Public Health and the Learning Health Care System

Lessons from Two Distributed Networks for Public Health

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Outline

• Introduction of Distributed Querying
• MDPHnet
• Mini-Sentinel
• Discussion
Query Health: Distributed Population Queries

“Send questions to the data!”
Distributed Querying Guiding Principles

• Data partners maintain control and analyze their data
• Standardize the data using a common data model
• Data partners’ ongoing involvement is needed to interpret findings
• Little or no exchange of person-level data is needed
• Secondary use can’t interfere with primary use
• Few data elements are needed to answer most questions
• Distribute code to partners for local execution
• Provide results, not data, to requestor
Network Architecture – Deployment Overview

- PMN Software – Supports multiple deployment models
  - Agnostic to data center infrastructure and complements existing network infrastructure
  - VM based deployments enabling ease of disaster recovery and planning
  - Seamless overlay of VPN Connections (Remote Access, Site to Site, Two Factor User Authentication)
  - Supports consolidation of remote sites into the data center for central management (Data Partner Components can be hosted in a central data center similar to the PMN Portal)
  - Secure End to End connection (Encrypted Transport using X.509 certificates)
  - Supports industry standard RBAC configuration for users
  - Supports Data Source provisioning based on RBAC and additional data source specific metadata
  - Data Partners execute queries using PULL model instead of PUSH model

Powered by PopMedNet

FISMA Compliant Data Center
- User and DataMart Provisioning and Administration
- DataMart Management (Metadata, Authorization)
- User Account Management (Groups/Roles/User Accounts)
- Request/Response Mgr
- User Interface
- Workflow
- Job Scheduling

PopMedNet Portal
- Network Security (IDS/IPS, VPN/RSA)
- Web Servers / Reverse Proxies/Load Balancers

Data Partner Organization
- Data Mart Client
- REST
- ETL
- Data Source (Common Data Model)
- Audit
- Optional Site to Site VPN

Internet
- HTTPS, TLS

VPN Client
- HTTPS, TLS

System Administrator (Two Factor AuthN)

Investigator

Observer

Enhanced Investigator

Data Administrators & Reviewers (Two Factor AuthN)

Data Partner Organization

DMZ

Non DMZ (Internal Components)

Powered by PopMedNet

Lincoln Peak
Distributed Networks*

- SPAN: Scalable PArtnering Network for CER (AHRQ)
- PEAL: Population-Based Effectiveness in Asthma and Lung Diseases Network (AHRQ)
- Mini-Sentinel (FDA)
- HMO Research Network (HMORN)
- MDPHNet (ONC)
- Health Care System Collaboratory (NIH)
- HMORN Cancer Research Network (NCI)
- Vaccine Safety Datalink (CDC)
- Post-licensure Rapid Immunization Safety Monitoring (FDA)
- Meningococcal Vaccine Safety Study (industry)
- MEPREP: Medication Exposure During Pregnancy (FDA)

*Selected list of networks we are involved in directly
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MDPHnet
MDPHnet

• ONC funded project to enable distributed querying for Massachusetts DPH

• Combines 2 software platforms
  – PopMedNet for connectivity, governance, security and querying (popmednet.org)
  – **ESP** for EHR data model and complex analytics (esphealth.org)

• MDPHnet launched in November 2012

• Functional and operating with 2 large multi-specialty group practices in MA
The MDPHnet Project is the marriage of two software systems created by Harvard Medical School’s Department of Population Medicine (DPM). The first system, Electronic Support for Public Health System (ESP), is a disease surveillance software application that can extract and analyze data from electronic health record system for events of public health importance. The second, PopMedNet, is a software application that enables controlled, secure, distributed analyses of health data owned by different organizations and stored in different locations. Marrying these two technologies will make it possible for hospitals and clinics to give the health department controlled access to their electronic health record data to study specific health indicators in their patient population. It will also make it possible for health departments to easily query the electronic health record systems of multiple providers at once to get a population level view of health indicators.
Electronic Support for Public Health (ESP)

• Software and architecture to extract, analyze, and transmit electronic health information from providers to public health.
  – Surveys codified electronic health record data for patients with conditions of public health interest
  – Generates secure electronic reports for the state health department
  – Designed to be compatible with any EHR system

Esphealth.org

JAMIA 2009;16:18-24
MMWR 2008;57:372-375
Am J Pub Health 2012;102:S325–S332
ESP: Automated disease detection and reporting for public health

Practice EMR’s ➔ ESP Server ➔ Health Department

- diagnoses
- lab results
- meds
- vital signs
- demographics

HL7 electronic case reports or aggregate summaries

*JAMIA* 2009;16:18-24
*Am J Pub Health* 2012;102:S325–S332
MDPHnet Implementation
MDPHnet Implementation Process

- Establish governance
- Assigns tasks and responsibilities
  - Network administrator, project director, etc
- Create and host secure portal
- Partners install ESP inside their firewalls
  - Transformation to the ESP data model
  - Run ESP case detection algorithms
- Partners install PopMedNet software and establish connection to network portal
- Partners assign roles for query response
- Maintain, manage, and enhance...repeat
MDPHnet Governance Rules Document developed and approved by all stakeholders

Governance document describes
- Overview of activities and participants
- Scope and use cases
- Organizational structure
- Guiding principles
- Implementation policies
- Network usage

All queries come from DPH

Sites maintain complete control of their data and its uses
Login

INSTRUCTIONS: Please complete the form below and read the Terms and Conditions before using the Query Tool.

Username:  investigator
Password:  ********

Forgot Password?

I agree to the Terms and Conditions of use.

Login

*Funded under contract No. 93.719 from the US Department of Health and Human Services’ Office of the National Coordinator for Health Information Technology (ONC) as part of the Health Information Exchange Challenge Program, awarded to the Massachusetts Technology Collaborative (MTC) on behalf of the Massachusetts eHealth Institute (MeHI) to create MDPHnet. PI: Michael Klompas, Jeffrey Brown.*
Software Version 3.0.1 Features and Enhancements

- MDPHnet functional enhancements:
  - Menu-driven query builder interface used to compose 2 request types: ICD-9 Diagnosis and Reportable Disease (Diabetes, ILI).

- PopMedNet 3.x technical enhancements:
  - New Request Model Plug-in architecture.
  - Upgraded technology platform that includes Microsoft .NET 4, Entity Framework 4, MVC 3, WCF, and MEF under Visual Studio 2010 solution.
  - Consolidation of all request and response data into documents that may be displayed using built-in viewer or downloaded to for use by custom applications.
  - Redesigned/rewritten DataMart Client application that uses a simplified threading model to process requests.
  - Use of the Windows Credential Manager to store local DataMart Client credentials.

*Under Construction* - This grid control is used to display recent event notifications that have been enabled for the user via the Notification Options control. Notifications may be filtered by Priority, Notification Type, and Sent Date. Notification Priority, Notification Type, and Sent columns will be sortable.

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<th>Name</th>
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<td>DataMartAdmin Draft</td>
<td>ICD-9 Diagnosis</td>
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</table>

Showing 20 requests per page
Mini-Sentinel
Mini-Sentinel

• Develop scientific operations for active medical product safety surveillance

• Create a coordinating center with continuous access to automated healthcare data systems, and the following capabilities:
  – Develop and evaluate scientific methods that might later be used in a fully-operational Sentinel System.
  – Offer FDA the opportunity to evaluate safety issues in existing automated healthcare data system(s) and learn more about barriers and challenges.
Initial Needs

• Policies
  – Privacy
  – Governance
• Data model
• Procedures at FDA, at Coordinating Center, at Partner sites
  – White papers
  – Standard operating procedures
• Infrastructure at FDA, at Coordinating Center, at Partner sites
  – Personnel
  – Hardware
  – Software
Populations with well-defined person-time for which most medically-attended events are known

- >130 million individuals*
  - 382 million person-years of observation time
- 3.7 billion dispensings
- 4.1 billion unique encounters
  - 46 million acute inpatient stays
- 24 million people with >1 laboratory test result

*As of January 2013. The potential for double-counting exists if individuals moved between data partner health plans.
Mini-Sentinel Distributed Querying

1- User creates and submits query (a computer program)
2- Data partners retrieve query
3- Data partners review and run query against their local data
4- Data partners review results
5- Data partners return results via secure network
6- Results are aggregated

Hundreds of queries completed
“This assessment [...used...] FDA’s Mini-Sentinel pilot...”
Key Contributors to Mini-Sentinel’s

- Close, frequent, interactions between FDA, data partners, content experts, epidemiologists, and statisticians
- Distributed data network → partners control their data
- Public health practice
- Focus on defined populations with sufficiently complete data
  - First: Claims and administrative data, plus access to full text records
  - Then: Electronic medical records, registries, ...
- Rapid cycle software development
- Ability to respond quickly to predefined needs
Welcome to Mini-Sentinel

Mini-Sentinel is a pilot project sponsored by the U.S. Food and Drug Administration (FDA) to study and facilitate development of a fully operational active surveillance system, the Sentinel System, for monitoring the safety of FDA-regulated medical products.

Mini-Sentinel is one piece of the Sentinel Initiative, a multi-faceted effort by the FDA to develop a national electronic system that will complement existing methods of safety surveillance.

Mini-Sentinel Collaborators include Data and Academic Partners that provide access to health care data and ongoing scientific, technical, methodological, and organizational expertise.
Mini-Sentinel Journal Supplement

• Supplement to Pharmacoepidemiology and Drug Safety
• 34 peer reviewed articles
• Goals, organization, privacy policy, data systems, systematic reviews, stats/epi methods, record retrieval and review, protocols for drug/vaccine studies...
• Open access!
Thank You
Contributors to Success

• Flexible and secure distributed querying options
  – Execution of custom analytic code
  – Menu-driven queries
• Role-based access control
• Data partner autonomy
• Query execution options from fully automated to manual
• Auditing
• Software-enabled governance
• Secure hosting
Engagement with National Initiatives

- Provides secure, customized, private portals, and file transfer capabilities that allow users to query data held by disparate partners
- Allows participating partners to maintain physical and operational control over their data
- Supports both menu-driven analyses and distribution of complex analytic programs
- Accommodates any network size, from single datasets held by two organizations to multi-year projects encompassing dozens of organizations and multiple projects
- Accommodates any data model
- PopMedNet allows users to send questions to the data

www.popmednet.org
• PMN is a key component of the ONC’s QueryHealth Initiative

• ONC national standard for distributed querying
  – QueryHealth Initiative uses PMN as the distributed querying platform for policy and governance

• Standards & Interoperability (S&I) Framework: http://wiki.siframework.org/Home
PMN Implements HHS ONC Query Health
QueryHealth – Query Lifecycle

Diagram showing the query lifecycle process with various components and processes involved.
# Query Health Pilots

<table>
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<tr>
<th>Pilot</th>
<th>Focus</th>
<th>RI Queries</th>
<th>RI Policy Layer</th>
<th>Data Sources</th>
<th>Kickoff</th>
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<td>PMN</td>
<td>RHIOs EHR Vendor</td>
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<td>Use of clinical data sources for FDA questions</td>
<td>PMN</td>
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<td>Quality Measures</td>
<td>hQuery</td>
<td>PMN</td>
<td>EHR Vendor</td>
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Query Health Pilot: MDPHnet

- Implement the Query Health Query Envelope standard
  - Standardize Privacy and Security
  - Query agnostic, content agnostic, facilitates privacy guidance from HIT Policy Committee

- Map ESP to the Query Health Clinical Element Data Dictionary
  - Query against the CEDD in addition to ESP

- Use Health Quality Measures Format (HQMF) to issue a query
  - Standardize Structure
  - Query format for distributed population queries to work across diverse platforms