Bridging the gap: Improving Secondary Use of EHRs with i2b2

Tobias BRONSCHA, Robert GÖTTB, Theresia EICHNERA, Christoph HAVEMANNB, Wolfgang HOFFMANNB, Oliver HEINZEA, Björn BERGH and Ulrike KUTSCHA

A Center for Information Technology and Medical Engineering, Heidelberg University Hospital, Germany
B Institute for Community Medicine, Greifswald University Hospital, Germany
Overview

• Introduction
• Methods
• Results
• Discussion & Lessons learned
Project GANI_MED

• „Greifswald Approach to Individualized Medicine“
• Aims at: Improving patient care by developing preventive, (early) diagnostic and therapeutic methods for individual patients
  – Optimal prediction of (future) diseases is not always possible using current clinical methods (also imaging)
  – Identify indiv. prognosis and risk factors for diseases
• Defines: Multiple patient cohorts for different common diseases (e.g. cardiovascular diseases, ...)
• Allows: Using collected medical data for research
Medical Informatics: Cornerstones

Clinical Routine

Collection of data from a heterogeneous landscape of sources, in many formats

Data extraction / integration and storage
Consent Management, Pseudonymization, and ID Management
Assurance of Data Privacy

QM and data transfer for research

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GANI_MED - Research data

Quarterly released, including data quality assurance (productive sources)

Linked to

Generic metadata

Generic medical data
Generic metadata

Input formats (GANI-forms-DD, HL7, ...)

AbstractIncoming (abstract super class)
- InG2D2XmlReader
- InGanFormsDDConnector
- InMednovoXmlReader
- InCRUFileReader

Generic metadata format

AbstractOutcoming (abstract super class)
- OutG2D2XmlWriter
- OutG2D2Connector
- Out2B2SQLWriter
- OutTreeWriter
- OutODMWriter

Output formats (i2b2, transfer unit, ...)

DTO: Data Transfer Objects
Generic research database

→ EAV-format
(similar to i2b2)

- New sources can be added dynamically
- No structural changes
- „Hidden“ complexity

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Researchers

Patient distribution, e.g. by gender?

Are there enough patients available for my research?

Data preview (using i2b2)

- Preview data
- Formal application for research data
- Deliver data to researcher

Review / data transfer

- Review
- Get review vote
- Data transfer unit
- Get research data

Research data application

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i2b2 for GANI_MED

- Installation of i2b2 as a virtual machine
- Data import from research database to i2b2
- Invent a Web Client plugin and interface to the data transfer unit (Integrate data preview and data application process)
Indication / Medication for Thrombosis (lower leg veins)

Indication / Medication for hypertension

Urine: Leuko >400/µl
i2b2 for GANI_MED – Example query II

Export
Clear

Detailed ListView
Category: ALL

Demographics (1 Patient Set) - Simple Counts
This plugin displays a demographic break down of a Patient Set.

Demographics (2 Patient Sets) - Simple Counts
This plugin compares the demographic break down of two Patient Sets.
i2b2 „Key User“ evaluation - Method

- i2b2 Workshop at Greifswald with selected researchers
- Principal aims:
  - Exchange of ideas with users
  - For development: Metadata changes necessary?
  - Measurement of perceived usefulness for research planning / benefit of using exact patient counts over clinical experience?
  - Visual representation of research planning process?
- Used questionnaire to determine user’s opinions (Granting a 2 weeks testing period)
i2b2 „Key User“ evaluation - Results I

- Metadata changes → More generated variables needed
- Unsure: Intervals as numbers / predefined text items
- i2b2 Web Client intuitively usable
- Query Tool with >3 Groups: May be difficult to keep overview over query
- Database querying time is acceptable (~5-15 sec during Workshop)
- Using tab to access Web Client plugin: Good solution
i2b2 „Key User“ evaluation - Results II

- „Drag & Drop“ of items is an intuitive way of defining i2b2 queries
- i2b2 showing exact patient counts is considered a significant improvement to research planning
- i2b2 represents research planning process well
- Wish: Compare multiple patient groups simultaneously → Current Query Tool may be "computer scientist's view" rather than medical researcher's view ("Group" means "metadata item group", not "patient group")

<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; 0x</td>
<td>Exclude</td>
</tr>
<tr>
<td>Treat Independently</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Query Name: 
- Temporal Constraint: 
  - Treat all groups independently

- Run Query | Clear | Print Query | 0 Groups
Lessons learned / new i2b2-features

• Source data alone may be too detailed.  ➔ Get definitions for „generated / derived variables“ from researchers / clinicians (> 10,500 items available)

Potential new i2b2 features:

• Use tabs beside Query Tool

• Use a search engine directly in „Navigate Terms“ section, not in additional Find Terms tool

• Changes in i2b2 DB not reported to users  ➔ Subscription of i2b2 Queries + Automatic report to user via email when patient count threshold is reached
Outlook

• i2b2 query import to Greifswald transfer unit needs to be developed

• More source systems are planned to be included
  – „Study of Health in Pomerania“ („SHiP“)
  – „Nationale Kohorte“ („National Cohort“)
  – …
Thank you!

Contact
Tobias Bronsch, M.Sc.: tobias.bronsch@med.uni-heidelberg.de
Robert Gött, Dipl-Ing.: robert.goett@uni-greifswald.de