Implementing an EHR-based Distributed Data Network for Public Health Surveillance of Notifiable Diseases and Chronic Conditions: A How-To Guide with Lessons Learned from Massachusetts

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Objective

Describe how we implemented a distributed data network of EHRs from multiple clinical sites in Massachusetts to conduct electronic notifiable disease reporting and aggregate-level chronic disease surveillance

• The system and its features
• Overview of implementation
• Current status in MA
• Key elements to success & lessons learned
ESP – EHR Support for Public Health

Software and architecture to extract, analyze, and transmit electronic health information from providers to public health

- Surveys codified EHR 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 – Requires ability to export data
- Open source software, PopMedNet (available via esphealth.org)

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

Practice EMR’s → ESP infrastructure
- diagnoses
- lab results
- meds
- vital signs
- demographics

updated nightly

Notifiable disease case reports

Aggregate-level custom queries

Health Department

JAMIA 2009;16:18-24
Am J Public Health 2012;102:S325–S332
Am J Public Health 2014;104:2265-2270
Capabilities and Features

Individual-level notifiable disease reporting
- Via encrypted HL7 messages to MAVEN, MDPH’s integrated surveillance and case management system
- HIV, chlamydia, gonorrhea, syphilis, acute HBV, acute HAV, HCV, TB
- New: Longitudinal case reporting for chronic infections (HIV, HCV, TB)

Aggregate-level reporting of chronic diseases and conditions of interest
- Via user interface with drop down menu (“query composer”) or SQL code
- Examples of outcomes and uses:
  - Diabetes, asthma, smoking, opioid Rx’s, obesity, hypertension (treated, controlled)
  - Influenza vaccine usage
  - ILInet reporting
  - IUD use after 2016 Presidential election
  - HIV and HCV testing
  - Lyme disease
  - Program evaluation
Decoupled architecture

ESP is decoupled from host electronic health record

<table>
<thead>
<tr>
<th>Implications</th>
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<tr>
<td>Universal</td>
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<tr>
<td>Unobtrusive</td>
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<td>Secure</td>
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- Allows system to be agnostic to the source EMR (local codes translated to common nomenclature)
- Offloads computing burden from clinical systems (and keeps ESP invisible to clinicians)
- Can remain within host practice’s firewall
ESPnet is a distributed data network

**How aggregate queries work**

- Enables timely access to aggregate-level data of public health importance not notifiable on the individual-level
- Confidential personal health data remain with original data holders
- Allows those most knowledgeable about participating systems to ensure data are used and interpreted properly
Model for participation varies by clinical site
5 sites in MA: 4 participate in notifiable disease reporting, 3 permit aggregate queries
Some enable vendor to access their ESP server for data quality and maintenance
Implementation steps

Step 1: Organizational buy-in
Step 2: Designate a physical or virtual server for ESP
Step 3: ESP installation & configuration
Step 4: Create data extract, back load data, implement daily extract & load
Step 5: Data extract validation
Step 6: Map local EHR lab codes to ESP abstract labs
Step 7: Implement case detection algorithms & lab mapping
Step 8: Data validation – notifiable diseases & accompanying data
Step 9: Implementation of notifiable disease reporting to DPH
Step 10: Ongoing support & maintenance
Current status of ESPnet in Massachusetts

- **Cambridge Health Alliance**
  - 20 sites • 230,000 patients

- **Atrius Health**
  - 27 Sites • 770,000 pts

- **Mass League of Community Health Centers**
  - 18 sites • 500,000 patients

66 sites • ~1.5 million patients
Percentage of Adults in Massachusetts Census Population Included in ESPnet, by Community
ESPnet vs BRFSS Estimates, Massachusetts 2014

The diagram compares the prevalence of various health conditions in adults age ≥20 between ESPnet and BRFSS estimates in Massachusetts for the year 2014. The conditions include Diabetes, Asthma, Smoking, Hypertension, and Obesity.

- **Diabetes**: ESPnet and BRFSS estimates are approximately 10% each.
- **Asthma**: ESPnet and BRFSS estimates are approximately 12% and 15% respectively.
- **Smoking**: ESPnet and BRFSS estimates are approximately 15% and 20% respectively.
- **Hypertension**: ESPnet estimates are approximately 30%, while BRFSS estimates are significantly higher at around 35%.
- **Obesity**: ESPnet and BRFSS estimates are approximately 22% and 25% respectively.

The comparison shows notable differences in the estimates for Hypertension and Obesity, with BRFSS providing higher estimates than ESPnet.
Lessons Learned / Reality Check

- Establishing and nurturing collaborative relationships between all participating entities has been the cornerstone of this work.

- DPH has invested in the system from the start.
  - Bureau of Infectious Disease and Laboratory Sciences committed to ESP as a data source beyond the initial case reporting.

- Champions within clinical sites make it easier in terms of initial buy-in and ongoing maintenance.

- Different approaches to set up yield more or less efficiency.
  - e.g. whether informatics vendor has VPN access.
Challenges

- Coverage is concentrated towards the eastern part of the state
- Validation of data, data completeness, and algorithm performance
- Importance of maintenance – e.g. ensure lab tests/results are mapped
- Sustainability / funding: staffing costs, hardware and software
- Have not quantified the benefit for the sites
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Participating sites

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- Fenway Health
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