Phenotype, Data Standards, and Data Quality Core

Update, Steering Committee Meeting, February 25, 2014
Bethesda, MD

Rachel Richesson, PhD
Assoc. Professor, Informatics
Duke University School of Nursing

William Ed Hammond, PhD
Dir., Duke Center for Health Informatics
Dir., Applied Informatics Research, DHTS
Professor of Community and Family Medicine

Meredith Nahm Zozus, PhD
Assoc. Director, Clinical Research Informatics
Duke Translational Medicine Institute

Rethinking Clinical Trials
Phenotype, Data Standards, Data Quality Core Participants

- **Monique Anderson**, Duke
- **Nick Anderson**, UC Davis Medical Center
- **Alan Bauck**, Kaiser Permanente
- **Denise Cifelli**, U. Penn
- **Lesley Curtis**, Duke
- **John Dickerson**, Kaiser Permanente Northwest
- **Bev Green**, Group Health Cooperative
- **W. Ed Hammond**, Duke
- **Chris Helker**, U. Penn
- **Michael Kahn**, Children’s Hospital of Colorado
- **Cindy Kluchar**, Duke
- **Reesa Laws**, Kaiser Permanente
- **Melissa Leventhal**, University of Colorado Denver
- **Rosemary Madigan**, U. Penn
- **Meredith Nahm Zozus**, Duke
- **Renee Pridgen**, Duke
- **Jon Puro**, OCHIN
- **Tammy Reece**, Duke
- **Rachel Richesson**, Duke
- **Shelley Rusincovitch**, Duke
- **Jerry Sheehan**, National Library of Medicine (NIH)
- **Greg Simon**, Group Health
- **Michelle Smerek**, Duke
Charter

- Promote multi-disciplinary discussion and collaboration.
- Participants will share their experiences using EHR to support research in various disease domains and for various purposes.
- Identify generalizable approaches, methods, and best practices to support the widespread use of consistent, practical, and useful methods to use widely available clinical data to advance health and healthcare research.
- Suggest where tools are needed.
- Explore and advocate for cultural and policy changes related to the use of EHRs for identifying populations for research, including measures of quality and sufficiency.
Projects

- Phenotype Use Cases in Collaboratory  (white paper in progress)
- Environmental Scan  (on-going; phenotype sources on Collaboratory KR)
- Literature search guidelines  (posted on Collaboratory KR)
- Phenotype “template”
- Phenotype validation guidelines
- Table 1 project  (update yesterday)
- Data quality guidelines  (three drafts circulated)
- Knowledge dissemination  (ongoing)
### Authoritative Sources of Phenotype Definitions

*(work in progress)*

#### Table 1: Primary Phenotype Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Comments</th>
<th>Link</th>
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<tbody>
<tr>
<td>Clinical Classifications Software (CCS), also known as AHRQ Bundles</td>
<td>Only based on diagnosis codes, but very large listing of conditions; this is the basis for most early SEER variables.</td>
<td><a href="http://www.hcup-us.ahrq.gov/toolssoftware/ccs.cfm">http://www.hcup-us.ahrq.gov/toolssoftware/ccs.cfm</a></td>
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<tr>
<td>CMS Chronic Conditions Warehouse (CCW)</td>
<td>Only based on diagnosis codes and procedure codes; clinical review to date has felt that inclusion logic can be overly broad.</td>
<td><a href="https://www.ccwdata.org/web/guest/condition-categories">https://www.ccwdata.org/web/guest/condition-categories</a></td>
</tr>
<tr>
<td>Mini-Sentinel</td>
<td>Exhaustively researched definitions, but limited number of phenotypes represented.</td>
<td><a href="http://www.minisentinel.org/assessments/diagnoses_and_medical_procedures/default.aspx">http://www.minisentinel.org/assessments/diagnoses_and_medical_procedures/default.aspx</a></td>
</tr>
<tr>
<td>eMERGE Network and PhenX phenotypes library</td>
<td>Probably the most well-known phenotyping source at present, but limited number of phenotypes represented; should be carefully evaluated because some of these studies can result in exclusionary logic inappropriate for the SEER population health focus.</td>
<td><a href="http://www.phenx.org/phenotypes">http://www.phenx.org/phenotypes</a></td>
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<tr>
<td>QualityNet (joint effort of CMS and Joint Commission)</td>
<td>Separates measures between inpatient basis and outpatient basis. Go to the “specifications manual” option; the appendices contain specific listings of ICD-9 code tables, medication tables, and CPT codes. This is one of the only CPT code groupings that we’ve seen so far (CPT measure is very restrictive), but QualityNet only includes for outpatient context.</td>
<td><a href="http://www.qualitynet.org/">http://www.qualitynet.org/</a></td>
</tr>
<tr>
<td>Professional society guidelines</td>
<td>These are an important source for definitions of abnormal laboratory results and specific ranges, which are often not represented in other definitions. Examples: American Diabetes Association, National Kidney Foundation, American College of Cardiology.</td>
<td></td>
</tr>
<tr>
<td>Major and well-recognized clinical trials and registries using EHR data to identify cohorts</td>
<td>Clinical and expert guidance can be important for identification of these pivotal trials; another potential technique might be to limit results to high-impact journals via a PubMed search.</td>
<td></td>
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</tbody>
</table>

#### Table 2: Secondary Phenotype Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Comments</th>
<th>Link</th>
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</thead>
<tbody>
<tr>
<td>Joint Commission</td>
<td>The CM/States Summit QualityNet is generally a better source, not using the Joint Commission directly. This organization does not require hospital adherence with federal regulations, and publishes a specifications manual for important quality measures, Appendix A.1 lists the definitions for specific conditions, mostly based upon ICD-9. A limitation is that these definitions are centered on inpatient admissions, and may not be applicable in an outpatient setting.</td>
<td><a href="http://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures.aspx">http://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures.aspx</a></td>
</tr>
<tr>
<td>World Health Organization (WHO) Global Burden of Disease</td>
<td>In general, this may be useful for mental health, but probably not helpful for most clinical condition phenotypes. The Global Burden of Disease classifications include both ICD-9 and ICD-10 diagnosis code groupings. See “cause-specific documentation” for individual conditions (e.g., cerebrovascular disease, diabetes mellitus, etc.). The diagnosis codes are not granular (e.g., it just lists 250 for diabetes mellitus), due to global application, and the clinical conditions are very broad. May be somewhat out of date; it appears that the classifications date back to 2000; the last formal GBD update appears to have been 2004, although this is difficult to ascertain from their website. However, there are a lot of mental health classifications, which may be useful.</td>
<td><a href="http://www.who.int/healthinfo/global_burden_disease/data_sources_methods/en/index.html">http://www.who.int/healthinfo/global_burden_disease/data_sources_methods/en/index.html</a></td>
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</tbody>
</table>

### Presented by Shelley Rusincovitch at Collaboratory Grand Rounds, Nov. 2013.

Rethinking Clinical Trials

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Attribution: Center for Predictive Medicine
### Evaluating Existing Definitions (work in progress)

**Phenotype Overview: Acute Myocardial Infarction (research by Maria V. Grau-Sepulveda)**

**Clinical Definition Source:** Joint ESC/ACCF/AHA/WHF Task Force for the Universal Definition of MI  

**Table 1: Authoritative Phenotype Comparison**

<table>
<thead>
<tr>
<th>Source</th>
<th>Evaluation of Prevalence vs. Incidence</th>
<th>EHR Data Subject Areas</th>
<th>Phenotype Comments</th>
<th>Phenotype Encounter Basis</th>
</tr>
</thead>
</table>
| AHRQ Bundles (Clinical Classifications Software) | Prevalence | ICD-9 Diagnoses | • Broad definition  
• AMI diagnosis codes:  
  - initial episode  
  - subsequent episode  
  - unspecified episode | Any encounter |
| CMS Chronic Conditions Warehouse | Incidence | ICD-9 Diagnoses Encounter Basis | • Only AMI initial episode codes | Inpatient basis, first/second diagnosis code |
| Mini-Sentinel #1 (AMI/Anti-Diabetic Agents) | Incidence | ICD-9 Diagnoses Encounter Basis | • AMI initial/unspecified episode codes | Inpatient basis, first diagnosis code |
| Mini-Sentinel #2 (Validation of AMI Cases) | Incidence | ICD-9 Diagnoses Encounter Basis | • AMI initial/unspecified episode codes  
• Does not include death criteria | Inpatient basis, first diagnosis code |
| CMS/Joint Summits QualityNet (Yale models for AMI and HF)  
Joint Commission Identification of AMI | Incidence | ICD-9 Diagnoses Encounter Basis | • AMI initial/unspecified episode codes | Inpatient basis, first diagnosis code |

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2. [http://www.hcup-us.ahrq.gov/toolssoftware/ccs/AppendixASingleDX.txt](http://www.hcup-us.ahrq.gov/toolssoftware/ccs/AppendixASingleDX.txt)  
5. [http://www.mini-sentinel.org/work_products/Validation_HeartOutcomes/Mini-Sentinel-Validation-of-AMI-Cases.pdf](http://www.mini-sentinel.org/work_products/Validation_HeartOutcomes/Mini-Sentinel-Validation-of-AMI-Cases.pdf)  

**Presented by Shelley Rusincovitch at Collaboratory Grand Rounds, Nov. 2013.**
Tool: Phenotype Templates

- Metadata and supporting documentation
  - Detailed definition sufficient to reproduce in different systems
  - Metadata about developers and PURPOSE

- Validation study methods and results
Identifying Computable Phenotypes for Table 1 Project

Multiple phenotype definitions:

**SUPREME-DM Phenotype**

Definition:
Adult Durham Population patients who meet ONE OR MORE of the following criteria during a DukeMed encounter between 2007-2011:
- One or more instances of the specified ICD-9-CM diagnosis codes (see Table 7) on an inpatient encounter
- OR 2 or more instances of the specified ICD-9-CM diagnosis codes (see Table 7) on outpatient encounters on separate days
- OR 1 or more instances of active stand-alone medication (see Table 8) reported during outpatient medication reconciliation
- OR 1 or more Oral Glucose Tolerance Test (OGTT) 2-hour 75g result >= 200 mg/dl where there is NO DIAGNOSIS CODE on the same encounter indicating pregnancy (V22, V23)
- OR 2 or more hemoglobin A1c results >= 6.5% on 2 different days within 730 days span
- OR 2 or more fasting glucose results >= 126 mg/dl on 2 different days within 730 days span
- OR 2 or more random glucose results >= 200 mg on 2 different days within 730 days span
- OR within a 750 day span on 2 different days:
  - Fasting glucose results >= 126 mg/dl
  - AND Random/glucose results >= 200 mg
- OR within a 750 day span (can be same day)
  - Hemoglobin A1c results >= 6.5%
  - AND Fasting glucose results >= 126 mg/dl

**Abnormal Lab Results**

Source: Laboratory results

Definition:
Adult Durham Population patients who meet ONE OR MORE of the following criteria during a DukeMed encounter between 2007-2011:
- One or more instances of hemoglobin A1c result >= 6.5%
- OR one or more fasting glucose results >= 126 mg/dl within 365 day span
- OR one or more random glucose results >= 200 mg/dl within 365 day span.

**Abnormal HbA1c (NCY A1c Registry Definition)**

Source: Laboratory results

Definition:
Adult Durham Population patients who meet ONE OR MORE of the following criteria during a DukeMed encounter between 2007-2011:
- One or more instances of hemoglobin A1c result >= 6.5%
Data Quality Assessment Update

- Three versions have been reviewed by the Core
- Has also been shared with a PCORI data quality working group looking at frameworks for data quality assessment
- Last comments were to remove much of the background and all literature review and evidence-based rationale to appendix so that the document contained only the recommendations. This is in progress.
- Next step: Final review with Core
Dissemination

- Posters/presentations on Phenotype Template, and Methods for Development and Evaluation
- Manuscript (informatics journal) on EHR Phenotyping experience and strategies of Demonstration Projects
- Collaboratory website and part of “Living Textbook”?
Future ideas

• Standards – consensus or strategy
• ICD-10 conversion (guidance for researchers)

• Cultural change/education/creativity regarding data quality
  • Getting specific about “which” quality and how much
  • Expecting data quality assessment
    • Comparison-based, i.e., data verification or reproducibility-based, i.e., multiple analyses on data from different sources
  • Using assessment results to answer how good is good enough?
    • Practicality versus perfection - how can we help draw some lines on the balance
Acknowledgements

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