Outbreak Management
Health IT in the United States

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Outbreak management health IT needs have been known for many years*

Health IT’s value in outbreak management is not notional, it has been demonstrated to be critical for some circumstances.

Adopted EHRs are a new addition to the national picture, but they are only partially relevant – much must occur outside of EHRs.

Health reform and "market motivators" may advance some interoperability, but even a reformed market does not address information exchange for outbreak management needs (why public Meaningful Use dollars are so important here).

Although the public expects a safety net IT infrastructure to be in place for public health emergencies, it largely is not

Some reasons include:

• Variable understanding of public health needs
• The business / market driven healthcare enterprise
• Variability in the layout of healthcare organizations and health IT systems nationally
• Variability in state laws, state and local public health departments, and infrastructure implementation nationally
• Variability in emergency events and nature!
Some Other Elements of Variability

**How contagious is Ebola?**
How the Ebola virus compares with other contagious viruses. The reproduction rate or $R_0$, calculates the number of people likely to be infected by one person who has a disease.

<table>
<thead>
<tr>
<th>REPRODUCTION RATE ($R_0$)</th>
<th>Initial infected patient</th>
<th>Person he or she has infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_0$</td>
<td>1 to 4 people</td>
<td>2 to 4</td>
</tr>
<tr>
<td>DISEASE</td>
<td>Ebola</td>
<td>SARS</td>
</tr>
<tr>
<td>HOW IT SPREADS</td>
<td>Bodily fluids</td>
<td>Airborne droplets</td>
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<td></td>
<td>Airborne droplets</td>
<td>Fecal-oral route</td>
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<td>Airborne droplets</td>
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</table>

Sources: Michigan Center for Public Health; WHO; Transmission Dynamics and Control of Severe Acute Respiratory Syndrome, Nature; Understanding the Dynamics of Ebola Epidemics, National Institute of Health

**Method of Spread**
- Bodily fluids, airborne, airborne droplets, environmental spores

**Pathogen**
- Ebola, MERS, SARS, Anthrax, Mumps, Pertussis…

**Duration of Contagiousness**
- Length of pre-symptomatic, symptomatic, and post-symptomatic risk

**Host Resistance**
- Natural and induced

**Infectiousness** - Average number of secondary cases from a primary one

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**Critical Outbreak Health IT Needs**
- Paper and phones may suffice
- Wash hands and close meeting places - aggregate data
Outbreak Management HIT

1. **Index case** identification

   - Limited awareness

   - Conceptually one place “syndromic surveillance” might help, but few outbreaks identified this way

   - Providers are still the best “detectors,” but they need information support and are not primarily “reporters”
Outbreak Management HIT

2. **Screening** for additional cases

   – Heightened awareness after index case brings different provider information support needs

   – Getting **possible cases** to people who are focused on looking for and managing outbreaks is a critical need – they have particular population focus and tools
Outbreak Management HIT

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   - Heightened awareness after index case brings provider information support needs
   - Getting possible cases to people focused on looking for and managing outbreaks is a critical need they have particular population focus and tools
3. Reporting for monitoring and case management

- Focus moves outside of EHR

- Automating the movement of cases to public health systems has demonstrated significantly greater yield of cases

- Also need link-back for clinical investigation of the outbreak population and for information sharing with providers
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First and foremost providers are not public health reporters

West Nile Virus NYC - 1999

![Bar chart showing number of cases reported and unreported over dates.](image-url)

Epi investigation started

- Date of Admission

- Number of cases

- Unreported cases

- Reported cases

NYC DOHMH – Marci Layton
4. Case management

- Public health receives **possible and confirmed cases** and works these populations

- Cases confirmed with **lab results** and / or investigation

- **Contact tracing** to manage, link, and work what can be a rapidly increasing number of possible cases
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4. **Case management**

- From a World Health Organization report diagram detailing SARS transmission in Singapore

- No diagnostic lab test, no vaccine, no medication

- Health IT case management is a critical
5. **Case reporting** and visualization
   - Managing **case counts** is a significant coordination issue

6. **Countermeasure** delivery and tracking
   - Medication and vaccine (inside and outside of healthcare)
   - **Quarantine** management (phone video monitoring, elsewhere - smart bracelets)

7. Research and **long term follow-up**
   - Tail of outbreak life cycle

From SARS transmission in Singapore
World Health Organization Regional Office for the Western Pacific 2005
Before widespread EHR adoption:

- Even “electronic” case reporting is manual
  - Reporting yield can be very low at times
  - in extreme example CDC reports that one out of ten cases of Lyme disease, recorded in clinical care, are reported to health department despite state laws
  - Providers frequently do not know when, how, or where to report

- **Electronic Laboratory Reporting (ELR)** is at times a case reporting surrogate
  - Automated delivery from lab systems leads to high yield
  - Data are limited to what is available in the lab order and the test result

- **Syndromic Surveillance** takes advantage of available electronic data
  - Automated, immediate data from clinical care organizations
  - Started with Admission Discharge and Transfer (ADT) “chief complaints”
  - Not suitable for case management
**Outbreak Functions:**

1. Support for index case detection
2. Screening for additional possible cases
3. Isolation

**Exchange Functions:**

4. Case-based data
5. Aggregate data
6. Guidance information
7. Investigation

**Outbreak Functions:**

8. Case management
   - Confirmation of possible cases
   - Lab result integration (public health and clinical)
   - Contact tracing
9. Case reporting and visualization
10. Situational awareness
11. Countermeasure delivery and tracking
   - Meds, vaccines, and more in commercial supply chain, health departments, and stockpile
   - Quarantine management
12. Research and long term follow-up
Surveillance / Outbreak Management Systems

- Commercial, self-developed, and CDC developed systems
- Implemented at state and local health departments and some mobile applications
- Surveillance, case management, contact tracing, investigation support, reporting to local and state health departments as well as CDC
Public Health Lab Information Management Systems

- Support testing that only public health labs do and when only public health labs will do it
- Rigorous preparedness protocol adherence
- Support surge capacity
- Must integrate with state health department, multiple federal agencies and clinical care
Countermeasure Tracking and Delivery Systems

- Track and manage countermeasures in state and local health departments, the national stockpile, and the commercial supply chain
- Push for use of new vaccines can have additional “take” and adverse events surveillance needs
- Important connections with immunization information systems, variety of systems / organizations that deliver vaccines
Research and Long Term Follow-Up Registries

- An important part of a learning health system
- With emerging infectious diseases, changing environmental pressures, antibiotic resistance and more, understanding how to deal with threats and best apply health IT for populations
- Insure that the safety net is in place that the public expects from their support
Conclusions

- Outbreak cases and their contacts can expand geometrically.
- When there is no vaccine or treatment, contact tracing and controlling new exposures is the countermeasure of choice.
- When case counts rise, dedicated surveillance / outbreak management systems are the only way to effectively manage cases and support contact tracing.
- Public health systems need to get electronic cases from EHRs and need to be funded to support their parts of these transactions.