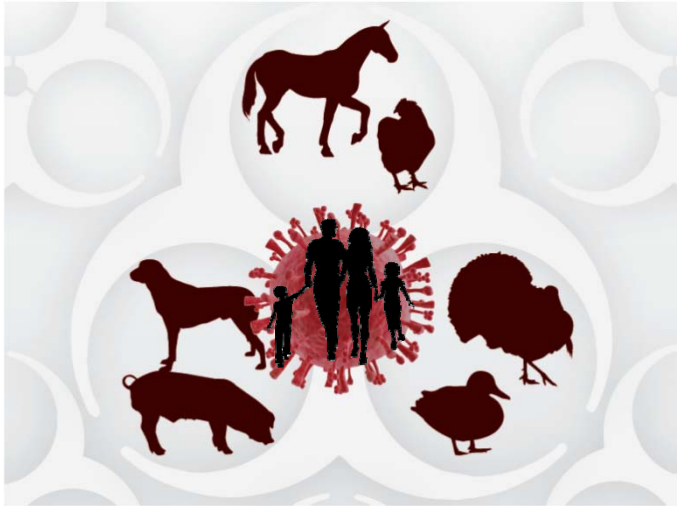
OPTIONS IX for THE CONTROL OF INFLUENZA
24–28 AUGUST 2016
Sheraton Grand CHICAGO Hotel
10 YEARS isirv International Society for Influenza and other Respiratory Virus Diseases

Influenza at the Animal-Human Interface



David E. Swayne[1], Amy Vincent[2], Tianna Brand[3], Gounalan Pavade[3], Gwen Dauphin[4], and Peter Daniels[5]

[1]U.S. National Poultry Research Center, Agricultural Research Service (ARS) U.S. Department of Agriculture (USDA), Athens, Georgia, USA; [2]National Animal Disease Center, ARS, USDA, Ames, Iowa, USA; [3]World Organisation for Animal Health (OIE), Paris, France; [4]Food and Agriculture Organization (FAO) of the United Nations, Rome, Italy; [5]Australian Animal Health Laboratory, Geelong, Australia

2016.isirv.org

David E Swayne, DVM, PhD
Laboratory Director
U.S. National Poultry Research Center
Agricultural Research Service (ARS)
U.S. Department of Agriculture (USDA)
Athens, Georgia, USA

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Grant/Research
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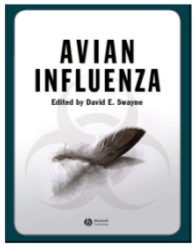
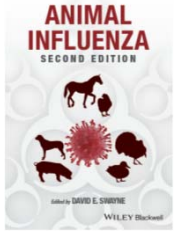
My presentation does not include discussion of off-label or investigational use



Presentation Overview



1. **OFFLU: Animal Influenza Expertise Network**
2. **Influenza A Virus at the Animal-Human Interface**
3. **Specific Strategies:**
    1. **Animal Influenza Surveillance – Ex. USA Swine Influenza Surveillance**
    2. **Pandemic Preparedness Vaccines**
    3. **Education for Proper Home Poultry & LPM slaughter**

1. OFFLU Network of Animal Influenza Experts

OIE (World Organization for Animal Health) and

FAO (Food and Agriculture Organization of the United Nations)

Animal InFLUenza Network: 6 continents, 26 countries, 60 experts

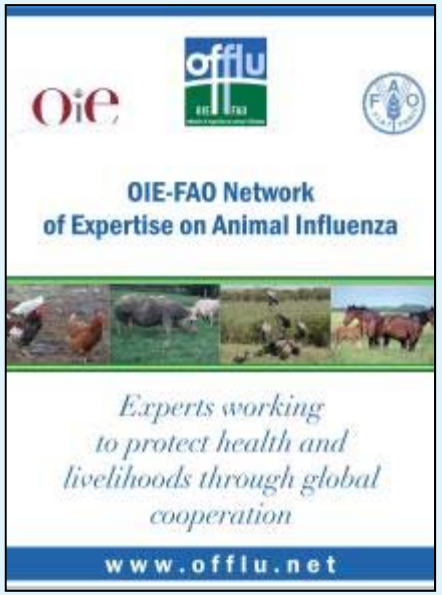
Avian (poultry and wild birds), equine and swine influenza expertise including OIE Reference Laboratories and FAO Reference Centres for Avian Influenza, OIE Reference Laboratories for Equine Influenza, OIE Collaborating Centres, OFFLU regional laboratory contacts for avian influenza, current members of OFFLU swine influenza group, and specific staff at OIE and FAO with responsibilities to OFFLU

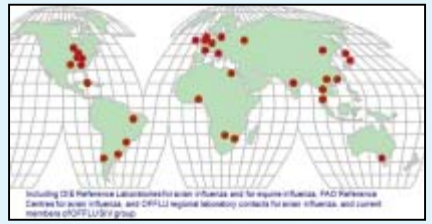
OFFLU

MISSION

- **Provide expertise for early recognition and characterization of emerging influenza viral strains in animal populations, and effective management of known infections, thereby better managing the risk to human health and promoting global food security, animal health and welfare, and other community benefits derived from domestic animals and wildlife**

- **Collaborate with the WHO and other public health organizations on issues relating to the animal-human interface, including pandemic preparedness for early preparation of human vaccine**





2005 – 2015 10 ANNIVERSARY

OFFLU OIE/FAO Network of...

www.offlu.net

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OIE/FAO
Network of expertise on animal influenza

ABOUT US | OFFLU PROJECTS | GUIDANCE | RESOURCE CENTRE | TRAINING | HUMAN-ANIMAL INTERFACE | MEETING REPORTS

OFFLU is the OIE-FAO global network of expertise on animal influenza working to reduce the negative impacts of animal influenza viruses by promoting effective collaboration between animal health experts and with the human health sector.

NEWS

12.08.13 New experts join OFFLU management Committee

Changes in the OFFLU Steering and Executive Committee

More +

30.04.13 The OIE press release

OIE expert mission finds live bird markets play a key role in poultry and human infections with...

More +

05.04.13 FAO press release on avian influenza A(H7N9) virus in China

Strong biosecurity measures required in response to influenza A(H7N9) virus

More +

PUBLICATIONS

OFFLU Annual Report 2012
More +

OFFLU RESEARCH AGENDA
More +

OFFLU SURVEILLANCE STRATEGY
More +

EVENTS

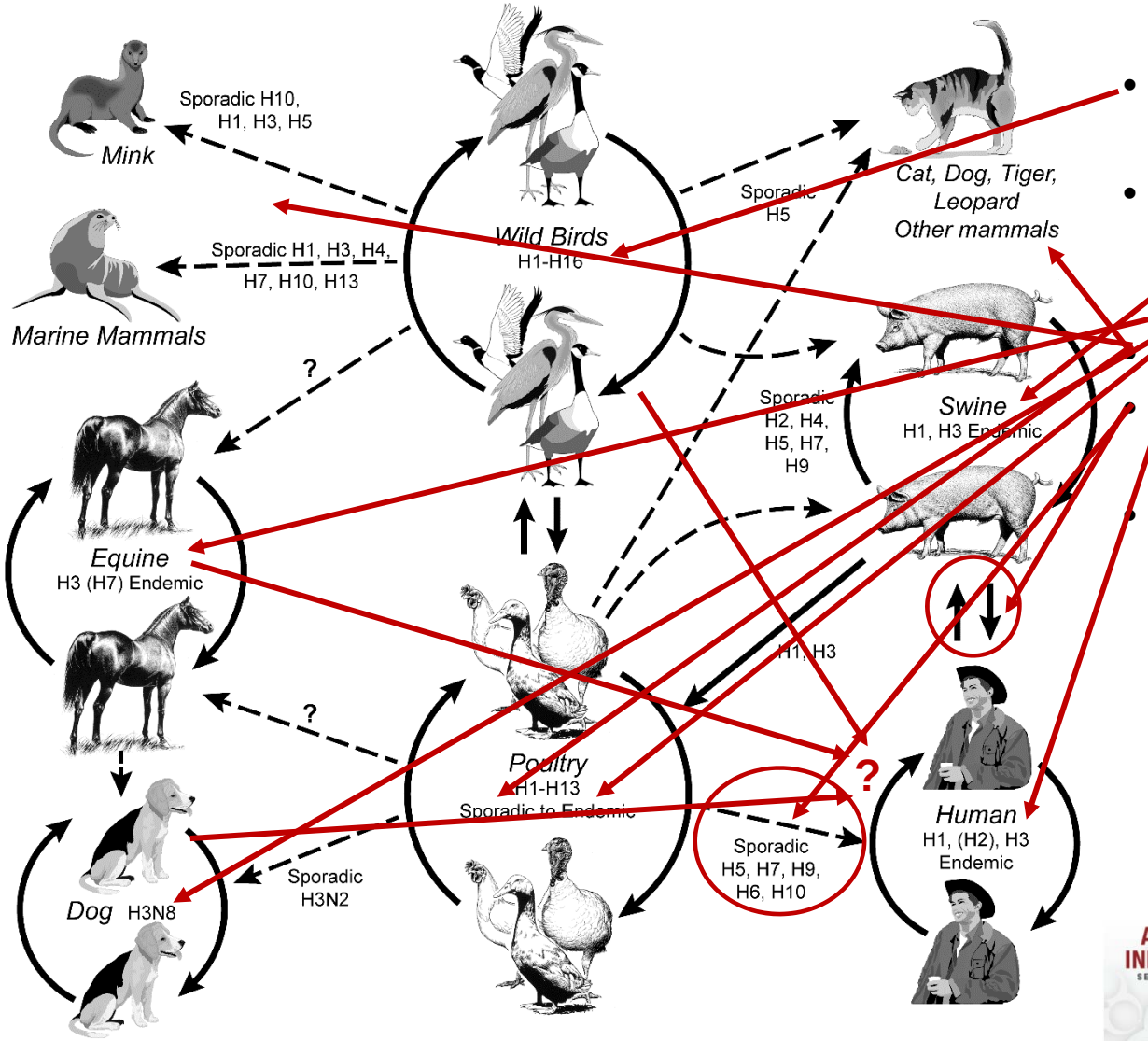
Avian Influenza A(H7N9) virus

For the latest information visit the Guidance and Resource Centre section at the top of our page

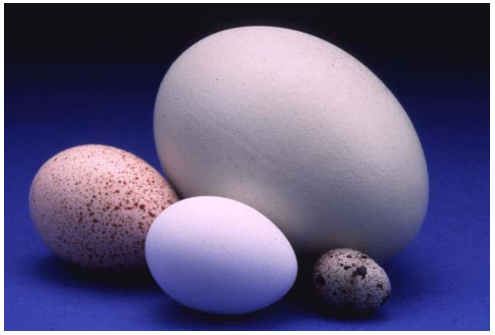
WAHID
World Animal Health Information Database
www.oie.int/wahid

EMPRES
Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES)
www.fao.org/EMPRES

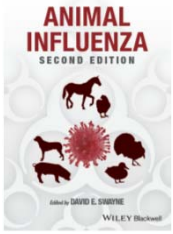
2. Influenza A Virus: Animal-Human Interface



- **Primordial reservoir of IAV genes**
- **Endemic IAV in animals**
  - **Global**
  - **Regional/National**
- **Sporadic IAV animals**
- **Infrequent transfer of whole viruses to humans**
- **Animal-Human interface**



Suarez, David. Influenza A Virus. In: Animal Influenza. DE Swayne ed. Wiley: Ames, Iowa. Pp. 92-132. 2016



Zoonotic Potential in Farmed Animals

An aspirational proposition?

Where animals are farmed to meet the needs of society, an informed society will require that the farming of these animals will not result in a health threat to people

Is animal influenza a threat to humans?

- **Highly pathogenic avian influenza H5Nx ... 854 human infections (450 deaths)**
- **Variant H3N2 in North American pigs ... 353 (0)**
- **Avian influenza A(H7N9) in China ... 793 (319)**
- **Low pathogenicity avian influenza A(H9N2) in Asia …. 16 (0)**
- **Pandemic H1N1 2009 globally .... ongoing**

(WHO 19 July 2015 Monthly Risk Assessment Summary - Influenza at the Human-Animal Interface: http://www.who.int/influenza/human_animal_interface/HAI_Risk_Assessment/en/)

Often identification of an infectious agent occurs in humans after human-to-human spread has begun, rather than in the animal from which it comes, and opportunities for control in animals and prevention of human infection are lost

(Chatham House (2010) *Shifting from Emergency Response to Prevention of Pandemic Disease Threats at Source)*

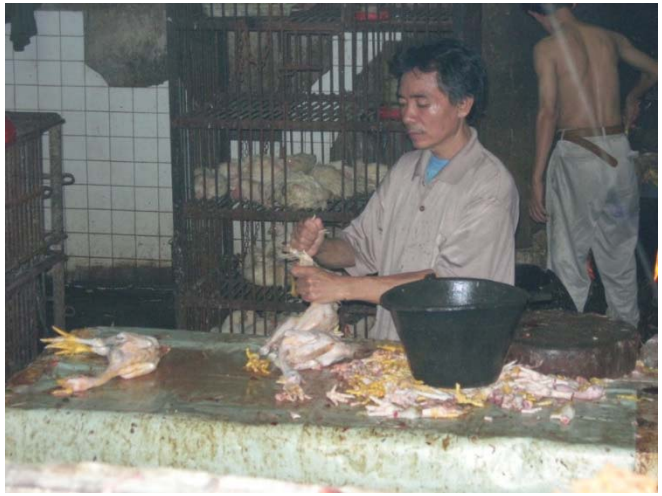
The threat to be managed…

- Possible emergence of a zoonotic influenza virus with the potential to cause a pandemic
- Identify the scenarios for emergence that would most likely enable animal influenza virus to cross to humans
- Take fair and rapid action

The main determinant of infectious animal disease is …….

HUMAN BEHAVIOR

Human behaviors (farming, marketing, etc.) allow the spread and transmission of infectious agent to succeed (anywhere along the "value chain")



Objectives (Benefits) of Surveillance

- **Early detection of animal influenza to facilitate control**
- **Early detection of genetic changes altering risks to human or animal health**
- **Early detection of phenotypic changes (antigenic, antiviral susceptibility, etc.) with implications for human or animal health**
- **Management of disease control programs**
- **Improved knowledge of viral epidemiology and disease pathogenesis**
- **Monitoring the performance of diagnostic tools**
- **Managing infections for more efficient animal production**
- **Detecting new infections (with modern technology)**

(Much excellent work is already being done)

(OFFLU Surveillance Strategy: http://www.offlu.net)

Factors that could contribute to inadequate surveillance

(the under assessment and under reporting of disease)

1. Inability

- **Inability to detect** — lack of awareness of benefits
- — lack of sampling and testing capacity
- **Inability to report** — No effective reporting and response chain

2. Unwillingness

- **Cost** — and lack of financial advantage or cost recovery
- **Negative consequences** — trade restrictions, movement bans
- — compulsory slaughter/no compensation
- **Loss of reputation** — national (loss of tourism), local (victimization)
- **No incentives** — no positive feedback or response plan

(World Bank 2010, *People, Pathogens and Our Planet* http://siteresources.worldbank.org/INTARD/Resources/PPP_Web.pdf)

Factors that could contribute to inadequate surveillance

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1. Inability — MUCH PROGRESS WITH THIS CHALLENGE!

- **Inability to detect** — lack of awareness of benefits
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2. Unwillingness — HUMAN BEHAVIORS CREATE HURDLES

- **Cost** — and lack of financial advantage or cost recovery
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Possible surveillance issues for farmers

1. **Who carries the cost?**
   - **Society? The whole value chain? Consumers?**

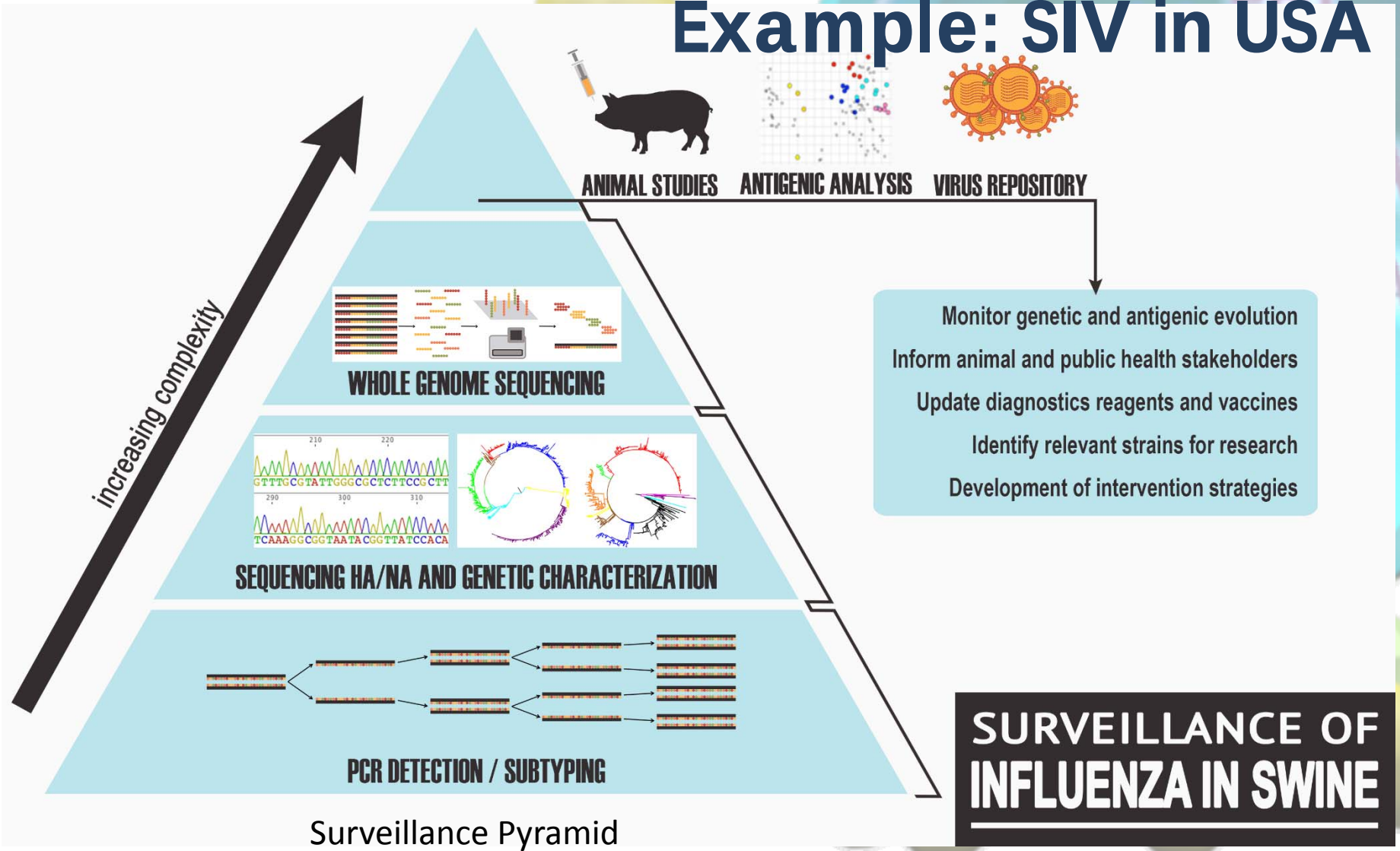
2. **What will be the response to findings?**
   - **Regulatory issues affecting business continuity**
   - **Public perception issues relating to profitability**

There is still too much uncertainty!

The informed debate is yet to be had,

The policy settings are yet to be developed.

3.1. How do we know what's out there? Example: SIV in USA

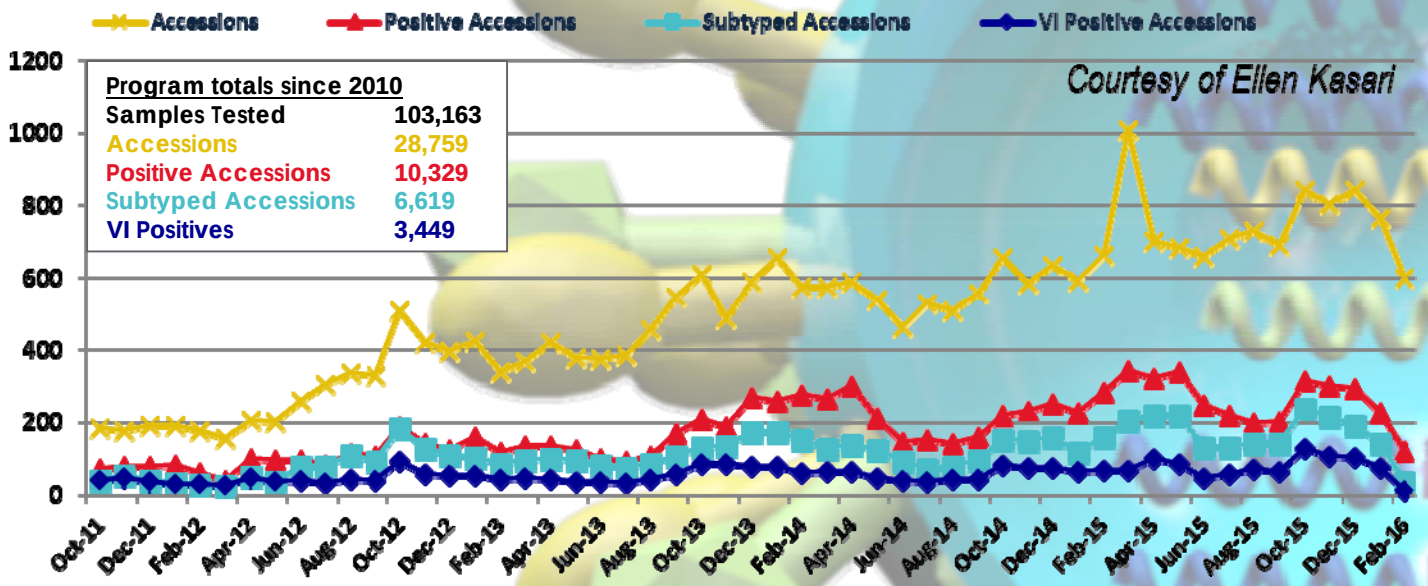


Surveillance Pyramid

https://www.pig333.com/swine-influenza/considerations-for-selecting-influenza-vaccines-for-swine_11238/

USDA IAV-S Surveillance

National Program Activities Oct. 2011 – Feb 2016

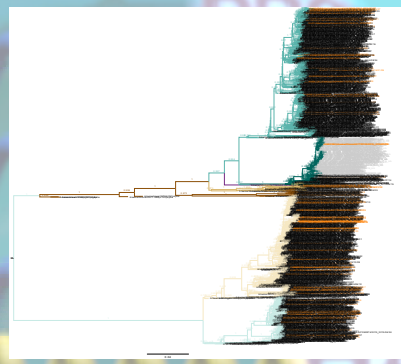


- USDA APHIS Veterinary Services system, active since 2009
- All virus isolates have HA, NA and M sequenced, WGS done for subset (**800**)
- Sequences in GenBank: USDA barcode A/swine/Arkansas/A01840698/2015
- Isolates available through USDA NVSL repository
  http://www.aphis.usda.gov/library/forms/pdf/VS_Form4_9.pdf
  Email your request to: **NVSL_Userfee@aphis.usda.gov**

NADC partners to do genetic, antigenic, and phenotypic characterization on viruses of interest

National Trends

- Dominant viruses detected in FY15 were gamma H1N1, delta-1 H1N2, Cluster IV-A H3N2, and delta2 H1N2.
- All viruses characterized in FY15 contained the pandemic-lineage M gene.
- The emerging human-like H3N2 continued to be detected with slightly increased frequency and spread to additional states (MO, AR, IA, MN, IN, IL, OH).
- Smattering of rare clades that don't get replaced by the dominant clades.

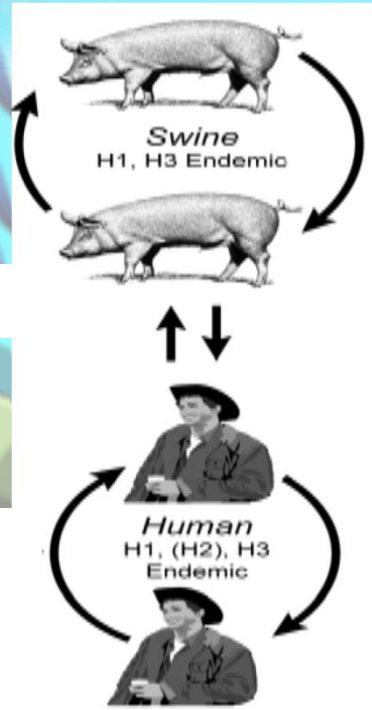


Genetic Analysis

Percentage of HA and NA combinations − Oct 2014 to Sept 2015

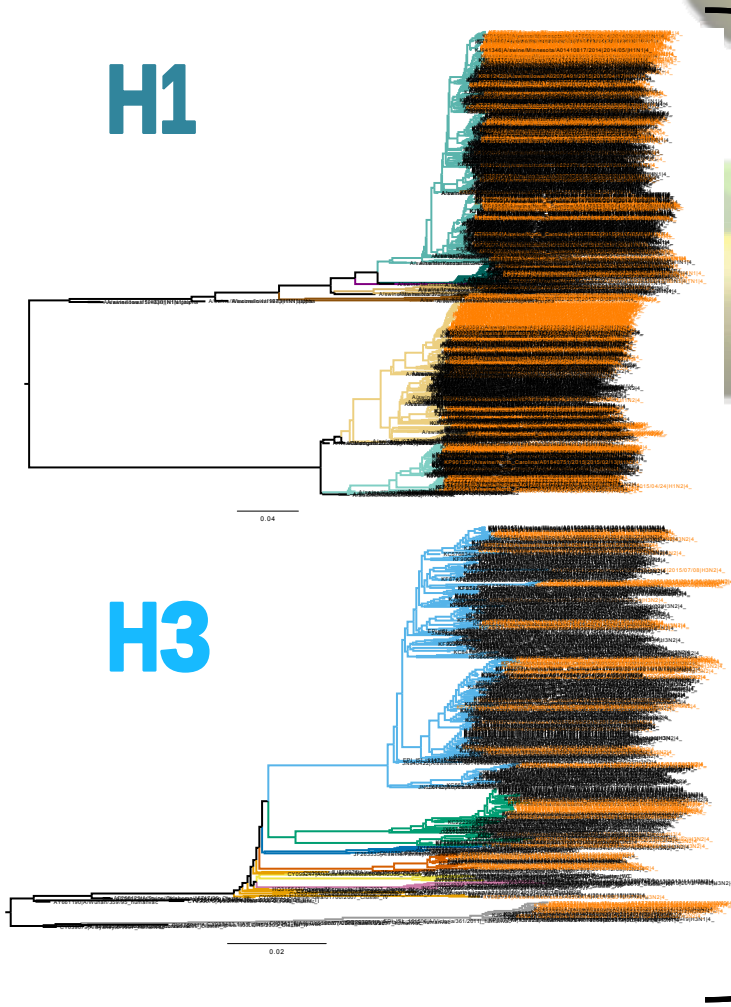
HA type \ NA type	N1.Classical	N1.Pandemic	N2.1998	N2.2002
H3.IV−E	0	0	0	2.11
H3.IV−D	0	0	0	0.23
H3.IV−C	0	0	0	0.12
H3.IV−B	0	0	0	4.69
H3.IV−A	0.12	0	0	17.35
H3.IV	0	0	0	0.12
H3.Human_H3	0.35	0	0	2.11
H1.pandemic	0	1.41	0	0
H1.gamma	34.58	0.12	0.12	0.82
H1.delta2	0.12	0	10.55	0.7
H1.delta1	0.12	0	0.23	22.16
H1.beta	0.12	0	0	0.23
H1.alpha	0	0	0	1.52

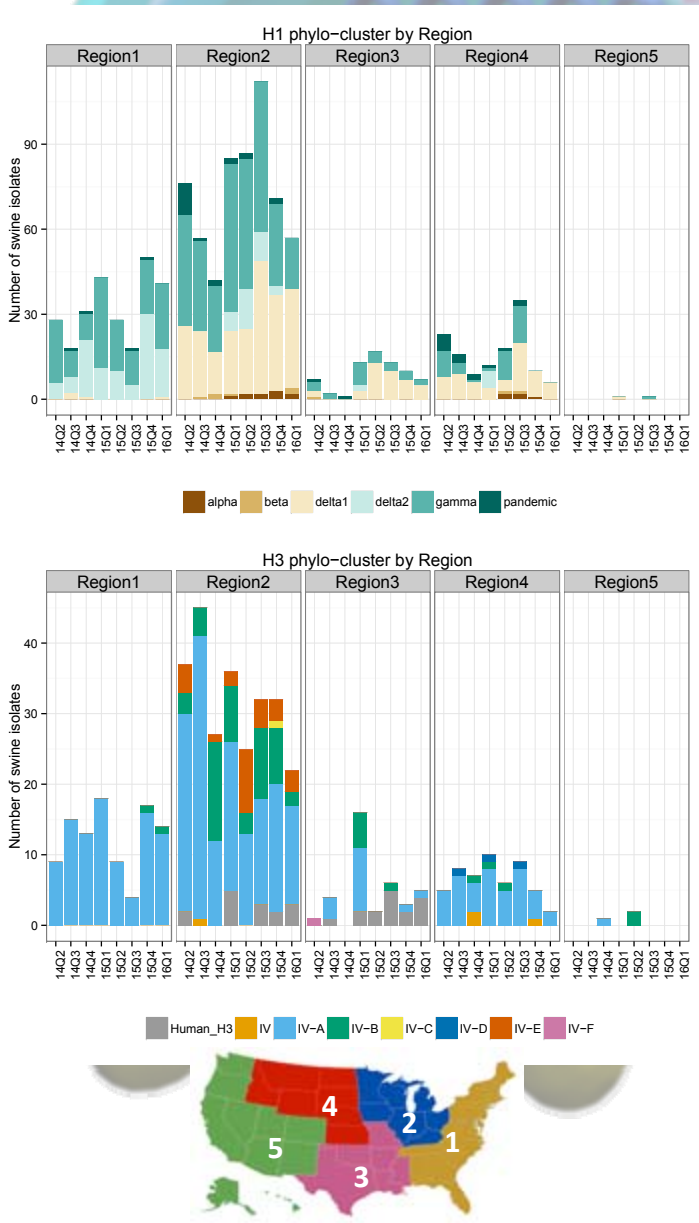
percent: 30, 20, 10, 0



Rasna Walia

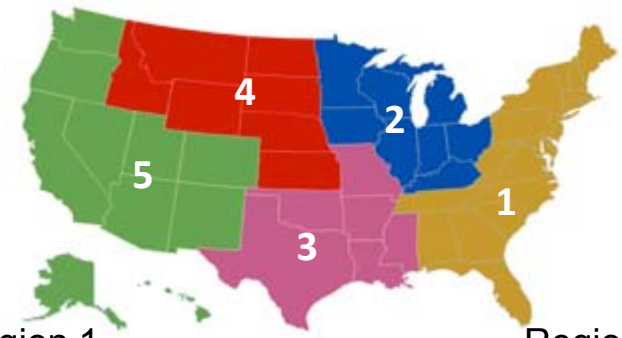
Regional Trends



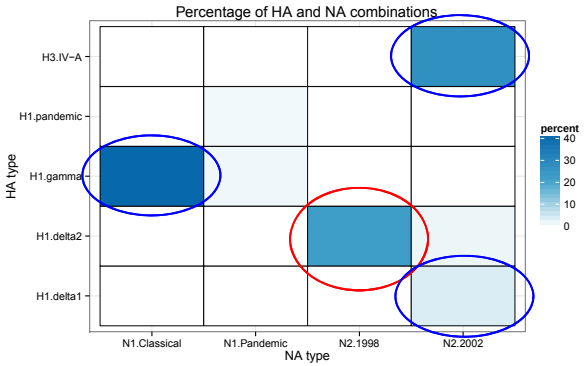


Rasna Walia

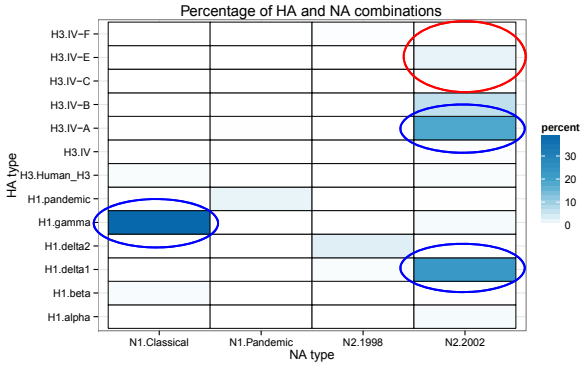
Regional patterns of HA/NA combinations



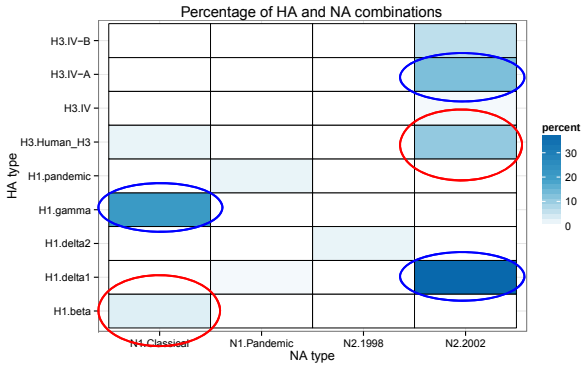
Region 1



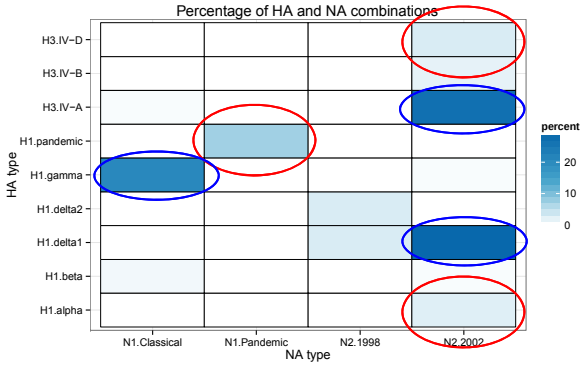
Region 2



Region 3



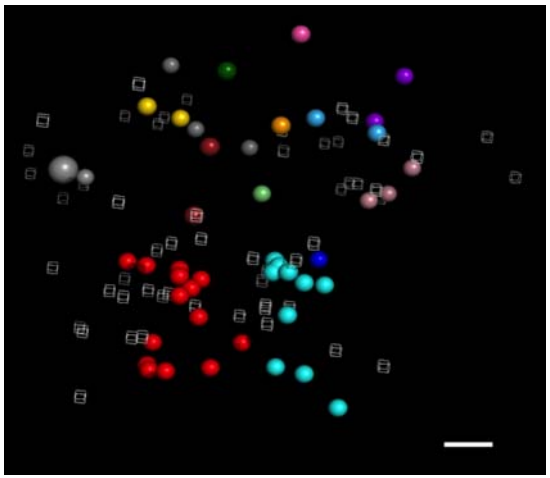
Region 4

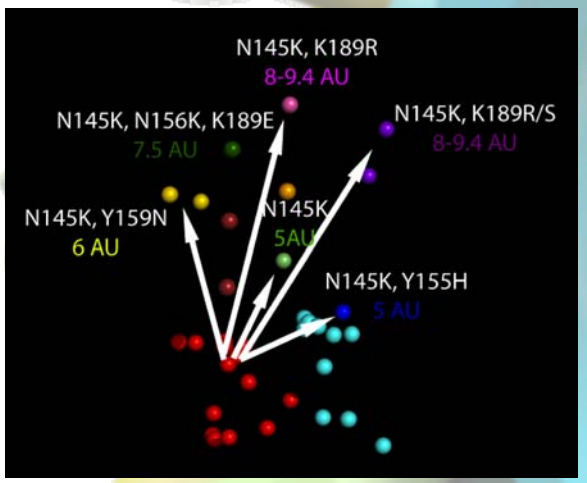


- **Common HA/NA combination across all regions**
- **Combinations more unique to a region**
- **Some regions demonstrate marked differences between states (not shown)**

Rasna Walia

Antigenic Analysis





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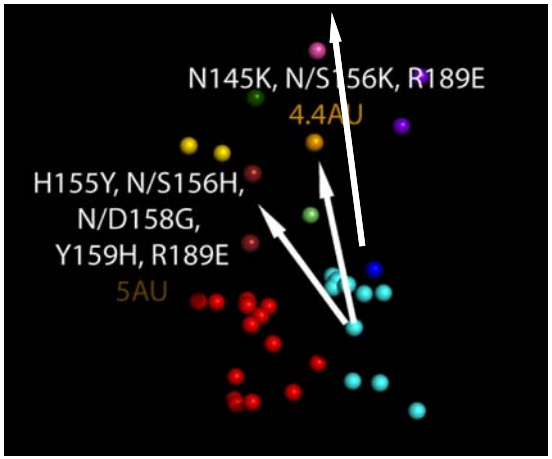

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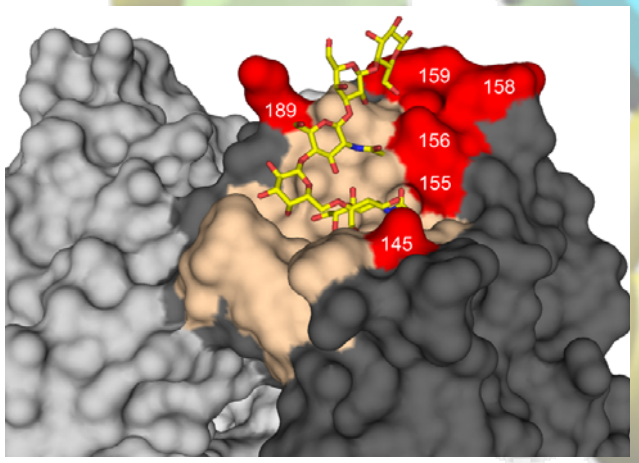
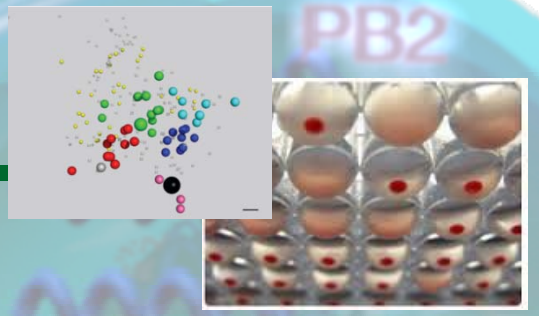
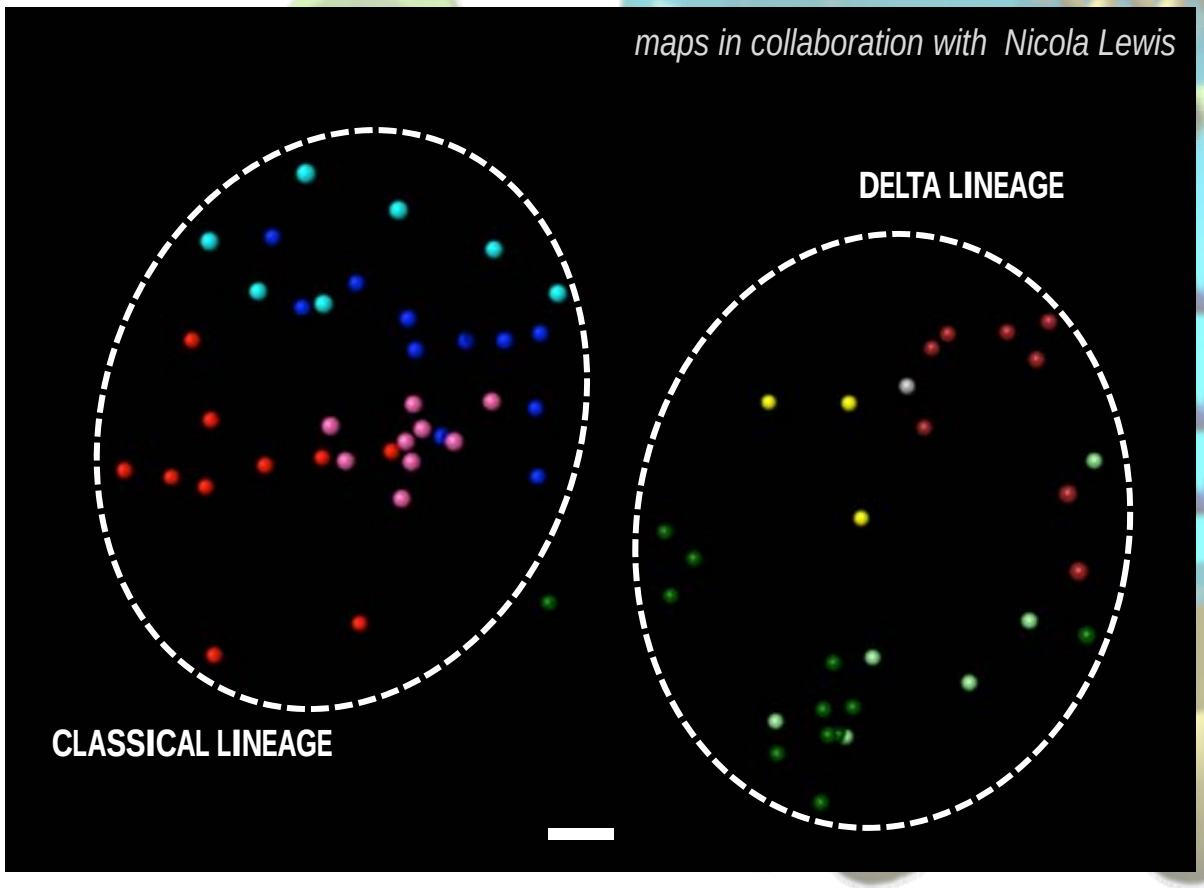




6 amino acid sites in the HA are correlated with antigenic drift of swine H3N2

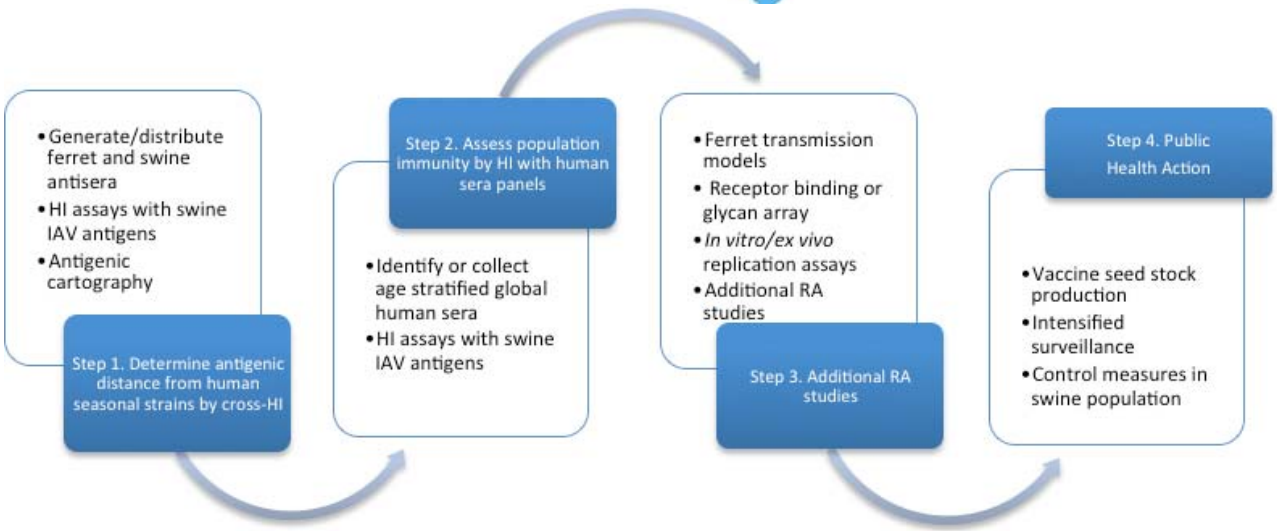
Lewis et al., Journal of Virology

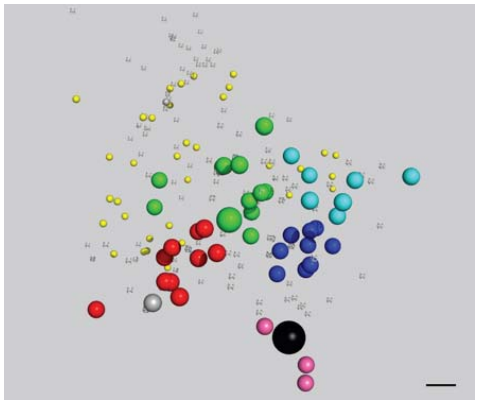
Antigenic diversity of swine H1



Daniela Rajao, unpublished

Swine Risk Assessment Pipeline

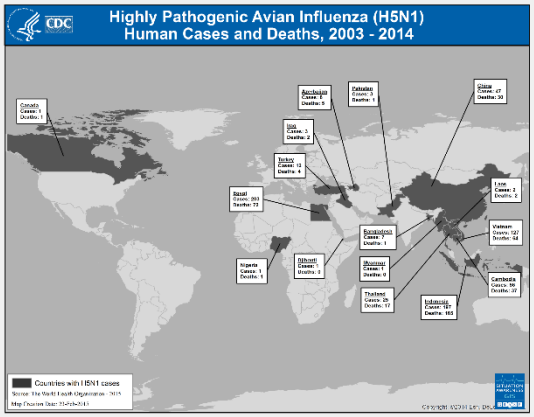




CRIP

CEIRS
Centers of Excellence for Influenza Research and Surveillance

3.2 Public Health Mitigation: Pandemic Preparedness Vaccine

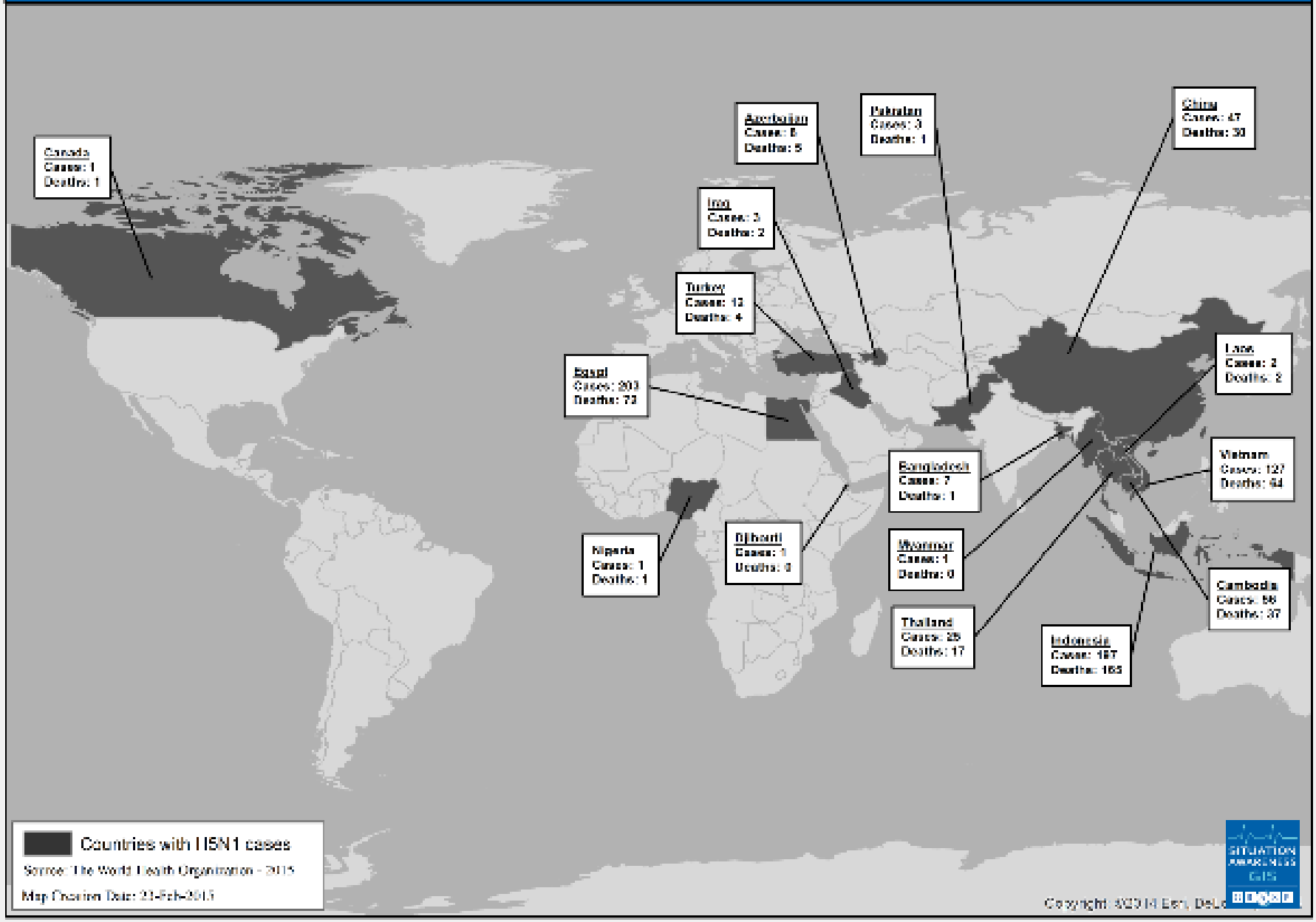


H5N1 (N6) Gs/GD HPAIV

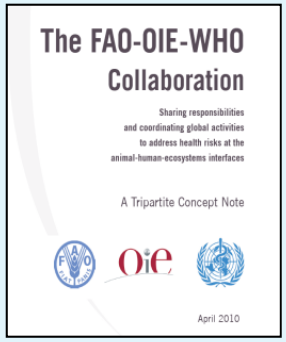
Country	2003-2009*		2010-2014**		2015		2016		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths
Azerbaijan	8	5	0	0	0	0	0	0	8	5
Bangladesh	1	0	6	1	1	0	0	0	8	1
Cambodia	9	7	47	30	0	0	0	0	56	37
Canada	0	0	1	1	0	0	0	0	1	1
China	38	25	9	5	6	1	0	0	53	31
Djibouti	1	0	0	0	0	0	0	0	1	0
Egypt	90	27	120	50	136	39	8	1	354	117
Indonesia	162	134	35	31	2	2	0	0	199	167
Iraq	3	2	0	0	0	0	0	0	3	2
Lao People's Democratic Republic	2	2	0	0	0	0	0	0	2	2
Myanmar	1	0	0	0	0	0	0	0	1	0
Nigeria	1	1	0	0	0	0	0	0	1	1
Pakistan	3	1	0	0	0	0	0	0	3	1
Thailand	25	17	0	0	0	0	0	0	25	17
Turkey	12	4	0	0	0	0	0	0	12	4
Viet Nam	112	57	15	7	0	0	0	0	127	64
Total	468	282	233	125	145	42	8	1	854	450

*(As of 7/19/16, WHO)

Highly Pathogenic Avian Influenza (H5N1)
Human Cases and Deaths, 2003 - 2014



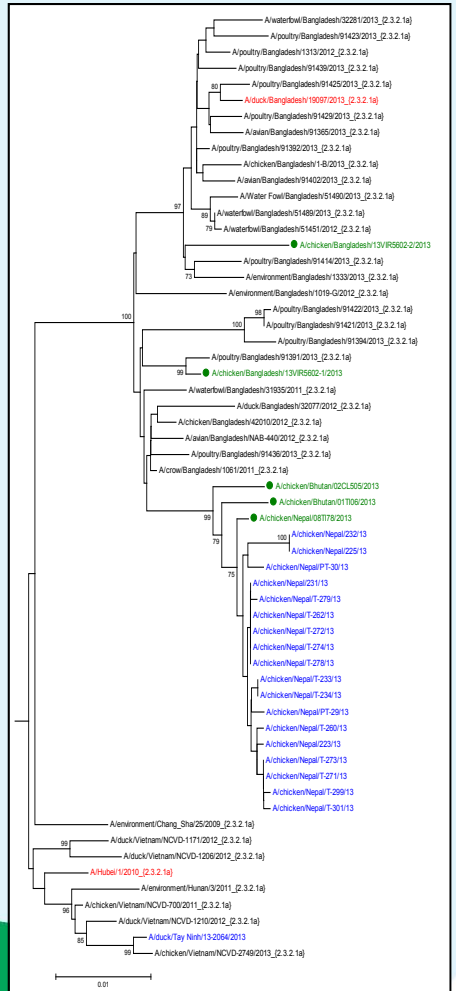
OFFLU – WHO agreement



- **Every six months OFFLU gather and analyse information on animal influenza viruses of public health concern and share that information during the WHO Vaccine Composition Meetings**

- **OFFLU contribution includes:**
  - Overview of epidemiologic situation for HPAI H5N1 in animals
  - Phylogenetic trees for HPAI H5N1
  - Antigenic testing of specified isolates using ferret derived antisera
  - Information for other animal influenza viruses considered to be of public health concern such as H9, H7 and other H5 subtypes

- **Information assists WHO in the selection of most appropriate circulating viruses for updating human vaccines for pandemic preparedness**



Summary of AI sequence data contribution

VCM meeting	H5 sequences	Countries	H7/H9 sequences	Countries
Feb 2012	35	4	38 H9	8
Sept 2012	135	9	17 H9	4
Feb 2013	93	6	14 H9	3
Sept 2013	47	7	46 H9	5
Feb 2014	7	4	11 H9	5
Sept 2014	40	6	6 H7/H9	2
Feb 2015	46	10	11 H7/H9	2
Sept 2015	91	19	4 H7/H9	2
Feb 2016	59	14	27 H9	4

Influenza
- Surveillance and monitoring
- GISRS and laboratory
- PIP Framework
- Vaccines
  - Vaccine viruses
  - Vaccine use
- Patient care
- Human animal interface
- Public health preparedness
- Information resources

Antigenic and genetic characteristics of zoonotic influenza viruses and candidate vaccine viruses developed for potential use in human vaccines

25 February 2016

This summary provides a review on the zoonotic influenza virus activity and virus characterization, and describes the current status of the development of candidate vaccine viruses for pandemic preparedness purposes. It is meant to provide guidance for national authorities and vaccine companies on the selection of candidate viruses for use in vaccine development.

February 2016
pdf, 618kb

Previous summaries

September 2015
pdf, 2.14Mb

February 2015
pdf, 909kb

September 2014
pdf, 283kb

February 2014
pdf, 800kb

September 2013
pdf, 761kb

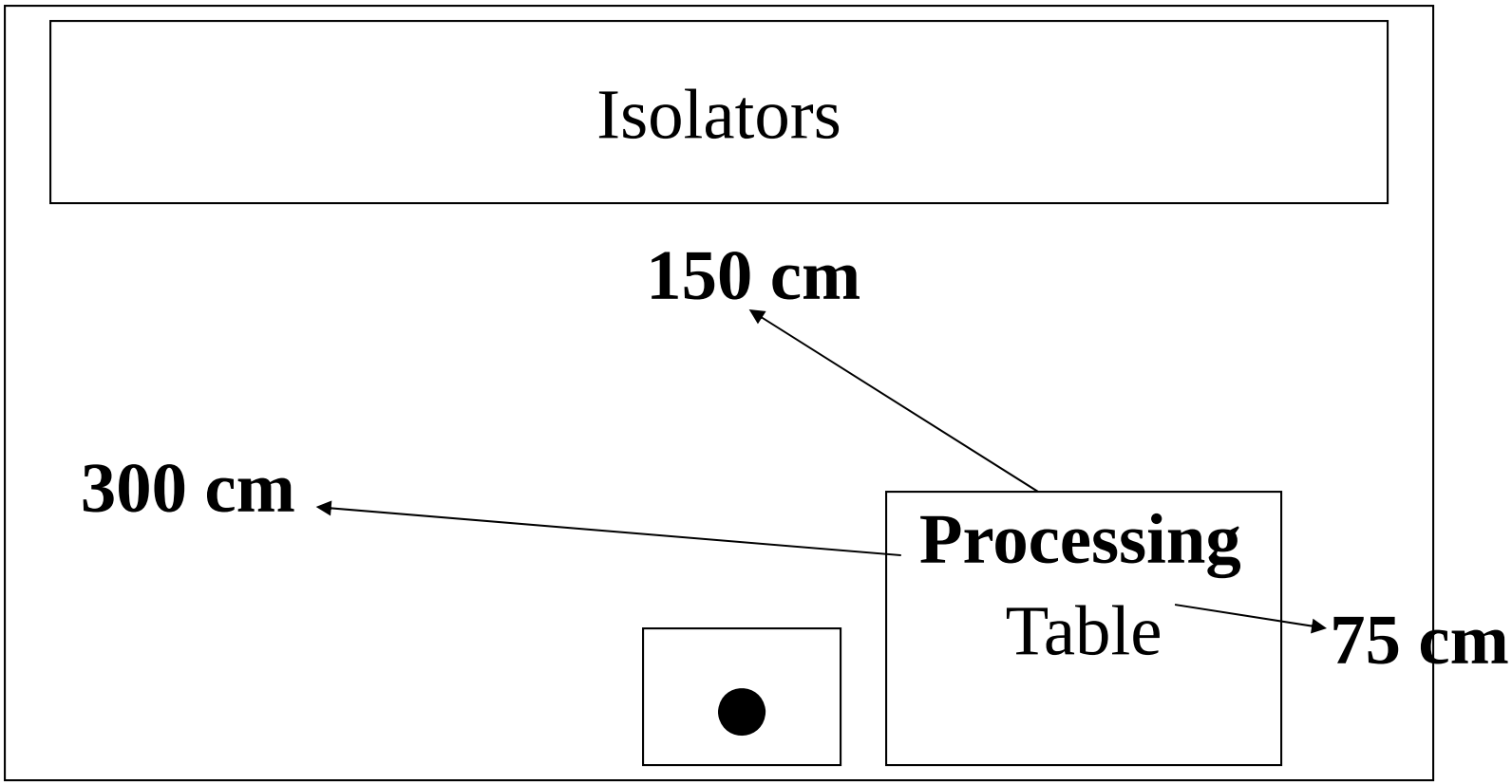
February 2013

Share Print

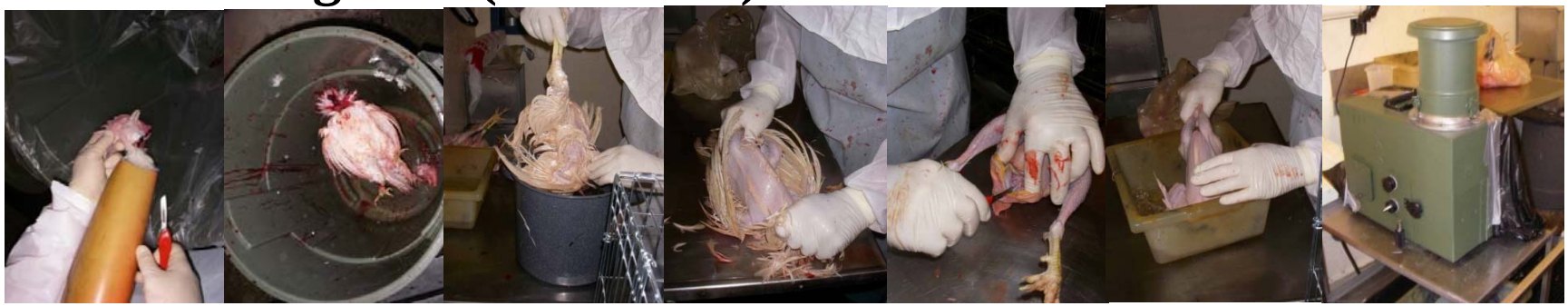
3.3 Education to Mitigate Zoonotic Influenza Exposure and Transmission

- **854 human cases & 450 deaths from H5N1 (N6) HPAI**
  (http://www.who.int/influenza/human_animal_interface/Influenza_Summary_IRA_HA_interface_07_19_2016.pdf?ua=1)
- **Most human cases have exposure to poultry, primarily through wet markets in developing countries or household poultry production & slaughter**
- **Egypt, most cases in women and children, who are primary caretakers and slaughter poultry**

Home Slaughter Simulation: Airborne Virus Generation



8.3 air changes/hr (340 m^3/hr)



Outcomes

Developed simulated home halal slaughter method to evaluate airborne transmission

- 5 steps in halal slaughter process
  - Kill (tranqualized)
  - Hard-scald
  - Defeathering
  - Evisceration
  - Clean-up



Particle Sizer



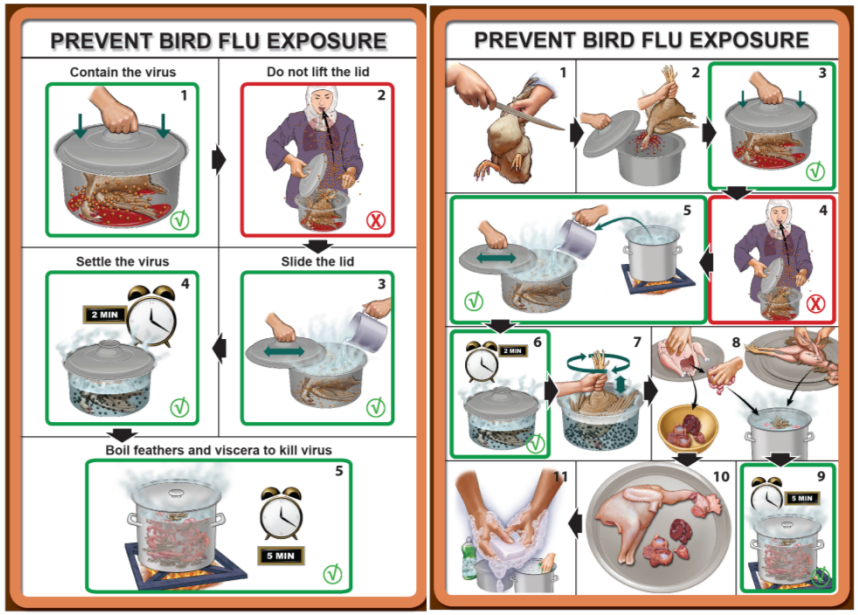

Particle Sampler

Outcomes

- **Processing of asymptomatic H5N2 infected chickens:**
  - **Recovered virus from air samples in the room**
  - **Transmitted the virus to chickens and ferrets exposure to same air space**
- **Mitigations:**
  - **Vaccinated birds**
  - **Do the processing in plastic bag, bucket with lid or Halal pot**

Education: Mitigation Strategies

- **Developing a educational poster for communicating the new process in English and Arabic**
- **Used in joint FAO/Egyptian NGO education program**
- **Transmitted material to CDC Bangladesh Project**



Conclusions

- **OFFLU serves as interface with public health on Animal Influenza Expertise**
- **On going exchange of IAV genes and viruses between farmed animals and humans**
- **Specific Strategies contributing to animal influenza control:**
  - **Surveillance to inform risk assessment and risk management**
  - **Pandemic Preparedness Vaccines**
  - **Education for proper home/LPM poultry slaughter**

OPTIONS IX *for*
THE CONTROL OF INFLUENZA
24–28 AUGUST 2016

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2016.isirv.org