A grayscale electron micrograph of a virus particle, showing a spherical head and a tail-like structure, serving as a background for the title.

# **Viruses: Select Agents and Emerging Pathogens**

Patricia Bolívar MS., CLS, PHM

# Objectives

- Review Select Agent Viruses.
- Key features to recognize Smallpox virus
- Update on emerging Viruses of possible pandemic potential

# A Few Definitions

- Endemic: disease is always present in small numbers
- Epidemic: local outbreaks of a disease
- Pandemic: worldwide outbreak of a disease



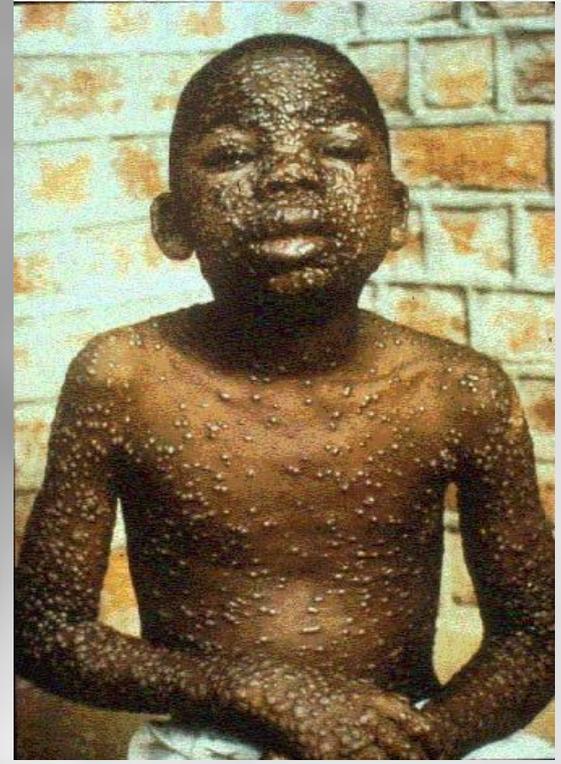
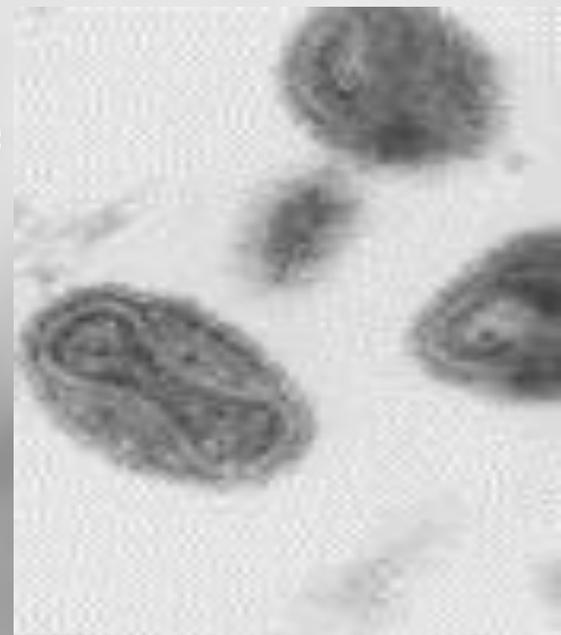
## Select Agents: Viral Hemorrhagic Fevers

### Ebola Virus

- Ebola and other hemorrhagic fevers are severe, often-fatal disease in humans
- Incubation period: 2 to 21 days. Abrupt onset of fever, headache, joint and muscle aches, sore throat, and weakness, followed by diarrhea, vomiting, and stomach pain. A rash, red eyes, hiccups and internal and external bleeding may be seen in some patients.
- Reservoir: animals (exact host unknown).
- Disease is acute in humans (no carrier state)
- Spread between people by contact with body fluids/blood
- Treatment: Patients receive supportive therapy.
- Prevention and control includes: Isolation of symptomatic patients

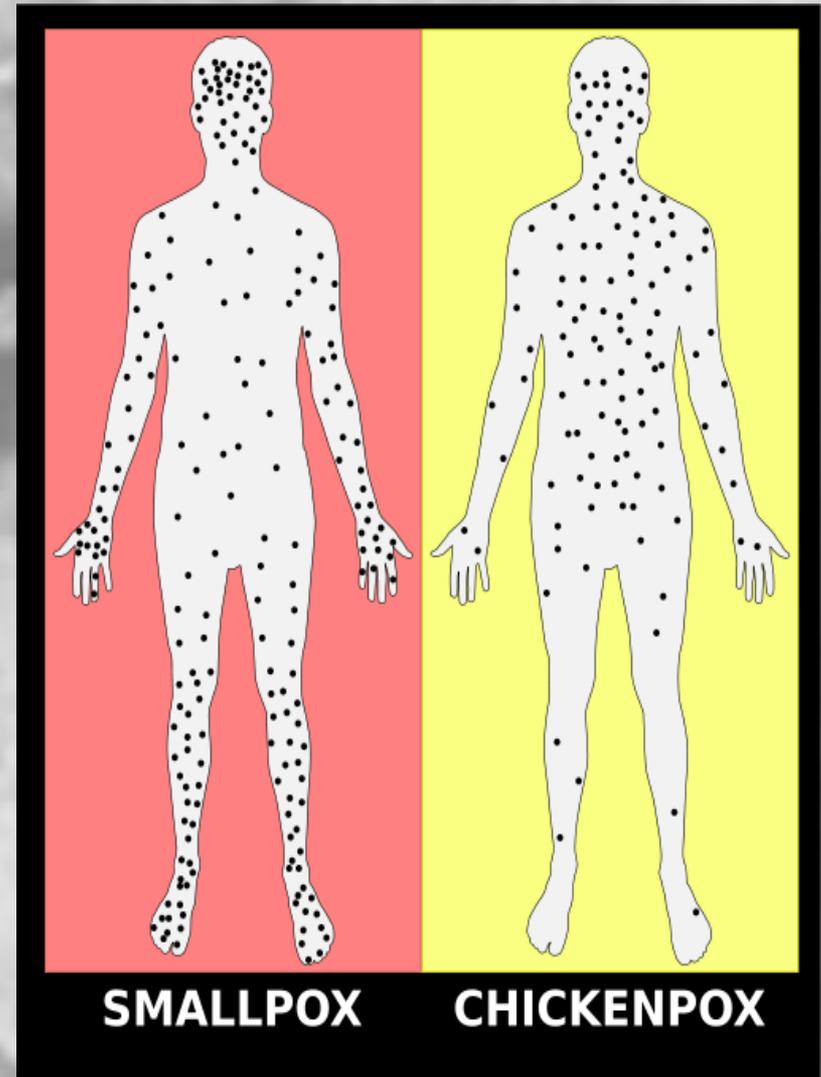
# Smallpox (Variola)

- Smallpox is a serious, contagious, and sometimes fatal infectious disease. There is no specific treatment for smallpox disease, and the only prevention is vaccination.
- Declared eradicated in 1979, 2 years after the last natural case in Somalia in 1977.
- The remaining known samples of Variola virus are held under secure containment at the CDC and in Russia.
- The entire population younger than 30 is fully susceptible to smallpox.



# Clinical Presentation of Smallpox

- Prodrome: fever and flu-like symptoms.
- Rash: first in the mouth and throat, then on the face, forearms, and hands.
- The distribution of the rash is centrifugal; profuse on the face and extremities; fewer in the center of the body.



# What isn't Smallpox: Chickenpox (Varicella)

- No or mild prodrome
- No history of varicella or varicella vaccination
- Superficial lesions “dew drop on a rose petal”
- Lesions appear in crops
- Lesions in DIFFERENT stages of development
- Rapid evolution of lesions
- Centripetal (central) distribution
- Lesions rarely on palms or soles
- Patient rarely toxic or moribund

# Differential Diagnosis: What isn't Smallpox

- Disseminated herpes zoster
- Impetigo
- Drug eruptions
- Contact dermatitis
- Erythema multiforme

# Bioterrorism and Smallpox

Smallpox is a high-priority Tier 1 agent for bioterrorism, defined as follows:

- Easily disseminated or transmitted from person to person
- High mortality rate and potential for significant public health effect
- Probable instigator of panic and social disruption
- Special actions required for public health preparedness

# Smallpox Diagnosis

*Orthopoxvirus* infections  
are readily diagnosed:

- PCR methods
- Requires Biosafety  
Level 3 Laboratory



# Preventable: Vaccination

- Edward Jenner demonstrated in 1796 that an individual could be protected against disease
- Presently, smallpox (Vaccinia) vaccine and Vaccinia Human Immunoglobulin (VIG), which is used to treat severe post-vaccination adverse effects, are available in the USA



# Always Something New: Influenza A Virus

- Family *Orthomyxovirus*, an RNA virus.
- Subtypes are based on the different hemagglutinin (HA) and neuraminidase (NA) molecules in the virus. There are 16 HA subtypes (H1-H16) and 9 NA subtypes (N1-N9). Example: H1N1.
- New Flu subtypes develop when more than one subtype “re-assorts” in an animal (pig or bird)
- Flu Pandemics are caused when:
  - People are exposed to new flu subtypes; no immune response.
  - Person to person transmission.
  - High Morbidity and Mortality

# Novel Viruses with Pandemic Potential

## Influenza A/H7 (Eurasian Lineage)

**A New Flu Virus:** On April 1, 2013 the World Health Organization reported a new influenza A (H7N9) human infection outbreak in China. The virus was detected in poultry. More than 130 infections reported contact with poultry. 43 people have died.

On April 19, 2013 it was determined that avian influenza A(H7N9) poses a significant potential for a public health emergency that has a significant potential to affect national security or the health and security of United States citizens living abroad.

**Ready to test:** On April 22, 2013, the FDA issued an Emergency Use Authorization (EUA) for the CDC Human Influenza Virus Real-Time RT-PCR Diagnostic Panel-Influenza A/H7 (Eurasian Lineage) Assay.

This virus has not yet developed the ability for person to person transmission. Wait and See.

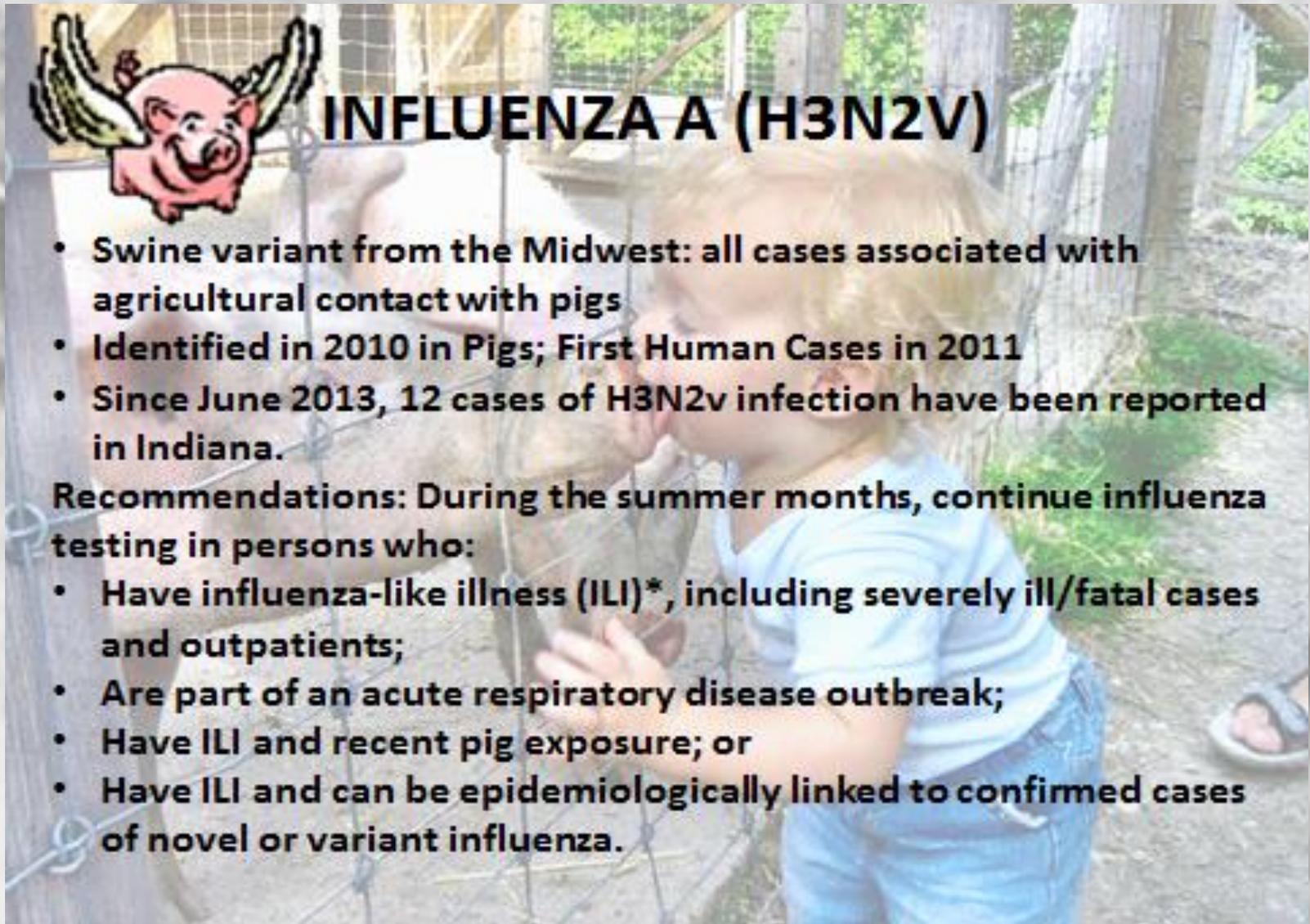


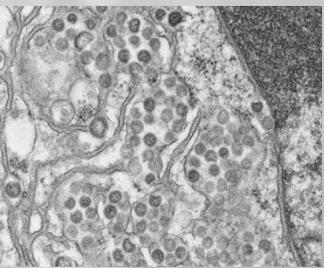
## **INFLUENZA A (H3N2V)**

- **Swine variant from the Midwest: all cases associated with agricultural contact with pigs**
- **Identified in 2010 in Pigs; First Human Cases in 2011**
- **Since June 2013, 12 cases of H3N2v infection have been reported in Indiana.**

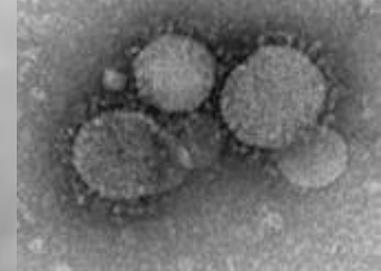
**Recommendations: During the summer months, continue influenza testing in persons who:**

- **Have influenza-like illness (ILI)\*, including severely ill/fatal cases and outpatients;**
- **Are part of an acute respiratory disease outbreak;**
- **Have ILI and recent pig exposure; or**
- **Have ILI and can be epidemiologically linked to confirmed cases of novel or variant influenza.**





# Emerging Disease: Middle East Respiratory Syndrome Coronavirus (MERS-CoV)



- **Middle East Respiratory Syndrome (MERS)** is viral respiratory illness first reported in Saudi Arabia in 2012. It is caused by a [coronavirus](#) called MERS-CoV.
- **Symptoms:** severe acute respiratory illness; fever, cough, and shortness of breath. About half of these people died.
- **Transmission:** Respiratory, close contact with ill people.
- Globally from September 2012 to July 7, 2013, WHO has been informed of a total of 80 laboratory-confirmed cases of infection with MERS-CoV, including 44 deaths.
- On May 29, 2013 it was announced that MERS-CoV poses a significant potential for a public health emergency.
- **Ready to test:** On June 5, 2013, the FDA issued an Emergency Use Authorization (EUA) for the CDC Novel Coronavirus 2012 Real-time RT-PCR Assay for its presumptive detection of MERS-CoV
- So far, the infection is not sustained in the community. Wait and See.