Syndromic Surveillance: Early Detection of Community Outbreaks

Dr. Charles Gardner, Medical Officer of Health,
Stephanie Wolfe, Epidemiologist
SMH, Sept 22, 2010
What is Syndromic Surveillance?

- Surveillance (systematic, ongoing collection, analysis, and interpretation) of health-related data that precede diagnosis

- Action-oriented: signal sufficient probability of a case or an outbreak to warrant further public health response

- Fully automated: Captures existing health data automatically in real time - does not change work flow.
  e.g. ED visits and all admissions to hospital.
  Over the counter pharmaceutical sales.
  School or work absenteeism

- Innovative electronic surveillance system.
Potential Strategies for Early Detection

Number of People

Onset of Symptoms
Specific Syndrome
Deaths

Demographics, Chief Complaint, Visit Data

Lab results, X-Rays, etc.

Biosensors

Intel

Courtesy: Michael Wagner, MD, University of Pittsburgh
Goals / Characteristics of Syndromic Surveillance

- To improve response times – data available 24 / 7 / 365 in real-time.
- To improve epidemiological analysis and outbreak detection.
- To enhance communication, collaboration.
- An infectious disease focus: e.g. GI and Respiratory.
- To integrate into existing surveillance systems for a more comprehensive picture of community disease activity.
Syndromic Surveillance Systems at SMDHU

- In addition to routine surveillance on reportable disease incidence, we currently collect or receive the following syndromic data:
  - facility and community outbreaks
    - Respiratory and gastro-intestinal outbreaks
  - school absenteeism
    - 2009-10 was pilot year. Evaluation report near completion
  - Telehealth syndromic clusters in our region
  - influenza-like illness visit rates.
    - one or two sentinel sites for SMDHU

- Provincial evaluation currently ongoing to determine value-added of syndromic surveillance during pandemic
Components of Syndromic Surveillance Systems

- IT linking data sources.
- Natural language processing-text mining.
- Syndromes of interest.
- Anomaly detection.
- Temporal spatial analysis-mapping.
- Communication of findings – enabling response.
Retrospective Analysis - EARS graph of revised GI syndrome (diarrhea +/- other Sx) for patients visiting KGH and HDH ED - Nov/05

Initial cluster of patients presents to ED with diarrhea +/- other symptoms – cultures taken

Provincial News Release on Salmonella Outbreak Issued Nov 24th

Data Source: Emergency Department Syndromic Surveillance (EDSS): A public health unit perspective. Presentation at: www.quesst.ca
Emergency Department Surveillance at SMDHU

- Emergency Department Syndromic Surveillance (EDSS)
  - Designed by Queens University Emergency Syndromic System Team (QUESST).
  - Ministry funded and expanding.
  - 5 years experience, 11 health units.
  - 28 hospitals in Ontario, data share agreements.
    - proposed to SMDHU hospitals in 2009.
    - Starting in February 2010, 4 / 6 SMDHU hospitals (OSMH, MAH, GBGH, RVH) have signed on.

- EDSS was a component of G8 Summit surveillance in June 2010 to detect clusters / outbreaks of infectious diseases
What information are we collecting?

- **Real-time** - ED visits and admissions to 4 regional hospitals:
  - date and time of visit or admission,
  - hospital,
  - age/sex,
  - postal code (5 digits),
  - chief complaint,
  - triage score,
  - febrile respiratory illness (**FRI**) screening results.

- Syndromes: gastroenteritis, respiratory, fever/ILI, asthma, derm-infectious, neuro-infectious, severe infection, other.
Privacy and Security

- The EDSS project directors consulted with legal council to develop principles, policies and procedures to meet PHIPA.
- A privacy impact assessment was conducted.
- The project was also approved by Queens University Research Ethics Board.
- The data-sharing agreement provides details.
Data Analysis

- Anomaly detection runs 4x daily.
  - Recursive least squares (RLS) and cumulative sum algorithms.

- Historical data was provided for comparison.

- Data can be analysed by:
  - age group,
  - gender,
  - 5-digit postal code,
  - hospital,
  - time frame, and/or,
  - syndrome.

- GIS mapping using geographic indicators.
Alerts, Investigation and Dissemination

- Alerts are automatically sent to email inbox.

- SMDHU monitors the EDSS 5 days per week.

- Alert investigation protocol at SMDHU includes:
  - comparing alerts with other infectious disease indicators,
  - notifying staff of anomalies, admissions of interest,
  - communicating significant alerts to hospitals.

- This fall, routine reports will be sent to hospitals and potentially other stakeholders.
  - Data will be aggregated so individual hospitals can not be identified.
  - Hospital-specific data may be provided to each hospital individually.
ED Registrations - SlMDHU (Participating Hospitals)

Fever/ILI

Counts vs Day


- Green Line: All Genders + Age <= 17 + All Hospitals
- Blue Line: All Genders + All Ages
# Example of Admission Data (Case-Level)

<table>
<thead>
<tr>
<th>Date Admitted</th>
<th>Age</th>
<th>Gender</th>
<th>Home Postal Code</th>
<th>Hospital</th>
<th>Syndrome</th>
<th>Chief Complaint</th>
<th>Triage/ Acuity</th>
<th>FRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-03-30 16:37</td>
<td>89</td>
<td>F</td>
<td>L3V3V</td>
<td>MAH</td>
<td>Other</td>
<td>Lower Extremity Pain</td>
<td>4</td>
<td>+</td>
</tr>
<tr>
<td>2010-03-30 16:31</td>
<td>65</td>
<td>M</td>
<td>L3V4H</td>
<td>OSMH</td>
<td>Other</td>
<td>Abdominal Pain</td>
<td>3</td>
<td>+</td>
</tr>
<tr>
<td>2010-03-30 16:25</td>
<td>60</td>
<td>M</td>
<td>P1H1J</td>
<td>OSMH</td>
<td>Other</td>
<td>LOW LT SIDE PAIN</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2010-03-30 16:10</td>
<td>4</td>
<td>F</td>
<td>L0K1T</td>
<td>OSMH</td>
<td>Fever/ILI</td>
<td>Fever</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>2010-03-30 16:06</td>
<td>15</td>
<td>M</td>
<td>P1L1W</td>
<td>MAH</td>
<td>Other</td>
<td>RT FOOT INJ</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2010-03-30 15:59</td>
<td>42</td>
<td>F</td>
<td>L4R2N</td>
<td>GBGH</td>
<td>Other</td>
<td>UNRESPONSIVE</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2010-03-30 15:54</td>
<td>54</td>
<td>F</td>
<td>P1L1B</td>
<td>OSMH</td>
<td>Other</td>
<td>Direct Referral For Consultation</td>
<td>3</td>
<td>+</td>
</tr>
<tr>
<td>2010-03-30 15:54</td>
<td>51</td>
<td>F</td>
<td>P1H1W</td>
<td>GBGH</td>
<td>Other</td>
<td>ABD PAIN</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2010-03-30 15:51</td>
<td>20</td>
<td>M</td>
<td>L0K2A</td>
<td>MAH</td>
<td>Other</td>
<td>HALLUCINATION</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2010-03-30 15:43</td>
<td>82</td>
<td>M</td>
<td>L4R5H</td>
<td>GBGH</td>
<td>Other</td>
<td>HEARING LOSS</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2010-03-30 15:37</td>
<td>69</td>
<td>M</td>
<td>L0K1S</td>
<td>OSMH</td>
<td>Other</td>
<td>UPPER EXT INJ</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2010-03-30 15:31</td>
<td>78</td>
<td>F</td>
<td>L0K1S</td>
<td>GBGH</td>
<td>Asthma</td>
<td>Shortness Of Breath</td>
<td>3</td>
<td>+</td>
</tr>
</tbody>
</table>
Map of Respiratory Syndrome Clusters,
Simcoe Muskoka District Health Unit, November 1, 2009.
Example of Bi-Weekly Report Sent to Hospitals, Kingston.

Syndromic Surveillance Report
Wednesday July 19, 2006 - Tuesday Aug 1, 2006
Participating Hospitals = KGH, HDH, LACGH

Emergency Department (ED) Activity by Syndrome (last 2 months)

Summary:
Total ED Visits and Some Visits from the previous week at KGH, HDH, LACGH.

Gastrointestinal ED Visits to KFL&A Hospitals by Age Group
June 22, 2006 - August 1, 2006

Admissions of Interest:
Reason for Admission

Respiratory ED Visits to KFL&A Hospitals by Age Group
June 22, 2006 - August 1, 2006

Relevant Alerts for this Time Frame:
None
# Cost-Benefit Analysis

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost to Hospital</th>
<th>Benefit to Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview of system and signing data sharing agreement</td>
<td>Staff time – approx. 2 hours</td>
<td></td>
</tr>
<tr>
<td>Information Technology set up</td>
<td>Staff time – less than 10 hours</td>
<td></td>
</tr>
<tr>
<td>Data are fed into system in real time</td>
<td>No cost to hospital</td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td>No cost to hospital</td>
<td></td>
</tr>
<tr>
<td>Dissemination of regular reports</td>
<td>No cost to hospital</td>
<td>Hospital receives regular, timely reports on community disease activity</td>
</tr>
</tbody>
</table>
Testimonials from SMDHU Hospitals

- The information technology set up of QUESST system was easy. It took less than 10 hours. The Kingston Team was very knowledgeable – Doug Bebb, Applications Specialist at Georgian Bay General Hospital.

- “very straightforward and took very little time (fewer than 5 hours)” - Dan Moloney, Information Technology Department, Muskoka Algonquin Healthcare.*

* Note that MAH does not use Medi-Tech so a contractor was hired to automate reports.
From June 17-30, 2010 SMDHU produced daily reports on 25+ indicators of infectious disease, environmental health, community health and communications.

EDSS provided the only active, real time infectious disease indicator.

No outbreaks or unusual infectious disease activity detected during surveillance period
- Saw increase in injury-related ER visits in Midland after tornado.

Evaluation of G8 surveillance and SMDHU response pending.

SMDHU Epidemiologist continues to work with QUESST project team to interpret data.
# Infectious Disease Indicators

<table>
<thead>
<tr>
<th>Area</th>
<th>Data Source</th>
<th>Indicator (defined in Definition Table below)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infectious Diseases</strong></td>
<td>QUESST baseline = average from same day of week in three previous weeks from May 30-June 15, 2010. Range = plus and minus 2 standard deviations based on this average.</td>
<td>Total Hospital Admissions¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total ER Visits¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gastroenteritis ER Visits¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Respiratory ER Visits¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fever/ILI ER Visits¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asthma ER Visits¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dermatological Infectious ER Visits¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Neurological Infectious ER Visits¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe Infectious ER Visits¥</td>
</tr>
<tr>
<td></td>
<td>CD Outbreak Log baseline=3 year mean for equivalent date</td>
<td>Active respiratory outbreaks¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active gastrointestinal outbreaks¥</td>
</tr>
<tr>
<td></td>
<td>CD Intake or email (Tb)</td>
<td>Reportable diseases (unusual or cluster)</td>
</tr>
<tr>
<td></td>
<td>MOHLTC Delayed by one day</td>
<td>Total ER Visits ¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gastroenteritis ER Visits ¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Respiratory ER Visits ¥</td>
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<tr>
<td></td>
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<td>Fever/ILI ER Visits ¥</td>
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<td>Asthma ER Visits ¥</td>
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<td>Dermatological Infectious ER Visits ¥</td>
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<tr>
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<td></td>
<td>Neurological Infectious ER Visits ¥</td>
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<tr>
<td></td>
<td></td>
<td>Severe Infectious ER Visits ¥</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Health care provider phone calls (unusual)</td>
</tr>
<tr>
<td></td>
<td></td>
<td># diseases reported by EMAT (federal mobile medical unit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td># diseases reported by TAF (Temporary Accommodation Facility – RCMP/OPP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other unusual activity (e.g. tick submission)</td>
</tr>
</tbody>
</table>
G8 EDSS Surveillance: hourly monitoring by syndrome

Total Number of ER Visits to Hospital, June 25 and June 26

- Total ER Visits
- Baseline
- Upper Threshold (+2 SD)
Thank you for your time.

Questions?

Contact Information:
charles.gardner@smdhu.org