Influenza Pandemic (Un?)Preparedness

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Medical Director
Scott County Health Department
Human influenza types

- Type A
  - Epidemics and pandemics
  - Birds, animals (swine) → humans
  - All ages
- Type B
  - Milder epidemics
  - Humans only
  - Primarily affects children
- Type C
  - Never mind
Influenza A

- Incubation: 1-4 days (average 2 d.)
- Whole respiratory tract may be involved
- Abrupt onset fever, chills, malaise and muscle aches. Cough, sore throat, headache.
- Duration of severe symptoms: 3-7 days
- Large amounts of virus in secretions
- Virus shed for 2-8 days after onset
  - Virus detected up to 24 hours before onset
  - Viral shedding in children can persist for longer
Influenza A

8 segments of – sense, single stranded RNA

A/Beijing/32/92 (H3N2)

Hemagglutinin

Neuraminidase
Drift vs. Shift: Darwin lives

• Antigenic Drift – Annual Influenza
  • Mutations leading to small change
  • Selection for strains which encounter the least resistance
  • Some immunity, but need new influenza vaccine

• Antigenic Shift – Pandemic Influenza
  • Generally very big changes in an animal virus
  • Genetic reassortment of viral genes when two viral strains infect the same cell or direct jump from avian sources
  • New virus, minimal immunity
Emergence of influenza A strains

1918  H1N1  Spanish
1957  H2N2  Asian
1968  H3N2  Hong Kong

*Avian influenzas
### 20th century Influenza A pandemics

all are not created equal

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Origin</th>
<th>Viral Change</th>
<th>Est. US deaths</th>
<th>Shape of mortality curve</th>
<th>Populations at risk</th>
<th>Spread and crest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918 H1N1</td>
<td>Kansas</td>
<td>Mutation from avian strain in HA</td>
<td>548,000</td>
<td>W</td>
<td>Well young adults</td>
<td>3 waves 1918-19, simultaneous around the world</td>
</tr>
<tr>
<td>1957 H2N2</td>
<td>Asia</td>
<td>Reassortment of 3 segments from avian strain</td>
<td>69,800</td>
<td>U or J</td>
<td>Infants and elderly</td>
<td>April 1957 Hong Kong, May Japan, June Chile, Oct. US with second wave Feb. 1958</td>
</tr>
</tbody>
</table>
Mortality patterns in 3 pandemics
Influenza A (H5N1)

- Majority of human cases in children, almost all with exposure to ill poultry
- Typical flu, evolves in 2-5 days to diffuse pneumonia
- Case-fatality rate ~50%
- Person-to-person transmission very inefficient
- Endemic across Asia
- Spread to Kazakhstan, Russia, Romania, Turkey, Greece, Croatia, Ukraine, Western Europe
- Adapting to other mammals
- Ducks have tolerance to infection (spread)
Spread of H5N1 avian (HP) Influenza A

WHO
Human H5N1 through 11-13-06

WHO
Steps to a pandemic (distinct from “avian flu”)

1. Animal-to-human transmission

2. Any person-to-person transmission

3. *Efficient* person-to-person transmission
<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpandemic</td>
<td>Low risk of human cases</td>
<td>1</td>
</tr>
<tr>
<td>New virus in animals, no human cases</td>
<td>Higher risk of human cases</td>
<td>2</td>
</tr>
<tr>
<td>Pandemic alert</td>
<td>No or very limited human-to-human transmission</td>
<td>3</td>
</tr>
<tr>
<td>New virus causing human cases</td>
<td>Increased human-to-human transmission</td>
<td>4</td>
</tr>
<tr>
<td>Pandemic</td>
<td>Efficient human-to-human transmission</td>
<td>6</td>
</tr>
</tbody>
</table>
## Impact of pandemic influenza in US if virus like 1957/1968 strains or 1918

<table>
<thead>
<tr>
<th></th>
<th>“Ordinary” annual</th>
<th>Pandemic Influenza Like1957/68</th>
<th>Pandemic Influenza Like 1918</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths</td>
<td>36,000</td>
<td>92,500</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>200,000</td>
<td>400,000</td>
<td>5-6 million</td>
</tr>
<tr>
<td>Total infections</td>
<td>17-50 million</td>
<td>120-180 million</td>
<td>120-180 million</td>
</tr>
<tr>
<td>Missed Work Days</td>
<td>70 million</td>
<td>150 million</td>
<td>???</td>
</tr>
<tr>
<td>Missed School Days</td>
<td>38 million</td>
<td>85 million</td>
<td>???</td>
</tr>
<tr>
<td>Direct/Indirect Costs</td>
<td>$3-15 billion</td>
<td>$35 billion</td>
<td>???</td>
</tr>
</tbody>
</table>
## Impact of pandemic influenza A in US

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Moderate (1958/68)</th>
<th>Severe (1918)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attack rate</td>
<td>90,000,000 (30%)</td>
<td>90,000,000 (30%)</td>
</tr>
<tr>
<td>Outpatient care</td>
<td>45,000,000</td>
<td>45,000,000</td>
</tr>
<tr>
<td>Admissions</td>
<td>865,000</td>
<td>9,900,000</td>
</tr>
<tr>
<td>ICU care</td>
<td>128,750</td>
<td>1,485,000</td>
</tr>
<tr>
<td>Ventilators</td>
<td>64,875</td>
<td>782,000</td>
</tr>
<tr>
<td>Deaths</td>
<td>200,000</td>
<td>1,903,000</td>
</tr>
</tbody>
</table>

Pandemic planning assumptions

- Outbreaks occur simultaneously throughout US
  - Overwhelming demand on the healthcare system
  - No “outside” help
- 35-45% absenteeism in all sectors at all levels
  - Public service, public safety
  - Healthcare personnel
  - Just-in-time economy
  - Critical utilities
- Order and security disrupted for months, not hours or days (e.g. 9/11, or Katrina)
- On multiple news outlets 24/7
INFLUENZA PANDEMIC
MORTALITY IN AMERICA AND EUROPE DURING 1918 AND 1919

DEATHS FROM ALL CAUSES EACH WEEK
EXPRESSED AS AN ANNUAL RATE PER 1000

NEW YORK
LONDON
PARIS
BERLIN

BERLIN RATES MISSING FOR AUG. 17, 31, OCT. 19, 1918.
What can we do??
Social distancing in 1918 (maybe)
### Cumulative US incidence/100 population with various interventions

<table>
<thead>
<tr>
<th>Reproductive rate ($R_o$)</th>
<th>1.6</th>
<th>1.9</th>
<th>2.1</th>
<th>2.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No intervention</td>
<td>32.6</td>
<td>43.5</td>
<td>48.5</td>
<td>53.7</td>
</tr>
<tr>
<td>Unlimited targeted prophylaxis</td>
<td>0.06</td>
<td>4.3</td>
<td>12.2</td>
<td>19.3</td>
</tr>
<tr>
<td>Dynamic vaccination</td>
<td>0.7</td>
<td>17.7</td>
<td>30.1</td>
<td>41.1</td>
</tr>
<tr>
<td>School closure</td>
<td>1.0</td>
<td>29.3</td>
<td>37.9</td>
<td>46.4</td>
</tr>
<tr>
<td>Travel restriction</td>
<td>32.8</td>
<td>44.0</td>
<td>48.9</td>
<td>54.1</td>
</tr>
<tr>
<td>DV, SD, SC, TR</td>
<td>0.04</td>
<td>0.2</td>
<td>0.6</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Germann et al. PNAS. 2006
Elements of a pandemic plan

• Authority, command and control
• Surveillance
• Vaccine management
• Antiviral agents
• Emergency response, surge capacity
• Communications
• Continuity of operations
Vaccine (conventional wisdom)

• Not available for 4 to 6 months
  • Not necessarily true
• Must be matched to strain
  • Grossly oversimplified
• Will become available in allotments, with number of doses dependent on potency
• When available, distribution will be prioritized
• It is likely that much of the pandemic experience will occur prior to availability
Antiviral medications

• Drug likely to be distributed to states pro rata
• Need 45 doses of oseltamivir for 6 wks of prophylaxis vs. 10 doses for 1 course of treatment
• Priority for access will be determined state-by-state
  • Risk/benefit
  • Ethical considerations
Expand and enhance annual influenza vaccination

• Enhance infrastructure
• Expand expertise implementing large vaccination clinics
• Develop trained cadre of volunteers
• *Enhance demand to enhance supply*
• Don’t forget pneumococcal vaccine
Communicating prevention to public: *it’s the big chunks*
Prevention for the public

• Frequent hand hygiene, teach children (right!)
  • Use antibacterial hand cleaner particularly after contact w/ public surfaces (e.g. shopping carts)
  • Keep your hands away from your face

• Cough etiquette
  • Cover mouth, avoid exposing others

• Unknown utility of PPE vs. public expectations

• If you get sick, stay home from school/work

• Stay $\geq 3$ feet from anyone coughing/sneezing

• Get an annual flu shot
Public preparedness (duct tape?)

- As best you can, keep a supply of canned and dried food in the home
- Develop a home emergency plan and put together a kit
- Talk with your healthcare provider about having more than a 30-day supply of needed medications
- Maintain general good health and habits
Challenges 1

- Effective surveillance for early recognition
- Operational continuity with 40% absenteeism
  - Business in general
  - Health care
  - Hy-Vee, Iowa Light and Power, Starbucks
  - Constitutional governance
- Coping with economic disruption
- Implementation/enforcement of social distancing
  - School closure
  - Event cancellation
  - Sheltering
Challenges 2

- Surge capacity for serious illness does not exist in US healthcare
- Workforce support to deal with stress and pressure of 1918–like event
Challenges 3

- Public buy-in for realistic planning
  - Low-tech prevention
  - Vaccine and antiviral priorities
  - Managing expectations
- Effective communication (despite the media?) during the pandemic
- Social cohesion at neighborhood level
- Acceptance and remediation of eroded public health infrastructure
Challenges 4:
The just-in-time supply-chain economy

Preparedness (public health) = Excess capacity = Waste
## Business Pandemic Influenza Planning Checklist

In the event of pandemic influenza, businesses will play a key role in protecting employees' health and safety as well as limiting the negative impact to the economy and society. Planning for pandemic influenza is critical. To assist you in your efforts, the Department of Health and Human Services (HHS) and the Centers for Disease Control and Prevention (CDC) have developed the following checklist for large businesses. It identifies important specific activities large businesses can do now to prepare, many of which will also help you in other emergencies. Further information can be found at [www.pandemicflu.gov](http://www.pandemicflu.gov) and [www.cdc.gov/business](http://www.cdc.gov/business).

### 1. Plan for the impact of a pandemic on your business:

<table>
<thead>
<tr>
<th>Completed</th>
<th>In Progress</th>
<th>Not Started</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
- Identify a pandemic coordinator and/or team with defined roles and responsibilities for preparedness and response planning. The planning process should include input from labor representatives.
- Identify essential employees and other critical inputs (e.g., raw materials, suppliers, subcontractors’ services/products, and logistics) required to continue business operations by location and function during a pandemic.
- Train and prepare auxiliary workforce (e.g., contract workers, employees in other job titles/descriptions, retirees).
- Develop and plan for scenarios likely to result in an increase or decrease in demand for your products and/or services during a pandemic (e.g., effect of restrictions on mass gatherings, need for hygiene supplies).
- Determine potential impact of a pandemic on company business success using multiple possible scenarios that affect different product lines and/or production sites.
- Determine potential impact of a pandemic on business-related domestic and international travel (e.g., quarantines, border closures).
- Find up-to-date, reliable pandemic information from community and public health, emergency management, and other sources and make sustainable links.
- Establish an emergency communications plan and review periodically. This plan includes identification of key contacts (with back-ups), chains of communications (including suppliers and customers), and procedures for tracking and communicating business and employee status.
- Implement an exercise/trial to test your plan, and revise periodically.

### 1.2 Plan for the impact of a pandemic on your employees and customers:

<table>
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</table>
- Forewarn and allow for employee absences during a pandemic due to factors such as personal illness, family member illness, community containment measures and quarantines, school and/or business closures, and public transportation closures.
- Implement guidelines to modify the frequency and type of face-to-face contact (e.g., hand-shaking, seating in meetings, office layout, shared workstations) among employees and between employees and customers (refer to CDC recommendations). Encourage and track annual influenza vaccination for employees.
- Evaluate employee access to and availability of healthcare services during a pandemic, and improve services as needed.
- Evaluate employee access to and availability of mental health and social services during a pandemic, including corporate, community, and faith-based resources, and improve services as needed.
- Identify employees and key customers with special needs, and incorporate the requirements of such persons into your preparedness plan.

December 6, 2005
Version 3.6
Surveillance: bird flu hits PV trailer park!