Genomic Medicine Centers Meeting VII

Genomic Clinical Decision Support – Developing Solutions for Clinical and Research Implementations

October 2-3, 2014

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

Introductions

- Introductions and Welcome:
  - Marc and Blackford
  - Around the room
- Logistics
  - Bathrooms
  - Breaks
  - Overview of Agenda

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

Potential Examples of GCDS

1. **Medication dosing support**
2. **Order facilitators**
3. **Alerts and reminders**
1. **Relevant information display**
2. **Expert systems Workflow support**
3. **Clinical genomics example**

- CDS automatically adjusts warfarin dosing as a result of known alleles in the VKORC1 and CYP2C9 genes
- An order for colonoscopy is recommended at a younger age as a result of known pathogenic mutations in genes associated with colon cancer
- During medication ordering, gene variants known to affect drug pharmacokinetics are checked and clinicians are alerted to potential gene- drug interactions
- Context aware infobuttons in the problem list leverage genome data to provide genetic risk information for a patient with breast cancer
- The EHR provides a 10-year cardiovascular disease risk score based on clinical, environmental, and genetic risk factors
- The EHR schedules a genetic counseling consultation during prenatal visit due to presence of an X-linked disease gene variant

Welch, B. M., Eilbeck, K., Fiol, G. D., Meyer, L. J., & Kawamoto, K. (2014). Technical desiderata for the integration of genomic data with clinical decision support. *Journal of Biomedical Informatics*. doi:10.1016/j.jbi.2014.05.014

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?

GM7 Survey

- Survey instrument based on the 14 key recommendations from Masys *et al,* and Welch *et al.*

- Survey response rate
  - 30 invited attendees
  - 25 responded
  - 83% response rate

Recall the 14 Elements of Masys and Welch

1 Maintain **separation** of primary molecular observations from the clinical interpretations of those data

2 Support **lossless** data compression from primary molecular observations to clinically manageable subsets

3 Maintain linkage of molecular observations to the laboratory **methods** used to generate them

4 Support compact representation of clinically actionable **subsets** for optimal performance

5 Simultaneously support human-**viewable** formats and machine-readable formats in order to facilitate implementation of decision support rules

6 Anticipate fundamental **changes** in the understanding of human molecular variation

7 Support both individual clinical care and **discovery** science

8 CDS knowledge must have the potential to incorporate **multiple** genes and clinical information

9 Keep **CDS knowledge** separate from variant classification

10 CDS knowledge must have the capacity to support **multiple EHR** platforms with various data representations with minimal modification

11 Support a large number of **gene variants** while simplifying the CDS knowledge to the extent possible

12 Leverage current and developing CDS and genomics **standards**

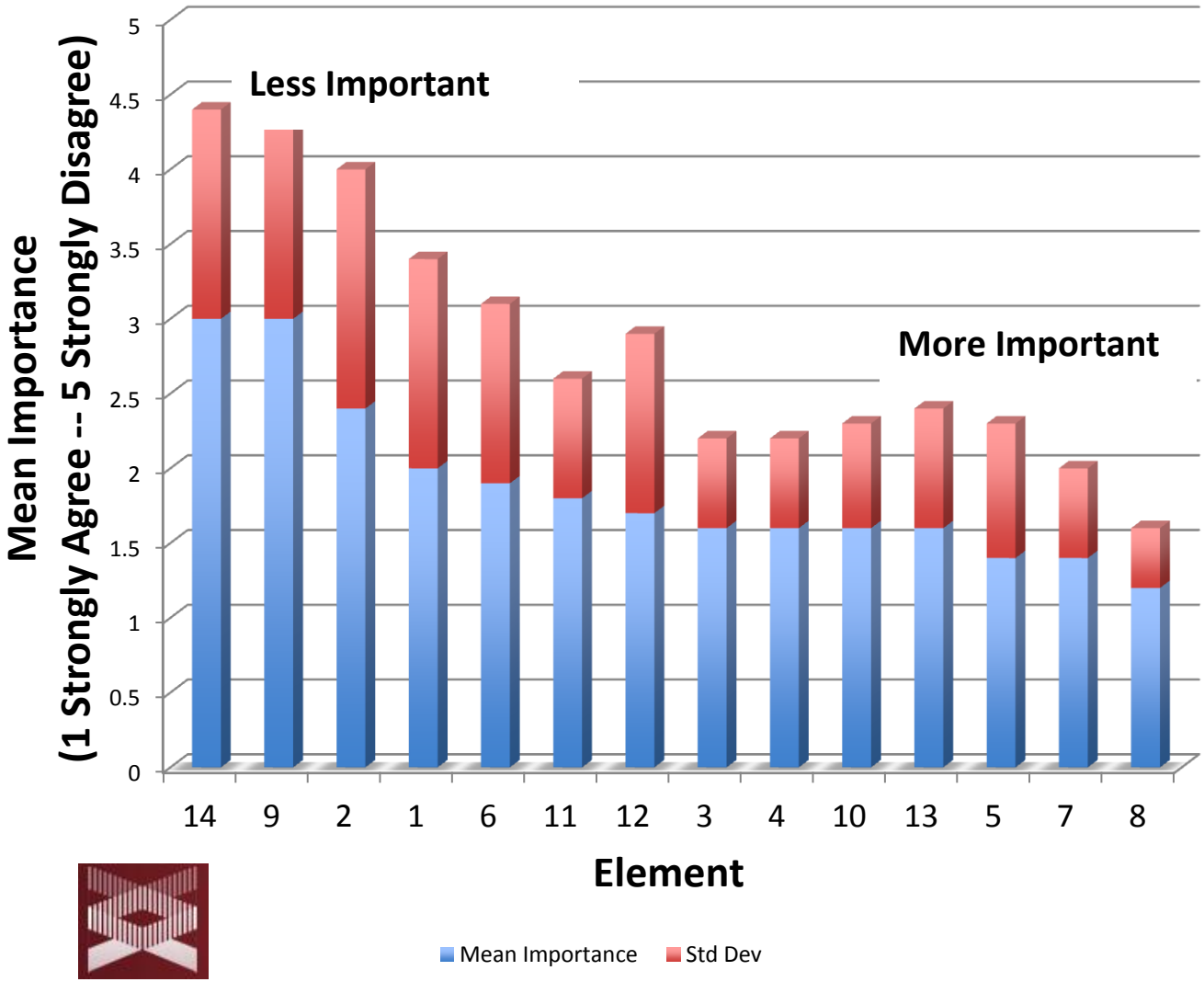
13 Support a **CDS knowledge base** deployed at and developed by multiple independent organizations

14 **Access and transmit** only the genomic information necessary for CDS

Welch, B. M., Eilbeck, K., Fiol, G. D., Meyer, L. J., & Kawamoto, K. (2014). Technical desiderata for the integration of genomic data with clinical decision support. *Journal of Biomedical Informatics*. doi:10.1016/j.jbi.2014.05.014

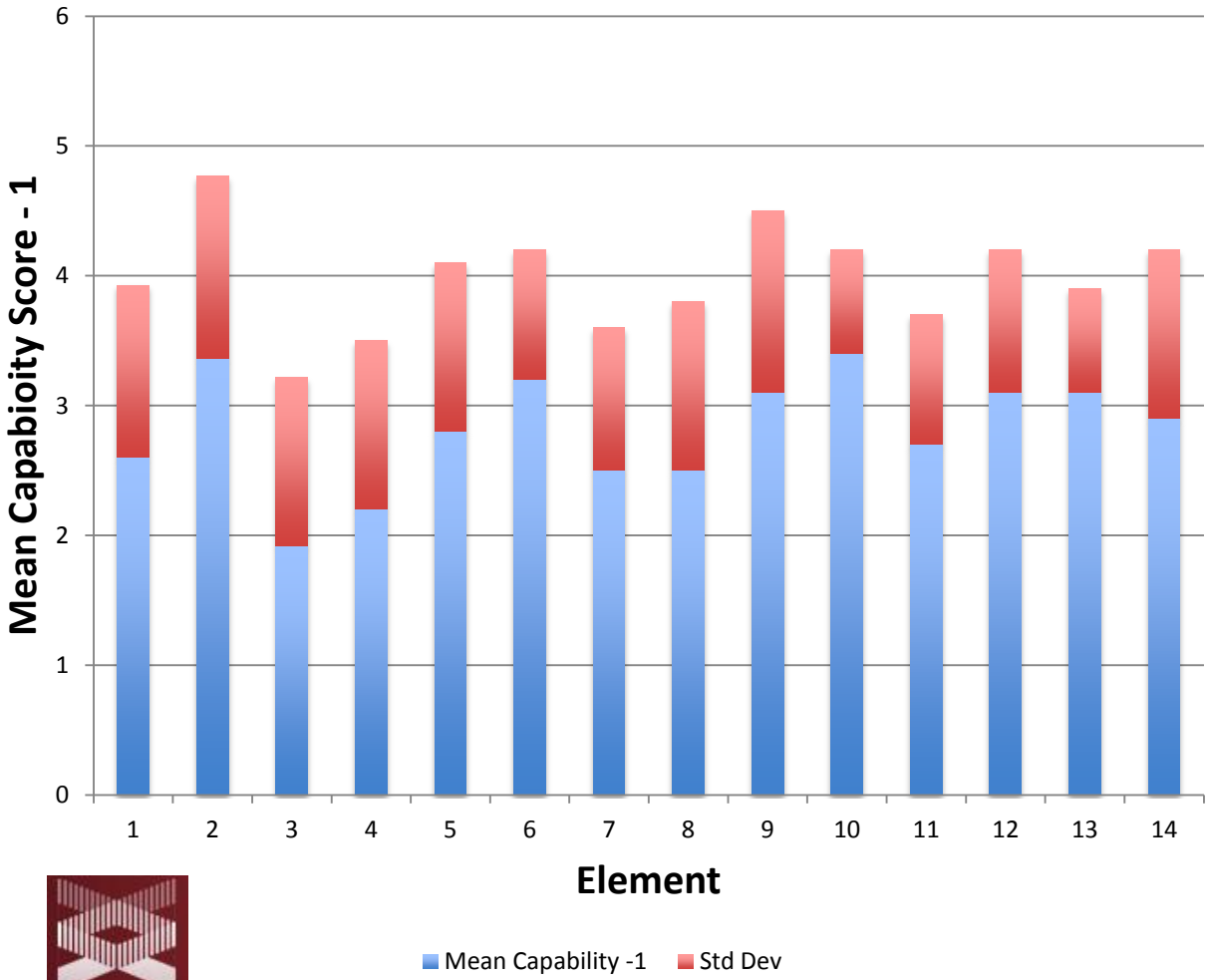
Masys, D. R., et al. (2012). Technical desiderata for the integration of genomic data into Electronic Health Records. *Journal of Biomedical Informatics*, *45*(3), 419–422.

Mean Element Importance



1. Separation of clin interp
2. Lossless compression
3. Methods linkage
4. Actionable subsets
5. Human /Machine readable
6. Changes in understanding
7. Discovery science
8. CDS over multiple genes
9. CDS Knowledge separate
10. Multiple EHR
11. Support Gene variants
12. Standards: CDS and genomics
13. Deploy shared CDS KB
14. Access and transmit minimum

Mean Difference from Ideal Capability



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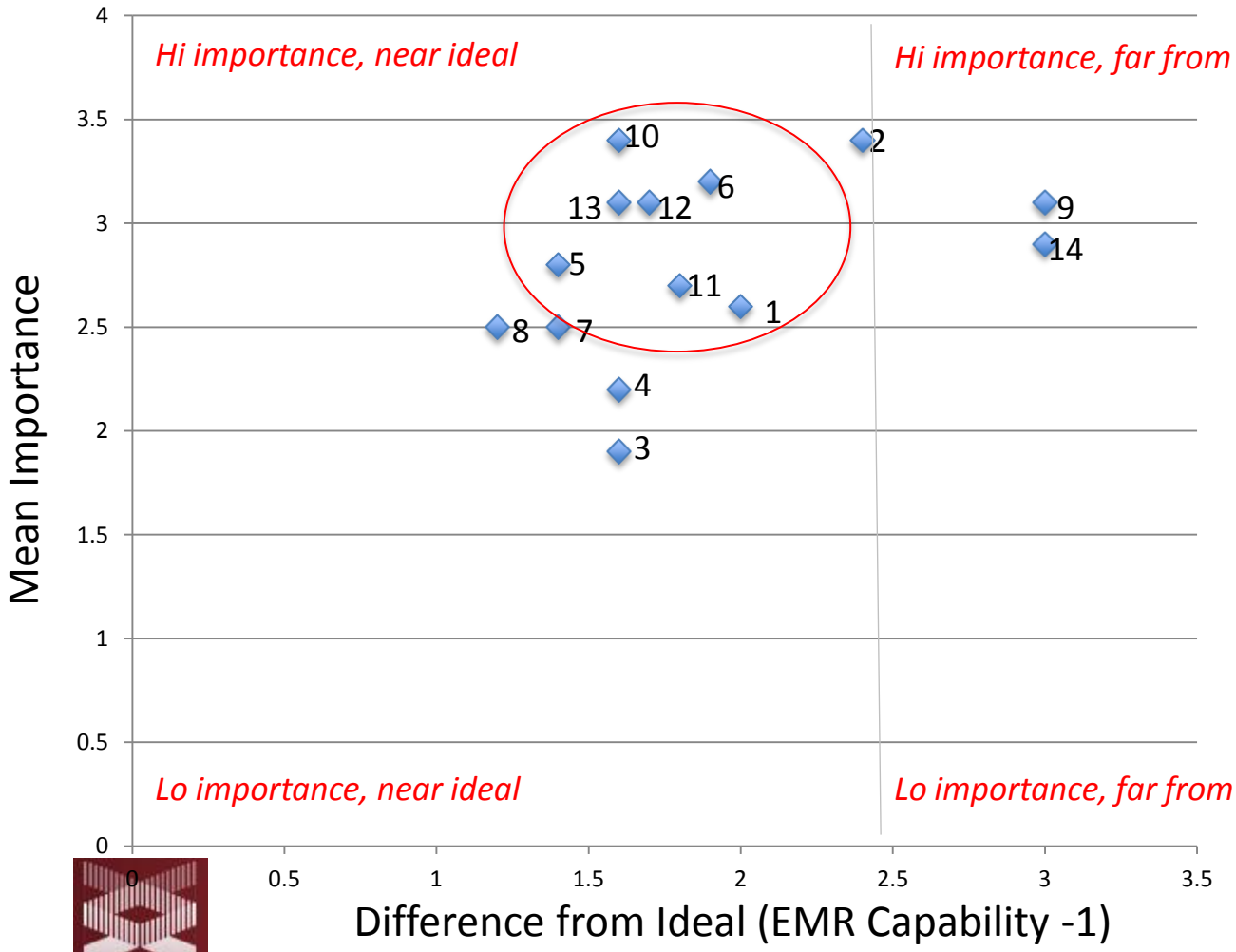
Mean Importance vs Mean Difference from Ideal



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Sum of Priorities Selections by Element

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Prioritization Insights from the Survey

From Import v Lo Diff from Ideal

- ★ 1 Maintain separation of primary molecular observations from the clinical interpretations of those data
- ★ 5 Simultaneously support human-viewable formats and machine-readable formats in order to facilitate implementation of decision support rules
- 6 Anticipate fundamental changes in the understanding of human molecular variation
- 10 CDS knowledge must have the capacity to support multiple EHR platforms with various data representations with minimal modification
- 11 Support a large number of gene variants while simplifying the CDS knowledge to the extent possible
- ★ 12 Leverage current and developing CDS and genomics standards
- ★ 13 Support a CDS knowledge base deployed at and developed by multiple independent organizations

From Top 5 Rankings

1 Maintain separation of primary molecular observations from the clinical interpretations of those data

5 Simultaneously support human-viewable formats and machine-readable formats in order to facilitate implementation of decision support rules

8 CDS knowledge must have the potential to incorporate multiple genes and clinical information

12 Leverage current and developing CDS and genomics standards

13 Support a CDS knowledge base deployed at and developed by multiple independent organizations

KEY THEMES FROM GM7 SURVEY

- Consensus on Masys: 1, 5; Welch: 12, 13
  - Agreement around separation of data and knowledge stores
  - Create machine-, and human-readable knowledge artifacts
  - Leverage current and developing CDS and genomic standards
  - Deploy a shared knowledge-base at several institutions
- Other 6, 8, 10, 11

Panel 1: 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

Panel 2: 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?

Panel 3: What are implementation issues surrounding genomic CDS?

- Moderators: Kensaku Kawamoto, MD, PhD, MHS and Casey Overby, PhD
  - Relevant Desiderata Elements 3, 7, 10, 12

- Discussion and Key Questions
  I. Are there common workflow issues to be considered when implementing GCDS? If so, what are they?
  II. What are the intra- and inter- institutional data and knowledge exchange issues implementing GCDS at scale?
    - a. Storage
    - b. System Requirements
    - c. Standards
    - d. Security
  III. What is the role for patient facing genomic clinical decision support?

Panel 4: Discussion – What are areas that should be prioritized for the research agenda for GCDS?

I. What existing entities (e.g. CPIC informatics, AMIA Genomics working group, CDSC, Health e-Decisions, ONC-HealthIT, Professional Societies, Guideline Developers, etc.) are aligned with the recommended strategies and how can they be engaged?

II. Avoidance of adverse reactions vs. improvement in health

III. Quality improvement vs. cost containment