical decision-making including those obtained outside of traditional clinical care settings (e.g., direct-to-consumer, consumer directed, workplace genetic testing) to support equitable precision health care.



Key Takeaways Heard from Individual Speakers

- Genomics could be integrated into routine clinical care across a life span in prevention, early detection, clinical diagnosis, treatment, and surveillance.

- An equitable precision healthcare system in which trust in health and science is built could be created.

- Speakers discussed opportunities for:
  - Equitable adoption of genomics at the population level
  - Improved education and training of clinicians and the public
  - Less reliance on genetics specialty clinics and greater support for integration of genetics into routine care
  - EHR-integrated clinical decision support tools
  - Engagement of all interested parties in realizing the potential of genomics in precision health care, including patients, their families, clinicians, payers, the public, and others.

Examining Clinical Guidelines for the Adoption of Genomic Testing: A Workshop – October 29, 2024

- The overarching goal for the workshop is to examine how guidelines for genomic testing are developed by various organizations and implemented within clinical practice, with a focus on exploring inconsistencies across guidelines.

- The workshop's presentations and discussions may focus on:
  - Exploring the processes and methodologies used by different professional societies, organizations, and collaborations to gather evidence and develop clinical guidelines for appropriate genomic testing.
  - Understanding how clinicians, payers, test developers, laboratory partners, and others decide which guideline(s) to follow and how they use these guidelines in practice.
  - Examining elements that are consistent and those that differ across clinical guidelines for genomics and how these areas impact access, coverage, and equity in care for patients and how they affect clinicians, payers, test developers, laboratories, and others.
  - Discussing opportunities for a possible path forward for more compatible clinical guidelines for genomics to improve patient care.

Cancer screening for populations!

Part 3: Genomics and Precision Health in Public Health

- Improving Genetics Education in Graduate and Continuing Health Professional Education: A Workshop (2014)
- Improving Diversity of the Genomics Workforce: A Workshop (2021)
- Next-Generation Screening - The Promise and Perils of DNA Sequencing of Newborns at Birth: A Workshop (2023)
    - Challenges and Opportunities in Using Residual Newborn Screening Samples for Translational Research (2010)

Improving Genetics Education in Graduate and Continuing Health Professional Education: A Workshop (2014)

- The overarching goal of the workshop was to examine pragmatic approaches to improving genetics education in both graduate and continuing health professional education.

- Speakers were asked to:
  - Discuss different educational approaches
  - Analyze challenges to success
  - Explore potential solutions for improving genetics education for graduate and health care professionals

Key Takeaways Heard from Individual Speakers

Educational Approaches

- **Just-in-time and online education provides health care professionals information they need to use/learn it.**
- Technological advances are a powerful adjunct to (not a replacement for) effective instruction and acquisition of clinical skills.
- Interprofessional education: achieve better communication and collaboration among learners, practitioners, patients, clients, families, and communities.
- Avoiding COI in educational materials requires strong commitment by the leadership of the medical community.
- Implementation research: promotes the integration of research findings into routine use in an evidence-based manner.
- Motivations of practitioners and the attributes of educational resources are key determinants of whether genetics education will be embraced.

Key Takeaways Heard from Individual Speakers

Graduate Health Professional Education and Post-Graduate Training

- Accreditation orgs for residency/fellowship training or that certify physicians for independent practice can shape the content of graduate and post-graduate education programs.
    - Standards for clinical use of genomics findings is needed to take advantage of accreditation as a lever for change.
- Focusing on the critical points to master relating to a specific disease process/condition is effective for learner retention.

CME Focused

- A needs-driven, learner-centric, evidence-based, outcomes oriented, and practice-embedded continuing medical education system can contribute to improved quality of care and patient outcomes.
- The accreditation system is designed to recognize and promote institutional and personal attributes that are effective in maintaining competencies, performance, and patient outcomes.
- Innovative methods in continuing medical education, such as simulations for workplace learning, massive online open classes, and Web-based learning portfolios, can help produce the changes that are needed as the effects of genetics on clinical practice continue to grow.
- Partnerships among professional societies can guide the development of educational initiatives and improve genetic literacy.

Improving Diversity of the Genomics Workforce: A Workshop (2021)

- The overarching goal for the workshop was to examine the current state of diversity (e.g. racial, ethnic) of the genetics and genomics workforce, the factors that have and are contributing to the diversity challenges, and possible steps forward that could lead to increasing workforce diversity to improve access to genomic services.

- Speakers were asked to discuss:
  - Historical perspectives on racism and its impacts on the culture of the fields of genetics and genomics;
  - Ways in which the genetics/genomics workforce is or is not uniquely affected by structural racism;
  - Current and ongoing workforce diversity efforts of genetics/genomics professional organizations and other groups;
  - Implications of diversifying the workforce for patient care and access to genomic services; and
  - Next steps and roles for institutions, societies, associations, community organizations, and other interested parties for fostering diversity, equity, and inclusion in this area.

Key Takeaways Heard from Individual Speakers

- Evidence shows having a diverse workforce in health care increases access and improves quality of care.
  - Patient and provider concordance is associated with delivering care in a more culturally sensitive way.
- Barriers to a diverse workforce: lack of exposure to profession; poor advising/mentorship; limited financial assistance; lack of role models; stereotypical threat; and lack of institutional and faculty support.

Possible ways to improve the diversity of the workforce:

- Ensure that training environments are safe spaces and supports DEIJ
  - Increase awareness about genetics/genomics professions early (e.g., in K-12 education)
  - Reassess what is deemed a “competitive applicant” in recruitment and acceptance into training programs
  - Promote mentorship and policies that expand who can provide/bill for genetic services

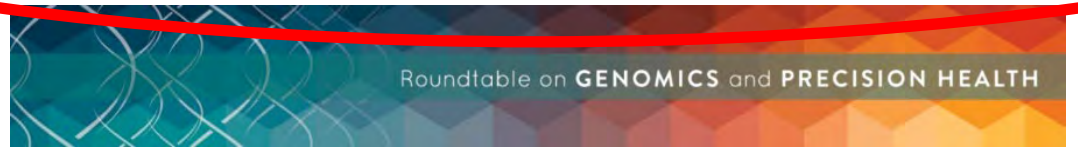
Speakers cautioned that if the workforce is not diversified, that:

- Reach of services will be reduced
- Advancements will be stymied
- Inclusion will be impeded

Next-Generation Screening - The Promise and Perils of DNA Sequencing of Newborns at Birth: A Workshop (2023)

- The overarching goals for the workshop were to (1) examine the known and expected benefits, and potential harms, of the widespread utilization of newborn DNA sequencing, (2) explore the ethical and data security and ownership issues associated with DNA sequencing of newborns at birth, and (3) address issues of next-generation newborn screening equity in the United States.

- Speakers were asked to:
  - Explore the scope of recently initiated programs (US, UK, and Australia) investigating NB DNA sequencing as a screening tool in diverse healthy NB populations and their relationship with established NBS efforts.
  - Engage families, patient advocates, public health system representatives and members of professional societies to provide their views on the need, impact, readiness, and risks of newborn DNA sequencing.
  - Address equity of access to screening, on the assumption that newborn DNA sequencing may be less available, and less likely to identify pathogenic variants in individuals from groups who are under-represented in genetic databases.



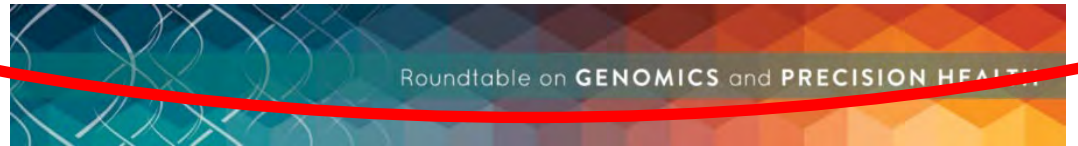
Key Takeaways Heard from Individual Speakers

- **Keep current NBS methods.** Do not try to replace them with genome sequencing. Genome sequencing nonetheless could be implemented with care to avoid disrupting the current system.
- **Informed consent will look different.** Clinicians can discuss sequencing with parents before birth to empower them in the decision-making process.
- **Reducing inequities.** Although NBS is generally equitable within state borders, the conditions screened for vary by state. Health disparities are seen in follow-up care, since it depends on access. Efforts are needed to leave academic health centers to care for patients where they live.
- **Building a trustworthy system.** Some systems are not built in a way that they can be trusted. Increasing diversity and representation within the workforce can help build trust by facilitating engagement of underserved populations.
- **Ensuring genomic privacy.** Laws to prohibit law enforcement from accessing blood spots or genomic data are needed. Incorporate community-based decision-making processes for determining uses for data that value beliefs and desires of the community. Consider destroying genomic data after receiving results.
- **Using clear language.** In discussing NBS, it is important to have a shared and common understanding of what is meant by “screening,” “sequencing,” and “building trust,” for example, so that all interested parties can work together to move the field forward

Sustaining Community Engagement in Genomics Research: A Workshop – July 17, 2024

- The overarching goal of the workshop is to help improve the quality of genomics research by understanding where obstacles to sustained community involvement remain.

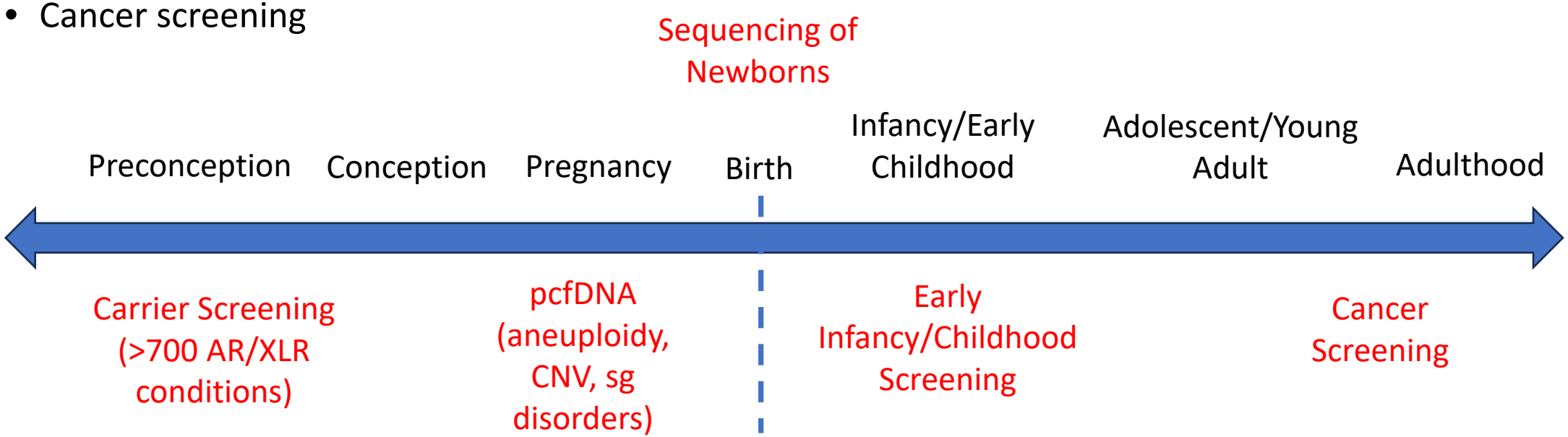
- The workshop will include invited presentations and discussions to:
  - Understand limitations, both logistical (e.g., funding) and structural (e.g., past harms, lack of trustworthiness), to sustained community outreach and discuss possible solutions to those obstacles.
  - Examine opportunities for researcher trainings related to sustained community outreach and engagement in genomics research.
  - Discuss community engagement methods for genomics research with foundations, societies, patient groups, and other organizations about lessons learned from how they fund, engage, form, and measure success of partnerships with communities, other foundations/organizations, and researchers.
  - Explore how community engagement methods for genomics research might differ when working with various underrepresented communities (e.g. LGBTQIA+, people with disabilities, racially minoritized groups, indigenous populations, women, geographically isolated groups).



Future Opportunities for Public Health

Evaluating emerging technologies effects on traditional delivery of public/population health across the lifespan…

- Advanced reproductive technologies
- Sequencing at birth
- Cancer screening



Future Opportunities for Public Health

- Ensuring diverse representation at all the tables
  - Research
  - Clinical/translational
  - Population Health
- Providing a backstop/reality check on accessibility and emerging disparities
  - Education of the public
  - Building trust/policy
  - Cost of care (gene therapy for SCD)
- Partnering with others on the continuum of population health to ensure equitable delivery and follow up on health-related advances in genomics and precision health.

Conclusions

- The intersections between public health goals and emerging genomics and precision health advances are meaningful and numerous
- Dialogue between public health and genomics communities can help ensure benefit to all in the population
- The Roundtable on Genomics and Precision Health of the National Academies stands ready to help facilitate that dialogue