Understanding the Impact of Pandemic Influenza on the Clinical Laboratory

Nebraska Public Health Laboratory

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EMERGENCY DEPT.
IS CLOSED UNTIL
FURTHER NOTICE
SORRY
NO
VISITORS
UNTIL FURTHER NOTICE
EXCEPTIONS
VISITORS FOR CRITICAL PATIENTS OR CRITICALLY ILL PALLIATIVE PATIENTS
What was this situation?

- Ontario: 375 probable and suspect cases, 44 deaths
- Worldwide: ≈8100 probable cases, 774 deaths
- $1 billion in economic losses for Toronto
- $60 billion (US) in overall loss in demand and in business revenue in East and SE Asia
- (313 cases, 191 deaths as of June 15, 2007 since 2003)
Outline

• Seasonal, avian, and pandemic influenza
• Impact on laboratory operations during a pandemic
• Components of a pandemic plan for the laboratory
Influenza: The Virus

- 3 Influenza virus Types
  - **Type A** influenza viruses infect humans & birds & other mammals.
  - **Type B** influenza viruses only infect humans.
  - Type C influenza virus, mild, no epidemic

- Influenza A Subtypes:
  - Birds - H_1 to H_{16}, N_1 to N_9
  - Human - H_1N_1, H_3N_2, H_1N_2, H_2N_2
  - Bird→Human - H_5N_1, H_9N_2, H_7N_7, H_7N_2, H_7N_3
Seasonal Influenza

• AKA (“common” influenza)
• A **respiratory** illness that can be transmitted person to person.
• Most people have some immunity
• Kills up to 36,000 annually
• Vaccine available
Seasonal Influenza: To Date

Weekly Influenza Activity Estimates Reported by State & Territorial Epidemiologists
Week ending May 19, 2007 - Week 20

http://www.cdc.gov/flu/weekly/fluactivity.htm
Seasonal Influenza: To Date-April

Weekly Influenza Activity Estimates Reported
by State & Territorial Epidemiologists
Week ending April 21, 2007 - Week 16

http://www.cdc.gov/flu/weekly/fluactivity.htm
Seasonal Influenza: To Date-March

Weekly Influenza Activity Estimates Reported by State & Territorial Epidemiologists
Week ending March 24, 2007 - Week 12

http://www.cdc.gov/flu/weekly/fluactivity.htm
What Is Avian Influenza?

• Avian influenza is a common natural infection of wild waterfowl caused by type A influenza viruses
  - There is no human immunity & no vaccine
  - Can be transmitted from birds to humans
• Two pathogenic forms occur: HPAI and LPAI
  - LPAI: common and mild
  - HPAI: rare and highly lethal
• To date, all outbreaks of HPAI caused by H5 and H7 subtypes
• H5N1 currently of greatest concern in humans; however other subtypes of concern
  - H7N2, H7N3, H7N7, H9N2, H2N2
Nations With Confirmed Cases
H5N1 Avian Influenza – June 15, 2007

http://www.pandemicflu.gov/images/pop_image.gif
### Influenza A/H5N1 - Count of Human Cases

**June 15, 2007**

<table>
<thead>
<tr>
<th>Country</th>
<th>2003 cases</th>
<th>2003 deaths</th>
<th>2004 cases</th>
<th>2004 deaths</th>
<th>2005 cases</th>
<th>2005 deaths</th>
<th>2006 cases</th>
<th>2006 deaths</th>
<th>2007 cases</th>
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<th>Total cases</th>
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<tr>
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<td>5</td>
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<td>8</td>
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<td>2</td>
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<td>10</td>
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<td>17</td>
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<td>5</td>
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<td>3</td>
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<td><strong>Total</strong></td>
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<td>4</td>
<td>46</td>
<td>32</td>
<td>97</td>
<td>42</td>
<td>116</td>
<td>80</td>
<td>50</td>
<td>33</td>
<td>313</td>
<td>191</td>
</tr>
</tbody>
</table>

Total number of cases includes number of deaths.

What is Pandemic Influenza?

- Results from a novel subtype of Influenza A virus to which the overall population possess no immunity
- Extremely rapid global spread
- Occurrence in multiple or widespread geographic areas worldwide; locally explosive epidemics
- Associated with unusually high rates of morbidity and mortality
- Multiple waves of disease
- Influenza pandemic is **inevitable**, not **imminent**
- Currently, **there is no pandemic influenza**.
### Impact of an Influenza Pandemic

Based on extrapolation of past pandemics (NE) 2006

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Moderate 1957/1968-like</th>
<th>Severe 1918-like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>1,711,263</td>
<td>1,711,263</td>
</tr>
<tr>
<td>Illness (30% rate)</td>
<td>513,379</td>
<td>513,379</td>
</tr>
<tr>
<td>Outpatient care</td>
<td>256,689 (50%)</td>
<td>256,689 (50%)</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>4,928 (0.96%)</td>
<td>56,472 (11%)</td>
</tr>
<tr>
<td>ICU Care</td>
<td>719 (0.14%)</td>
<td>8,471 (1.65%)</td>
</tr>
<tr>
<td>Mech. Ventilation</td>
<td>359 (0.07%)</td>
<td>4,261 (0.83%)</td>
</tr>
<tr>
<td>Deaths</td>
<td>1,181 (0.23%)</td>
<td>10,832 (2.11%)</td>
</tr>
</tbody>
</table>

**FluAid Model:** [http://pandemicflu.gov/plan/tools.html](http://pandemicflu.gov/plan/tools.html)

Taken from NHHSS Pandemic Influenza Guidelines – Version 2-21-06
QUESTION:

DOES AVIAN INFLUENZA ALWAYS RESULT IN PANDEMIC INFLUENZA?

NO!!!
Three Requirements for
A Human Influenza Pandemic

1. Emergence of a novel subtype of influenza
   An immunologically naïve population
2. Replication in humans $\rightarrow$ disease
3. Efficient human-to-human transmission
## Pandemic Influenza: WHO Phases

<table>
<thead>
<tr>
<th>Inter-pandemic phase</th>
<th>Low risk of human cases</th>
<th>Higher risk of human cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>New virus in animals, no human cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pandemic alert</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>New virus causes human cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pandemic</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

- No or very limited human-to-human transmission
- Evidence of increased human-to-human transmission
- Evidence of significant human-to-human transmission
- Efficient and sustained human-to-human transmission

Pandemic Influenza: Impact on the Laboratory

Assumptions...
Role of the Laboratory in Pandemic Influenza

- Provide diagnostic testing for patient management
  - Influenza-related
  - Other diagnostic services
- Support surveillance activities for seasonal influenza & novel influenza subtypes
  - Selected patient samples and viral isolates for testing at NPHL
- Provide information for clients & staff
- Support community
Testing: Pandemic Expectations

• Influenza testing
  • Virus culturing not recommended
  • Utility of rapid tests…
• Other (non-influenza testing)
  • Increased testing likely for secondary infections, antimicrobial susceptibility & other patient support
Impact …

- National pandemic response will begin with sustained human to human transmission anywhere.
- Laboratory demands may begin when 1st lab confirmed novel virus detected in U.S. or increased concern by public (worried well).
- Personnel (including laboratory staff) may be mobilized during an emergency to fill positions & perform duties outside their normal roles & work hours.
Addressing the Impact on the Laboratory

- Federal, State, Community and Institutional preparedness plans
  - The NHHSS Plan States:
    - “The Nebraska Pandemic Influenza Prevention and Control Guidelines address the basic elements that are critical to Nebraska’s pandemic response. One of the most important elements is the **Laboratory and Disease-Based Surveillance System**.”

Taken from NHHSS Pandemic Influenza Guidelines – Version 2-21-06

http://www.hhs.state.ne.us/pandemic/
NHHSS – Plan in Action

http://www.hhs.state.ne.us/pandemic/

HHSS Plan in Action

This is an example of how our state pandemic flu plan would work if there’s human-to-human transmission of a new deadly virus. The responses here are based on the given scenarios. In real life, things could happen very differently. It could be worse, it could be better. We won’t know until it happens.

What happens in Nebraska if...

The United States has a confirmed case of pandemic flu (human-to-human transmission).

Response:
- Issue state public health alert.
- Ramp up surveillance (data from doctor’s offices, hospitals, schools, labs and travel histories).
- Activate the Health Alert Network and send message telling all Nebraska healthcare providers, health departments and hospitals what signs and symptoms to watch out for and to report anything suspicious.
- Work with the media to get preparedness and personal protection messages out to Nebraskans.
- Activate HHSS pandemic flu hotline and special web pages.
- Tell Nebraskans to watch their children and family members for signs and symptoms of pandemic flu. If they think that they or a family member might have pandemic flu, they should call their healthcare provider.
- Pull together government pandemic flu groups along with healthcare providers, businesses and schools to discuss situation and decide next steps. Identify who will receive vaccine and antivirals, if available.
- Survey pharmacies to see how much antiviral medication is on hand.
- If vaccine is available, begin vaccinating Nebraskans.

Pandemic flu outbreaks are in surrounding states.

Response:
- Surveillance is ongoing.
- Limit activities to those considered essential (i.e. school, grocery shopping, medical visits, work).
- Discuss closing public activities (i.e. athletic events, concerts).
- Continue to work with media to get preparedness and protection information to Nebraskans.
- Monitor illnesses and deaths in other states and nationally.

Nebraska has one confirmed case of pandemic flu.

Response:
- Person with pandemic flu would be hospitalized, isolated and receive antiviral medication.
- Governor declares public health emergency.
- Continue discussions about public closures.
- Work closely with medical community to identify new cases and spread of disease.
- Voluntary quarantine for people exposed.
- Encourage members of the business community activate pandemic plans.
- Keep Nebraskans informed of new developments through the media and HHSS website, continue personal preparedness/protect messages.

Nebraska has several cases of pandemic flu.

Response:
- Work with local health departments to contain outbreaks.
- Issue voluntary restrictions on activities and travel.
- Recommend school and business closures.
- Recommend people work from home and stay home.
- Request federal stockpile of medical equipment and medicine.

Nebraska has a large amount of sick people and numerous deaths.

This is the point where government resources and the hospitals would be strained or overwhelmed, ... that is why planning and partnership is crucial at a local level. This is where Nebraskans would need to take care of each other in their own communities.
Pandemic Influenza Checklist for Laboratories

- Developed by the Wisconsin State Laboratory of Hygiene

- Components
  - Lab Personnel and Staffing
  - Testing
  - Other Services
  - Supplies
  - Communication
  - Biosafety

http://www.nphl.org/influenza_prepinfo.html
Laboratory Pandemic Plan Components

• Staffing
  • Identify resources for additional staffing, including support staff, pool, cross-train
  • Develop report to work policies, influenza-like illness (ILI) surveillance
  • Develop staff support plans – family, child & adult care, emotional, etc.
  • Develop accelerated hiring, orientation, training protocols
  • Develop prioritization plan for tests, etc.
    • You will not have enough staff and/or supplies
  • Develop policies regarding “non-essential” staff or those on quarantine/isolation who are not able to work during an emergency
  • Compensation, return to work, work from home
Laboratory Pandemic Plan

Components

- Supply/Operations
  - Identify critical, vulnerable supplies
  - Identify alternate vendors & distributors
  - Identify stockpile contacts & protocols
  - Develop plans with other institutions
  - Develop plan to prioritize testing
  - Identify substitutions for supplies
  - Maintain increased inventories
  - Develop plan for discontinued testing
  - Evaluate plan for potential return to previous laboratory safety practices (e.g., work on “open bench” with no PPE)
Laboratory Pandemic Plan Components

• Other Services
  • Develop alternate courier plans
  • Develop alternate waste disposal plans
  • Develop alternate instrument maintenance plans
  • Develop alternate facility maintenance plans
  • Community-level services (e.g., transportation)
Laboratory Pandemic Plan

Components

• Communications
  • Develop mechanism to rapidly adopt & communicate changes in testing
  • Identify effective mechanisms to disseminate information
  • Assure up-to-date communications plans exist internally and externally
  • Communicate with the public health department and state
Laboratory Pandemic Plan

Components

• Addressing Family Issues
  • Encourage influenza vaccination for staff and their family
  • Encourage development of individual/family stockpiles (food, water, etc.)

Biosafety Resources

• Public Health Guidance for Community-Level Preparedness and Response to Severe Acute respiratory Syndrome (SARS), Version 2.3; July 20 2004
  www.cdc.gov/ncidod/sars/guidance

• Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th ed
  www.cdc.gov/od/ohs/biosfty/bmbl5/bmbl5toc.htm

• Biosafety compliance checklist
  • Is your laboratory operating as a BSL-2 lab?
  http://www.nphl.org/documents/LaboratoryInspectionChecklistBSL2.pdf
What Should Laboratories Do Now?

- Lab personnel should be educated as to what may happen and what their roll will be
- Support surveillance activities
  - Seasonal influenza
  - Novel influenza subtypes
- Encourage staff to develop individual or family plans and vaccinate
- Participate in pandemic planning & exercises
  - Get engaged in the process
- Develop laboratory-specific pandemic plan/checklist
- Engage state partners for guidance NOW!
Acknowledgments

• Jodi Garrett
  • Microbiology Manager, NPHL

• Wisconsin State Laboratory of Hygiene
  • Pete A. Shult, Ph.D.
    • Director, Communicable Disease Division & Emergency Laboratory Response
  • Carol Kirk
    • Laboratory Network Coordinator

• National Laboratory Training Network
Acknowledgments


Resources

• CDC home page for influenza
  www.cdc.gov/flu
  www.cdc.gov/flu/weekly/fluactivity.htm

• U.S. web site for pandemic flu & U.S. Pandemic Flu Plan and Preparedness Planning
  www.pandemicflu.gov/

• W.H.O. home page for influenza (including avian influenza)
  www.who.int/csr/disease/influenza/en/
Resources

• NHHSS web site
  www.hhs.state.ne.us/pandemic/
  NHHSS Pandemic Influenza Guidelines document (2/21/2006 revision)

• NPHL web site
  www.nphl.org

  www.mlo-online.com/articles/0207/0207education.pdf
Mission Statement:
"Dedicated to protecting the health and safety of Nebraskans through diagnostic laboratory science, technology, and education."

New to www.nphl.org:
- Click HERE for the 2007 WNV testing guidelines from NHSS
- Click HERE for the Spring 2007 NPHL Newsletter
- NEW LINK: Use the Influenza Preparedness Information Link on the Left for Updated Information
- Click HERE for the new Shipment of Isolates for Banking guidelines from the NPHL

ELIRT Users:
- New users or those wanting more information about the ELIRT system should click ELIRT in the blue task bar
- Existing ELIRT users may click ELIRT SIGN-ON in the red task bar at anytime to enter the system.

Testing available from the Nebraska Public Health Laboratory must be authorized by the appropriate state screening program or the state epidemiologist. Questions regarding the investigation of reportable disease should be directed to the appropriate county or state epidemiologist.

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**SEASONAL INFLUENZA INFORMATION**

Click **HERE** for the Guide for Viewing Specimens Received for Influenza Surveillance.

**PANDEMIC INFLUENZA PREPAREDNESS INFORMATION**

This section will be used to post information regarding influenza preparedness information for laboratories. Please check back for further updates/changes.

- **Document 2, Pandemic Influenza Laboratory Testing Guidelines, October 10, 2006**
- **Document 1, Pandemic Influenza Laboratory Testing Guidelines, January 9, 2006**

Laboratory Checklist for Pandemic Influenza - Click one of the following links to download a customizable checklist that you can modify to fit your needs:
- [PDF Document](#)
- [Word Document](#)

**Important Links**

- NHHS Pandemic Influenza Information
- NHHS Seasonal Influenza Information
- PandemicFlu.gov
- World Health Organization Influenza Information

*Contact Tony Sambol if you have any questions.*

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- Cell Phone: 402-203-8498
- Pager: 402-888-5388