Enhancing the Timeliness and Granularity of Public Health Surveillance using Electronic Health Record Data

National Academy of Medicine
Digital Learning Collaborative
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“No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring”

Introductory statement printed each week in Public Health Reports, 1913-1951
ESP: Automated disease detection and reporting for public health

Practice EMR’s → ESP Server → Health Department

diagnoses
lab results
meds
vital signs
demographics

electronic case reports or aggregate summaries

JAMIA 2009;16:18-24
Am J Pub Health 2012;102:S325–S332
Current ESP Installations

- Cambridge Health Alliance
  - 20 sites • 400,000 patients
- Mass League of Community Health Centers
  - 18 sites • 300,000 patients
- Atrius Health
  - 27 Sites • 800,000 pts
- Planned Parenthood
  - 4 Sites • 50,000 pts
- Fenway Health
  - 4 Sites • 50,000 pts
- Tarrant County, TX
  - 4 Sites • 50,000 pts

© Google Maps
MDPHnet

Mass League of Community Health Centers
18 sites • 300,000 patients

Cambridge Health Alliance
20 sites • 400,000 patients

Atrius Health
27 Sites • 800,000 pts

© Google Maps
Current Modules

• Notifiable diseases

• Influenza-like illness

• Chronic diseases

• Vaccine adverse events
ICDs
Obesity
Tuberculosis
Depression
ESP
Hypertension
Opioid Prescribing
Diabetes Mellitus

- Hemoglobin A1C ≥ 6.5
- Fasting glucose ≥126
- Random glucose ≥200 on two or more occasions
- Prescription for INSULIN outside of pregnancy
- ICD9 code 250.x (DM) on two or more occasions
- Prescription for any of the following:
  - GLYBURIDE, GLICLAZIDE, GLIPIZIDE, GLIMEPIRIDE
  - PIOGLITAZONE, ROSIGLITAZONE
  - REPAGLINIDE, NATEGLINIDE, MEGLITINIDE
  - SITAGLIPTIN
  - EXENATIDE, PRAMLIINTIDE
Sensitivity of definition components

- ICD9 250.x (two instances): 78%
- Hemoglobin A1C: 65%
- Fasting glucose: 3.8%
- Insulin: 24%
- Oral hypoglycemic (not metformin or TZDs): 32%

*Diabetes Care* 2013;36:914-21
Step 1. Health department creates a query.

Step 2. MDPHnet distributes queries to practices

Step 3. Practices review queries & authorize execution against their local ESPnet tables

Step 4. MDPHnet integrates results and returns them to the health department

Am J Public Health 2014;104:2265-70
### Surveillance for Certain Health Behaviors, Chronic Diseases, and Conditions, Access to Health Care, and Use of Preventive Health Services Among States and Selected Local Areas — Behavioral Risk Factor Surveillance System, United States, 2012

**TABLE 47. Estimated prevalence of adults aged ≥18 years who are obese,* by metropolitan and micropolitan statistical area — Behavioral Risk Factor Surveillance System, United States, 2012**

<table>
<thead>
<tr>
<th>MMSA(s)</th>
<th>Sample size</th>
<th>%</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aguadilla-Isabela, Puerto Rico</td>
<td>519</td>
<td>23.8</td>
<td>2.2</td>
<td>(19.6–28.0)</td>
</tr>
<tr>
<td>Akron, Ohio</td>
<td>698</td>
<td>29.7</td>
<td>2.4</td>
<td>(25.0–34.4)</td>
</tr>
<tr>
<td>Albuquerque, New Mexico</td>
<td>3,137</td>
<td>25.1</td>
<td>1.0</td>
<td>(23.2–27.0)</td>
</tr>
<tr>
<td>Allentown-Bethlehem-Easton, Pennsylvania-New Jersey</td>
<td>1,270</td>
<td>28.8</td>
<td>1.9</td>
<td>(25.1–32.6)</td>
</tr>
<tr>
<td>Anaheim-Santa Ana-Irvine, California†</td>
<td>971</td>
<td>21.5</td>
<td>2.0</td>
<td>(17.7–25.4)</td>
</tr>
<tr>
<td>Anchorage, Alaska</td>
<td>1,426</td>
<td>25.3</td>
<td>1.4</td>
<td>(22.5–28.0)</td>
</tr>
<tr>
<td>Asheville, North Carolina</td>
<td>557</td>
<td>19.4</td>
<td>2.0</td>
<td>(15.5–23.3)</td>
</tr>
<tr>
<td>Atlanta-Sandy Springs-Roswell, Georgia</td>
<td>2,399</td>
<td>26.5</td>
<td>1.2</td>
<td>(24.1–28.9)</td>
</tr>
</tbody>
</table>
Type 2 Diabetes in Adults

Outcome(s) of Interest
Type 2 Diabetes

Inclusion Criteria
Age Group: ≥20 / Lifetime Encounters: ≥1 / Recent Encounters: ≥1 in the past 2 years

Graph Stratifiers and Parameters
By: Sex / In: Massachusetts / From: Jan '14 To: Sep '16

-- View Trendline Summary --
### Type 2 Diabetes in Adults

-- View Trendline Summary --

#### GLS Regression Results

<table>
<thead>
<tr>
<th>Dep. Variable:</th>
<th>Reference</th>
<th>R-squared:</th>
<th>0.996</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model:</td>
<td>GLS</td>
<td>Adj. R-squared:</td>
<td>0.996</td>
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<tr>
<td>Method:</td>
<td>Least Squares</td>
<td>F-statistic:</td>
<td>8369.</td>
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<tr>
<td>Date:</td>
<td>Mon, 03 Apr 2017</td>
<td>Prob (F-statistic):</td>
<td>2.77e-39</td>
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<tr>
<td>Time:</td>
<td>01:23:11</td>
<td>Log-Likelihood:</td>
<td>70.004</td>
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<tr>
<td>No. Observations:</td>
<td>33</td>
<td>AIC:</td>
<td>-136.0</td>
</tr>
<tr>
<td>Df Residuals:</td>
<td>31</td>
<td>BIC:</td>
<td>-133.0</td>
</tr>
<tr>
<td>Df Model:</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Covariance Type:</td>
<td>nonrobust</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|           | coef    | std err | t     | P>|t| | [95.0% Conf. Int.] |
|-----------|---------|---------|-------|------|-------------------|
| Intercept | 7.9137  | 0.015   | 520.456 | 0.000 | 7.883-7.945       |
| time      | 0.0176  | 0.001   | 21.708 | 0.000 | 0.016-0.019       |

Omnibus: 10.985  Durbin-Watson: 1.656
Prob(Omnibus): 0.004  Jarque-Bera (JB): 14.516
Skew: -0.776  Prob(JB): 0.000795
Kurtosis: 5.854  Cond. No. 35.9
MDPHnet Estimates vs BRFSS Estimates
Massachusetts 2014

Condition Prevalence in Adults Age ≥20

- Diabetes
- Asthma
- Smoking
- Hypertension
- Obesity

MDPHnet vs BRFSS Estimates
Summary

• Live EHR systems can support rich, timely, and detailed public health surveillance
• There are now many working models of ways to facilitate clinical practices participating in public health surveillance while retaining ownership and control of their data
• EHR data allows for more sensitive and specific disease detection compared to claims
• Interactive visualization software can help unlock the power of surveillance data to help us understand disease rates, characteristics, and trends
Thank You!

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