Genomic Medicine Centers Meeting VII

Summary of Themes Discussed in Keynote and Panel Discussions

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genome.gov
National Human Genome Research Institute
National Institutes of Health

Meeting Objectives

- GM 7 will convene key thought leaders in genomic implementation and application of clinical decision support to:
  - Compare current state with ideal state of genomic clinical decision support to define gaps and strategies to close the gaps
  - Identify and engage US and international health IT initiatives that would support recommended strategies
  - Define a prioritized research agenda for GCDS

Meeting Objective #2-Accomplished

- Identify and engage US and international health IT initiatives that would support recommended strategies
  - NHGRI/NIH funded projects (eMERGE, CSER, IGNITE, Newborn sequencing, ClinSeq, CPIC, etc.)
  - IOM Action Initiative
  - ONC/AHRQ CDS initiative
  - VA
  - CDSC
  - Health eDecision
  - Open infobutton, OpenCDS
  - SMART/FHIR
  - Others

Our Key GCDS Questions

1. Is clinical decision support an essential element in the successful implementation of genomic medicine?
   - Does genomic clinical decision support differ significantly from decision support used for other purposes? Ifyes, what are the key differences?
   - What is the ideal state of genomic clinical decision support?
   - How can the impact of genomic clinical decision support be defined and measured?

2. What are data issues that impact genomic CDS?

3. How do we manage knowledge for genomic clinical decision support?

4. What are implementation issues surrounding genomic CDS?

5. What are areas that should be prioritized for the research agenda for GCDS?

Key Question 1: Is clinical decision support an essential element in the successful implementation of genomic medicine?

- Keynote: Dan Masys
  - Ideal GCDS for **Users**
    - Current, re-purposeable to different settings, health literacy and numeracy sensitive, explanations for recommendations, learning/adaptive
  - For **Healthcare Organizations**
    - A *system* to improve quality/reliability, tracks GCDS events and f/u whether followed or not, continues to continuous local and national learning

Ideal GCDS: Building Blocks

- Knowledge Representation Standards for interoperable electronic "decision support packages"
  - Representation of genetic/genomic results related to management system
  - Recognition logic for genotype and phenotype recognition in EHR
  - Guidance for target users (clinician, patient, family)
  - Recognition logic for "closed loop decision support": process or outcome measure including whether user accepted or rejected guidance
- Decision support authoring systems:
  - Tools to easily import, review, and implement decision support packages
- Event monitors embedded in EHR and PHR systems
- System-generated alerts at the "teachable moment" of diagnostic testing, therapy decision making, counseling
- Automated tracking of outcomes vs. user decisions, with upload of outcomes to CDS Public Library (*quid pro quo)*

KQ 1: Synthesis

- Dynamic knowledge-base, hierarchical knowledge representation, manage consensus development
- Assess baseline GCDS, address business case, incentives, transparency
- Assure quid pro quo in Public GCDS Library – use implies contribution of outcomes data
- Assure linkage of clinical implementation with discovery science

Key Question 2: What are the data issues that impact genomic CDS?

- Moderators: Robert Freimuth, PhD and James Ostell, PhD
  - Relevant Desiderata Elements 1, 2, 9
- Discussion of Key Questions
  - I. What data types are essential for genomic CDS
    - a. Patient Level / Clinical Data?
    - b. Provider / Institutional Data?
    - c. Other?
  - II. How does the massive nature of genomic data influence development and implementation of genomic CDS?
  - III. Are there unique attributes of genomics data that present unique challenges to the development and implementation of genomic clinical decision support?
    - a. Persistent nature of germ-line variation
    - b. Rapidly changing knowledge around genomic variants
    - c. Somatic vs. germline variation

KQ2 Synthesis

- Establish hierarchical set of knowledge representation and technical stds
  - Same set of data used for different CDS instances
- Define standard trigger events for GCDS engine
- Define methods to maintain provenance of data and knowledge
- Assure interoperability of data elements between record systems
  - Patients are mobile—data available where patient is being cared for
  - Also for family members/descendants
- Address current and future legal/regulatory/policy environment and obstacles
- Public Health role
  - Role of public vs. public's health
    - Screening vs. care
    - Portability and interoperability
    - Trusted repository

Key Question 3: How do we manage knowledge for genomic clinical decision support?

- Moderators: Atul Butte, MD, PhD and Josh Peterson, MD, MPH
  - Relevant Desiderata Elements 4, 5, 6, 8, 11, 13

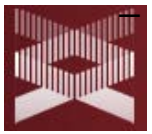
- Discussion of Key Questions
  I. What are the necessary elements of knowledge management and representation to achieve ideal state? What standards exist or are needed to achieve ideal state?
  II. What type of clinical decision support architecture (Wright and Sittig, 2008) is needed to achieve ideal state?
  III. What governance issues arise in knowledge management?

KQ3 Concepts from Discussion

- Description of best practices for knowledge representation
  - Not expressed in current standards
  - Map to current representational standards
  - Encoding genomic knowledge and keeping it in a centralized repository for access
  - Define KM schema (or other formalism) for GCDS
  - Different sources of information/provenance
    - Knowledge is fit for specific purpose
    - How to vet disparate information
  - Dynamic information management
  - Can we agree to a single database of knowledge?
  - Build the end to end knowledge cycle (get to outcomes)
  - Compare to other fields (radiology, pathology)
- Is CDS needed for all genomic return of results?

KQ3 Synthesis

- Study of implemented genetic/genomic information to develop standardized way to represent knowledge
  - IOM action collaborative pilots
  - Data sourcing/portability
  - Represent AHRQ/ONC and study usage
  - NIH requirement to deposit CDS created as part of funded projects using AHRQ/ONC standards (assuming they work)
- WGS/WES use cases to feed information to CDS system across heterogeneous questions
  - CSER
  - Newborn sequencing
  - eMERGE 3
  - IGNITE (3 PGx projects)
  - UDN
  - Somatic sequencing
  - Microbial sequencing
  - BD2K(?)
- End to end project based on CDS
  - Data stds, knowledge stds, process/outcomes stds
  - Economic/business and pragmatic trial methodology
  - Standardization of EMR process measures
  - Study of unstructured data



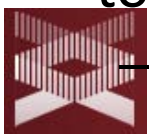
Key Question 4: What are implementation issues surrounding genomic CDS?

- Moderators: Kensaku Kawamoto, MD, PhD, MHS and Casey Overby, PhD
  - Relevant Desiderata Elements: 3 (Lab Methods), 7 (Dual Purpose), 10 (Multiple EHR Support), 12 (Standards)

- Discussion and Key Questions
  - **I. How should GCDS be provided within workflow?**
    - End-user involvement, Content, Technical options
  - **II. How can GCDS data and knowledge be exchanged and implemented at scale?**
    - Storage, System Requirements, Standards, Security, Architecture, ROI, Alignment (EHR, ONC/CMS, SDOs, Institution, etc.)
  - **III. What is the role for patient-facing GCDS?**
    - Data collection (e.g., FHx), Pt. preferences, CDS content and delivery

KQ4 Synthesis

- Explore different CDS approaches in context of different use cases - What are end user needs?
- Define return on investment/business case
  - Identify the problem(s) we're trying to solve (extension beyond genomics)
- Evaluate existing CDS standards to test their feasibility within genomic use cases
- Research focused on workflow, user interaction including patients
  - When does result show up to the clinician?
    - Ordered lab test vs. WGS results
- Research agenda regarding to patient role in GCDS
  - Partner with PCORI?
- National developmental certified EHR environment and toolkit (sandbox)
  - NIH?, NCI? (TCGA), ONC?, i2b2



Key Question 5: Overall Synthesis and outline of a prioritized research agenda for GCDS

- Business case – ROI for GCDS
- Clinical epidemiology/Health services research – what is baseline for GCDS?
- What would be the ideal presentation layer?
- Standards: terminology, data, knowledge rep (hierarchical), uncertainty mgmt, transaction (FHIR)…
  - Context of data and knowledge -- “What does CDS engine fire off of?”
  - Work within HL-7 for synergy
  - Consistent with existing standards through meaningful use
- Demonstration project: End to end project (with outcomes)
  - Collection of best practices from implementers (eMERGE PGx/eMERGE CSER)
- Role of public vs. public’s health
  - Screening vs. care
  - Portability and interoperability

Key Question 5: Overall Synthesis and outline of a prioritized research agenda for GCDS, cont.

- Genomic CDS use cases to promote to ONC/AHRQ
  - Build on immunization model
  - HLA-B*57:01 Abacavir
  - ACMG Newborn screening ACT sheets
- National developmental certified EHR environment and toolkit (sandbox)
- Exploration of the role of the patient/caregiver for genomic CDS (PCORI)
- Exploring different types of CDS (beyond alerts) which also fits with exploration of user experience with GCDS
- Funded CDS center (similar to sequencing center)

Mapping to Key Questions

1. Is **clinical decision support** an essential element in the successful implementation of **genomic medicine**?

2. What are **data issues** that impact genomic CDS?

3. How do we **manage knowledge** for genomic clinical decision support?

4. What are **implementation issues** surrounding genomic CDS?

5. What are areas that should be prioritized for the **research agenda** for GCDS?

- 1 Genomic CDS use cases
- 2 Standards: terminology, data, knowledge rep (hierarchical), uncertainty mgmt, transaction (FHIR), persistence of data
- 3 Intersections of acute care, longitudinal care, and generational considerations (public health), KM methods, governance
- 4 Clinical epidemiology of GCDS/genomic medicine, ROI, gather best practices GCDS,
- 5 Demonstration at scale (multiple disparate EHR)