

Panel 1 – Evidence Gaps

- For implementation you need evidence, and for evidence you need implementation
- QI projects don't get published, how to maximize sharing of those, engage them (HCSRN et al.); include unique methods for QI
- Need criteria for quality and types of evidence; **support cross-program identification** of types of evidence (tailored to goal) to collect and share
- Identify payers' needs across diverse payers
- Patients' needs should be integrated and emphasized
- Testing equivalent of pharmacovigilance, follow outcomes of testing, from pts, registries?
- **Develop collaborative projects with Genome Canada**

Panel 2 - Variant Interpretation

- Role of HG: best structure for knowledgebase, encourage deposition within projects
- Need emphasis and structure similar to sharing genotypes for sharing phenotypes (safe harbor)
- Support standards for phenot description common across model organisms to humans
- Bring more basic scientists to table, learn what challenging clinical questions are being faced
- Functional assays don't always correlate with clinical manifestations; promote virtuous cycle
- Facilitate data deposition through coverage with evidence development through payers-HG role?

Panel 2 - Variant Interpretation

- Cooperative sequencing groups like Cooperative Oncology Groups
- Explore/exploit potential of crowdsourcing for phenotyping
- Test many of these questions in existing studies
- Add family hx tool to large-scale sequencing effort, determine when fhx more useful than sequence info
- Encourage more extensive data sharing including longitudinal phenotypes, those most useful for model organism studies (GM9)
- Accelerate genot-phenot exploration at speed to benefit pts

Panel 3 – Changing Evidence

- Study dynamic nature of data return to existing projects to study data return, duty to inform, in rare disease, cancer, healthy patients; **impact/consequences of changed annotation**
- Clinical trials of added value of whole genome to limited testing, vs. cost of testing
- Genomic sequence only the first of 'omic types of dynamic data to be incorporated in healthcare
- Can FDA companion diagnostic process keep up with rapidly evolving genomic data
- Crowd-sourcing of rare variants for assessing actionability and finding cause and treatment, patient-oriented ontology

Panel 3 - Changing Evidence (2)

- More likely to order new test with better tech than re-analyze data years later
- If already interpreted how to update variant database, lawyers to accept automatic system
- Most effective way for clinicians to understand meaning of variants especially VUS (genome consult service like radiologist)
- Testing segregation in families is most effective way for identifying pathogenicity

Panel 4 – Metrics and Impact

- Expand use of similar methods and common elements as in IGNITE
- Support and expect common measures and other program-wide efforts; more challenging the more diverse the programs
- Include in solicitations plans to produce program-wide data and common efforts
- Integrate with HCSRN, has payers at the table
- Measure outcomes of value to patients, payers, healthcare delivery systems, providers, regulators
- Looking to genomics to transform the way we care for patients– new era, now value is key

Panel 4 – Metrics and Impact (2)

- Can design systems to guide clinician to specific test, research can determine when to do that
- Each profession looks toward its own societies for guidelines– promote joint development
- Engage societies in study design, in what information useful for their guidelines
- Create “computable” guidelines if possible
- Can we create an implementation commons

Panel 5 – EHR Functionality

- E-phenotyping needs multiple data types, lab, meds, processing of text notes
- Enhance approaches for patients to phenotype themselves using standardized terms (HPO)
- Offline repository for genomic data like picture archiving (PACS), present only what's useful
- Improve provenance data (5 Ws) and consent; never separate from genomic data
- Multiple training programs in EHR/informatics, engage those trainees?

Panel 5 – EHR Functionality (2)

- When is phenotype measure superior to (or adds to) genotype as with *TPMT*, *HFE*; challenging where genot more distant from phenot
- Can use EHRs to flip into rich deep phenotyping at almost no incremental cost?
- Stimulate phenotype sharing to inform value of shared genotypes
- Enhance portability, interop of e-phenotypes and gCDS algorithms and study impact
- Provide logic structure for CDS rule, to be coded, have to be able to share underlying data
- Precise and 2^o phenotyping more impt with rare variants; good enough vs perfect phenotype

Panel 6 - Diversity

- Promote synergism among multiple diversity efforts NIH-wide
- What is unique or different about genomics?
- Identify specific health disparities research questions related to genomics
- Use mobile technologies to overcome IT barriers
- Particularly impt in pediatrics– 56% non-minority
- Need better methods to utilize ethnic genomes for discovery analytically and interpretation

Panel 6 - Diversity

- Community advisory boards critically impt, involve from beginning of study design
- Give freedom to push back with investigators
- Need more than getting more non-EA data, also much greater genetic diversity to deal with
- Dedicated programs for non-EA populations
- Could genomics be special “draw” for non-EA trainees?

Panel 7 – Clinical Workflow

- Specific roles for NHGRI in EMR:
 - Agreed-upon nomenclature and variant definitions for alleles, for pulling by CDS
 - Annotate what was tested, what could and couldn't be detected
 - Automated delivery system for genomic info; PACS paradigm
- Need more than one naming system, as what computer needs is not what clinician can use
- Joint training opportunities (with ACMG, AMIA, ASHG, BD2K, NLM) could be explored
- Broaden eMERGE activities and other programs, engage with VA and GenomeCanada

Panel 7 – Clinical Workflow

- Explore turnaround time in relation to acuity
- Promote software development for presenting genomics to clinicians
- Clinical workflow always local, focus on tools that help manage data
- Laboratory workflow may be more amenable at least for facilitating ClinVar submissions
- Assist new entrants by building on tools and knowledge from more expert settings
- Build better business case for EHR vendors to incorporate genomic info, not unlike other NIH health economics efforts

Panel 8 – Clinician Education

- ISCC challenges: differing missions among societies, no funding or dues
- UK spending £20M for clinician education—partner, learn from, borrow materials?
- How can clinicians provide valuable consultation without being board-certified geneticist
- Consider supporting certificate program for non-geneticists – estimate/document the need
- Identify and disseminate best practices including InfoButton and underlying knowledgebases
- Need for physician-lab interaction like calling radiologist or other consultant to discuss report
- Embrace affiliate/associate models in programs

Panel 8 – Clinician Education

- Convene reporting groups to unify clinical reports, consider bake-off of data comparability
- Study effectiveness of various clinical reporting formats, perhaps in CSER?
- Make reporting similar to resources routinely used like UpToDate
- Partner with 23AndMe in funding education around providers presented with DTC results?
- Education around when to order harder than what to do with results
- Need more engagement with clinician end-users as to what they need

Panel 9 – Participant Engagement

- Research and clinical care need more integration to reflect the patient experience
- Involve patients and clinicians in process of developing tools
- Little pt engagement in GenomMed programs, at least not systematically (some locally)
- Integrate tool development into funded implementation projects
- Develop and evaluate tools in clinical settings
- Support trainees in communication science?
- Patient access to data

GMVIII: NHGRI's Genomic Medicine Portfolio

June 8-9, 2015



Next Steps

- Send around these lists for prioritization
- Redistribute grid and improve, add 2+ level
- Meeting summary
- Video with slides on website
- White paper on research directions – short
- Take advantage of ongoing programs to provide input to other projects of potential collaborative efforts or specific areas to be addressed
- Establish single cross-consortia groups for overarching topics: return of results, consent, etc., need investigators to identify
- GM9 basic science; scientific meeting

Other Key Barriers to Implementation

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- nostra Galli appellantur.

Recommended Approaches to Addressing Gaps and Barriers

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Training Needs and Approaches

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Bedside Back to Bench Research Questions: Facilitating A Virtuous Cycle

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Panel 1 - Presentation

- Multiple types of evidence: clinical, molecular, behavioral, emotional, financial
- Combine projects somehow to produce evidence
- For implementation you need evidence, and for evidence you need implementation
- Where are economic analyses that will convince payers to adopt
- QI initiatives often not published, lose those results, may need evidence databases
- Evidence databases, training in evidence generation – link fellows to these programs