i2b2 Clinical Research Chart

Shawn Murphy MD, Ph.D.
Griffin Weber MD, Ph.D.
Michael Mendis
Vivian Gainer MS
Lori Phillips MS
Rajesh Kuttan
Wensong Pan MS
Henry Chueh MD
Susanne Churchill Ph.D.
John Glaser Ph.D.
Isaac Kohane MD, Ph.D.
Use Cases

- Identifying cohorts for clinical trials
- Access to human specimens
- Population health surveillance
- Observational studies of genetic variants
Technical Overview

- Formed as a collection of interoperable services provided by i2b2 Cells
- Loosely coupled
- Makes no assumptions about proximity
- Connected by Web services
- Activity can be directed manually or automatically
i2b2 Environment

A

B

C

shared / central

i2b2 project portal

local

“Hive” of software services and core CRC cells

remote

Clinical Research Chart
i2b2 Cell: Canonical Hive Unit

HTTP XML
(minimum: RESTful, others like SOAP optional)

Programmatic Access
Use Case Development of i2b2 technology

Enterprise-wide repurposing and distribution of medical record data for research

- Hospital-wide availability of clinician-driven queries to find research cohorts
- Suggestion of novel relationships between genes and disease through mutual information theory methods
- Display of large collections of odds ratios as calculated following environmental exposures (Pharmacovigilance)
Enterprise-wide repurposing and distribution of medical record data for research

- Enable high performance collection of medical record data for querying and distribution
  - Enterprise web client
  - Create patient cohorts for further investigation
- Enable discovery within data on enterprise wide scale
  - Relevance networks
  - Pharmacovigilance
Enterprise web client
http://services.i2b2.org/webclient/
Workbench display of Mutual Inform. Correlations
Use Case Development of i2b2 technology

Provide distribution of medical records and tools for their manipulation in supporting specific research projects.

- Select patients for clinical trials
- Working out details for calculating odds ratios of pharmacovigilance
- Annotating images in clinical studies
Set of patients is selected through Enterprise Repository and data is gathered into a data mart.
- Repurpose medical record information for research studies
  - I2b2 Workbench
  - Natural language processing
- Enable genomic studies
  - Tissue/blood selection
  - Genetic data integration

Use of medical record data in clinical studies focused upon genomics and pharmacology
Select patients for clinical trials
### i2b2 Workbench for Avandia Pharmacovigilance

**Query Tool:**

#### Query Name:

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates</td>
<td>Occurs &gt; 0</td>
<td>Jude</td>
</tr>
<tr>
<td>Dates</td>
<td>Occurs &gt; 0</td>
<td>Jude</td>
</tr>
<tr>
<td>Dates</td>
<td>Occurs &gt; 0</td>
<td>Jude</td>
</tr>
</tbody>
</table>

**Timeline:**

- [ ] Timeline
- [ ] Patient Count

**Result:**

<table>
<thead>
<tr>
<th>Row #</th>
<th>Name of Terms</th>
<th>Value</th>
<th>Value Text</th>
<th>Height</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Rosiglitazone event</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Blue</td>
</tr>
<tr>
<td>3</td>
<td>Cardiovascular event</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>No Ros And CV</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Blue</td>
</tr>
<tr>
<td>4</td>
<td>No Ros And No CV</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>Ros And CV</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Blue</td>
</tr>
<tr>
<td>4</td>
<td>Ros And No CV</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Green</td>
</tr>
<tr>
<td>5</td>
<td>Avandia - NLP</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Blue</td>
</tr>
<tr>
<td>5</td>
<td>Rosiglitazone - NLP</td>
<td>N/A</td>
<td>N/A</td>
<td>Medium</td>
<td>Green</td>
</tr>
</tbody>
</table>
Project data can be added back to Enterprise Repository.

- [Enterprise Shared Data]
- Shared data of Project 1
- Shared data of Project 2
- Shared data of Project 3

- Ontology
- Consent/Tracking
- Security

- i2b2 DB Project 1
- i2b2 DB Project 2
- i2b2 DB Project 3
Enterprise Querytool allows:

- Selection of patient populations through complex queries
- Specifically targeted population analysis
- Privacy Management
Project Workbench allows:

- Patient population medical record review and exploration of data in a targeted population
- Use of Natural Language Processing
- Import of batch data sets
- Workflow support to simulate sequences of operations
- Export of batch outputs for specific applications
- Privacy management
Help outside of i2b2

- Ontology management
  - NCBO

- Imaging Research
  - BIRN / XNAT

- Tissue management
  - Crimson

- Cross Platform Integration
  - caBIG / SHRINE
Extensible Neuroimaging Archive Toolkit (XNAT) used to integrate image management into i2b2
Genotype samples and compare to controls
SHRINE (Shared Research Informatics Network) = Distributed Queries

Central “aggregator” broadcasts query to local hospital “adaptors”, which return aggregate counts only.
i2b2 Clinical Research Chart

Shawn Murphy MD, Ph.D.
Griffin Weber MD, Ph.D.
Michael Mendis
Vivian Gainer MS
Lori Phillips MS
Rajesh Kuttan
Wensong Pan MS
Henry Chueh MD
Susanne Churchill Ph.D.
John Glaser Ph.D.
Isaac Kohane MD, Ph.D.