Query Health and i2b2: Enabling Standards-based, Multiplatform Population Health Queries

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Introduction

- Understanding population-level health is essential to effective public health.
- Many institutions are unwilling to share patient data due to privacy and security concerns.
- One solution are distributed queries, bringing the question to the data and sharing only results.
- The ONC is leading the Query Health Initiative, a public-private collaboration seeking to build a national network for distributed, population-level health queries across multiple platforms.
- The Query Health reference implementation (RI) includes i2b2, a widely-used clinical data repository and analysis platform.
- Here we describe the reference implementation of QueryHealth, focusing on “QueryHealth-enabling” i2b2 for distributed queries.

Materials and Methods

QueryHealth RI uses PopMedNet (PMN) for distributed queries. PMN supports additional platforms through client and server plugins.

i2b2 instances are comprised of “cells” that communicate via web services, together called a “hive” (see Fig 5). Custom cells can be added to the hive.

To integrate i2b2 into the QueryHealth client, we developed a PMN Client Adapter cell. It provides the backend to the i2b2 web interface and replaces the data repository cell. It routes queries developed in the i2b2 web interface (and requests for previous query results) to the PopMedNet portal. (See Figs. 1-3).

The PMN Portal distributes queries to DataMart client software at configured data partner sites.

To QueryHealth-enable existing i2b2 instances, we developed a PMN Client Adapter, to link i2b2 to the DataMart Client Software. It receives queries from the DataMart Client and sends them to the i2b2 instance, exactly as the web client does. (See Fig 5.)

The complete QueryHealth enablement, we also developed a Health Quality Measures Format translator cell, to convert queries to and from a standard format. With these changes, i2b2 and custom queries can be distributed to supported PMN platforms (currently i2b2, PMN native, and hQuery).

This has been implemented as a QueryHealth client and server and deployed in two pilots.

Results

- QueryHealth-enable your i2b2 instance with minimal effort, by only installing these new additional components.
- QueryHealth enables multiproblem population health research and surveillance through distributed queries in a common language.
- QueryHealth RI pilots are beginning; several more are planned. Right now:
  - New York State Department of Health is preparing to widely use i2b2 and PMN for disease management and surveillance. One clinic will be active by mid-November.
  - FDA, as part of Mini-Sentinel, is sending HQMF queries to i2b2 through PMN. One hospital will be active by mid-November.
  - All code will be available shortly. See the QueryHealth website, http://wiki.siframework.org/Query+Health+, and i2b2 and PopMedNet’s websites.

Discussion and Summary

- QueryHealth-enable your i2b2 instance with minimal effort, by only installing these new additional components.
- QueryHealth enables multiproblem population health research and surveillance through distributed queries in a common language.
- QueryHealth RI pilots are beginning; several more are planned.

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QueryHealth Enabling i2b2

Figure 1: A QueryHealth investigator logs into the i2b2 webclient and virtually develops a research query.

Figure 2: The i2b2 hive is configured to send queries to the PMN Client Adapter cell rather than a local data repository. This cell sends the query to the HQMF Translator and forwards the result to the PMN portal.

Figure 3: The PMN portal is administrator-configured to send the query securely to any number of data partners, which process it and return results to the portal. The results are aggregated and shown in i2b2.

Figure 4: Any number of data partners can receive the query. Each receives the query into the PMN DataMart Client Software, which is configured to pass the query along to a supported platform. QueryHealth RI supports i2b2, hQuery, and PMN Native queries.

Figure 5: Shown here – a standard i2b2 hive (in blue) with two new cells (in red). The PMN Server Adapter cell receives queries from the PMN DataMart Client Software, uses the HQMF translator to convert the query to i2b2 format, and then sends the query to the data repository cell for processing, as if it came from the local web client.

Figure 6: A QueryHealth web interface displays results from two data partners. A user develops queries in the web client interface, and they are transparently distributed to data partners through PopMedNet. This entire process is hidden from the user.