

# Informatics Tools for Healthcare Research

Mark Abajian

*Presented to the Avetis Fellows, Thursday, 01 December 2022*

# Program

- |   |            |
|---|------------|
| ● Introductions and Participant Goals   | 10 minutes |
| ● Sneak Peek at i2b2                    | 5 minutes  |
| ● Introductory Slides                   | 10 minutes |
| ● i2b2 Web Client Introduction          | 5 minutes  |
| ● i2b2 Informatics Domains (Ontologies) | 10 minutes |
| ● i2b2 Query Building                   | 10 minutes |
| ● i2b2 Reporting                        | 5 minutes  |
| ● Review                                | 5 minutes  |
| ● Discussion and Questions              | 15 minutes |

# Introductions

- **Mark Abajian**
  - 30+ years in software development
  - 4 years in informatics software
  - Retired from USC and Caltech
  - Native of Los Angeles
  - Fluent in Armenian
- **Avetis Fellows**

# Participant Goals

- Be aware of the role of electronic health records in medical and pharmaceutical research
- Be aware of the role of i2b2 and similar software applications in supporting clinical and translational science
- Understand the two principal modes of research that these software programs support
- Be aware of the various ontology/informatics domains used by such programs
- Become exposed to the layout, configuration, and operation of the i2b2 web client
- Be able to construct rudimentary research queries using the i2b2 software
- “Stretch” Goal: Brainstorm the possible future uses of software like i2b2 in academics and healthcare in Armenia

## Sneak Peek at i2b2

• <https://www.i2b2.org/webclient/>

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The screenshot displays the i2b2 Web Client interface. On the left, a tree view shows a hierarchy of folders including 'demo', '0. Enumerated Values', '0. LargeString', '0. Numeric Values', '0. Temporal Queries', 'AMIA2022', 'CT\_APPROVE', and various patient sets. The main panel is divided into two sections. The top section, 'Query Tool', shows a 'Temporal Query' for 'Female@7:10:33'. It includes a 'Query Timing' dropdown set to 'Non-Temporal Query: Treat Independently' and three groups for query execution. The bottom section displays the results for the query 'Female@7:10:33', showing a total of 51 patients. Below this, a bar chart titled 'Number of Patients' shows the distribution of patients by race. The chart has a y-axis labeled 'Number of Patients' ranging from 0 to 40. The x-axis lists various racial categories. The bars show the following counts: Aleutian (0), American Indian (0), Asian (6), Black (23), Eskimo (0), Hispanic (11), Indian (6), Middle Eastern (0), Multiracial (0), Native American (0), Navajo (0), Not recorded (0), and Other (5).

Race	Number of Patients
Aleutian	0
American Indian	0
Asian	6
Black	23
Eskimo	0
Hispanic	11
Indian	6
Middle Eastern	0
Multiracial	0
Native American	0
Navajo	0
Not recorded	0
Other	5

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# Introduction to Informatics Tools

- **Electronic Health Records (EHR)**
- **Role of EHR**
- **Clinical and Translational Science**
- **Role of Informatics Tools**
- **EHR in Informatics**
- **Informatics Tools**
- **Informatics Domains**

# Electronic Health Records (EHR)

- Personal and Health History
  - name, DOB, primary language, address, family health
- Medical History
  - clinic/hospital visits, providers, vital signs, symptoms, diagnoses, medications, procedures, lab test results, etc.
- Demographics
  - gender, race, ethnicity, marital status, religion
- Genomics
  - markers and risk factors

# Role of Electronic Health Records (EHR)

- Clinical
  - Healthcare Delivery
  - Consultations
- Administrative
  - Contact Information
  - Billing / Insurance Records
- Academic
  - Retrospective Analyses
- Academic / Industrial / Pharmaceutical
  - Cohort Discovery for Clinical Trials (medications, testing, procedures, prosthetics)



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# Clinical and Translational Science

- **Clinical Research / Science**
  - **Patient Surveys**
  - **Health Services Research**
  - **Clinical Trials**
- **Translational Research / Science**
  - **Bridging different areas of research**
  - **Bringing new discoveries into the mainstream**

## Role of Informatics Tools

- **Clinical Research / Science**
  - Patient Surveys: Cohort Discovery
  - Health Services Research: Retrospective Analyses
  - Clinical Trials: Cohort Discovery
- Translational Research / Science
  - Bridging different areas of research
  - Bringing new discoveries into the mainstream

# EHR in Informatics



# Informatics Tools

- **Single Institution (single EHR system)**
  - **i2b2 (Informatics for Integrating Biology and the Bedside)**
  - **tranSMART**
- **Multiple Institutions**
  - **TriNetX (global data sources)**
  - **SHRINE (Shared Health Research Informatics NEtwork)**
    - **ACT (50 institutions in USA)**
    - **LADR (Los Angeles Data Resource, 4 local institutions)**

# Informatics Tools — at USC

- Single Institution (single EHR system)
  - i2b2 (Informatics for Integrating Biology and the Bedside)
  - tranSMART
- Multiple Institutions
  - TriNetX (global data sources)
  - SHRINE (Shared Health Research Informatics NEtwork)
    - ACT (50 institutions in USA)
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# Informatics Tools — Today's Focus

- Single Institution (single EHR system)
  - i2b2 (Informatics for Integrating Biology and the Bedside)
  - tranSMART
- Multiple Institutions
  - TriNetX (global data sources)
  - SHRINE (Shared Health Research Informatics NEtwork)
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# Informatics Domains — Standardized

- ICD-CM
  - Diagnoses, symptoms, history
- LOINC
  - Vital signs, measurements, lab orders, lab test results
- RxNorm, RxCUI, NDC
  - Medication orders, strength, delivery
- ICD-PCS, HCPCS, CPT
  - Procedures
- SNOMED
  - all of the above



# Informatics Domains — Non-Standard, Custom

- **Demographics:** age, gender, race, ethnicity, marital status, religion, etc.
- **Vital Status:** alive or deceased
- **Visit Details:** ambulatory, ED/ER, length of stay, clinic, age at visit
- **Notes, Reports, Records**
- **Biospecimens:** blood, urine, saliva, tissues; number and size
- **Social and Environmental Determinants of Health:** neighborhood demographics, social status, exposure to pollutants
- **Genomics:** markers and risks

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Race	Number of Patients
Aleutian	0
American Indian	0
Asian	6
Black	23
Eskimo	0
Hispanic	11
Indian	6
Middle Eastern	0
Multiracial	0
Native American	0
Navajo	0
Not recorded	0
Other	0
White	5

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# Review

- Role of EHR
  - Clinical, Administrative, Research (Academic, Industrial, Pharma)
- Role of informatics software
  - Retrospective Analyses, Cohort Discovery
- Informatics ontologies/domains
  - Diagnoses, Measurements, Medications, Procedures, Demographics, etc.
- Informatics tools
  - i2b2, tranSMART, TriNetX, SHRINE networks
- i2b2 interface
  - ontology tree, query tool, query types, query history, workspace, results window, reports

## Discussion and Questions

- Possible future uses of software like i2b2 in academics and healthcare in Armenia?

## For More Information...

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# Supporting Materials

# Glossary

- **CPT**                      **Current Procedural Terminology**
- **HCPCS**                **Healthcare Common Procedure Coding System**
- **ICD-CM**                **International Classification of Diseases, Clinical Modification**
- **ICD-PCS**                **International Classification of Diseases, Procedure Coding System**
- **LOINC**                  **Logical Observation Identifiers Names and Codes**
- **NDC**                    **National Drug Codes**
- **RxCUI**                  **Concept Unique Identifier (for RxNorm codes)**
- **RxNorm**                **(normalized naming system for generic and branded drugs)**
- **SNOMED**                **Systemized Nomenclature Of MEDicine**