

Avian Influenza/Newcastle Disease Virus Subcommittee

David L. Suarez D.V.M., Ph.D.
Southeast Poultry Research Laboratory
United States National Poultry Research Center
Athens, GA

Zoonotic Avian Influenza

- Both LPAI and HPAI can infect humans
- Recent LPAI zoonotic reports
 - H7N9 China
 - H9N2 Bangladesh
- Recent HPAI
 - H5N1 **Egypt**, China, Indonesia
 - H5N6 China

Cumulative number of confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003-2015

Country	2003-2009*		2010		2011		2012		2013		2014		2015		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths
Azerbaijan	8	5	0	0	0	0	0	0	0	0	0	0	0	0	8	5
Bangladesh	1	0	0	0	2	0	3	0	1	1	0	0	0	0	7	1
Cambodia	9	7	1	1	8	8	3	3	26	14	9	4	0	0	56	37
Canada	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1
China	38	25	2	1	1	1	2	1	2	2	2	0	5	1	52	31
Djibouti	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Egypt	90	27	29	13	39	15	11	5	4	3	37	14	136	39	346	116
Indonesia	162	134	9	7	12	10	9	9	3	3	2	2	2	2	199	167
Iraq	3	2	0	0	0	0	0	0	0	0	0	0	0	0	3	2
Lao People's Democratic Republic	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Myanmar	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Nigeria	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pakistan	3	1	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Thailand	25	17	0	0	0	0	0	0	0	0	0	0	0	0	25	17
Turkey	12	4	0	0	0	0	0	0	0	0	0	0	0	0	12	4
Viet Nam	112	57	7	2	0	0	4	2	2	1	2	2	0	0	127	64
Total	468	282	48	24	62	34	32	20	39	25	52	22	143	42	844	449

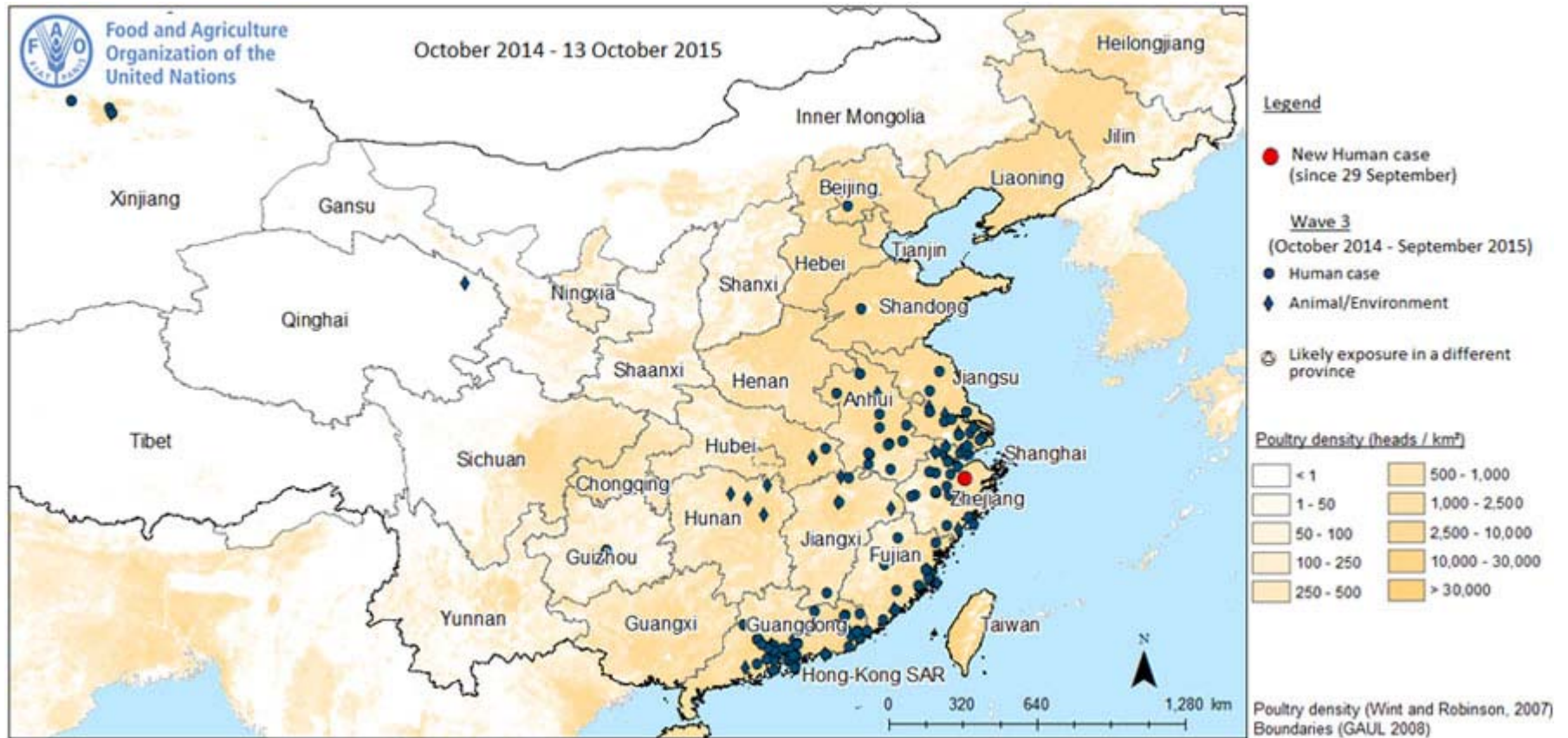
* 2003-2009 total figures. Breakdowns by year available on next table

Total number of cases includes number of deaths
WHO reports only laboratory cases
All dates refer to onset of illness

Source: WHO/GIP, data in HQ as of 4 Sept 2015

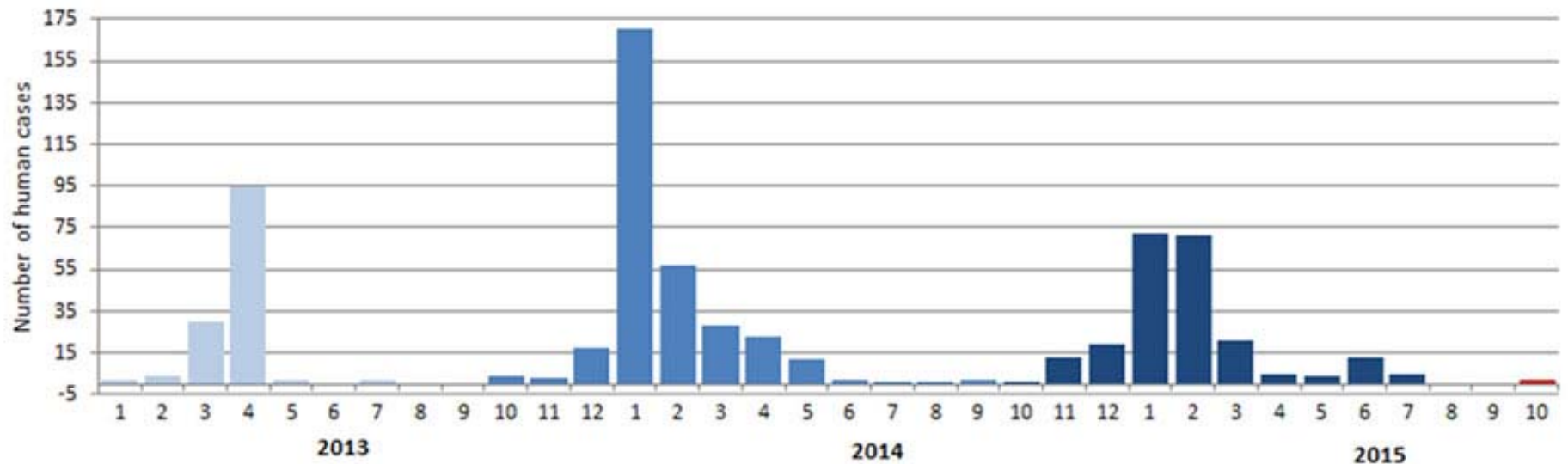


H7N9 China



Source:FAO

H7N9 Human Cases by Month



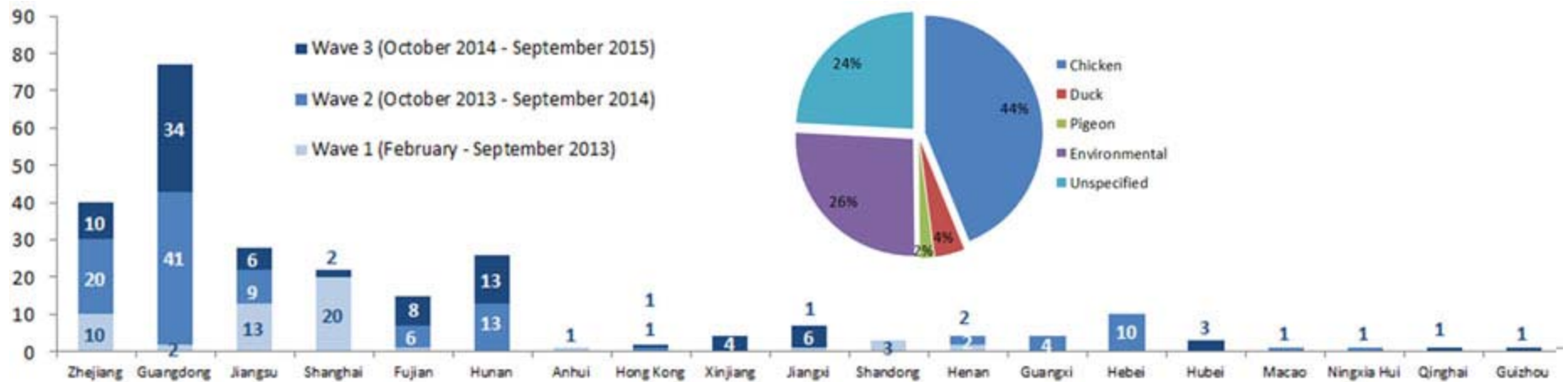
680 Confirmed Human Cases

271 deaths

3 humans cases reported September-October 2015

Source:FAO

Poultry Surveillance H7N9

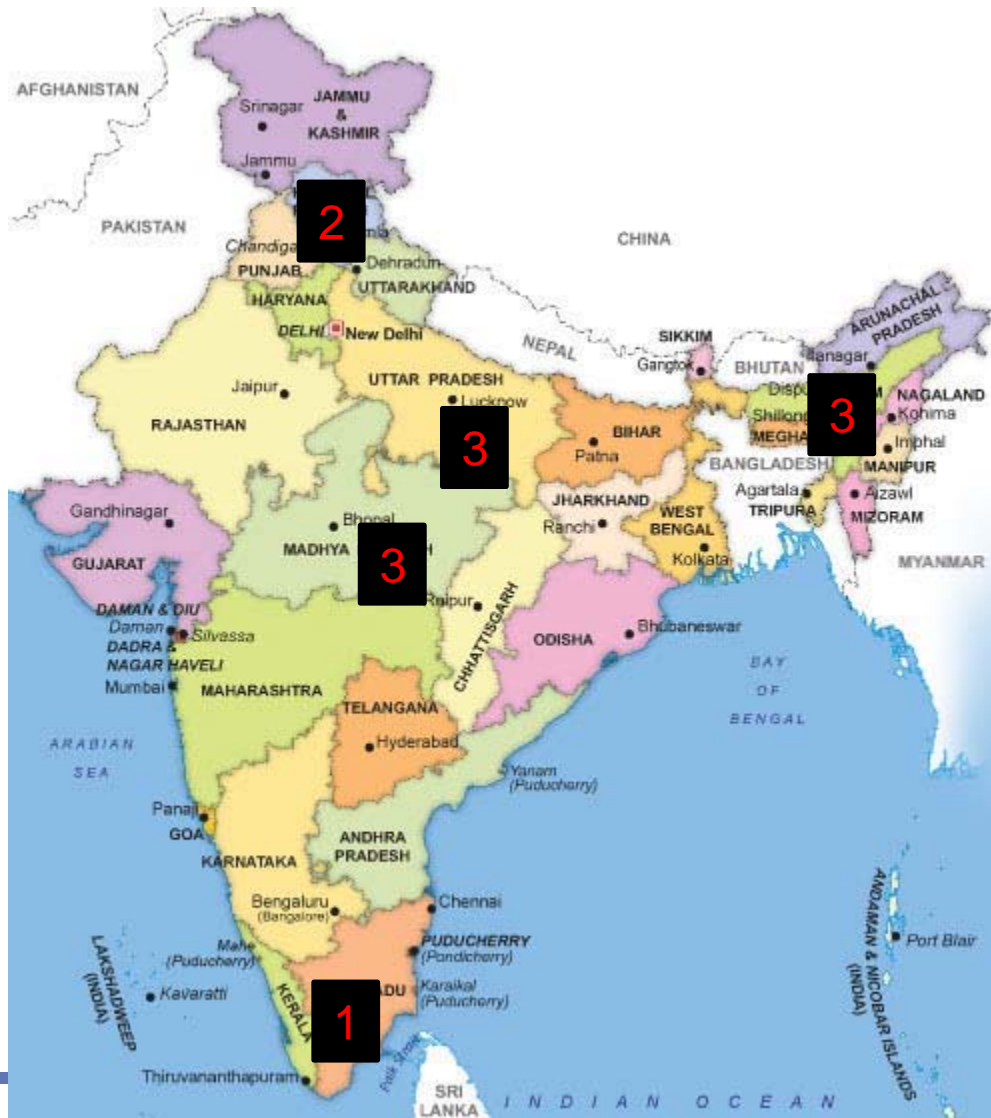


Source:FAO

HPAI Poultry Outbreaks in 2014-15

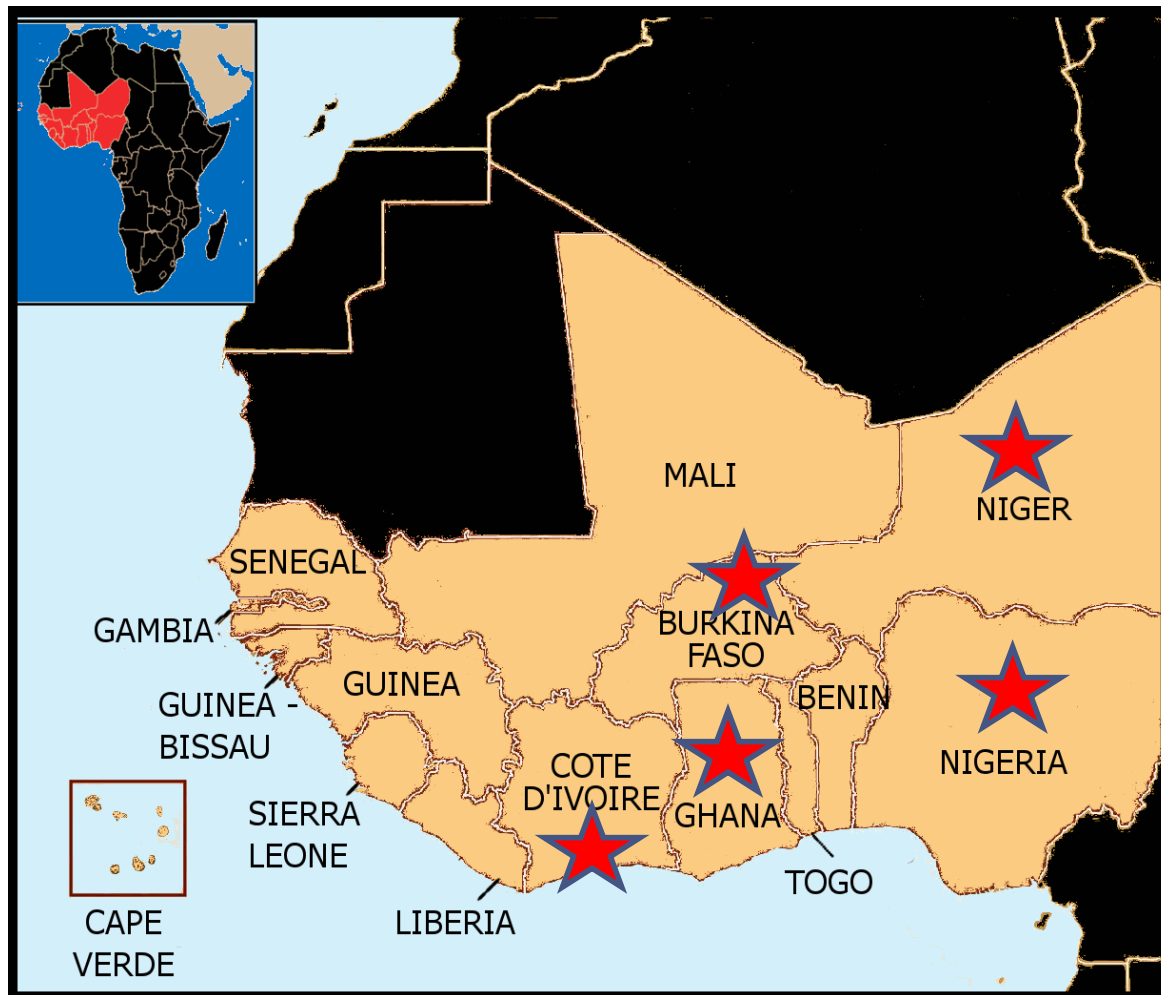
- H5N1 continues to dominate
 - China, Vietnam, Bangladesh, Indonesia, Egypt are endemic
 - Poultry outbreaks in India, West Africa, Middle East (Iran, Israel, Palestine), Bhutan, Laos, North Korea
 - Wild bird outbreaks in Russia and Kazakhstan
- H5N8 also widespread
- H5N2 in China and Taiwan
- H5N6 in China and Vietnam
- H7N3 in Mexico continues
- H7N7 in Germany
- H7N7 in Great Britain

H5N1 Outbreaks India



- Nov 2014-Jan 2015
 - 390,000
 - Poultry
- Dec 2014-Jan 2015
 - 110
 - Domestic ducks
- March 2015
 - 224,000
 - Poultry and wild birds
- Clade not reported

H5N1 HPAI West Africa



- Currently there is no publicly available sequence
- Nigeria is paying indemnity, but only small number of farms
- FAO has requested international funds to respond to outbreak

H5N8 HPAI in Europe

2014

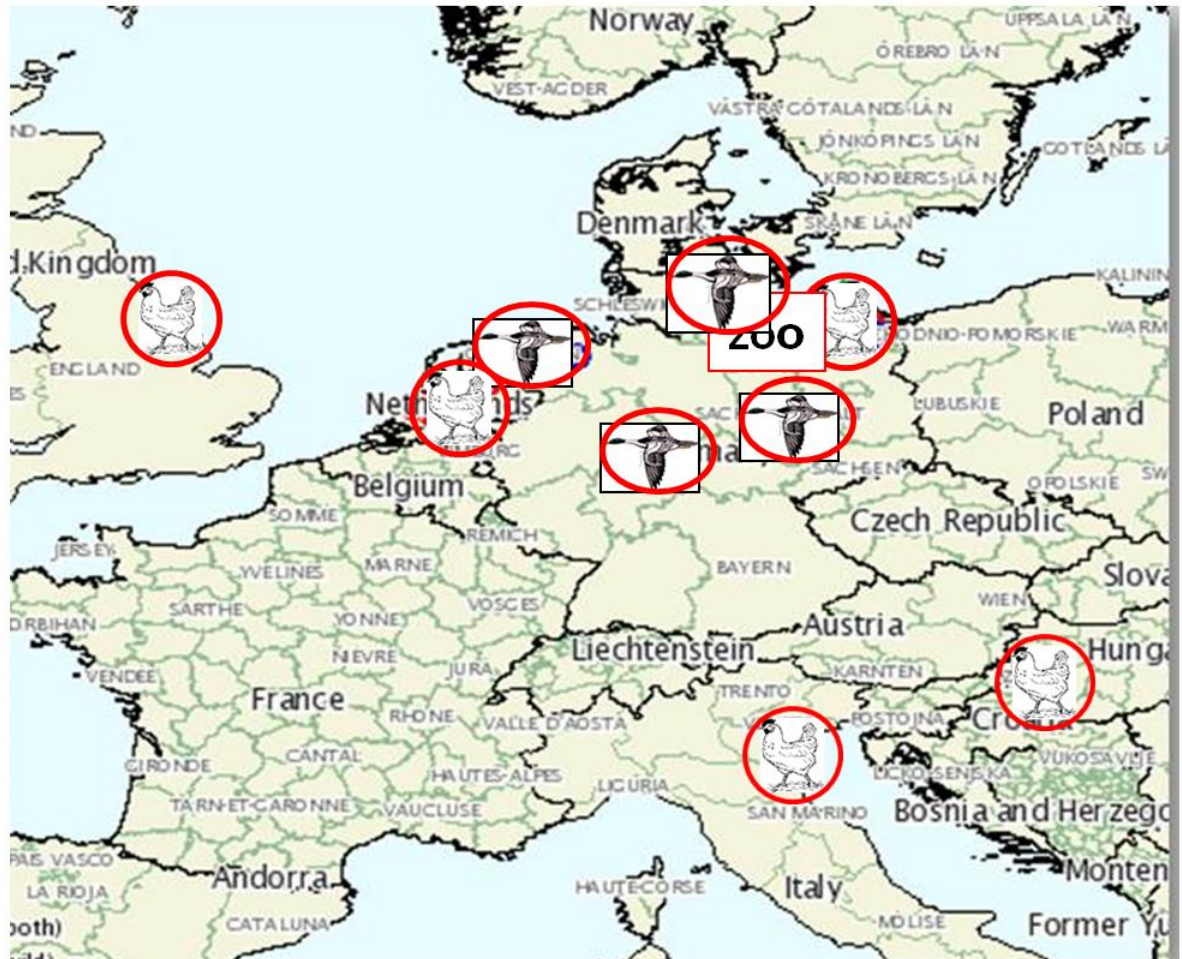
Nov. 7- Germany, turkeys
Nov. 17- UK, domestic ducks
Nov. 15, 20, 30- Netherlands, layers
Nov. 21- Netherlands, multi. unit
Nov. 23- Germany, wild duck

Dec. 1- Netherlands, widgeon
Dec. 1- Netherlands, broilers
Dec. 16- Germany, turkeys
Dec. 16- Italy, layers
Dec. 19- Germany, wild duck
Dec. 21- Germany, domestic ducks

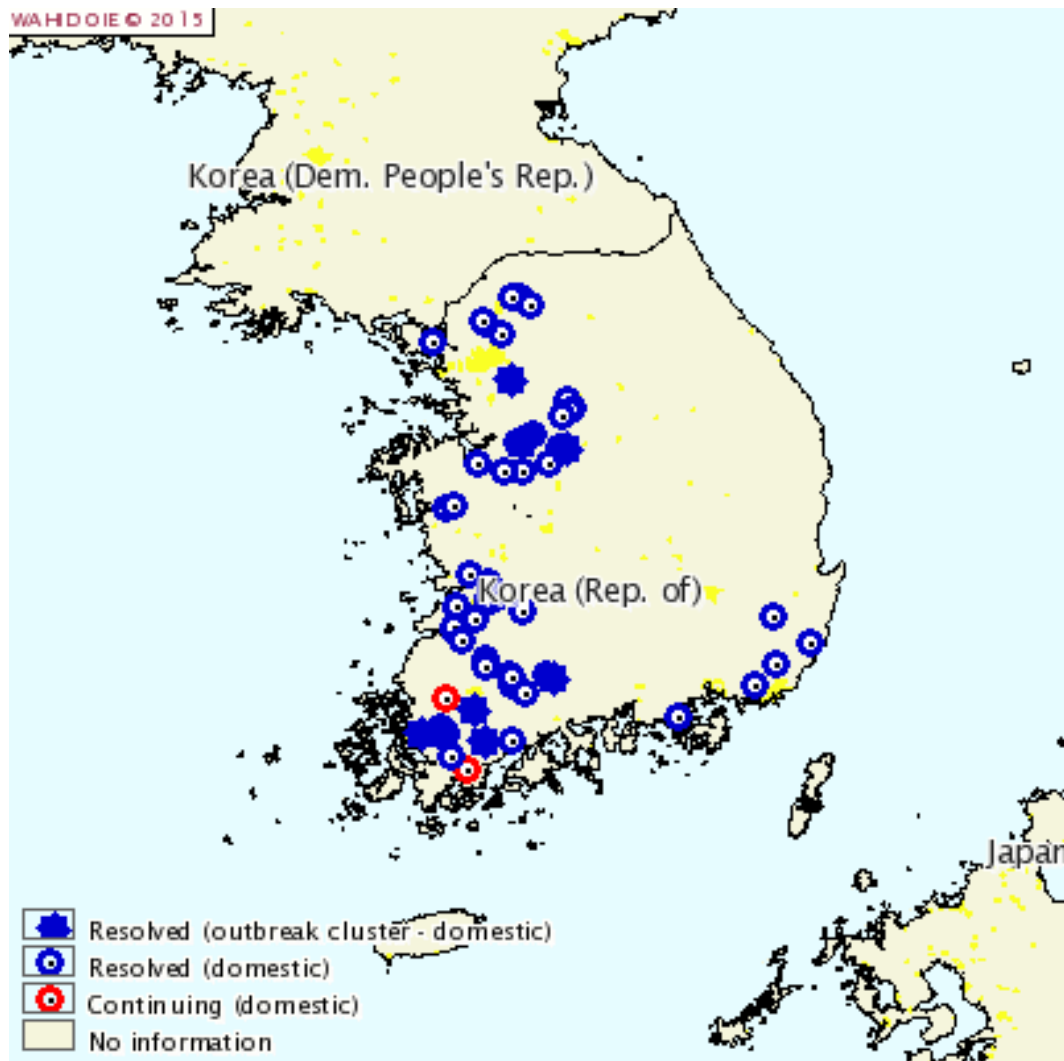
2015

Jan. 8- Germany, wild duck
Jan. 12- Germany, zoo animals
Jan. 13- Germany, gull and wild duck
Jan. 20- Germany, mixed domestic

Feb. 25. Hungary, domestic ducks



H5N8 South Korea



Taiwan



- H5N2 continuing with Mexican origin H5
- H5N8 outbreak similar to U.S. virus
- H5N3 outbreak with unique Asian N3 on H5N8 backbone

China

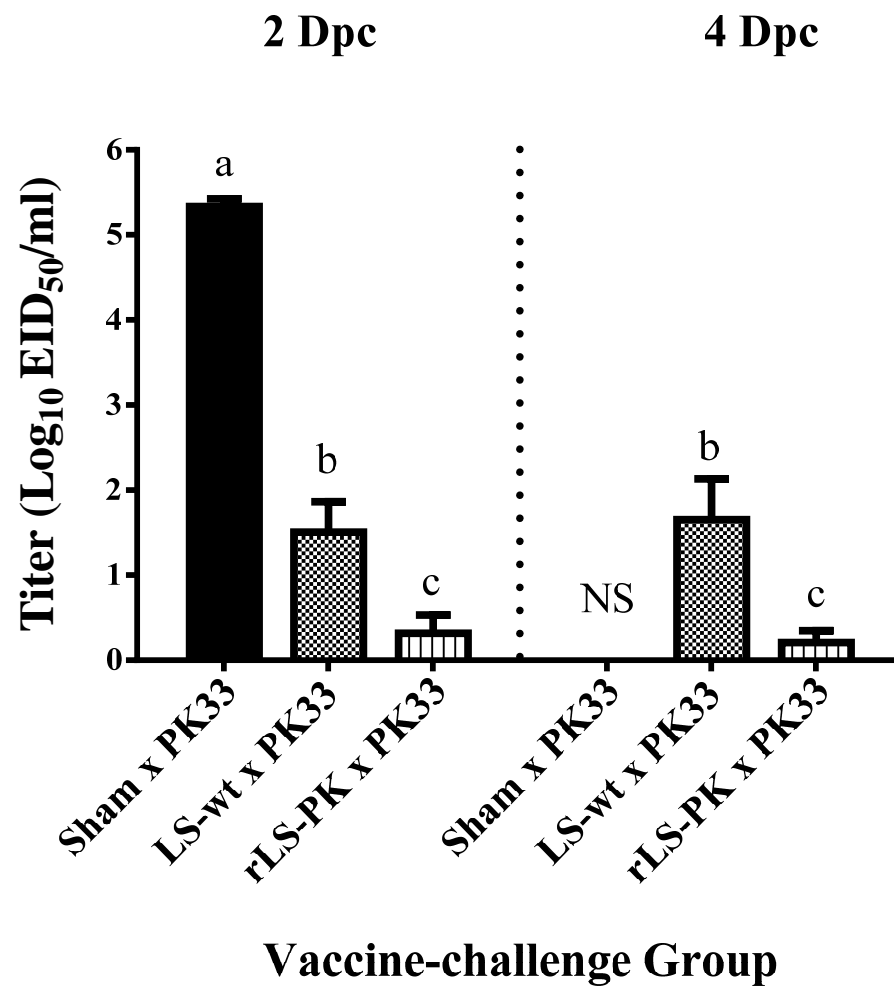


- H5N1 widespread in country despite of vaccination
- Live poultry markets and wild bird reports including black headed gulls at Qinghai Lake with high mortality >2000
- H5N6
 - Closely related to H5N8
 - Also reported Vietnam
 - Human infections
- H5N2
 - Largest report of poultry affected by outbreak

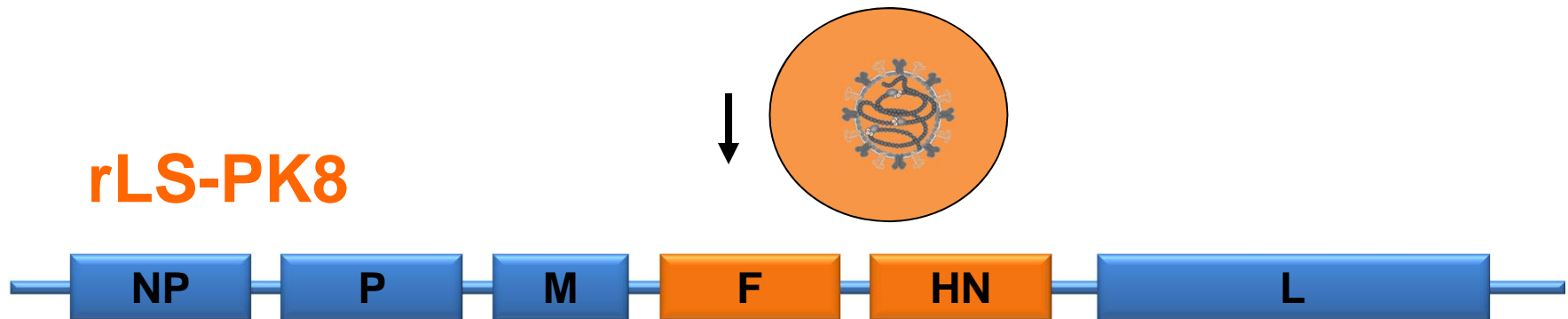
Challenges in NDV Vaccination

- Virulent NDV outbreaks still occur despite use of vaccination
- Matched vaccines to challenge strains are recommended to reduce virus replication and reduce transmission
- New technology allow development of vaccines capable of reducing replication and transmission of challenge virus.
- Difficult to demonstrate differences in mortality under laboratory conditions with SPF birds.

Results : Viral shedding after challenge



Recombinant vaccines: Strategy



Why F and HN genes?

Binding and fusion of the virus to the host cell.

Induce specific cell mediated immunity.

Neutralizing antibodies in vaccinated birds.

Fusion protein cleavage site determines virulence.

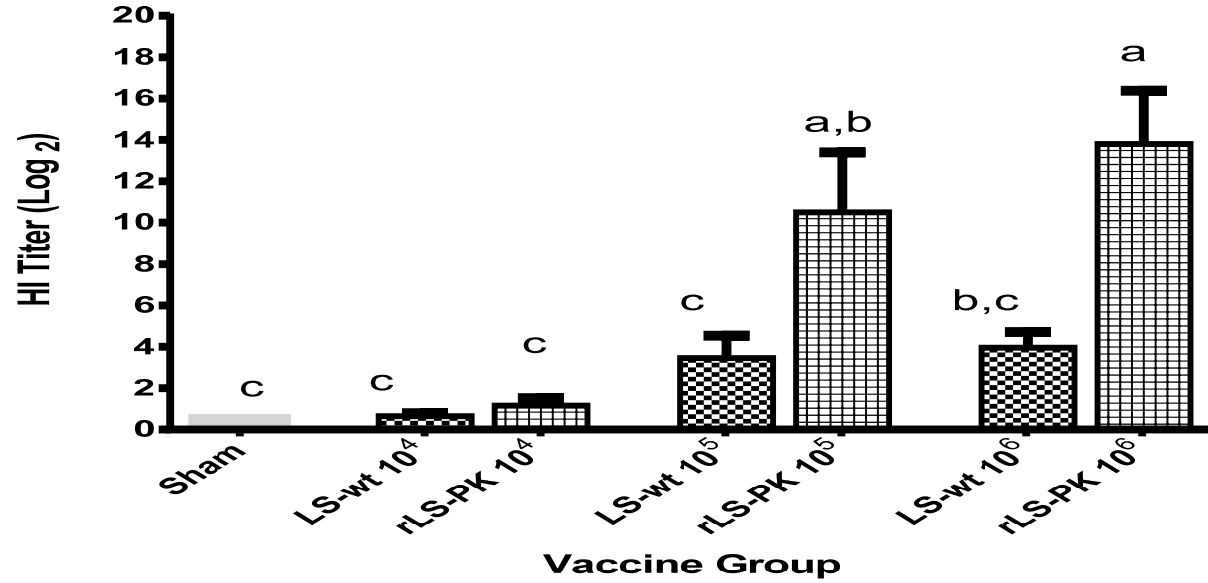
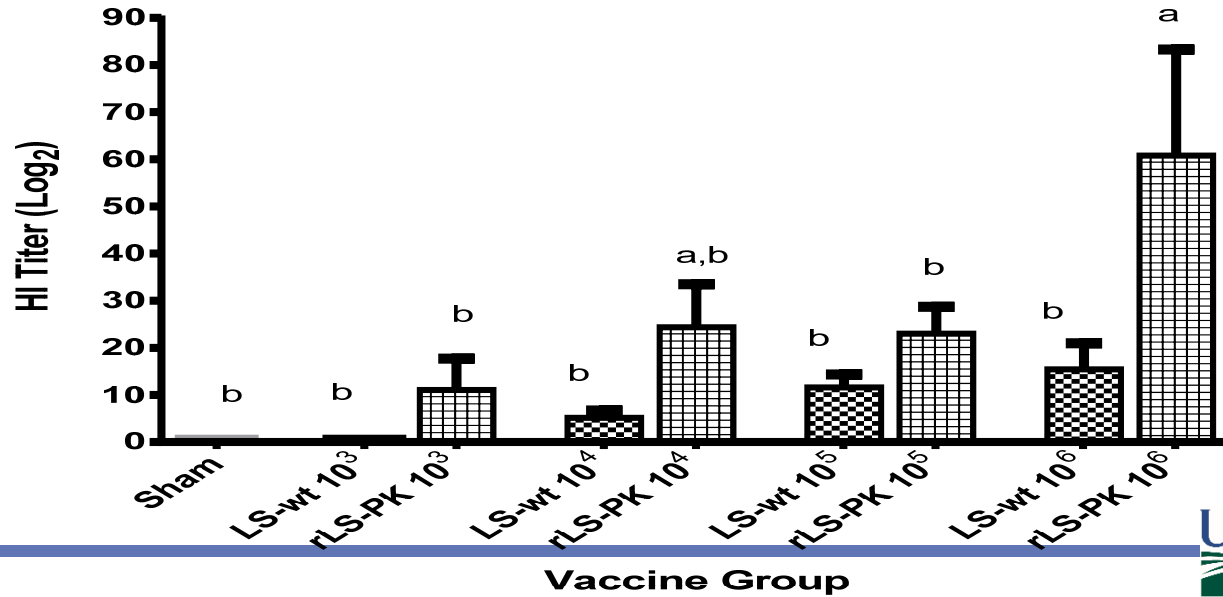
Experimental Strategy: Vaccinate with multiple vaccine doses to replicate field conditions

- 4-week-old White Leghorn chickens
- Vaccines:
 - LaSota 10^3 , 10^4 , 10^5 or 10^6
 - rLS-PK 10^3 , 10^4 , 10^5 or 10^6

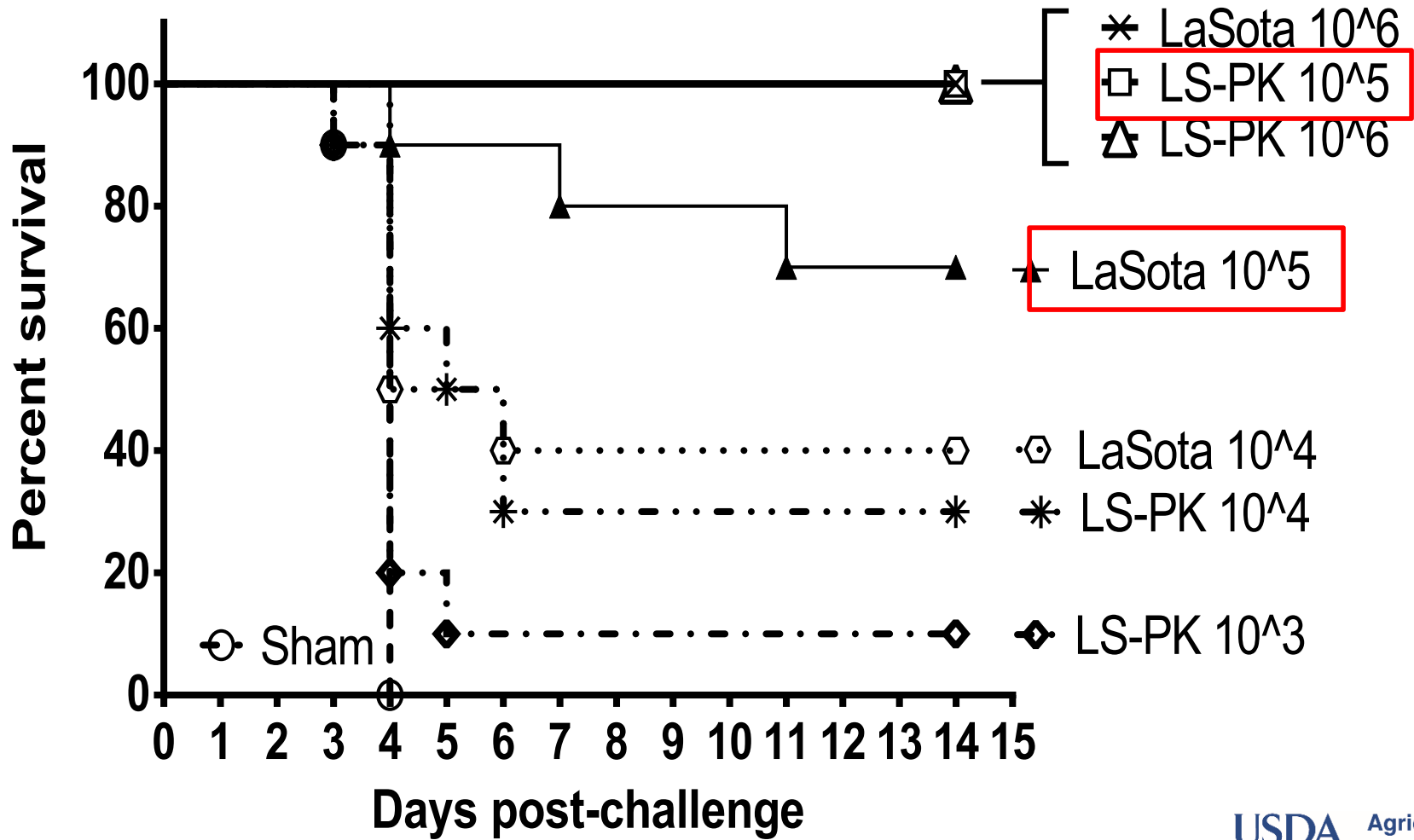
Challenge:

- PK8 $10^{8.5}$ 7 dpv or 14 dpv

Followed for 14 days after the challenge

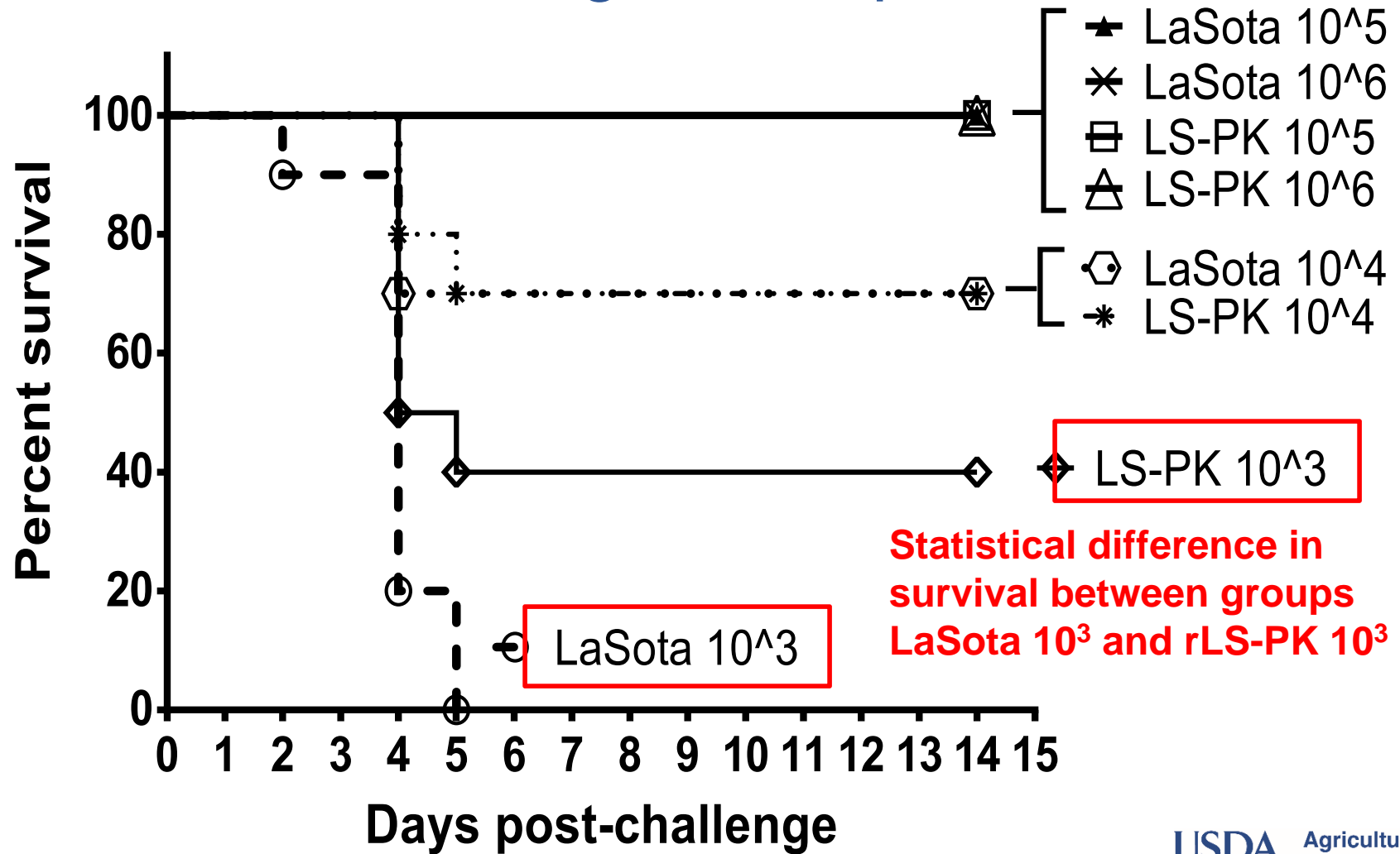
A**Pre-challenge PK8 HI titers 7dpv****B****Pre-challenge PK8 HI titers 14dpv**

Results: Survival after challenge at 7dpv



Results:

Survival after challenge at 14 dpv



Acknowledgements

- Dr. Claudio Afonso, Southeast Poultry Research Laboratory