



**EMORY**  
LIBRARIES &  
INFORMATION  
TECHNOLOGY



## **I2b2 Product Team**

**Andrew Post**

**Miao Ai**

**Blair Boyd**

**Patrick Maloney**

# I2b2 Roles and Responsibilities

- Andrew Post – MD, PHD Biomedical Informatics
  - Product Owner: Consult with researchers on building queries and troubleshooting complex queries.
- Miao Ai – MS, Systems Software Engineer
  - Support: Troubleshooting technical and data issues.
- Patrick Maloney - Product Management Manager
  - Product Manager: 1<sup>st</sup> Tier support, demos, consultations.
- Blair Boyd – Product Manager
  - Product Manager: 1<sup>st</sup> Tier support, demos, consultations.

# What is I2b2?

- Emory i2b2 lets you query Emory Healthcare electronic health record data for patient counts and aggregate information free of charge.
- It is operated and funded by Emory's Clinical and Translational Science Award (CTSA) program in partnership with Library and Information Technology Services (LITS) and the Department of Biomedical Informatics.
- It is an open source technology created by Partners Healthcare and is used by academic medical centers around the world.

# What is i2b2 for?

- For determining study feasibility. Have an idea for a study and want to know if there are enough patients to conduct that study.
- Accelerates the pre-research process.
- Getting counts for grants for IRB protocols.
- Way for investigators to interact with the data in the clinical data warehouse in an interactive and self-service fashion.
- Accelerates the use of electronic health record data for use in research.
- To map electronic health record data to standards for data sharing.

# i2b2 Data Types and Where They Come From:

- All visits at EUH, EUHM, TEC, EJCH and ESJH from 2011 - present (2 day time lag):\*
  - Demographics (age at query, gender, race, ethnicity, vital status)
  - Visit details (age at visit, length of stay, type)
  - ICD-9 and ICD-10 diagnosis codes (type, priority)
  - ICD-9 and ICD-10 procedure codes
  - Medication orders (inpatient vs. ambulatory)
  - 204 selected laboratory tests (laboratory vs. point of care)
  - \*Data from the Emory Clinical Data Warehouse

# Pricing

- I2b2 accounts and queries are free of charge.
- Product Management and The Informatics Core will work with new users if they have questions about how to build queries and for orientation to the product.
- If you would like a data set, we help your analyst to extract that data set.
- If you do not have an analyst, we will put you in touch with the LITS data solutions team to work with you to extract your data set for a fee.

# i2b2 Access

- You may use either your Emory University login or your Emory Healthcare login, if you have both, but i2b2 will keep these accounts and associated information separate. In effect, you will have two accounts.

# Who can use i2b2?

- Anyone with an Emory NetId or Emory Healthcare login, after agreeing to a User Agreement.
- You can log into i2b2 via:  
<https://i2b2.emory.edu>
- You may use either your Emory University login or your Emory Healthcare login, if you have both, but i2b2 will keep these accounts and associated information separate. In effect, you will have two accounts.
- Users do not need an IRB Protocol because there is no access to patient level data provided by i2b2 at present.



# Basic Query:

- Demographics
  - In the Navigation Terms, drag and drop the 18-74 age ranges over to Group 1 and run the query.

The screenshot displays the i2b2 Query & Analysis Tool interface. The left pane, titled "Navigate Terms", shows a tree view of demographic categories. The "Age" category is expanded, listing various age ranges. A red arrow points from the "18-34 years old" range in the left pane to the "18-34 years old" range in the "Group 1" column of the "Query Tool" pane. The "Query Tool" pane shows a query named "RA Query Age" with a temporal constraint of "Treat all groups independently". The "Query Tool" pane is divided into three groups: Group 1, Group 2, and Group 3. Each group has columns for "Dates", "Occurs > 0x", and "Exclude". The "18-34 years old" range is selected in Group 1, and the "35-44 years old", "45-54 years old", "55-64 years old", and "65-74 years old" ranges are also listed in Group 1.

Group 1			Group 2			Group 3		
Dates	Occurs > 0x	Exclude	Dates	Occurs > 0x	Exclude	Dates	Occurs > 0x	Exclude
Treat Independently			Treat Independently			Treat Independently		
18-34 years old								
35-44 years old								
45-54 years old								
55-64 years old								
65-74 years old								

# Basic Query:

- Rheumatoid Arthritis query age + Diagnosis

i2b2 Query & Analysis Tool Project: Emory I2b2 User: Blair Boyd

**Navigate Terms** **Find**

Search by Names Search by Codes

Containing

**Find** ACT Diagnoses

- Monoarticular juvenile rheumatoid arthritis
- Other rheumatoid arthritis with visceral or systemic involvement
- Pauciarticular juvenile rheumatoid arthritis
- Polyarticular juvenile rheumatoid arthritis, acute
- Polyarticular juvenile rheumatoid arthritis, chronic unspecified
- Rheumatoid arthritis
- Rheumatoid arthritis and other inflammatory polyarthropathies
- Screening for rheumatoid arthritis

**Query Tool**

Query Name: RA Query Age + Inclusion Dx

Temporal Constraint:  Treat all groups independent

Group 1			Group 2		
Dates	Occurs > 0x	Exclude	Dates	Occurs > 0x	Exclude
Treat Independently			Treat Independently		
	18-34 years old			Rheumatoid arthritis	
	35-44 years old			Rheumatoid arthritis, unspecified	
	45-54 years old				
	55-64 years old				
	65-74 years old				

# Basic Query (on your own)

- Rheumatoid Arthritis + Hypertension

The screenshot displays the i2b2 Query & Analysis Tool interface. The top navigation bar includes "i2b2 Query & Analysis Tool", "Project: Emory I2b2", "User: Blair Boyd", and "Find Patients | Analysis Tools |".

The interface is divided into several panels:

- Navigate Terms:** Contains search fields for "Search by Names" and "Search by Codes". A search for "hypertension" is active, showing a list of ICD10 diagnosis codes. A red arrow points from the "Essential (primary) hypertension" code in this list to the corresponding term in the query builder.
- Query Tool:** The main area for building the query. It shows a "Query Name:" field and a "Temporal Constraint:" dropdown set to "Treat all groups independently". The query is structured into three groups:
  - Group 1:** Contains age ranges: "18-34 years old", "35-44 years old", "45-54 years old", "55-64 years old", and "65-74 years old".
  - Group 2:** Contains the terms "Benign essential hypertension" and "Essential (primary) hypertension".
  - Group 3:** Is currently empty.Logical operators "AND" are placed between the groups. A "drop a term on here" button is visible at the bottom right.
- Workplace:** A tree view on the left showing a project structure under "SHARED". It includes folders for "Analyst Training 201701 (draft)", "Age+Dx", "Age+Hypertension", "Exclusions", "Modifiers", and "Rheumatoid Arthritis Queries".

# Query with Exclusion

- Exclusions: Age + Inclusion Diagnosis + not Prednisone

The screenshot displays the I2b2 Query & Analysis Tool interface. The main window is titled "Query Tool" and shows a query configuration for finding Prednisone with specific age and diagnosis constraints, and an exclusion for Prednisone.

**Left Panel (Navigate Terms):** Shows a search for "prednisone" under "ACT Medications". A list of various Prednisone formulations is displayed, with "Prednisone" selected.

**Right Panel (Query Tool):** Shows a query configuration with three groups:

- Group 1:** Contains age ranges: 18-34 years old, 35-44 years old, 45-54 years old, 55-64 years old, and 65-74 years old.
- Group 2:** Contains diagnoses: Rheumatoid arthritis and Rheumatoid arthritis, unspecified.
- Group 3:** Contains the exclusion: Prednisone.

The query is configured with "Treat all groups independently" and "one or more of these" for each group. The groups are connected by "AND" operators. A red box highlights the "Exclude" button for Group 3, and a red arrow points from the "Find" button in the left panel to the "Exclude" button in the right panel.

**Bottom Panel (Workplace):** Shows a tree view of the workspace with folders for "SHARED", "Analyst Training 201701 (draft)", "Age+Dx", "Age+Hypertension", "Exclusions", "Modifiers", and "Rheumatoid Arthritis Queries".

# Query with Exclusions (on your own)

- Exclusions: Age + Inclusion Diagnosis + None of the following: etanercept, golimumab

The screenshot displays the i2b2 Query & Analysis Tool interface. The top navigation bar includes 'i2b2 Query & Analysis Tool', 'Project: Emory I2b2', 'User: Blair Boyd', and 'Find Patients | Analysis Tools | Help | Logout'. The main workspace is divided into several panels:

- Navigate Terms:** Contains search options for 'Find' and 'Find' with a search box containing 'golimumab'. A list of search results for 'golimumab' is shown, including '0.5 ML golimumab 100 MG/ML Prefilled Syringe', '1 ML golimumab 100 MG/ML Prefilled Syringe', 'Golimumab', 'golimumab 12.5 MG/ML Injectable Solution', 'golimumab Injectable Solution', and 'golimumab Prefilled Syringe'. A red arrow points from the 'golimumab' result to the 'Rheumatoid arthritis' diagnosis in Group 2.
- Workplace:** A tree view showing a project structure under 'SHARED', including 'Analyst Training 201701 (draft)', 'Age+Dx', 'Age+Hypertension', 'Exclusions', 'Modifiers', and 'Rheumatoid Arthritis Queries'. The 'Rheumatoid Arthritis Queries' folder is expanded, showing several query names.
- Query Tool:** The main configuration area. It shows a 'Query Name' field and a 'Temporal Constraint' set to 'Treat all groups independently'. The query is structured into three groups:
  - Group 1:** 'Occurs > 0x' with a date constraint '18-34 years old'.
  - Group 2:** 'Occurs > 0x' with a date constraint 'Rheumatoid arthritis'.
  - Group 3:** 'Occurs > 0x' with a date constraint 'Etanercept' and 'Golimumab'.Each group has an 'Exclude' checkbox. A red box highlights the 'Exclude' checkbox for Group 3. Below the groups, there are 'AND' operators and three boxes: 'one or more of these' (green), 'AND', 'one or more of these' (green), 'AND', and 'none of these' (red, highlighted with a red box).

# Query with Modifier:

- Principal Diagnosis of Acute Myocardial Infarction.

The screenshot displays the i2b2 Query & Analysis Tool interface. The top bar shows the project name 'Emory I2b2', the user 'Blair Boyd', and navigation links for 'Find Patients', 'Analysis Tools', 'Help', and 'Logout'. The interface is divided into several panels:

- Navigate Terms:** A tree view on the left showing a hierarchy of medical terms. The 'Acute myocardial infarction' category is expanded, and the 'Principal' modifier is selected. A red arrow points from this selection to the query tool.
- Workplace:** A panel on the bottom left showing a list of folders and files, including 'SHARED', 'Analyst Training 201701 (draft)', 'Age+Dx', 'Exclusions', 'Modifiers', 'Rheumatoid Arthritis Queries', 'Same Encounter Queries', 'Threshold', and 'bboyd8'.
- Query Tool:** The main workspace for building queries. It features a 'Query Name' field, a 'Temporal Constraint' dropdown set to 'Treat all groups independently', and a table for defining query groups. The table has three columns: 'Group 1', 'Group 2', and 'Group 3'. Each column contains a 'Dates' dropdown set to 'Treat Independently', a condition 'Occurs > 0x', and an 'Exclude' checkbox. The term 'Acute myocardial infarction [Principal]' is entered in the first group. Below the table, there are buttons for 'one or more of these', 'AND', and 'drop a term on here'. At the bottom of the tool, there are buttons for 'Run Query', 'Clear', 'Print Query', and 'New Group', along with a status bar showing '1 Group'.

# Query with Modifier (on your own):

- Ambulatory Order for Lisinopril

The screenshot displays the i2b2 Query & Analysis Tool interface. The main window is titled "Query Tool" and shows a query configuration for "Lisinopril [Ambulatory Order]". The interface is divided into several sections:

- Navigate Terms:** A tree view on the left showing a hierarchy of terms. The path "Cardiovascular medications" > "ACE inhibitors" > "Lisinopril" > "Order Type" > "Ambulatory Order" is highlighted. A red arrow points from this path to the query configuration area.
- Workplace:** A tree view at the bottom left showing a hierarchy of workspaces. The path "SHARED" > "Modifiers" is highlighted.
- Query Tool:** The main configuration area on the right. It shows a query name "Lisinopril [Ambulatory Order]" and a temporal constraint "Treat all groups independently". The query is configured with three groups, each with a "Dates" field and a "Occurs > 0x" constraint. The groups are connected by an "AND" operator. A green box labeled "one or more of these" is positioned below the first group, and a yellow box labeled "drop a term on here" is positioned below the second group.

At the bottom of the interface, there are buttons for "Run Query", "Clear", "Print Query", and "New Group". The status bar at the bottom indicates "1 Group" and provides options for "Show Query Status" and "Graph Results".

# Query with Threshold:

- Threshold: Hypertension + elevated potassium

The screenshot displays the i2b2 Query & Analysis Tool interface. The main window is titled "Query Tool" and shows a query configuration for "Hypertension + elevated potassium". The query is structured into three groups:

- Group 1:** Benign essential hypertension, Essential (primary) hypertension
- Group 2:** Potassium in Blood
- Group 3:** (Empty)

The temporal constraint is set to "Treat all groups independently". The "By Value" option is selected in the dialog box, and the value "5" is entered. The dialog box also shows a range in mmol/L from 3.4 to 5.3.

The dialog box "Choose value of K - pl (Test:K-pl)" contains the following text and controls:

Searches by Lab values can be constrained by the high/low flag set by the performing laboratory, or by the values themselves.

No Value

By Flag

By Value

Please select operator:

Please enter a value:

Click on a bar segment to help specify a value or range:  
Range in mmol/L

3.4 3.6 4.5 5.3

Units =

OK Cancel

one or more of these AND drop a term on here

Run Query Clear Print Query 2 Groups New Group



# Query with Threshold continued:

The screenshot displays the i2b2 Query & Analysis Tool interface. The top bar shows the project name 'Emory I2b2' and the user 'Blair Boyd'. The main interface is divided into three main sections:

- Navigate Terms:** Located on the left, it contains a search box with 'potassium' and a tree view of terms. The tree view shows 'Potassium' expanded, with sub-terms like 'Potassium in Blood' and 'Potassium in Serum or Plasma'. Red arrows point from these terms to the 'Query Tool' panel.
- Query Tool:** The central panel where the query is constructed. It shows three groups of terms being combined with 'AND' operators. The terms are: 'Essential (primary) hypertension', 'Potassium in Blood > 5 mmol/L', and 'Potassium in Serum or Plasma > 5 mmol/L'. The interface also shows 'Temporal Constraint' and 'Treat all groups independently' options.
- Workplace:** Located at the bottom left, it shows a tree view of the query structure, including 'Analyst Training 2017/01 (draft)', 'Age+Dx', 'Age+Hypertension', 'Exclusions', 'Modifiers', 'Rheumatoid Arthritis Queries', 'Same Encounter Queries', and 'Threshold'.

The 'Query Tool' panel shows the following structure:

Group 1	Group 2	Group 3
Essential (primary) hypertension	Potassium in Blood > 5 mmol/L	Potassium in Serum or Plasma > 5 mmol/L

The interface also includes buttons for 'Run Query', 'Clear', and 'Print Query' at the bottom. The status bar indicates '2 Groups'.

# Query with Threshold (on your own)

- Threshold: Age + Inclusion Diagnosis + not bilirubin total  $\geq 1$  and not bilirubin total in serum or plasma  $\geq 1$

The screenshot displays the i2b2 Query & Analysis Tool interface. The top navigation bar includes the project name "Project: Emory i2b2", the user "User: Blair Boyd", and links for "Find Patients", "Analysis Tools", "Help", and "Logout".

The main interface is divided into several sections:

- Navigate Terms:** Contains search fields for "Search by Names" and "Search by Codes". The "Find" button is visible. Below, a list of terms is shown, with "Bilirubin" and "Bilirubin total" highlighted. Red arrows point from these terms to the query groups.
- Query Tool:** The central area for building the query. It features a "Query Name" field and a "Temporal Constraint" dropdown set to "Treat all groups independently".
- Query Groups:** Three groups are defined:
  - Group 1:** Contains a "Dates" field set to "Treat Independently" and a condition "Occurs > 0x". Below this, a list of age ranges is shown: "35-44 years old", "45-54 years old", "55-64 years old", and "65-74 years old".
  - Group 2:** Contains a "Dates" field set to "Treat Independently" and a condition "Occurs > 0x". Below this, a list of diagnoses is shown: "Rheumatoid arthritis, unspecified".
  - Group 3:** Contains a "Dates" field set to "Treat Independently" and a condition "Occurs > 0x". Below this, two conditions are listed: "Bilirubin total  $\geq 1$  mg/dL" and "Bilirubin total in Serum or Plasma  $\geq 1$  mg/dL".
- Logic:** The groups are connected by "AND" operators. Below each group, a green box indicates "one or more of these".
- Buttons:** At the bottom, there are "Run Query", "Clear", and "Print Query" buttons. The status "3 Groups" is displayed.

## Questions?

For more information on how to use i2b2:

<https://i2b2webprod1.cc.emory.edu/i2b2/webclient/help/content.html>

If you would like a consultation on running a query  
please contact us at:

[i2b2.help@emory.edu](mailto:i2b2.help@emory.edu)