



# PANDEMIC INFLUENZA PREPAREDNESS

Tim Uyeki, MD, MPH, MPP, FAAP  
Centers for Disease Control and Prevention

# FACULTY DISCLOSURE

- I have no relevant financial relationships to disclose.



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# LEARNING OBJECTIVES

By the end of the presentation, participants will be able to:

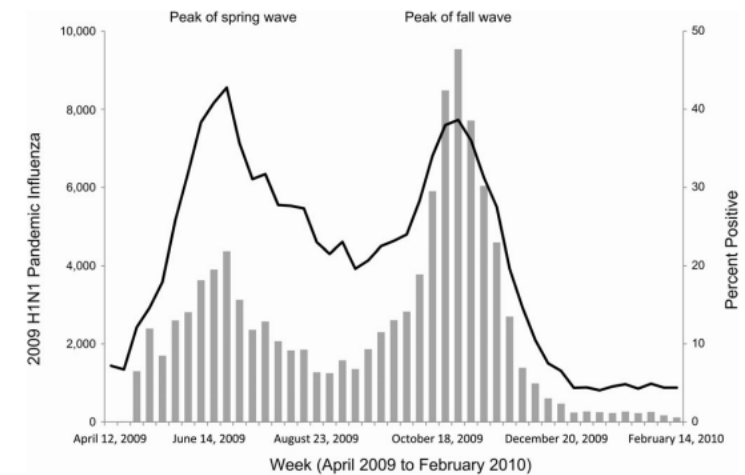
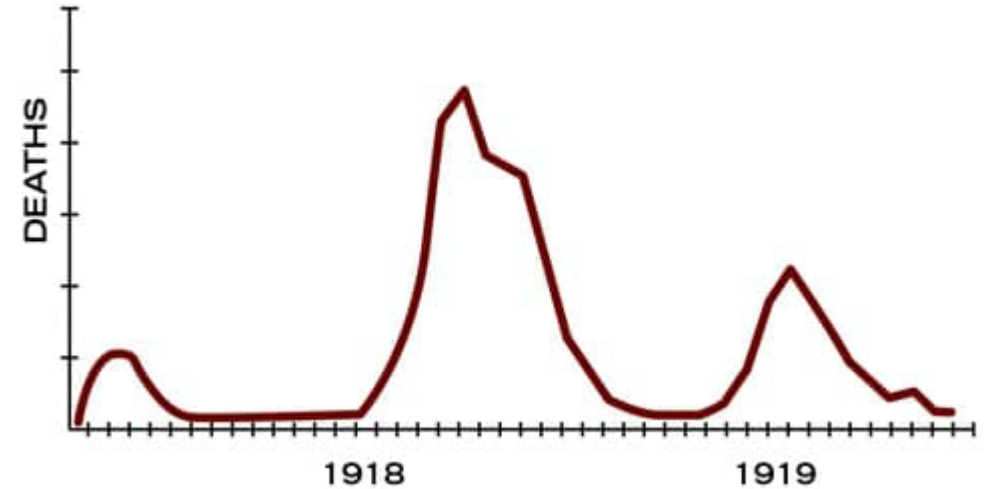
1. List past influenza pandemics
2. Explain the origin of pandemic influenza viruses
3. Describe the impact of pandemic influenza on children
4. Discuss diagnosing, treating, and preventing the spread of influenza
5. Prepare for pandemic influenza



# PAST INFLUENZA PANDEMICS

## Estimated global mortality

- 1918 H1N1: 50 million deaths (675,000 U.S.)
- 1957 H2N2: 1.1 million deaths (116,000 U.S.)
- 1968 H3N2: 1 million deaths (100,000 U.S.)
- 2009 H1N1: 151,700 to 575,400 deaths (12,500 U.S.)



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# ORIGIN OF PANDEMIC INFLUENZA VIRUSES

- Origin of pandemic influenza A viruses
  - Animal reservoirs (eg, 1918 H1N1 & 2009 H1N1 viruses)
  - Reassortant virus (eg, 1957 H2N2 & 1968 H3N2 viruses)
- A novel influenza A virus can cause a pandemic if:
  - The novel influenza A virus has the ability for sustained transmission among humans, **AND**
  - Lack of immunity to the novel influenza A virus among humans

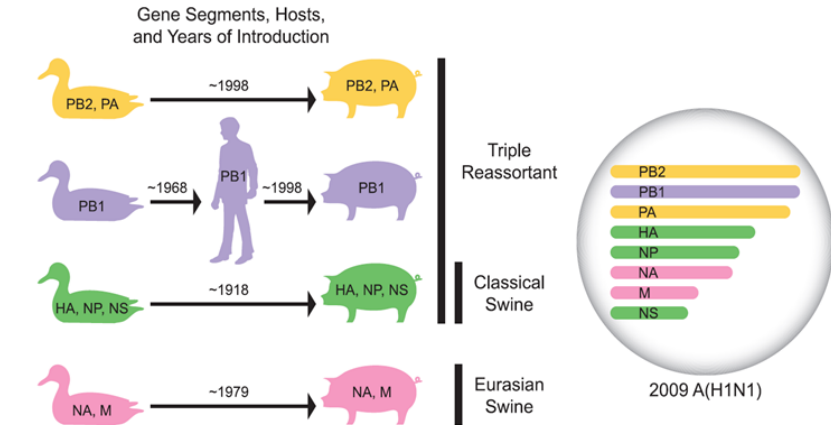


Figure 1: From Rebecca J. Garten et al., Antigenic and Genetic Characteristics of Swine-Origin 2009 A(H1N1) Influenza Viruses Circulating in Humans. *Science* 325, 197-201(2009). DOI:10.1126/science.1176225. Reprinted with permission from AAAS.

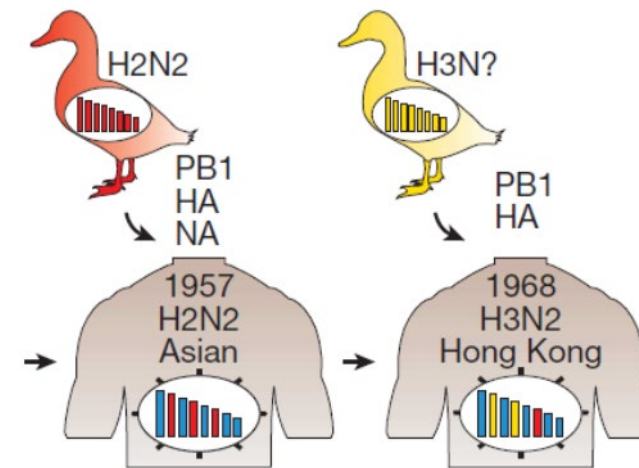


Figure 2: From Neumann, G., Noda, T. & Kawaoka, Y. Emergence and pandemic potential of swine-origin H1N1 influenza virus. *Nature* 459, 931-939 (2009). Permission grant by Yoshihiro Kawaoka.

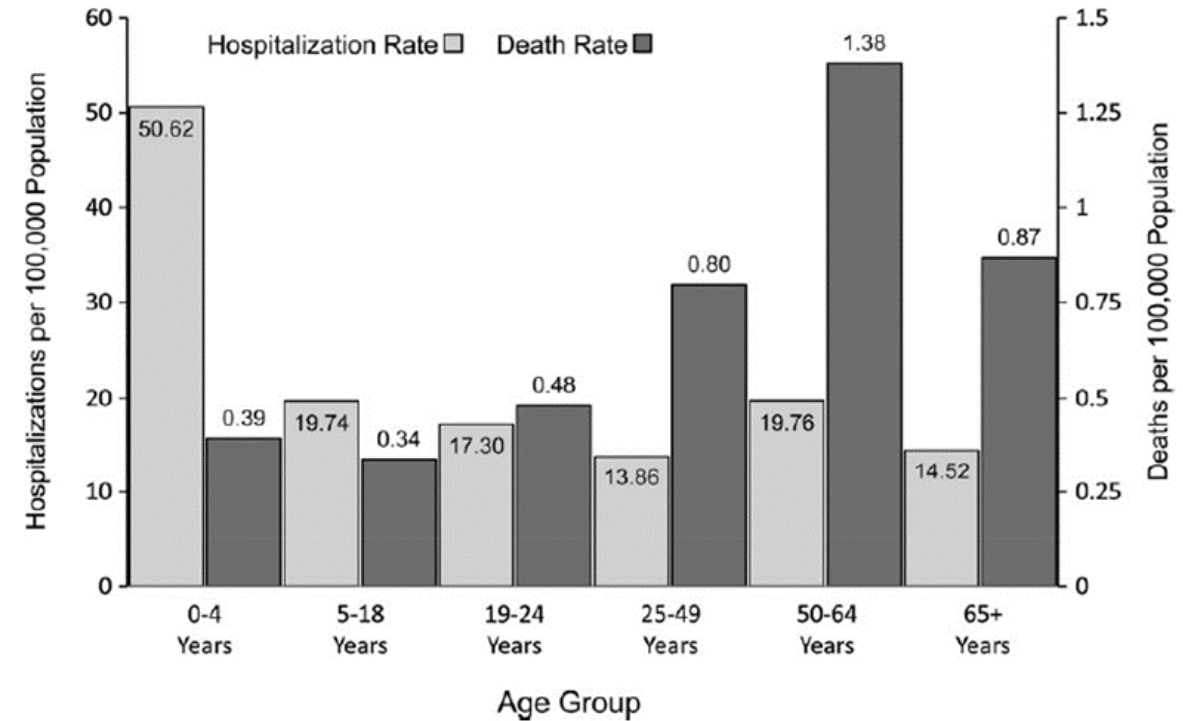
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# IMPACT OF INFLUENZA PANDEMICS ON CHILDREN

- High attack rates:
  - School-aged children often have high rates of pandemic influenza illness, and introduce pandemic influenza to households
    - Outbreaks are common in schools and daycare centers
- High hospitalization rates:
  - Young children aged <5 years have high hospitalization rates



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Source: CDC, 2009 Pandemic H1N1 Epidemiology CID 2011:52 (Suppl 1)

# CLINICAL SYNDROMES OF PANDEMIC INFLUENZA IN CHILDREN

- Pandemic influenza results in similar signs and symptoms, and complications as seasonal influenza
- **Uncomplicated Disease:**
  - Upper respiratory symptoms with or without fever; gastrointestinal symptoms are more common in children than adults
- **Complications:**
  - Exacerbation of chronic disease
  - Respiratory: pneumonia (primary viral, 2° bacterial), bronchiolitis, croup, bronchospasm
  - Cardiac: myocarditis, pericarditis
  - Neurologic: febrile, seizures, encephalopathy, encephalitis



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# DIAGNOSIS OF PANDEMIC INFLUENZA

- Respiratory specimens (ideally collected <4 days from illness onset):
  - Nasopharyngeal swab/aspirate, nasal swab, combined nasal/throat swabs
- Commercially available tests that detect influenza A viruses
  - Rapid antigen (detect virus antigens)
  - Molecular assays (detect virus nucleic acids)
    - Molecular assays have higher sensitivity & specificity than antigen detection tests
  - Multiplex assays that detect influenza A/B and other respiratory viruses
- Molecular tests available at public health laboratories (RT-PCR)
  - Tests in development



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# ANTIVIRAL TREATMENT FOR PANDEMIC INFLUENZA

- FDA-approved antivirals currently recommended:
  - Neuraminidase inhibitors (oral oseltamivir, inhaled zanamivir, IV peramivir)
    - Different age approvals
  - Cap-dependent endonuclease inhibitor (oral baloxavir) (aged  $\geq 5$  years)
- Start antiviral treatment as soon as possible for high-risk outpatients (aged  $< 2$  years, or any age with chronic medical conditions) and hospitalized patients with suspected/confirmed influenza
  - Empiric antiviral treatment
  - Post-exposure prophylaxis



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# PREVENTION OF PANDEMIC INFLUENZA

- Before pandemic vaccine is available:
  - Non-pharmaceutical interventions (NPIs) (eg, face masks, social distancing) help prevent and control the spread of pandemic influenza
    - Use of face masks for source control for symptomatic persons
- Pandemic influenza vaccines:
  - Following clinical trials, vaccine availability may be limited during the 1<sup>st</sup> pandemic wave
  - Two doses of an adjuvanted vaccine will likely be required

# NOVEL INFLUENZA A VIRUSES WITH PANDEMIC POTENTIAL

- Novel influenza A viruses are influenza A viruses that have infected people and are antigenically and genetically distinct from seasonal influenza A viruses (pose pandemic potential)
  - Of animal origin (avian or swine influenza A viruses)
  - Sporadic human infections have caused a wide range of disease severity
    - Some rare cases of limited, non-sustained human-to-human transmission
- Surveillance of influenza A viruses among humans, birds, and pigs can inform preparedness & response
- [CDC Pandemic Influenza Risk Assessment Tool \(IRAT\)](#)
  - The IRAT assesses the potential pandemic risk posed by influenza A viruses that currently circulate among animals



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# PANDEMIC INFLUENZA PREPAREDNESS FOR PEDIATRICIANS

- Lessons learned from COVID-19:
  - Use of non-pharmaceutical interventions by staff and patients
  - Telemedicine
  - Separating well care visits & sick visits (eg, AM versus PM), separate entrances/exits
  - Maintaining adequate supplies of routine vaccines for well child visits
- Develop a Pandemic Influenza Preparedness Plan to organize resources and processes for the effective management of pandemic influenza
  - Plan for when pandemic vaccines are available, need for 2 doses for primary series
  - Triage, diagnosis, and antiviral treatment issues
  - Infection prevention and control measures in the health care setting
  - Medical surge preparedness during peak community activity
  - Backup plan for potential staffing issues
  - Keeping up with new prevention and control recommendations
  - Educating and communicating frequently with staff, patients, and families



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# CONCLUSION

- The best way to prepare for pandemic influenza is to improve prevention and clinical management of seasonal influenza for pediatric patients
  - Diagnosis and early antiviral treatment of high-risk children with seasonal influenza
- Because an influenza pandemic could begin at any time, planning and preparedness for patient surges is essential for pediatricians
  - Planning for pandemic influenza can help prepare for surges in other respiratory viruses (eg, RSV)
  - Pediatric Pandemic Network: <https://pedspandemicnetwork.org/about/>
  - CDC Information on Pandemic influenza: <https://www.cdc.gov/flu/pandemic-resources/index.htm>



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# PREVENTION AND CONTROL GUIDANCE AND GUIDELINES

- Advisory Committee on Immunization Practices Annual Influenza Vaccine Recommendations
  - <https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/flu.html>
- Infectious Diseases Society of America Influenza Clinical Practice Guidelines
  - <https://academic.oup.com/cid/article/68/6/e1/5251935?login=true>
- CDC Information for Clinicians on Influenza Virus Testing
  - <https://www.cdc.gov/flu/professionals/diagnosis/index.htm>
- CDC Influenza Antiviral Medications: Summary for Clinicians
  - <https://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm>



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# AAP RESOURCES

## Information for Pediatric Health Care Providers

- AAP Recommendations for Influenza Control and Prevention
  - Policy Statement [aap.org/influenzapolicystatement](http://aap.org/influenzapolicystatement)
  - Technical Report [aap.org/influenzatechnicalreport](http://aap.org/influenzatechnicalreport)
- Red Book Online Influenza Resources: [aap.org/RBOinfluenzaresources](http://aap.org/RBOinfluenzaresources)
- Influenza Patient Care Page: [aap.org/influenza](http://aap.org/influenza)
- Project Firstline Infection Prevention and Control Resources: [aap.org/projectfirstline](http://aap.org/projectfirstline)

## Information for Patients, Families, and Caregivers

- Healthy Children Flu Subsite in English: [healthychildren.org/flu](http://healthychildren.org/flu)
- Healthy Children Flu (Gripe) Subsite in Spanish: [healthychildren.org/gripe](http://healthychildren.org/gripe)



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# THANK YOU!

Members of AAP and medical providers of children and adolescents



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