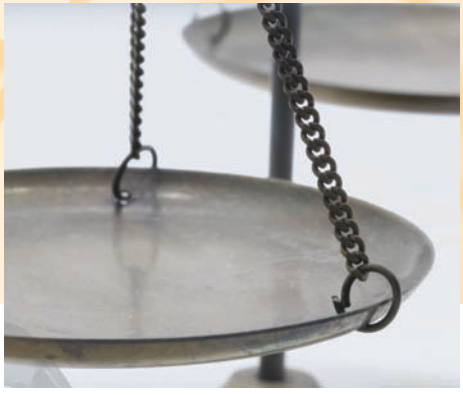
BOARD ON HEALTH SCIENCES POLICY

Roundtable on Translating Genomic-Based Research for Health

2014 Annual Report



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Message from the Co-Chairs

Health care reform in the United States was a major highlight of 2014. As a nation we aim to reduce costs, increase access, and improve quality and outcomes. Now, more than 10 years since the completion of the human genome project (HGP), what can sequencing the human genome and other related technological advances do to help enable these goals? Although the HGP was not conceived with these direct goals in mind, the opportunities for applying genomics to meet the goals of the triple aim are tremendous and this presents a spectacular opportunity for the Roundtable to make its greatest impacts in the coming years.

"Genomic medicine" — an aspirational term 10 years ago — is practiced today across the spectrum of risk assessment in healthy individuals through genome-guided management of complex diseases in patients. Cancer has been the most prolific area of genomic medicine (but not the only one), with a steady growth in targeted therapeutics since the approval of trastuzumab targeting HER2/neu for breast cancer in 1998.

Innovation in sequencing technology has driven the cost down such that it may be routinely used in certain clinical settings. Genome sequencing for the identification of genes for rare Mendelian disorders is now being applied to newborns, in utero (prenatal diagnosis), or at the pre-conception stage (carrier testing). As a result, the diagnostic odyssey is increasingly shortened for many families as more children are diagnosed earlier or as reproductive decision making is enhanced. Sequencing advances have also contributed to our awareness of the role of the microbiome in health and disease and early results suggest that for some diseases (e.g., inflammatory bowel disease) alterations in microbiota are both pathognomonic of disease as well as potential probiotic solutions. Pathogen sequencing for diagnosis of infectious disease was recently used in "real time" to track and control an outbreak in a neonatal intensive care unit.

However, translation of genome-based research into health care applications remains challenging due to a currently underdeveloped evidence base, a misalignment between basic research and clinical needs, and the lack of a robust knowledge generating system that incorporates genomic information from both basic and clinical research. Many important questions must be addressed to ensure that this new technology is appropriately adopted, but overcoming these obstacles is not an easy task.

The Roundtable on Translating Genomic-Based Research for Health provides a venue for various stakeholders to work together to identify, illuminate, and collaboratively develop potential solutions for critical scientific and policy issues throughout the research, development, and health care environment. Since its establishment in 2007, the Roundtable has organized and hosted 24 meetings and 21 public workshops and published 19 workshop summary reports. During these meetings,

the Roundtable has provided strategic thinking around some of the most paramount issues facing the field of genomics, including genomics as an enabler of a new drug development pipeline paradigm; the impact of genomics on the future of health care; challenges and opportunities for integrating genomic information into the electronic medical record; leveraging DNA samples to enable future discoveries; data sharing; and ethical considerations in conducting genomics research.

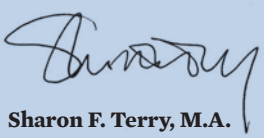
As a forum for academia, industry, advocacy and provider groups, government, and others, we stimulate discussion, press to clarify complex concepts, and seek pathways to solutions. In 2014, the Roundtable sponsored workshops and meetings on the use of genomic sequencing information in health care decision making, improving graduate education and continuing health professional education in genetics, and creating genomics-enabled learning health care systems as a means to drive research and patient care. Essential to our process is discourse that allows all perspectives to be voiced, with special attention given to clarifying competing views and identifying actions and strategies for resolving issues.

Our agenda for 2015 will include articulation of the next series of grand challenges for genomics in the areas of genome informatics and "big data," diagnostics, genome-based interventions, health system integration, and population health. A major focus of our work will be on the use of genomics in the practice of medicine and in drug development, with special emphasis on understanding how genomics might alleviate disparities. We will continue to identify key issues in the evidence evaluation process for genomic technologies, approaches to educating health care providers about genomics, integrating genomic information into electronic health records, and addressing the challenges of genomic medicine with the global community of stakeholders.

The Roundtable recently welcomed new sponsoring members from Eisai, Inc. and Merck Research Laboratories. We welcome our new members and look forward to a 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 2014

Roundtable Meetings

Roundtable members met three times in 2014 to discuss continuing and emerging issues for the field of genomics. These meetings brought various stakeholders from health information management systems, academic health centers, government agencies, and others together with Roundtable members to discuss challenges and opportunities for integrating genomic information into the electronic health record, strategies for sharing clinical trial data, international efforts in genomic medicine, current practices for DNA sample collection across clinical studies, regulation of laboratory developed tests, genomics as an enabler of a new drug pipeline paradigm, and focused genomic screening of companion genes for complex diseases.

Roundtable Workshops

Assessing Genomic Sequencing Information for Health Care Decision Making (February 3, 2014)

The sequencing of the human genome has led to tremendous advances in research and development, increasing our understanding of the basis of disease and hastening genetic-based targeted therapeutic development. Over the past 10 years, these advances have been buoyed by the equally significant advances in technologies that have increased accuracy and lowered genome sequencing costs from $2.7 billion in 2003 to $1,000 today. As a result of these scientific and technological advances, large-scale genome sequencing is beginning to move into clinical practice for determining patient treatment options. The clinical use of sequencing relies on the

identification of linkages between genetic variants or groups of variants and disease. These findings may enhance patient care; however, the majority of associations have not been rigorously confirmed and may only play a minor role in disease. Until ideal information is developed, best practices for gathering and evaluating the available evidence are needed. The Roundtable hosted a workshop to examine how evidence for genomic applications is gathered and assessed for clinical and reimbursement decision making, guideline development, and patient care and health decisions in the absence of an ideal evidence base.

Improving Genetics Education in Graduate and Continuing Health Professional Education (August 18, 2014)

Despite the growing use of genomic applications in clinical practice, health professional knowledge about genomic information and confidence in using it have not kept pace. Although the need to improve genetics knowledge among health care providers is clear, the best approaches to educating health care providers in a way that produces meaningful changes in clinical practice are not, especially given the competing coursework and training needs that exist in today's increasingly complex health care settings. Simply providing information is often not sufficient to spark interest among graduate health professional students, residents, and fellows or to elicit behavioral change in providers. The Roundtable hosted a workshop to examine pragmatic approaches to improving genetics education in both graduate and continuing education of health professionals. The workshop examined a variety of approaches that could improve the teaching of genetics; these approaches included online and interactive instruction, just-in-time approaches, the development of clinical decision support tools, and the incorporation of genetics requirements into licensing and accreditation. Stakeholders, including health care providers, representatives of graduate and residency programs, professional society representatives, board examiners, education specialists, and others, presented their perspectives and participated in discussions during the workshop.

Genomics-Enabled Learning Health Care Systems: Gathering and Using Genomic Information to Improve Patient Care and Research (December 8, 2014)

The sequencing of the human genome has facilitated a tremendous increase in our understanding of disease. Health care practitioners now have the ability to determine in which patient a drug will be most effective or where a patient may forgo therapy due to lack of clinical benefit. This greater understanding, combined with the technological advances that have significantly improved genome sequencing

accuracy while decreasing its cost, has led to large-scale sequencing now being used in clinical practice to aid in diagnosis and to identify treatment options for patients. As a direct effect of this integration into practice, discussions about how to maximize the benefits of this large amount of data are beginning to occur. With the significant promise that combining genomic and other health data holds to derive new knowledge about disease biology, treatment efficacy, outcomes, and drug safety, there are still several challenges to using these data to their full potential. The electronic health record (EHR), for example, could be used as a valuable tool to store and access clinical genomic information, as could other data sources like self-reported databases and social media. However, the current health care system is largely unprepared to handle this large-scale information. Standards are lacking for the data, and interoperability, scalability, privacy, security, and storage issues need to be resolved. While individual efforts may exist to collect and use these data, a more coordinated effort that engages the broader stakeholder population will be needed in order to improve patient health and maximize the knowledge that would be obtained from integrating genomic information. The Roundtable hosted a workshop to examine how various systems are capturing and making use of genomic data to advance patient care and research. The workshop goal was to evaluate the challenges, opportunities, and best practices for translating genomic data into knowledge for both basic research and clinical care. The workshop addressed various sources, tools, and methodologies for the assessment of data related to the health care system, and included a discussion on data structure, access, security, and reusability issues. Stakeholder groups, including EHR developers and health information technology professionals, clinical providers, academic researchers, patient groups, and government representatives, presented their perspectives and participated in discussions during the workshop.

Action Collaborative Meetings

Representing Genomic Information in the Electronic Health Record Ecosystem (June 26, 2014, and September 11, 2014)

The Roundtable's EHR action collaborative (EHR AC) convened key stakeholders from health information technology and management vendors, academic health centers, government agencies, and other organizations to enable the uniform representation and integration of genetic and genomic information into EHRs in a standards-based, interoperable format. The EHR AC identified the minimum data elements needed to be represented for both germline and somatic genetic determinants and completed a data mapping process to facilitate the development of clinical decision support based on genetic and genomic information. So far, ARUP Laboratories, Cerner, and Intermountain Healthcare have committed to piloting the development and implementation of a genetics platform through the efforts of the action collaborative. Other pilots are in discussion.

Looking Forward

Roundtable Activities in 2015

Roundtable Meetings

The Roundtable members will meet three times in 2015 to discuss major initiatives and areas of focus for future activities. These discussions will articulate grand challenges facing the field in areas such as implementation, incentives, evidence, discovery science, drug development, informatics, and the integration of genetics and genomics into health care systems. Overarching issues such as the value of genetic and genomic technologies, patient-centricity, workforce issues, and the potential for genomics to alleviate health disparities will also be major themes discussed by the Roundtable. In addition, the Roundtable will continue its seminal work examining the use of big data and genome informatics for discovery and clinical care, genome-based drug discovery and development, and the global implementation of genomic medicine.

Action Collaboratives

The Action Collaborative on ***Representing Genomic Information in the Electronic Health Record Ecosystem*** will meet in 2015 to define and further refine use cases for the integration and representation of genetic and genomic information in the EHR. Discussions will also focus on defining the necessary data standards and identifying the relevant bodies for their creation, identifying further participants for pilot implementation projects, delineating success criteria for pilots, and ensuring that other organizations and activities working to integrate genetic and genomic information into health information technology are actively engaged.

The goal of the ***Global Genomic Medicine Collaborative (G2MC)*** 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. To accomplish these goals, seven working groups were created, including communications, education, evidence, information technology (IT)/bioinformatics, pharmacogenomics, policy, and a steering group to guide and support efforts among working groups.

Working Groups

DNA Sample Collection

DNA samples are a potentially underutilized resource that may be leveraged to facilitate future scientific discoveries and medical breakthroughs. However, there is currently no accepted standard of practice regarding how or even whether to collect DNA samples in clinical studies. A number of barriers exist, including cost, utility of the samples post collection, and varying consent practices. This working group examines current practice trends in DNA sample collection from clinical studies.

Education, Engagement, and Cultural Change

Implementation of new genomic technologies requires the education and engagement of health professionals and institutional administrators. This working group is examining pragmatic approaches to improving the genetics education of health professionals and institutional decision makers and the cultural barriers and changes needed to facilitate this education.

Fundamental Understanding of Next-Generation Sequencing

Over the past 10 years, there has been an exponential increase in identified single base changes that have been associated with diseases, including 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. Members of this group are working to identify the evidence needed to support the use of genome sequencing in the clinic.

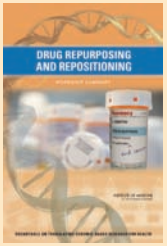
Knowledgeable Health Care System for Precision Medicine

Genomic data are increasingly being generated in the clinical practice of medicine with genome sequencing being used to direct therapeutic prescribing as well as patient management. Significant questions exist regarding how to incorporate this genomic information into the EHR, the standards for doing so, and the readiness and interoperability of the current system to accept these data to be usable over a lifetime for directing care. This group is working with health information and management systems vendors, clinical end users, health information technology professionals, academic researchers, government agencies, patient groups, and others to explore how genomic and genetic information can be effectively and efficiently integrated with other data (including both health-system and patient-generated) to improve overall patient care and outcomes through a rapid learning process.

Overview Group

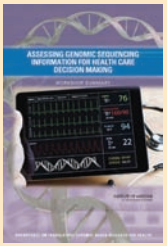
The Overview group examines cross-cutting issues for all members and working groups as well as responds to emerging issues within the genetics and genomics field. Currently, this group is focusing its efforts on defining grand challenges for genomics.

Reports Released in 2014

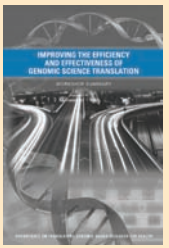


Drug Repurposing and Repositioning: Workshop Summary

Refining Processes for the Co-Development of Genome-Based Therapeutics and Companion Diagnostic Tests: Workshop Summary



Assessing Genomic Sequencing Information for Health Care Decision Making: Workshop Summary



Improving the Efficiency and Effectiveness of Genomic Science Translation: Workshop Summary

Conflict of Interest and Medical Innovation: Ensuring Integrity While Facilitating Innovation in Medical Research: Workshop Summary

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(as of December 2014)

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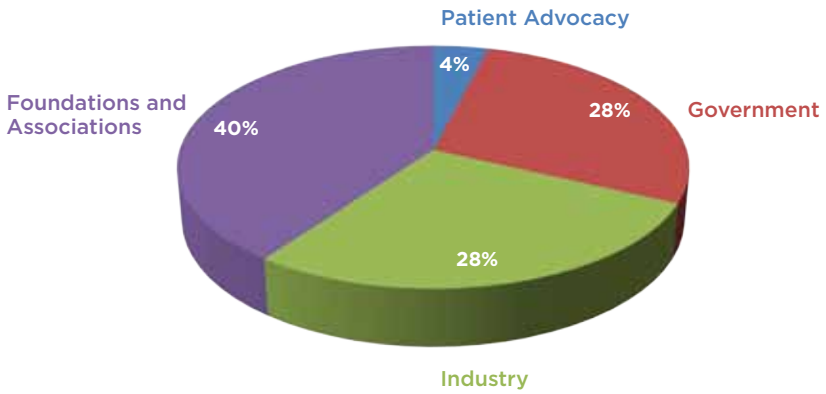

About the Genomics Roundtable

The Roundtable on Translating Genomic-Based Research for Health provides both a mechanism and a venue for interested parties from government, academia, industry, and other stakeholder groups to explore and implement strategies for improving health through the translation of genomics and genetics research findings into medicine, public health, education, and policy. The primary purpose of the Roundtable is to foster dialogue across sectors and among stakeholders, and to identify, illuminate, and develop potential solutions for critical scientific and policy issues related to the translation of genomic discoveries.

For more information about the Roundtable on Translating Genomic-Based Research for Health, please visit our website at www.iom.edu/genomicroundtable or call Adam Berger at (202) 334-3756.

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