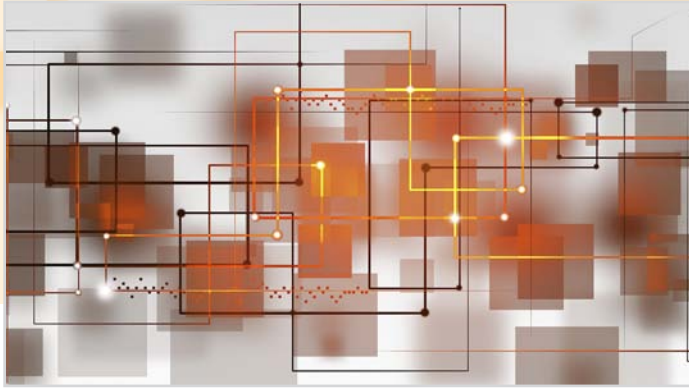


Roundtable on Translating Genomic-Based Research for Health

2015 Annual Report



The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Message from the Co-Chairs

Geoffrey S. Ginsburg and Sharon F. Terry



Last year was a landmark year for genomics and precision medicine. In January 2015, President Obama announced the Precision Medicine Initiative (PMI), stating that the field “gives us one of the greatest opportunities for new medical breakthroughs that we have ever seen.” With this new national agenda — spearheaded by the National Institutes of Health (NIH), the Food and Drug Administration, and the Office of the National Coordinator for Health Information Technology — as well as global efforts to harness the information from human genomes to advance discovery science and inform clinical decision making, our Roundtable is poised to have even greater impact on health and health care policy than ever before.

NIH defines precision medicine as “an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment, and lifestyle for each person.” Our Roundtable has adopted a slightly modified definition, which is “an evidence-based approach to the care of people and patients that uses innovative tools and data science to customize disease prevention, detection, and treatment; improve the effectiveness and quality of care; and sustain health.” The Roundtable refers to these expanded concepts as “genomics and precision health” and plans to explore these areas in 2016.

While population health and precision health (and medicine) are often spoken of as separate research domains, the quantitative machinery for stratifying populations and characterizing individuals uses the same toolbox. It is clear that the aggregate of individual determinants of health, disease risk, and response to therapy provides a robust means to manage populations and subgroups with preventive and therapeutic interventions. Population health management requires more than precision health approaches alone (see list below), but linking the two will advance both fields. For example, the quantitative rigor of precision medicine data science may support approaches to “non-medical” determinants of population health. Likewise, precision medicine tools will be more effectively deployed using population health strategies.

Importantly, as the PMI begins to generate findings that have the potential to lead to novel diagnostics, and more effective therapeutics and health care, the Roundtable will focus on overcoming remaining challenges to ensure that new genomic technologies are appropriately adopted into clinical practice. The challenges that the Roundtable hopes to address in the coming years include further developing the evidence base for genomic applications, standardizing implementation strategies, aligning the needs of basic research and clinical research, and supporting the development of a robust knowledge generating system that incorporates genomic information from both basic and clinical research.

The Roundtable provides a venue for diverse stakeholders to collaboratively identify, illuminate, and develop potential solutions for critical scientific and policy issues throughout the research, development, and health care environments. As a forum for academia, industry, advocacy and provider groups, government, and others, the Roundtable fosters robust dialogue, seeks to clarify complex concepts, and identifies pathways to solutions. Essential to our process is open discourse that allows all perspectives to be voiced, with special attention given to the clarification of competing views and the identification of strategies for resolving issues. Since its establishment in 2007, the Roundtable has organized and hosted 27 meetings and 22 public workshops and published 21 workshop summary reports. In 2015, the Roundtable convened in-person meetings to examine

issues such as strengthening the evidence base in order to better inform local, state, and national policy makers and pinpointing approaches to addressing health disparities. The Roundtable also sponsored a public workshop that brought stakeholders together to explore the tools and approaches from the field of implementation science as they pertain to the widespread integration of genomic medicine.

Elements for the discovery and delivery of precision and population health:

- Use of sequencing and other “omic” technologies in the evaluation of patients
- Mobile and electronic health technologies
- Public and patient engagement in data sharing
- Social and behavioral sciences methods
- Advanced diagnostics, early disease detection, and novel therapeutics
- The learning health system, outcomes research, and evidence generation
- Implementation science expertise
- Epidemiology and cohort studies linked to electronic health records (EHRs)
- Data science and data analytics
- “Non-medical” determinants of population health
- A policy framework for data sharing, privacy, and security
- Public health and precision health collaborative framework

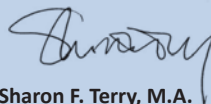
Our agenda for 2016 will focus on grand challenges for genomics in the areas of genomic-based drug discovery and development, mHealth, informatics and “big data,” diagnostics, health system integration, and population health. We are especially interested in the value proposition for utilizing genomics in the practice of medicine and in drug discovery and development, with special emphasis on understanding how genomics might alleviate health disparities. We will continue our work on key issues such as the evidence evaluation process for genomic technologies, approaches to educating health care providers about genomics, the integration of genomic information into EHRs, and the challenges that face the global community of genomic medicine stakeholders.

The Roundtable on Translating Genomic-Based Research for Health welcomed a new sponsoring member from Biogen in 2015. In 2016, we will become the Roundtable on Genomics and Precision Health and will welcome new sponsoring members from 23andMe and GeneDx. We look forward to another productive year with the participation of all stakeholders.

Sincerely,



Geoffrey S. Ginsburg, M.D., Ph.D.
Director, Duke Center for Applied
Genomics & Precision Medicine;
Professor of Medicine and of Pathology and
Biomedical Engineering
Duke University Medical Center



Sharon F. Terry, M.A.
President & CEO
Genetic Alliance

Reflecting Back

Roundtable Activities in 2015

Roundtable Meetings

Roundtable members met three times in 2015 to discuss ongoing and emerging issues for the field of genomics. These meetings brought various stakeholders from government agencies, academic institutions, industry, and others together with the Roundtable members to discuss precision medicine, grand challenges for genomics, implementing programs in health systems in the United States and in countries around the world, innovative mechanisms to generate an evidence base and synthesize information to inform stakeholder decision making, genomics and discovery science, health disparities related to implementing genomic medicine, successes and challenges in integrating evidence-based genomic applications into population health programs, and incorporating genetic information in the EHR. The Roundtable convened the public workshop and collaborative meetings described below.

Roundtable Workshop

Applying an Implementation Science Approach to Genomic Medicine, November 19, 2015

Technological advances in genome sequencing have improved accuracy while, at the same time, decreased the cost of large-scale sequencing. Genomic data is being used more commonly in clinical practice for disease prevention, diagnosis, and to identify and monitor treatments for patients. Despite the progress in associating gene variations with diseases, there remains limited evidence for the majority of these associations and their use in clinical decision making. Additionally, sequencing is being introduced in a fragmented way and at mostly large academic health centers. One risk of this approach is that it may introduce unintended disparities in the adoption of and access to genomic-enabled health care if genomic medicine is not integrated across diverse populations and at both community hospitals and larger medical centers. Because genomic medicine implementation is in its early stages, there is an opportunity to use knowledge from other efforts to inform best practices and potentially reduce disparities. The emerging field of implementation science focuses on examining methods that influence system-wide changes to routine care when new evidence-based practices are adopted. Principles from this field and examples from the incorporation of other technologies may be considered for overcoming institutional-, provider-, and

patient-related challenges in genomics, especially in the context of conducting large-scale sequencing studies. The Roundtable hosted a workshop to examine how implementation science can be applied to genomics by using existing implementation efforts to demonstrate how challenges and successes are measured, assessed, and addressed over time.

Action Collaborative Meetings

Displaying and Integrating Genetic Information Through the EHR (DIGITizE) Action Collaborative, January 14, 2015

The Roundtable's DIGITizE Action Collaborative convened key stakeholders from health information technology (IT) and management vendors, academic medical centers, laboratories, government agencies, standards bodies, and other organizations to enable the uniform



representation and integration of genetic and genomic information into EHRs in a standards-based, interoperable format. DIGITizE participants developed an implementation guide containing LOINC code structures and clinical decision support rules that will be employed by pilot programs in 2016. So far, Cerner, ARUP Laboratories, and Intermountain Healthcare have committed to piloting the development and implementation of a genetics platform through the efforts of the Action Collaborative. Additional pilot partners are being identified.

Global Genomic Medicine Collaborative (G2MC), November 6-7, 2015

G2MC members met for their second meeting in Singapore to discuss implementing genomic medicine into practice in countries around the world. More than 25 countries were represented at the meeting, spanning five continents. The main goals of the meeting were to create a global tool box for genomic medicine implementation, facilitate collaborations that could enable effective implementation, and discuss solutions for obstacles encountered during implementation.



Participants and speakers discussed current activities, national sequencing programs, data solutions, and policy challenges. Six working groups, including IT/Bioinformatics, Education, Pharmacogenomics, Evidence, Policy, and Sequencing also met to further refine goals and next steps.

Genomics and Population Health Action Collaborative, November 18, 2015

A new group on Genomics and Population Health met for the first time in 2015 to consider perspectives on opportunities, challenges, and best practices for employing genomics to improve population health. They explored developing a framework for assembling tools and educational materials to increase the implementation of validated genomic applications in health care for disease prevention and health improvement. A variety of stakeholders participated, including public and population health officials, experts in health disparities and genetics education, and patient advocacy groups.



Looking Forward

Roundtable Activities in 2016

Roundtable Meetings

Roundtable members will meet three times in 2016 to discuss major initiatives and areas of focus for future activities. These discussions will examine current issues in genomics and precision health, such as collaborations in discovery that can enable genetically-guided drug discovery and development, efforts to implement genomics at the population health level, health disparities, mobile health technologies, and ways to utilize large research cohorts for maximum discovery and implementation research. In addition, the Roundtable will continue to examine evidentiary issues for genomic technologies, the use of big data and genome informatics for improving clinical care and research, and the policy and implementation challenges surrounding global applications of genomic medicine.



Action Collaboratives

The Action Collaborative on *Displaying and Integrating Genetic Information Through the EHR* (DIGITizE) will meet in 2016 to initiate pilot projects based on the pharmacogenomic use case implementation guide completed by this group in 2015. A pilot group will focus on identifying further participants for pilot implementation projects and providing a forum to share best practices and challenge areas among participants as issues arise during the implementation phase. The new use case working group will focus on defining and establishing new non-pharmacogenomic use cases to incorporate in a future phase of the pilot projects.

The goal of the *Global Genomic Medicine Collaborative* is to identify opportunities and foster global collaborations for enabling the demonstration of value and the effective use of genomics in medicine. Engaging multiple stakeholders across the globe, the G2MC group, under the auspices of the Roundtable, seeks to improve global health by implementing genomic tools and knowledge into health care delivery. The group will convene in 2016 to plan their next in-person meeting.

A *Genomics and Population Health Action Collaborative* was initiated to explore opportunities for genomics to be used to improve health and prevent disease and death; inform and engage various stakeholders about the implementation of genomics in practice; and assess how evidence-based genomic applications could be integrated into implementation activities and programs at the health care–public health interface. As an activity of the Roundtable, the Genomics and Population Health Action Collaborative may seek to develop methods for assessing best practices and outcomes for the implementation of genomic applications and their impact in practice; develop a framework for tools and education materials to increase the uptake of genomic applications in health care and disease prevention (such as a plan for a public health genomics “toolkit”); inform and engage providers, policy makers, and the general public; and explore pilot projects for the implementation of genomic applications at the interface of public health and health care that may focus on surveillance and measurement, policy impact, education, and programs. This group will meet in 2016 with the goal of producing an online guide for public health implementation to be available in 2017.

Working Groups

Discovery

The proliferation of high-quality human genetic and genomic data is increasing the confidence and odds of success for targeted research and development, presenting an opportunity to reinvigorate drug discovery and development through a genomics-enabled paradigm. However, the rate-limiting step in developing a genetically-based drug discovery and development hypothesis is not the ability to identify new gene-disease associations, but rather the lack of a complete understanding of the underlying biology and mechanism of disease. This group is exploring how to improve the translation of identified genetic signals into validated drug targets through deep phenotyping. Members are also interested in exploring what key pieces of health information should be collected by large-scale sequencing efforts to drive drug discovery as well as what enables and impedes investment from the private sector in this space.

Evidence for Policy and Practice

Over the past several years, there has been an exponential increase in identified single base changes that have been associated with diseases, such as Alzheimer's disease and type 2 diabetes. This information can potentially be used to greatly enhance the care that patients receive. However, the evidence base for the majority of these associations is not developed enough for clinical decision making. In the past, this group addressed approaches to assessing and evaluating evidence that are needed to use sequencing in the clinical setting. Their current goal is to enable stakeholder decision making in precision medicine by identifying evidence gaps, prioritizing translational research, and exploring innovative mechanisms of evidence generation and evaluating health impact.

Implementation

With technological advances in gene sequencing driving down costs and a growing demonstration of utility for large-scale sequencing in disease diagnosis or to identify and monitor treatments for patients, an opportunity for more widespread use in clinical practice across settings has arisen. However, sequencing is being

introduced in a fragmented way and mostly at large academic health centers. This group is examining how other technologies in health care were adopted successfully in order to identify best practices and principles that could be applied for the widespread implementation of genomic medicine. Specifically, issues of public, provider, and systems engagement will be addressed in the context of improving access and the incorporation of genomics across a diverse population. The group's mission is to enable the use of genomic information for the benefit of individuals and communities for wellness, health care, and/or research.

Overview Group

The Overview group examines cross-cutting issues for all members and working groups as well as responds to emerging issues within the genetics and genomics field. Currently, this group is focusing its efforts on precision medicine and precision health.



Roundtable Members

(as of December 2015)

Geoffrey S. Ginsburg, M.D., Ph.D.
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Duke University

Sharon F. Terry, M.A. (Co-Chair)
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National Human Genome Research Institute

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Board on Health Sciences Policy Staff

Andrew M. Pope, Ph.D.
Director

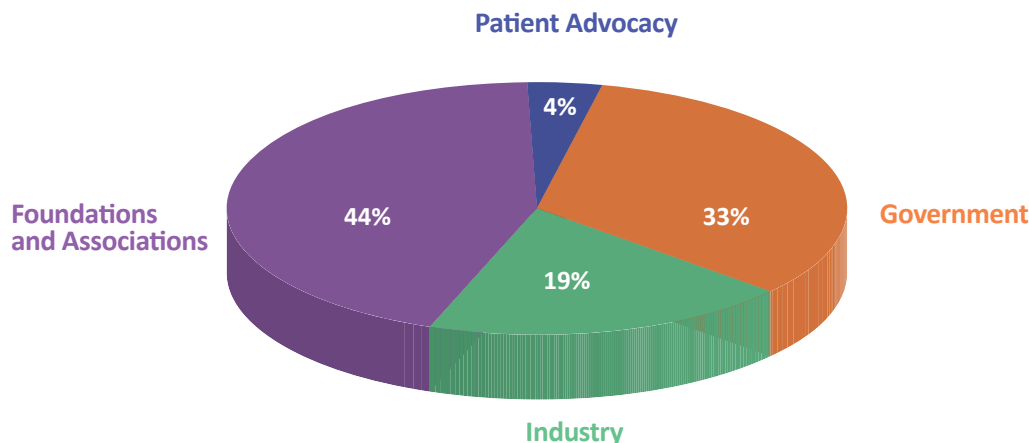
Hilary Bragg
Program Coordinator

Roundtable Sponsors

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 Health Resources and Services Administration

International Society for Cardiovascular Translational Research
 Janssen Research and Development, LLC
 Kaiser Permanente Program Offices Community Benefit II at the East Bay Community Foundation
 Merck Research Laboratories
 National Cancer Institute
 National Human Genome Research Institute
 National Institute of Mental Health
 National Institute of Nursing Research
 National Institute on Aging
 National Society of Genetic Counselors
 Northrop Grumman
 PhRMA



Timeline

2007 | **July 11-12** Meeting 1 | **December 4** Diffusion and Use of Genomic Innovations in Health and Medicine Workshop | **December 5** Meeting 2

2008 | **April 1-2** Meeting 3 | **July 28** Innovations in Service Delivery in the Age of Genomics Workshop | **July 29** Meeting 4 | **October 6-7** Meeting 5

2009 | **February 12** Systems for Research and Evaluation for Translating Genome-Based Discoveries for Health Workshop | **February 13** Meeting 6 | **June 9-11** Meeting 7 | **August 31-September 1** Direct-to-Consumer Genetic Testing Workshop | **November 16-17** Meeting 8

2010 | **March 22** The Value of Genetic and Genomic Technologies Workshop | **March 23** Meeting 9 | **May 24** Challenges and Opportunities in Using Newborn Screening Samples for Translational Research Workshop; Meeting 10 | **July 22** Establishing Precompetitive Collaborations to Stimulate Genomics Driven Drug Development Workshop | **July 23** Meeting 11 | **November 17** Generating Evidence for Genomic Diagnostic Test Development Workshop | **November 18** Meeting 12

2011 | **February 22-23** Meeting 13 | **July 19** Integrating Large-Scale Genomic Information into Clinical Practice Workshop | **July 20** Meeting 14 | **November 15**

Facilitating Development and Utilization of Genome-Based Diagnostic Technologies Workshop | **November 16** Meeting 15

2012 | **March 21** New Paradigms in Drug Discovery: How Genomic Data Are Being Used to Revolutionize the Drug Discovery and Development Process Workshop | **March 22** Meeting 16 | **May 24** Evidence for Clinical Utility of Molecular Diagnostics in Oncology Workshop | **July 17-18** Assessing the Economics of Genomic Medicine Workshop | **July 18** Meeting 17 | **October 4-5** Sharing Clinical Research Data Workshop | **December 3** Improving the Efficiency and Effectiveness of Genomic Science Translation Workshop | **December 4** Meeting 18

2013 | **February 27** Refining Processes for the Co-Development of Genome-Based Therapeutics and Companion Diagnostic Tests Workshop | **February 28** Meeting 19 | **June 5** Conflict of Interest and Medical Innovation: Ensuring Integrity While Facilitating Innovation in Medical Research Workshop | **June 24** Genomics-Enabled Drug Repositioning and Drug Repurposing Workshop | **June 25** Meeting 20 | **December 4-5** Meeting 21

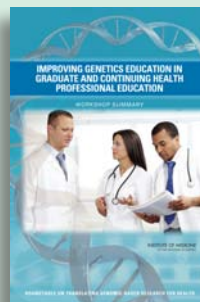
2014 | **February 3** Assessing Genomic Sequencing Information for Health Care Decision Making Workshop | **February 4** Meeting 22 | **August 18** Improving Genetics Education in Graduate and Continuing Health

Reports Released in 2015

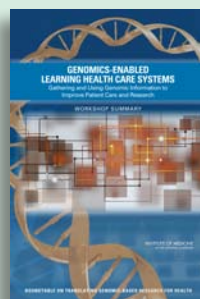
Professional Education Workshop | **August 19** Meeting 23 | **December 8** Genomics-Enabled Learning Health Care Systems: Gathering and Using Genomic Information to Improve Patient Care and Research Workshop | **December 9** Meeting 24

2015 | **March 10-11** Meeting 25 | **July 14-15** Meeting 26 | **November 19** Applying an Implementation Science Approach to Genomic Medicine Workshop | **November 20** Meeting 27

2016 | **March 22** Deriving Drug Discovery Value from Large-Scale Genetic Bioresources Workshop | **March 23** Meeting 28 | **July 19-20** Meeting 29 | **November 8-9** Meeting 30



Improving Genetics Education in Graduate and Continuing Health Professional Education: Workshop Summary



Genomics-Enabled Learning Health Care Systems: Gathering and Using Genomic Information to Improve Patient Care and Research: Workshop Summary

About the Roundtable

The National Academies of Sciences, Engineering, and Medicine established a Roundtable on Translating Genomic-Based Research for Health (now called the Roundtable on Genomics and Precision Health) to provide both a mechanism and a venue for interested parties from government, academia, industry, and other stakeholder groups to meet and discuss global issues of mutual interest and concern regarding the translation of genomics research findings in a neutral setting. The primary purpose of the Roundtable is to foster dialogue across sectors and among interested parties and institutions and to illuminate and scrutinize critical scientific and policy issues.

The Roundtable explores and implements strategies for improving health through the translation of genomics and genetics research findings into medicine, public health, education, and policy. During the three meetings the Roundtable holds each year, specific scientific and policy issues will be identified and discussed that will help further the field of genomics and enable the translation of genomics into health care applications.

For more information about the Roundtable, please visit our website at nas.edu/genomicsRT or call Sarah Beachy at (202) 334-2217.

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