H1N1 Influenza Pandemic: Lessons Learned for Today and Tomorrow

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- Decision making during a pandemic
- Measuring pandemic severity
- Critical products for pandemic response
- Transmission
- Vaccine
- Public policy
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Making Sense of Influenza Pandemics

- Human influenza pandemics are a part of our history
  - 11 in the past 300 years
- Novel influenza virus subtype emerges in humans with:
  - little or no human immunity
  - transmission of the virus to humans by humans
  - moderate to severe disease occurrence
WHO Phases Of Pandemic Alert
The H1N1 Influenza Pandemic

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Making Sense of Influenza Pandemics

- Assessment of the novel H1N1 pandemic and the September, 2010 Options meeting (Hong Kong)
  - "We are fortunate that this was a mild pandemic."
  - "If this virus had been deadly...."
  - "This pandemic was really just a dry run."
  - "This pandemic was regarded as not severe."
  - The 2009 pandemic...largely a huge relief and a practice run."

- Our current "mild, moderate and severe" measurement system (i.e. number of deaths) is outdated

- Death is a difficult topic to discuss, particularly when it's about ourselves
Graph A: 2009 H1N1 Hospitalizations Frequency of Underlying Conditions in Adults EIP (n=4,987) (April 15, 2009 - February 16, 2010)

- Asthma: 30%
- Diabetes: 25%
- Chronic Cardiovascular Disease: 20%
- COPD: 16%
- Neurocognitive Disease: 5%
- Renal Disease: 4%
- Pregnancy: 2%

Graph B: 2009 H1N1 Hospitalizations Frequency of Underlying Conditions in Children EIP (n=2,600) (April 15, 2009 - February 16, 2010)

- Asthma: 15%
- Diabetes: 10%
- Heart Disease: 6%
- Chronic Lung Disease: 6%
- Central Nervous System Disease: 3%
- Renal Disease: 2%
- Pregnancy: 1%
- Other: 1%

55% of hospitalized children with 2009 H1N1 infections had at least one underlying condition.
In recent publications, we described more than 700 people admitted to intensive care units (ICUs) throughout these two countries with pandemic (H1N1) 2009 influenza. These were often young and previously healthy people, and many were pregnant women. Two-thirds needed mechanical ventilation for influenza-induced respiratory failure, and a smaller but substantial number developed rapidly progressive acute respiratory distress syndrome and required extracorporeal membrane oxygenation (ECMO), the most extreme life support available. This is not the normal pattern of influenza in Australasia. In comparison to a normal winter, ICU admissions for viral pneumonitis increased 15-fold, and the use of ECMO for acute lung injury increased 17-fold. Patients infected with pandemic (H1N1) 2009 influenza required prolonged stays in both the ICU and hospital and, despite optimal care, more than 100 died. ICU bed occupancy by patients with pandemic (H1N1) 2009 influenza ran as high as 19% in a system that normally runs close to maximal occupancy. There is a real risk that the pandemic will affect Australia again next winter or earlier, and we feel the Australasian medical community should not be misled into believing that the pandemic (H1N1) 2009 influenza virus is not virulent and has not been responsible for significant mortality and morbidity in a population not normally affected.
Complications and Outcomes of Pandemic 2009 Influenza A (H1N1) Virus Infection in Hospitalized Adults: How Do They Differ From Those in Seasonal Influenza?


March 20, 2010

Preliminary Estimates of Mortality and Years of Life Lost Associated With the 2009 A/H1N1 Pandemic In the US and Comparison With Past Influenza Seasons

Viboud C, Miller M, Olson D, Osterholm M, Simonsen L.

March 20, 2010
Estimates of Number of Deaths, Mean Age of Deaths, and Years of Life Lost Attributable to the 2009 Pandemic In the US.

<table>
<thead>
<tr>
<th></th>
<th>Number of deaths (adjusted to 2000 pop.)</th>
<th>Mean age of deaths (yrs)</th>
<th>Years of life lost (adjusted to 2000 pop.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2009 Pandemic</strong></td>
<td>7,500–44,100</td>
<td>37.4</td>
<td>334,000–1,973,000</td>
</tr>
<tr>
<td></td>
<td>12,000 (9,500–17,800)</td>
<td>**</td>
<td>463,300 (328,800–600,300)</td>
</tr>
<tr>
<td><strong>1968 Pandemic</strong></td>
<td>88,000 ***</td>
<td>82.2</td>
<td>1,693,000</td>
</tr>
<tr>
<td></td>
<td>150,800 ***</td>
<td>64.6</td>
<td>2,898,000</td>
</tr>
<tr>
<td><strong>1918 Pandemic</strong></td>
<td>1,272,300 ***</td>
<td>27.2</td>
<td>63,718,000</td>
</tr>
<tr>
<td><strong>Average A/H3N2</strong></td>
<td>47,800 ***</td>
<td>75.7</td>
<td>594,000</td>
</tr>
<tr>
<td><strong>seasons, 1979–2001</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Range is based on estimates of excess *A* deaths (upper), based on projections from the 122 cities mortality surveillance.

**Estimates based on CDC’s probabilistic estimates, using 2009 pandemic survey data (different from CDC’s excess mortality method for measuring seasonal influenza burden).

***Estimates based on excess mortality approach applied to final national vital statistics and adjusted to the 2000 population age structure.

Viboud C, Miller M, Olson D, Osterholm M, Simonsen L. 2010 March 20

Death and Years of Life Lost From Influenza

![Graph showing number of deaths and years of life lost for different pandemics and seasons.]

Mean Age of Death for Influenza Pandemics and Life Expectancy At Birth; United States

<table>
<thead>
<tr>
<th>Year</th>
<th>Life Expectancy</th>
<th>Mean Age of Death (Pandemics)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918</td>
<td>56.4</td>
<td>27.2</td>
<td>(29.2)</td>
</tr>
<tr>
<td>1957</td>
<td>69.1</td>
<td>64.6</td>
<td>(4.5)</td>
</tr>
<tr>
<td>1968</td>
<td>70.3</td>
<td>62.2</td>
<td>(8.1)</td>
</tr>
<tr>
<td>2009</td>
<td>78.2</td>
<td>41.0</td>
<td>(37.2)</td>
</tr>
</tbody>
</table>
Making Sense of Influenza Pandemics

- The 2009 novel H1N1 influenza pandemic, together with the experience of the 3 previous pandemics, seasonal influenza and H5N1, reinforces that "flu isn’t simple"
- Our current “mild, moderate and severe” measurement system (i.e. number of deaths) is outdated
- We need a new way to measure and describe the impact of pandemic influenza in a modern world
  - years of life lost
  - impact on our modern health care system

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Critical Products for Pandemic Response

- Drug shortages have been increasing over the last 5 years
  - Estimated to cost at least $200 million
  - In some cases they require 1 FTE pharmacist to manage
- Shortages are occurring without any significant geopolitical events
  - Items for critical care on drug shortage list
FDA Expectations for Drug Shortages in 2011

“In 2010, there were 178 drug shortages reported to the U.S. Food and Drug Administration, 132 of which involved sterile injectable drugs. In 2011, FDA has continued to see an increasing number of shortages, especially those involving older sterile injectable drugs. These shortages have involved cancer drugs, anesthetics used for patients undergoing surgery, as well as drugs needed for emergency medicine, and electrolytes needed for patients on IV feeding.”

Critical Products for Pandemic Response

• What are the most critical and vulnerable products to stockpile for pandemic preparedness
  – What keeps patients alive
    • Single use items
    • Reusable items
    • Pharmaceuticals
  – What keeps staff safe
Critical Products for Pandemic Response

• Pandemic/Bioterrorism/Disaster preparedness is partially based on having items on a formulary
  – Are all the items critical
  – How vulnerability are items to disruptions
• A critical product has a direct and immediate (≤ 48hrs) impact on patient mortality or severe morbidity
• A vulnerable product is one that is likely to be disrupted in a severe pandemic scenario

Critical Products for Pandemic Response

• Limited vulnerability assessment
  – Data either propriety or does not exist
  – Federal Government has limited data to assess vulnerability
• Urgent need to incorporate the criticality and vulnerability of products in preparedness activities
  – Guidance to do this is lacking

Critical Products for Pandemic Response

• What are the products to stockpile for pandemic preparedness
• Identified 4 guidance documents that listed products:
  – What keeps patients alive
    • Single use items
    • Reusable items
    • Pharmaceuticals
  – What keeps staff safe
Critical Products for Pandemic Response

- Survey of critical care physicians in the US to rank product criticality
- Interviews with critical care physicians on frontline with H1N1 and SARS
- Physicians have difficulty in identifying criticality of products
- Dichotomy between ICU care and palliative care
  - Eventually ICU care won’t be possible, switching to palliative care due to supply/staff issues is difficult

CIDRAP Survey of Critical Care Physicians Regarding Critical Products for Pandemic Response

<table>
<thead>
<tr>
<th>Product</th>
<th>Criticality Ranking*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical ventilators</td>
<td>4.88</td>
</tr>
<tr>
<td>Endotracheal tubes</td>
<td>4.63</td>
</tr>
<tr>
<td>Normal saline</td>
<td>4.63</td>
</tr>
<tr>
<td>Insulin</td>
<td>4.50</td>
</tr>
<tr>
<td>Broad-spectrum intravenous antibiotics</td>
<td>4.50</td>
</tr>
<tr>
<td>Antivirals</td>
<td>4.38</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.38</td>
</tr>
<tr>
<td>Central line kits</td>
<td>4.38</td>
</tr>
<tr>
<td>Oxygen tubing and regulators</td>
<td>4.38</td>
</tr>
<tr>
<td>Norepinephrine and similar pressors</td>
<td>4.25</td>
</tr>
</tbody>
</table>

*Ranking scale 1-5, with 5 being the most critical and 1 being the least critical.

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Biggest swine flu regret for U.S.: vaccine chaos

By Maggie Fox, Health and Science Editor

WASHINGTON (Reuters) - A year after the swine flu pandemic, new research has emerged about how the vaccination program might have been better handled.

The U.S. government's response to the pandemic was praised as a model of efficient and effective public health strategy. The CDC and state health authorities worked together to ensure that vaccines were distributed promptly and efficiently.

However, new research has emerged about how the vaccination program might have been better handled. The government's response to the pandemic was praised as a model of efficient and effective public health strategy. The CDC and state health authorities worked together to ensure that vaccines were distributed promptly and efficiently.

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Pandemic Influenza Vaccine: The US Government Is Not Doing Enough

ME Ostroski

"It is not serving our country's best interest to have a vaccine that is not widely available in a timely manner." William Churchill

Influenza pandemics, like earthquakes, hurricanes, and tornadoes, occur. They have been (and will be) pandemic in the past. Influenza pandemics occur in the last century. Where one nation fails in an emergency, the world can help. The current situation with H1N1 influenza is unusual and can be treated.

This conclusion regarding our current state of pandemic vaccine research, development, manufacturing, and future distribution takes into account the significant increase in research and development carried out by the US government and other countries as well as the World Health Organization (WHO). However, I believe that there remains a significant gap between the potential human harm caused by this epidemic and the need for effective vaccines and interventions.

World Health Organization

Pandemic (H1N1) 2009 vaccine deployment update - 23 December 2009

Background information

To help countries protect people from developing severe disease from pandemic H1N1 infection, the World Health Organization (WHO) is coordinating the distribution of donated pandemic influenza vaccines to 92 countries. This document is an update on efforts to mobilize resources, secure a sufficient supply of pre-empted vaccines, support countries in deploying vaccines and surveillance products to countries that have a national deployment plan in place.

Mobilizing resources

Governments, foundations, and manufacturers have offered contributions of vaccines, priority products (such as syringes and safety lancets) and finance to support the deployment

Planning for national deployment

WHO has convened 3 regional workshops in all regions to help countries prioritize national deployment plans and prepare for vaccine and manage pandemic influenza H1N1 vaccines. The deployment plans for 12 countries have been completed. A revised national vaccine distribution plan will be implemented, and other aspects of the evaluation of the operation. The next phase of the task group will be implemented, and other aspects of the evaluation of the operation. The next phase of the task group will be completed.

Current situation

Countries have completed national deployment plans

Supplying vaccines to countries

After a country meets the criteria for receiving donated pandemic vaccines, WHO deploys donated vaccines to the country through its partners and its distribution service (WHO/DSDP).

Effectiveness of Non-Adjuvanted Pandemic Influenza A Vaccines for Preventing Pandemic Influenza Acute Respiratory Illness Visits in 4 U.S. Communities

Marie H. Cottert, MD, MPH, Arnold S. Marcus, MD, Aladon A. Jirapatrakul, MD, John J. Breiman, MD, PhD, Leslie A. Zeller, MD, PhD, Sandra M. Peck, MD, PhD, Robert T. Volunteer, MD, PhD, Paul Stange, MD, PhD, Lawrence D. Darmo, MD, PhD, for the U.S. FluNet Network

ABSTRACT

This study examined the effectiveness of non-adjuvanted pandemic influenza A (H1N1) 2009 vaccine in reducing illness in the U.S. FluNet Network, which is an ongoing, prospective, multi-site, community-based surveillance study. Surveillance was conducted within four communities in the U.S. during April-July 2009. The study site was characterized by its history of influenza vaccination and epidemiology. While the study sites contained few households, the results of the study were characterized by few householders and households with household members vaccinated with adjuvanted influenza vaccine. Therefore, it is important to note that the study involved a relatively small number of households and individuals, and that results may not be applicable to all communities. However, the study provides useful insights into the potential benefits of influenza vaccination and can be used to inform future research.
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“It’s no use saying, ‘We’re doing our best.’ You have got to succeed in doing what is necessary.”

Sir Winston Churchill