

# The One Flu Approach: Overview & Case for Sharing Viruses and Data



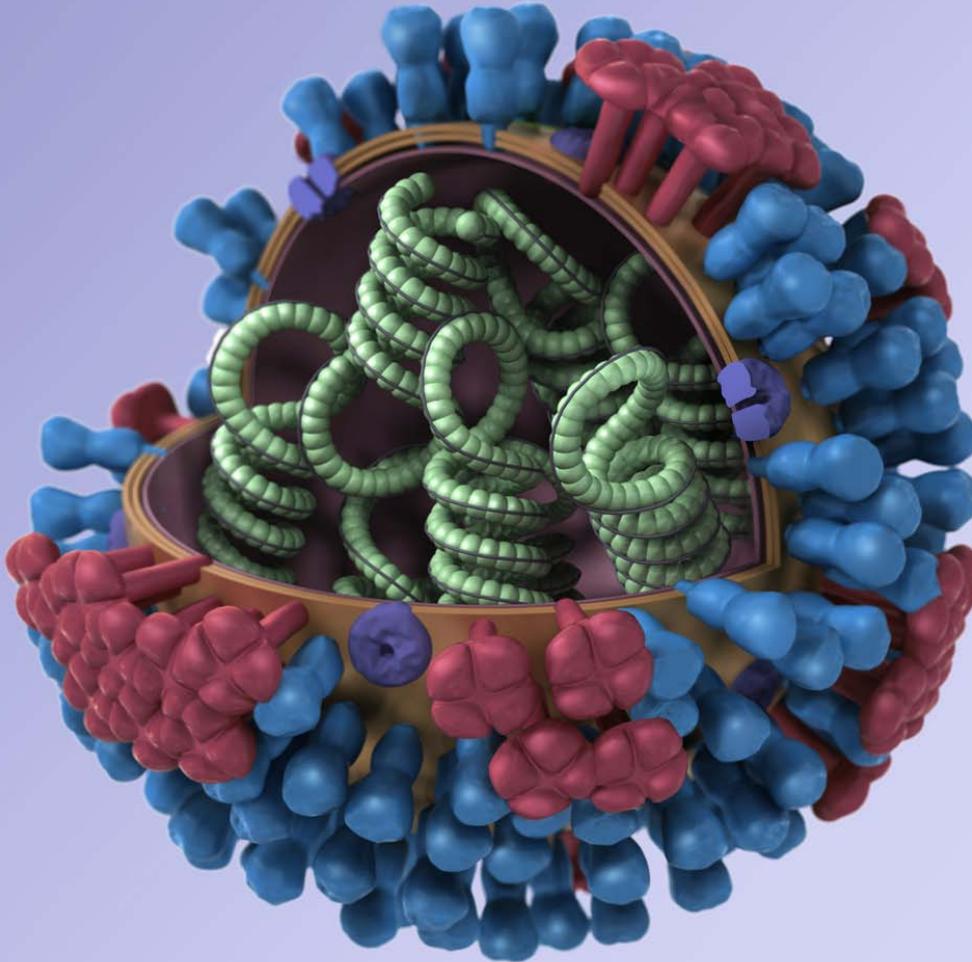
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**CDC, Atlanta, GA**  
**One Flu Strategic Retreat**  
**Castelbrando, Italy**



# Why Focus on One Flu?

- **We live with an ongoing risk of another influenza pandemic**
  - The H1N1 pandemic did not decrease the risk
- **We live with enzootic H5N1 in at least 6 countries with ongoing culling required and sporadic human cases (food security risk & animal and human suffering)**
- **We have invested globally in human and avian surveillance and pandemic planning and must capitalize on this investment**

# The virus is part of the problem!



- 16 subtypes of HA and 9 of NA with constant evolution and reassortment of genes
- Most dx tests do not differentiate subtypes, a problem for our Mexican colleagues using IFA
- Need for more very rapid development of vaccine viruses and ramp up for vaccine production

# One Flu is intra- and inter-species surveillance and research

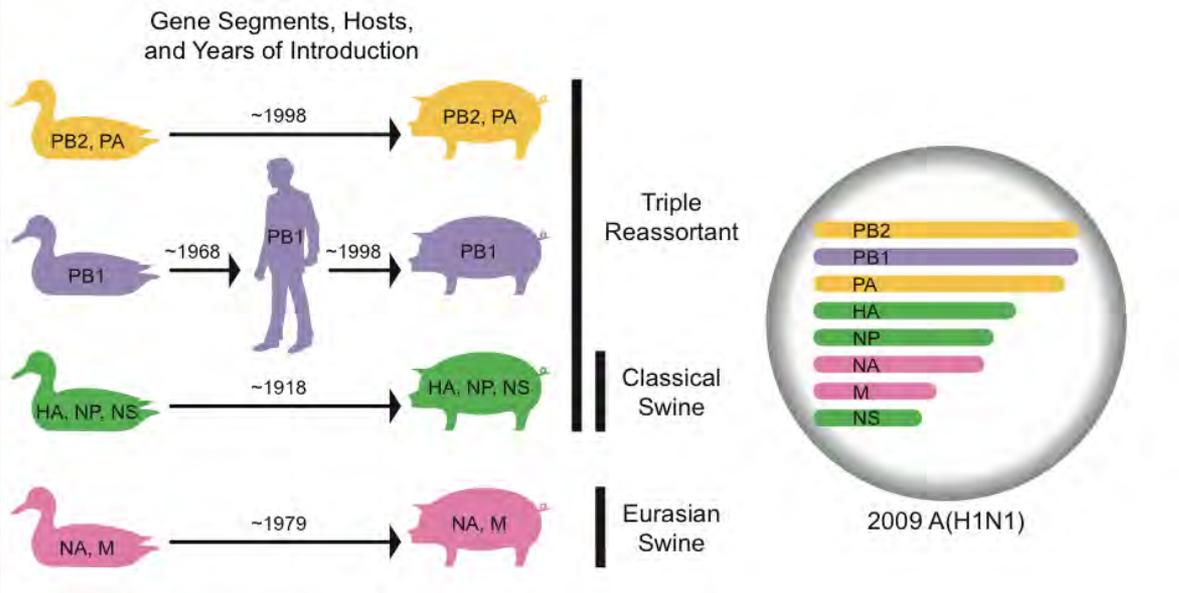




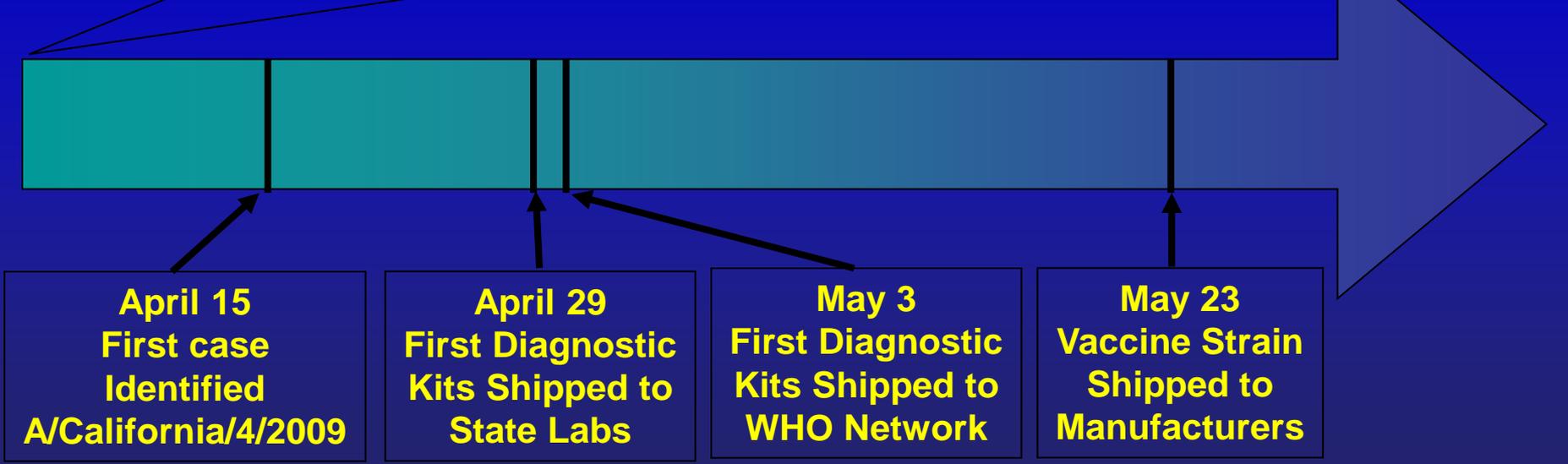
# Concept Note: FAO-OIE-WHO Collaboration

## Vision

**A world capable of preventing, detecting, containing, eliminating, and responding to animal and public health risks attributable to zoonoses and animal diseases with an impact on food security through multi-sectoral cooperation and strong partnerships**



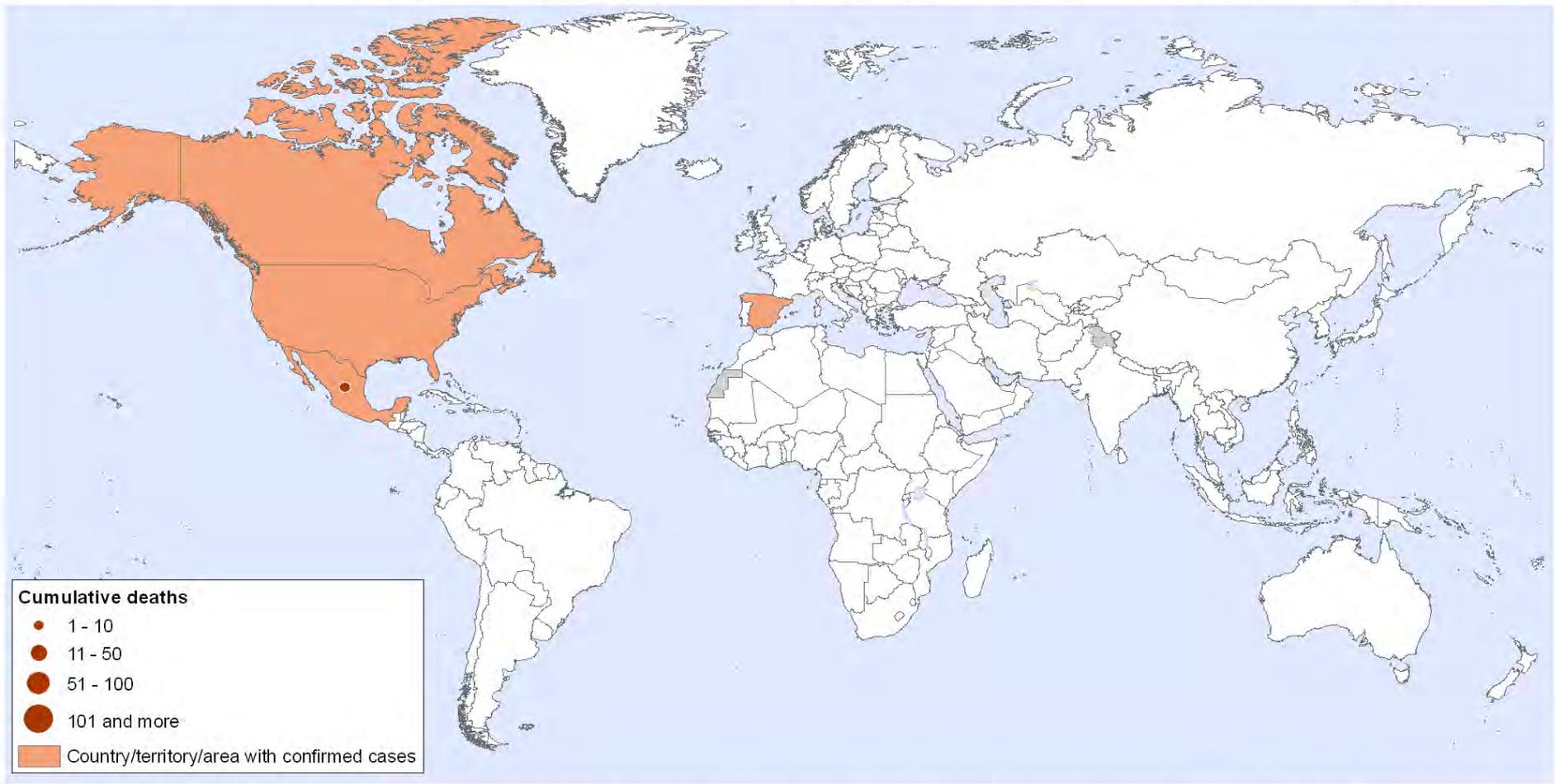
**First retrospectively detected case in San Luis Potosi, Mexico: 24 Feb 2009**



# Pandemic (H1N1) 2009

Status as of 27 April 2009

## Countries, territories and areas with lab confirmed cases and number of deaths as reported to WHO



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization  
 Map Production: Public Health Information and Geographic Information Systems (GIS)  
 World Health Organization



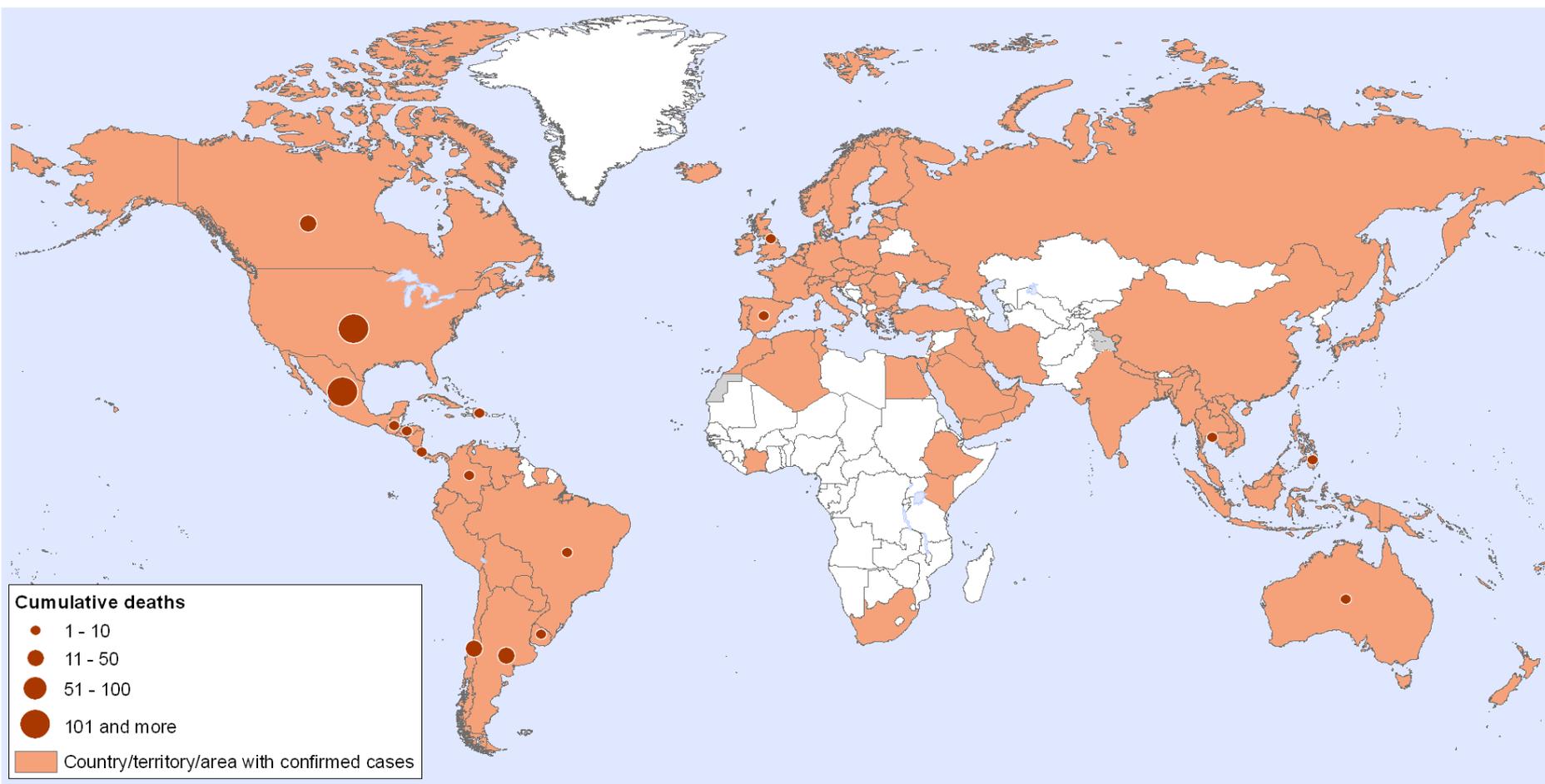
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Map produced: 08 October 2009 09:56 GMT

# Pandemic (H1N1) 2009

Status as of 01 July 2009

## Countries, territories and areas with lab confirmed cases and number of deaths as reported to WHO



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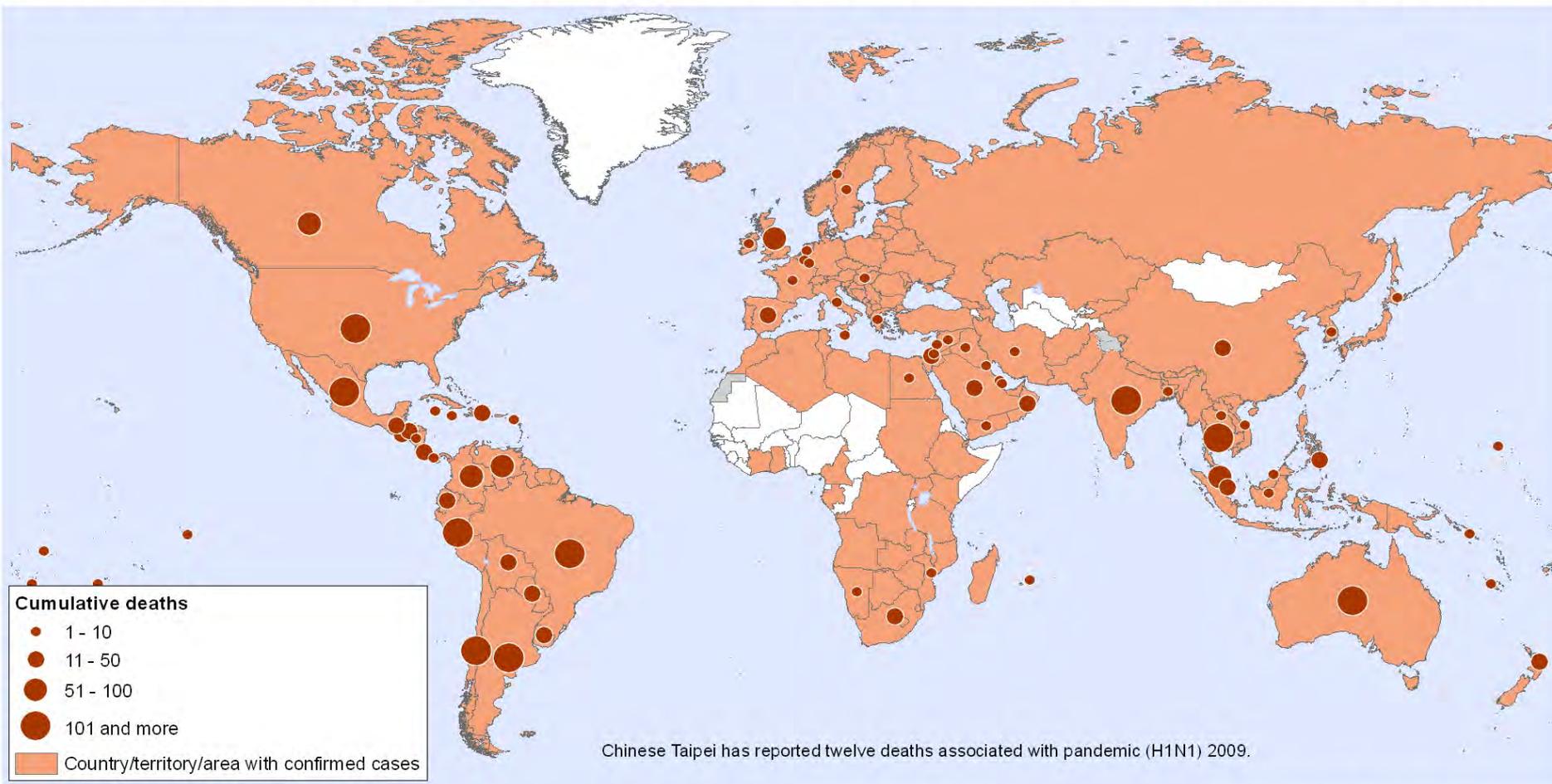


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# Pandemic (H1N1) 2009

Status as of 20 September 2009

## Countries, territories and areas with lab confirmed cases and number of deaths as reported to WHO



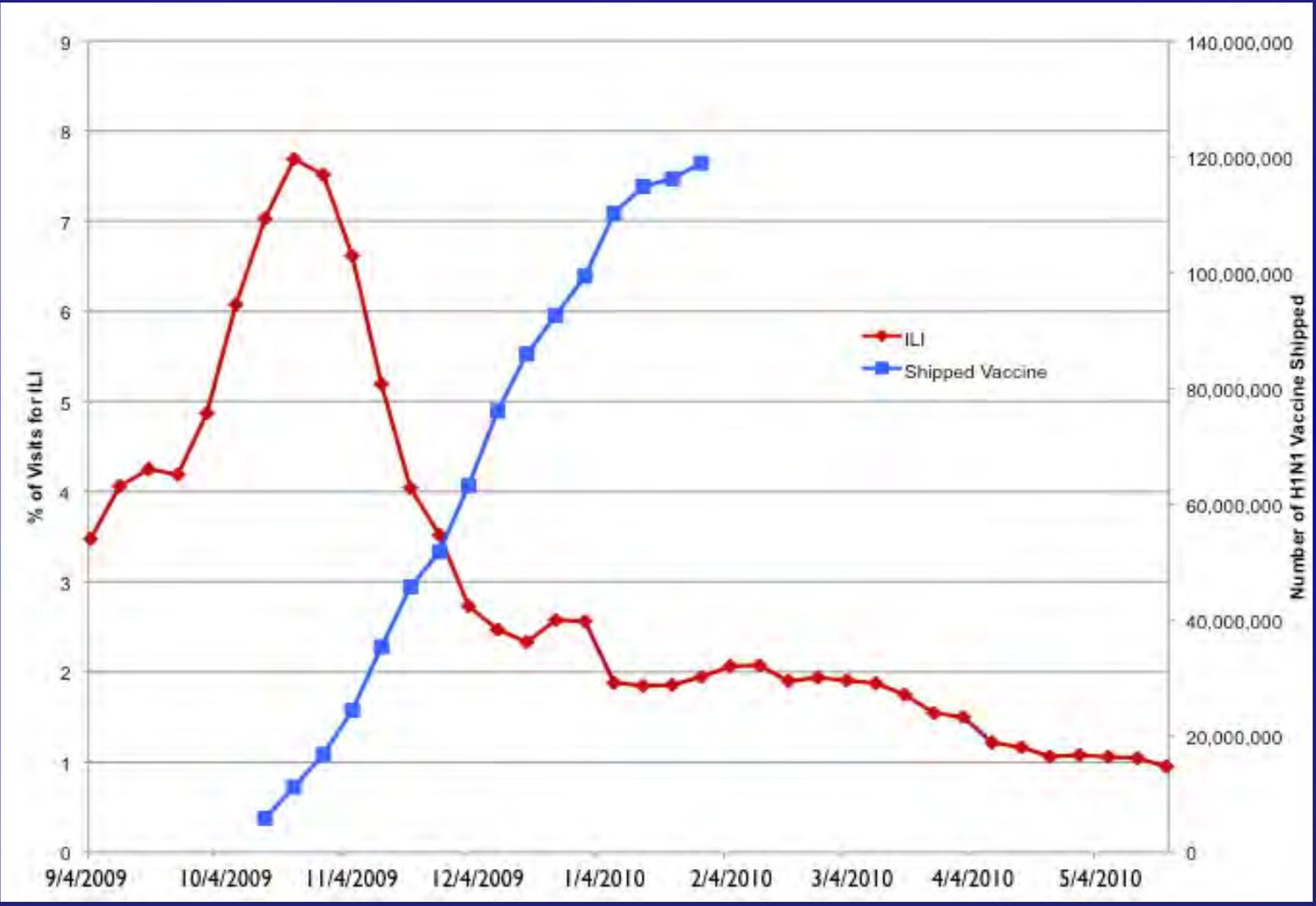
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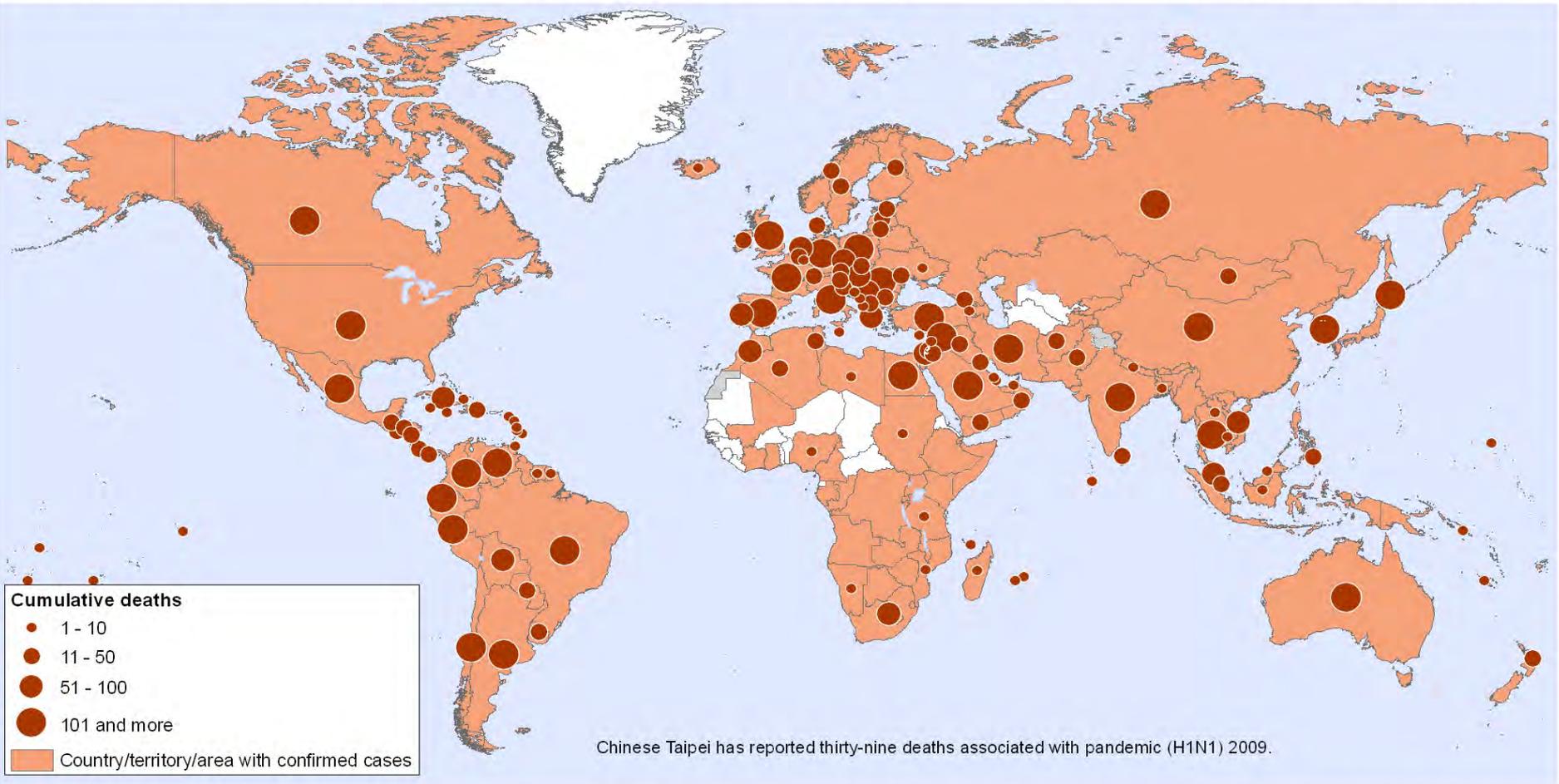
# 2009 H1N1 Pandemic Vaccine: The United States



# Pandemic (H1N1) 2009

Status as of 24 January 2010

## Countries, territories and areas with lab confirmed cases and number of deaths as reported to WHO



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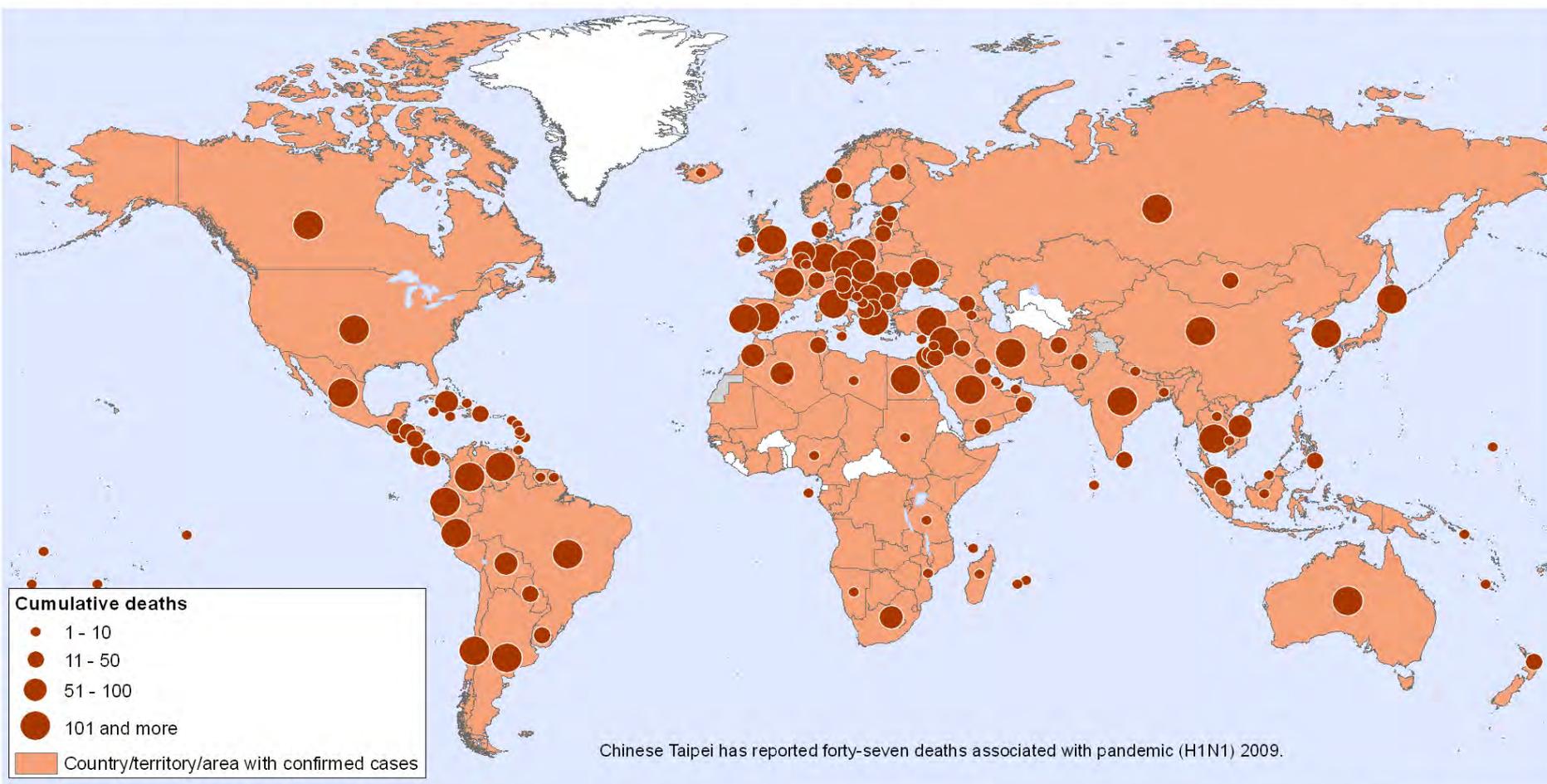
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Map produced: 15 April 2010, 15:15 GMT

# Pandemic (H1N1) 2009

Status as of 15 August 2010

## Countries, territories and areas with lab confirmed cases and number of deaths as reported to WHO



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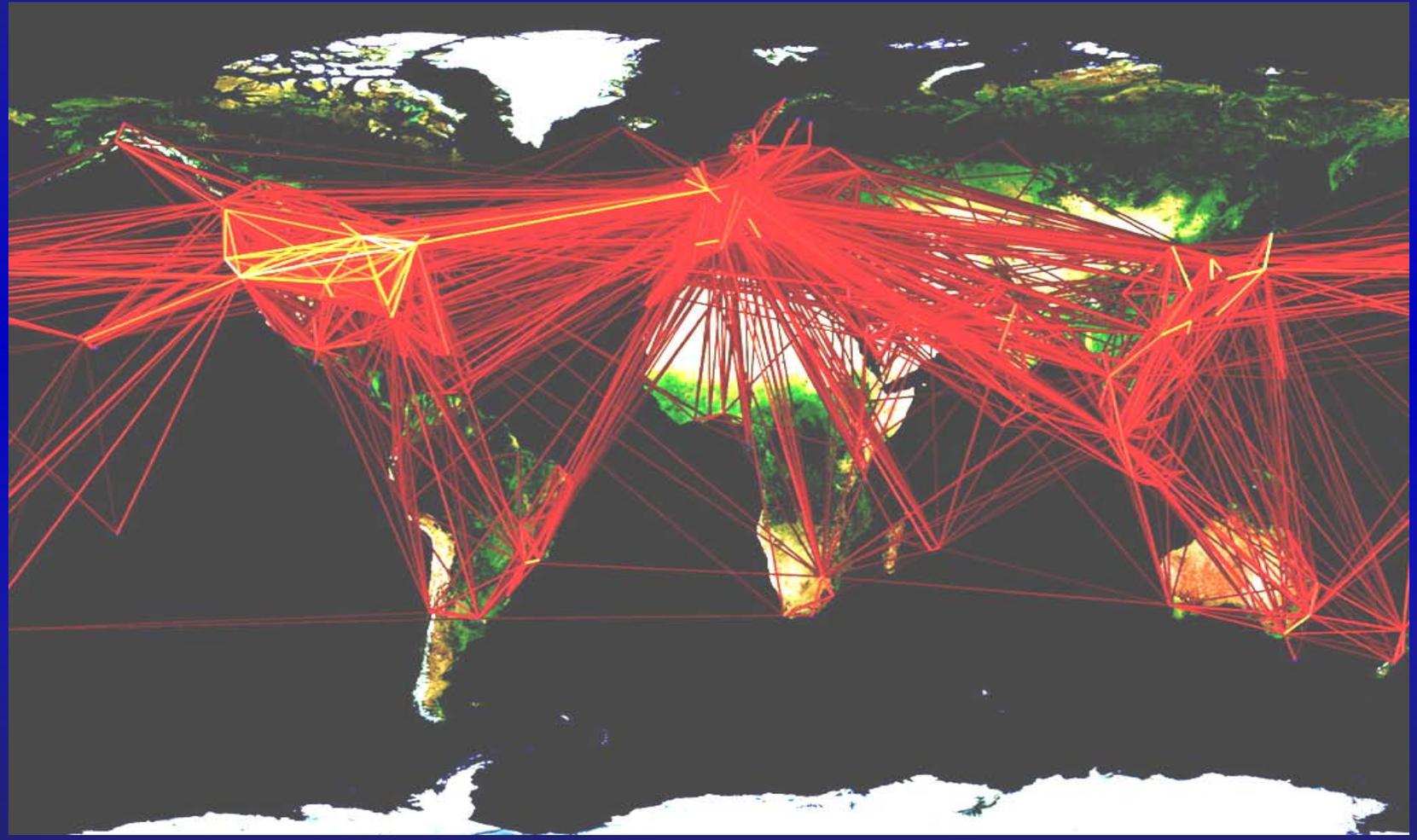
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Map produced: 19 August 2010, 11:30 GMT

# H1N1 pandemic





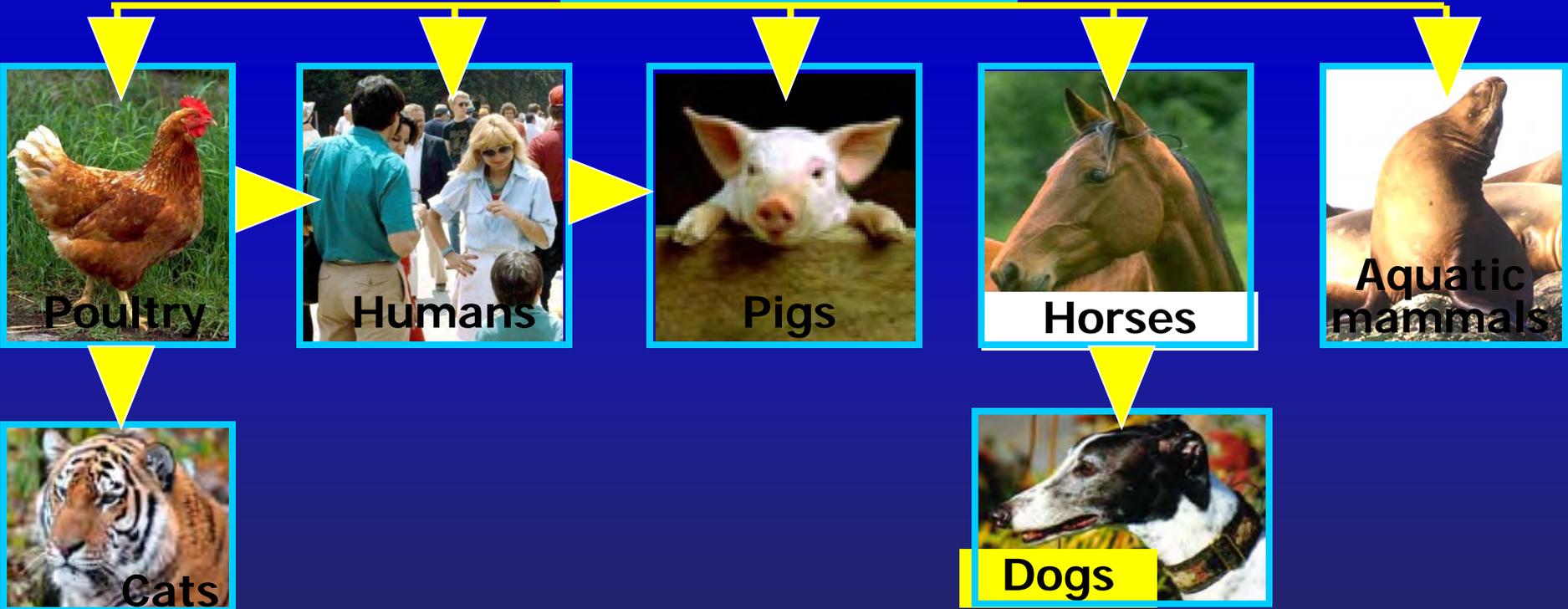
# What Did We Miss? What Must We Do Better?

- There were huge gaps in available information on swine influenza virus genetic diversity (Europe 339; US and Canada 249; Asia 204; Latin America and Africa 0 swine influenza sequences in GenBank)
- There were generally unrecognized public health benefits of understanding diversity of influenza viruses circulating in pigs; better understanding for avian species due to H5N1
- Need better surveillance in swine, birds, humans, etc.
- Need a better track record of processing collected specimens and quickly publishing data
- Need better data banks including metadata
- Need “push button pandemic risk assessment” for novel human/mammalian influenza infections
- Need joint projects for vaccine and dx test development

# Influenza A Viruses

➤ Aquatic birds reservoir for viruses with all HAs and NAs

- H1 - H16
- N1 - N9



# The Influenza Virus “Gene Pool”

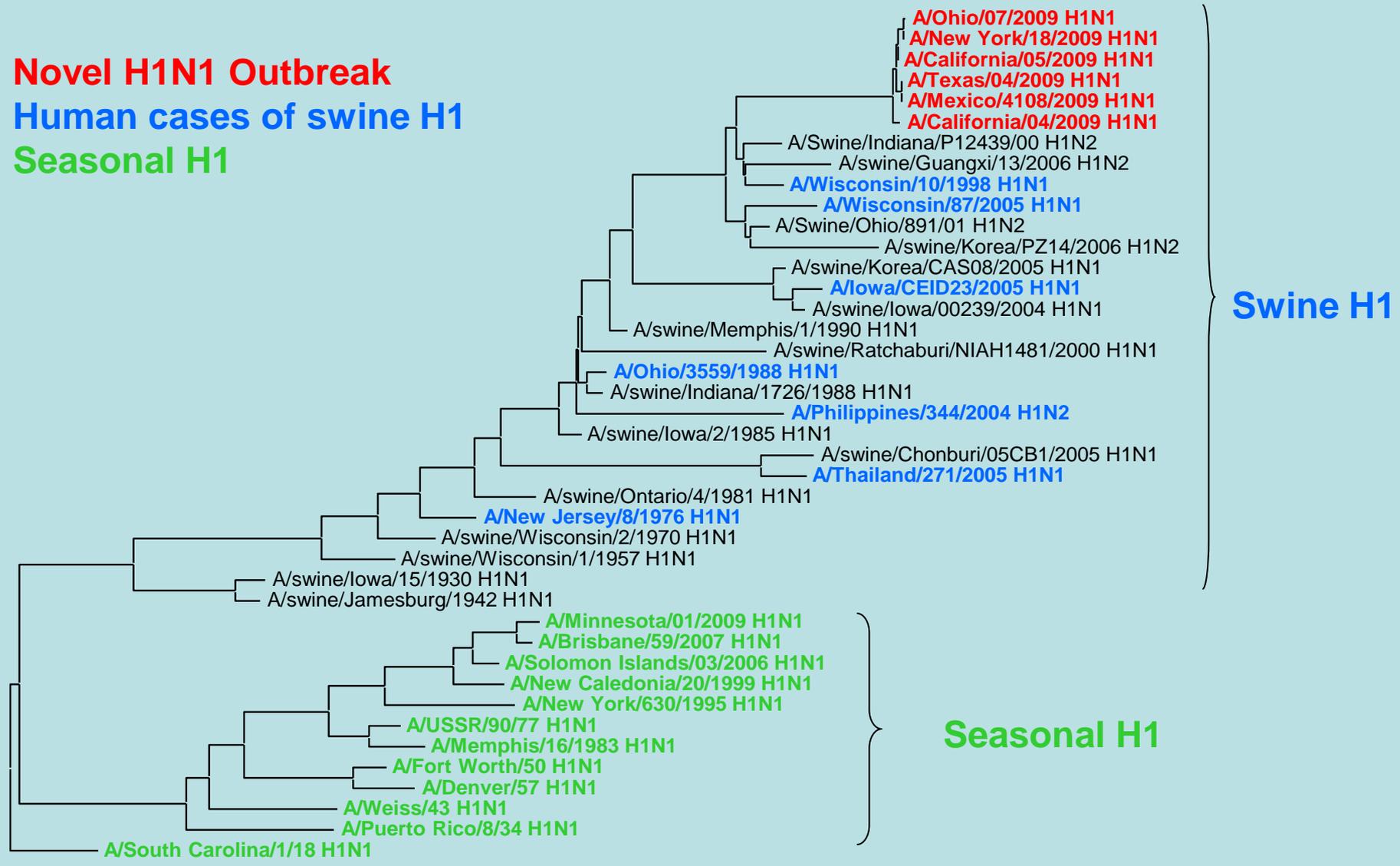
- **Historical literature and complex surveillance and gene sequence analysis of influenza viruses in nature suggests that gene segments of influenza A viruses are uniquely promiscuous within their primary aquatic bird reservoir - constant reassortment and transient gene constellations**
- **Much greater gene constellation stability appears to exist when a successful 8 segment gene constellation jumps from aquatic birds to infect a secondary host such as poultry, pigs, horses, humans etc.**
- **The adaption to the secondary host provides a “stabilized” 8 segment genome that then is transmitted onwards**

# Influenza Gene Mutation & Reassortment

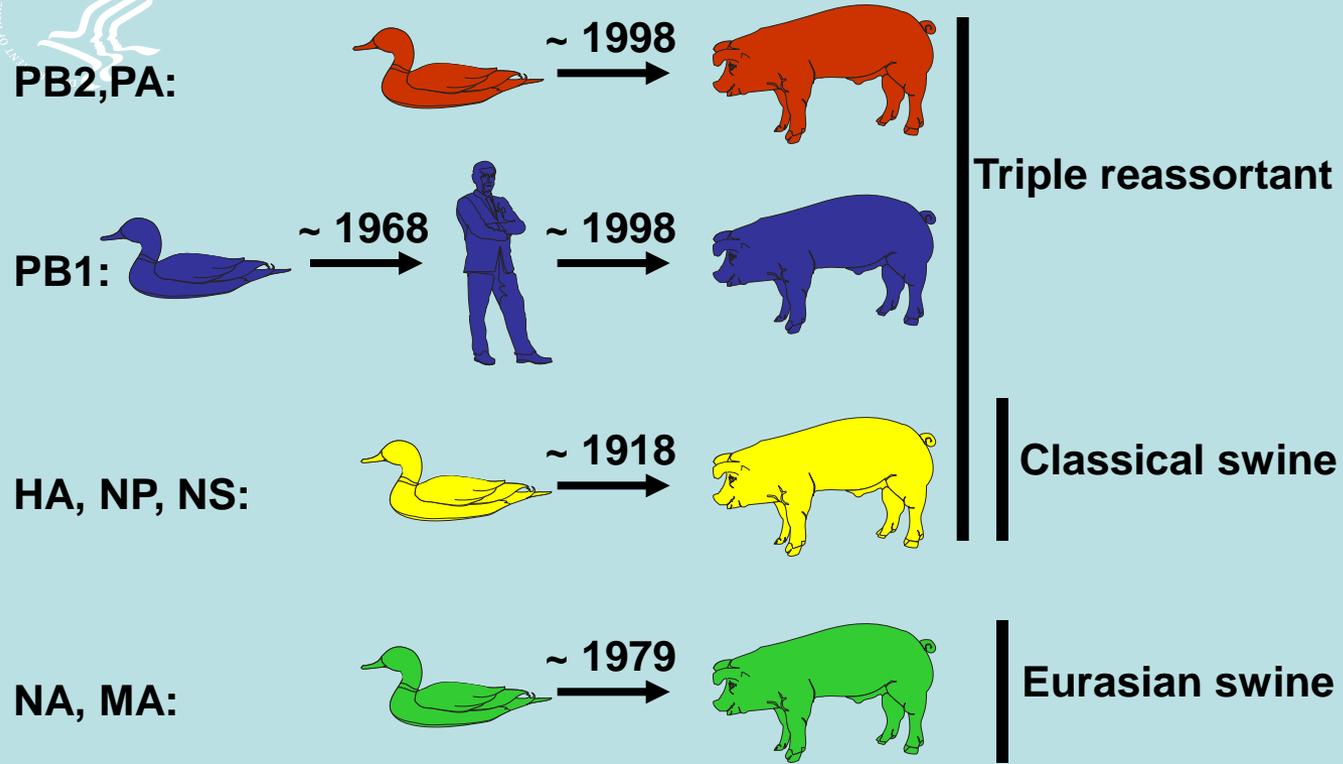


# Phylogenetic Tree of Hemagglutinin H1: Swine vs. Seasonal Influenza Viruses

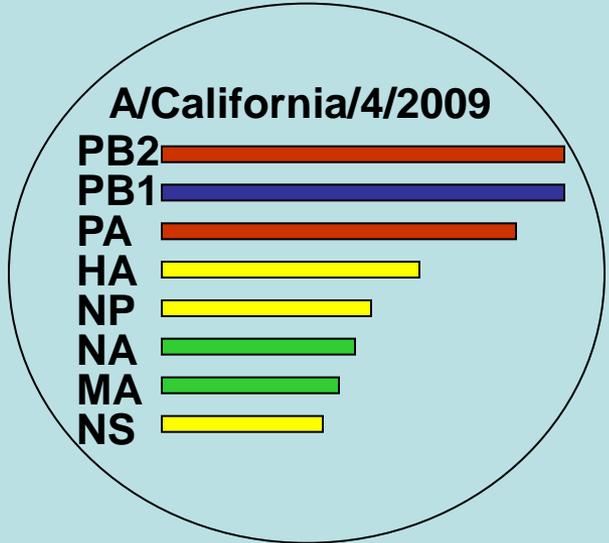
**Novel H1N1 Outbreak**  
**Human cases of swine H1**  
**Seasonal H1**



(Garten, et al Science 2009)



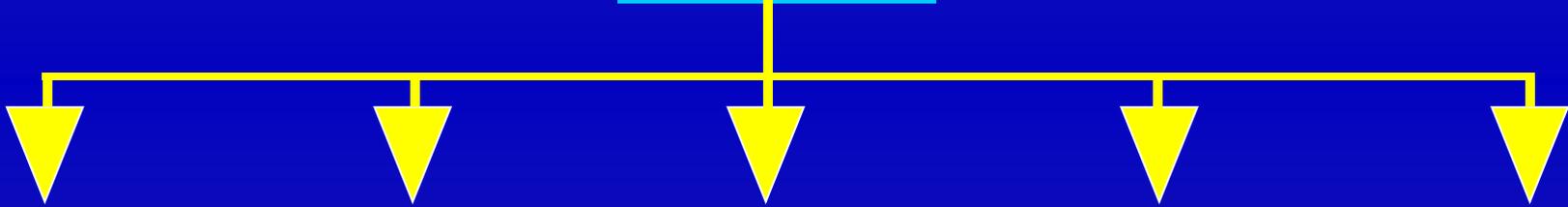
Genes originating from viruses of three animal species and two hemispheres



# 2009 H1N1 Pandemic Influenza Virus Transmission



Humans



Pigs



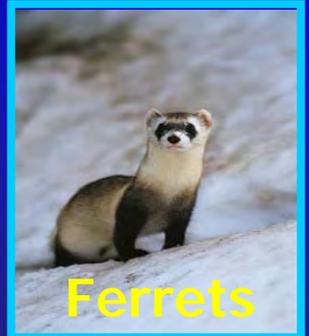
Turkeys



Cats



Dogs



Ferrets

# One Flu is a Public and Animal Health Partnership





# Getting Back to Push Button Risk Assessment

- Influenza pandemics and epidemics are unpredictable
- All human pandemic influenza viruses acquired some or all of their gene segments from the avian influenza A virus gene pool
- Diverse influenza A viruses are widely distributed globally in their natural reservoirs
- Once there is a jump into an “unnatural” host many things can occur: dead end replication; limited onward transmission; widespread transmission in a region; global pandemic
- Sporadic transmission to humans of a novel influenza virus is a red flag and public health risk assessment must occur



# Developing a Risk Assessment Algorithm

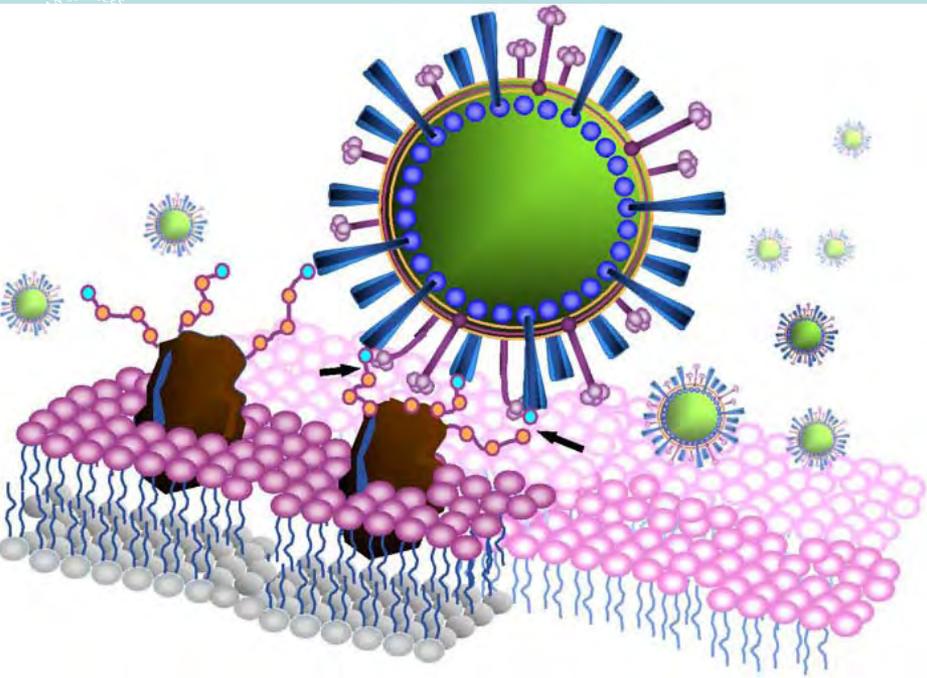
- Identify the elements to consider in risk assessment of threat to public health
- Define these elements
- Weight each element
- Come up with a composite score
- For high scoring viruses develop diagnostics and candidate vaccine libraries of high growth reassortants
- For very high scoring viruses develop pre-pandemic vaccines
  - Candidate vaccine library useful for human and animal health
  - Vaccine stockpiles
  - Pre-pandemic vaccine use to prime the population



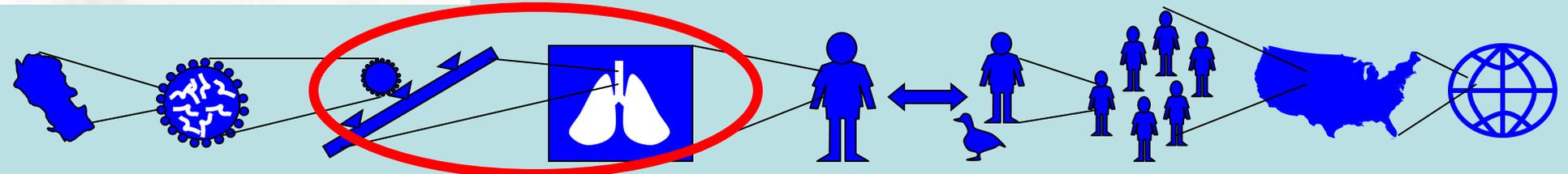
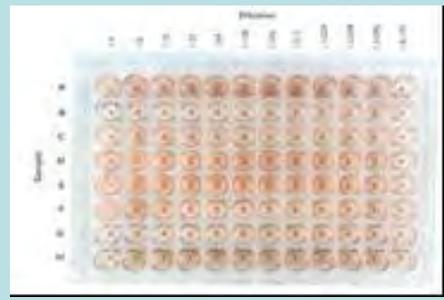
# Some Elements of a Risk Assessment Algorithm

- **Secondary hosts infected by the novel virus (including poultry, swine and other mammals, especially humans)**
- **Geographic spread of the virus in secondary hosts**
- **Transmissibility of infection**
- **Susceptibility of the population- seroprevalence**
- **Severity of infection**
- **Virus characterization**
  - **Genetic features such as virulence markers**
  - **Genetic and antigenic variation**
  - **Receptor binding properties**
  - **Pathogenesis**

# Understanding Transmission and Immunity as a Risk Assessment



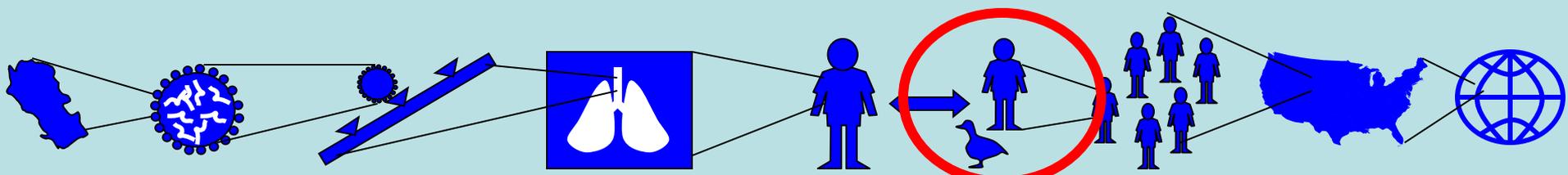
- Immunopathogenesis studies
- Transmission studies
- Receptor binding evaluation
- Glycan Arrays
- Microneutralization
- Hemagglutination inhibition studies
- Serologic studies



# Studies at the Human-Animal Interface



- Serologic surveys
- Anthropological and cultural evaluations
- Studies among persons exposed to H5N1
- Investigations of swine, canine, and avian influenza infections
- Novel Influenza Case Investigations





# **Risk Assessment is a Joint Human and Animal Health Endeavor**

- **Requires multidisciplinary approach**
- **Requires pooling information derived from many researchers around the globe**
- **Requires association of meta-data with genetic data**
- **Requires collaboration and constant refinement**
- **Requires a One Flu Approach**



# Lessons Learned from the H1N1 Pandemic



- Having influenza vaccines even 4-6 weeks earlier likely to make big difference in disease reduction and vaccine acceptance
  - » **THE FUTURE**
- Set goals: Move detection of novel influenza viruses closer to emergence & move the availability of vaccines prior to disease occurrence: What do we need?
  - Robust risk assessment of pandemic threats that involve a One Flu Approach
  - Library of truly HG reassortants tested and production-ready
  - Streamline influenza vaccine productions
  - Use of adjuvants for Ag sparing & more robust immune response
  - Improve influenza vaccine production capacity and use globally
  - Enhance partnerships domestically and globally
  - **NOW** is the time to act

# Thank you!

## Questions?

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