DEPARTMENT OF MICROBIOLOGY
THE UNIVERSITY OF HONG KONG
香 港 大 學 微 生 物 學 系

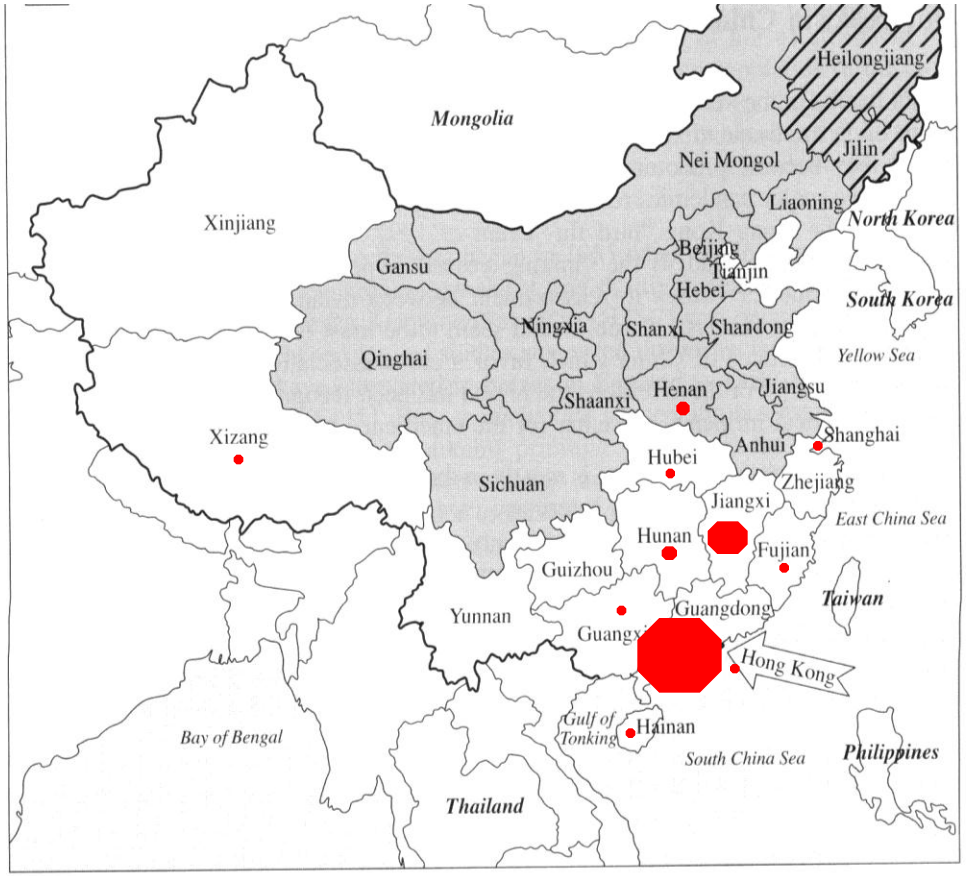
Areas of Excellence Scheme
Control of Pandemic and Inter-Pandemic Influenza
Funded by the Research Grants Council of Hong Kong

Update on Surveillance of swine influenza viruses: Hong Kong

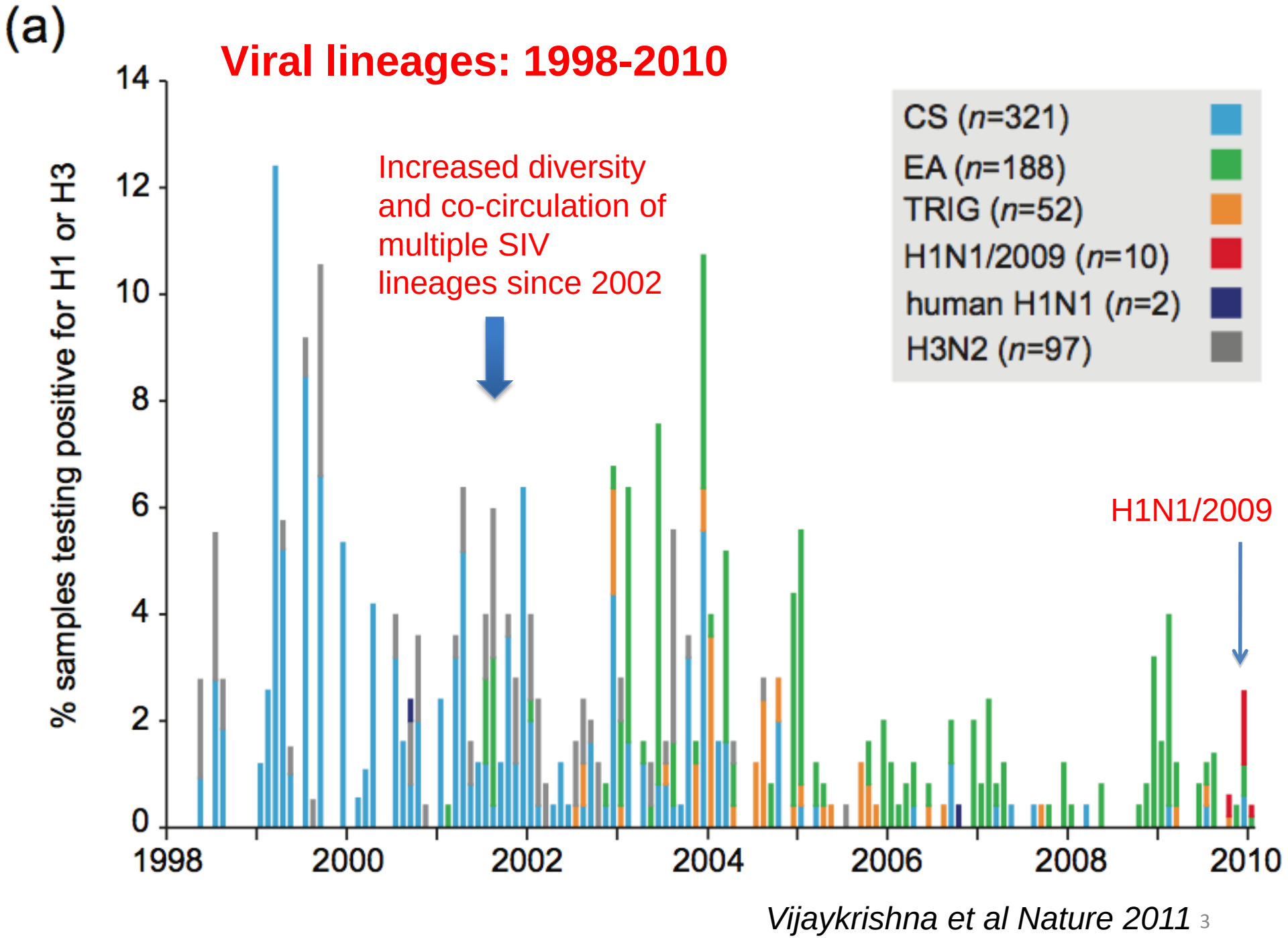
Malik Peiris
The University of Hong Kong

National Institute of Allergy and Infectious Diseases
Leading research to understand, treat, and prevent infectious, immunologic, and allergic diseases.

Surveillance in Hong Kong/China



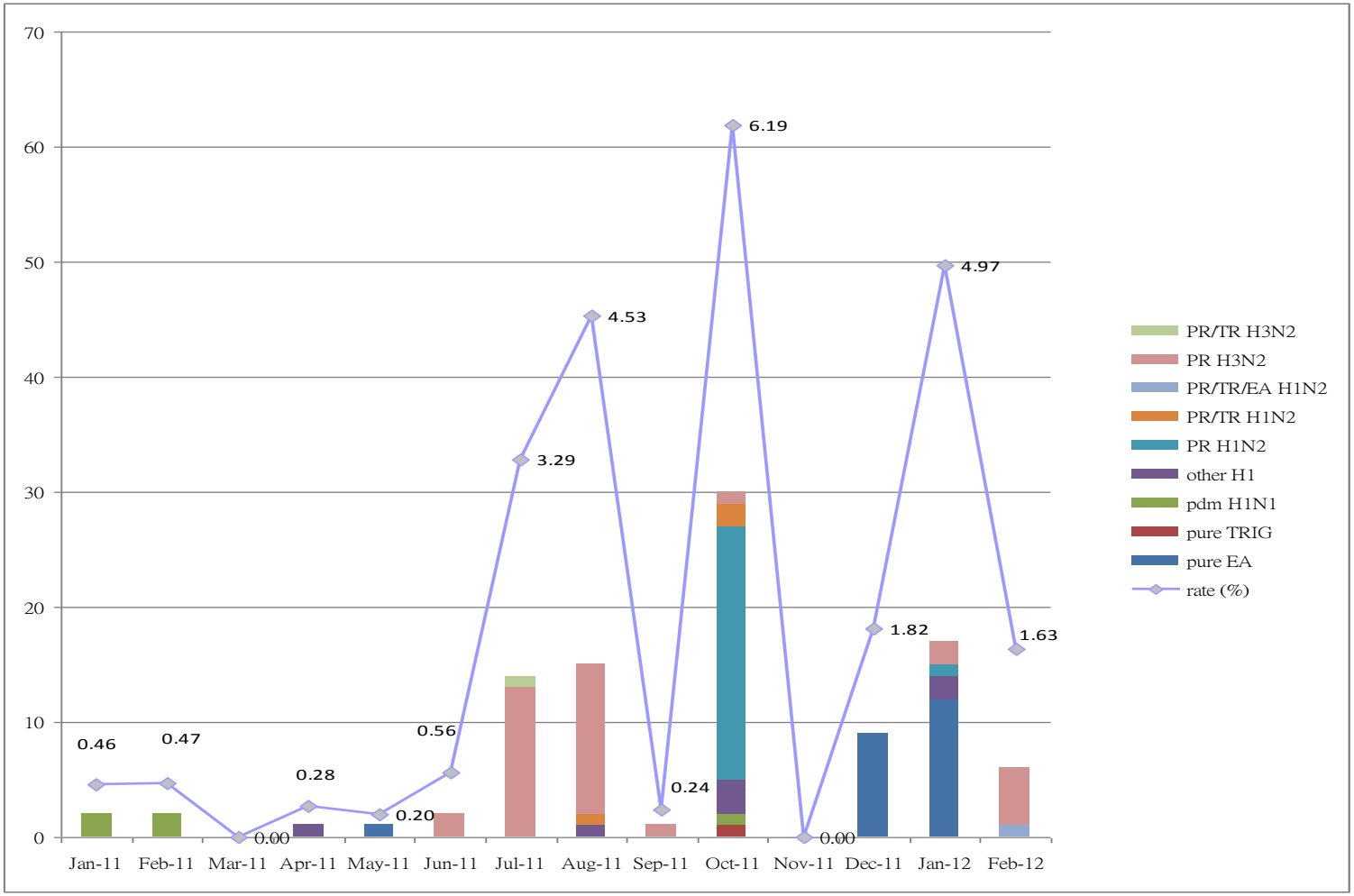
- **4000–5000 pigs are slaughtered each day.**
- **Only 5-20% of pigs are from Hong Kong.**



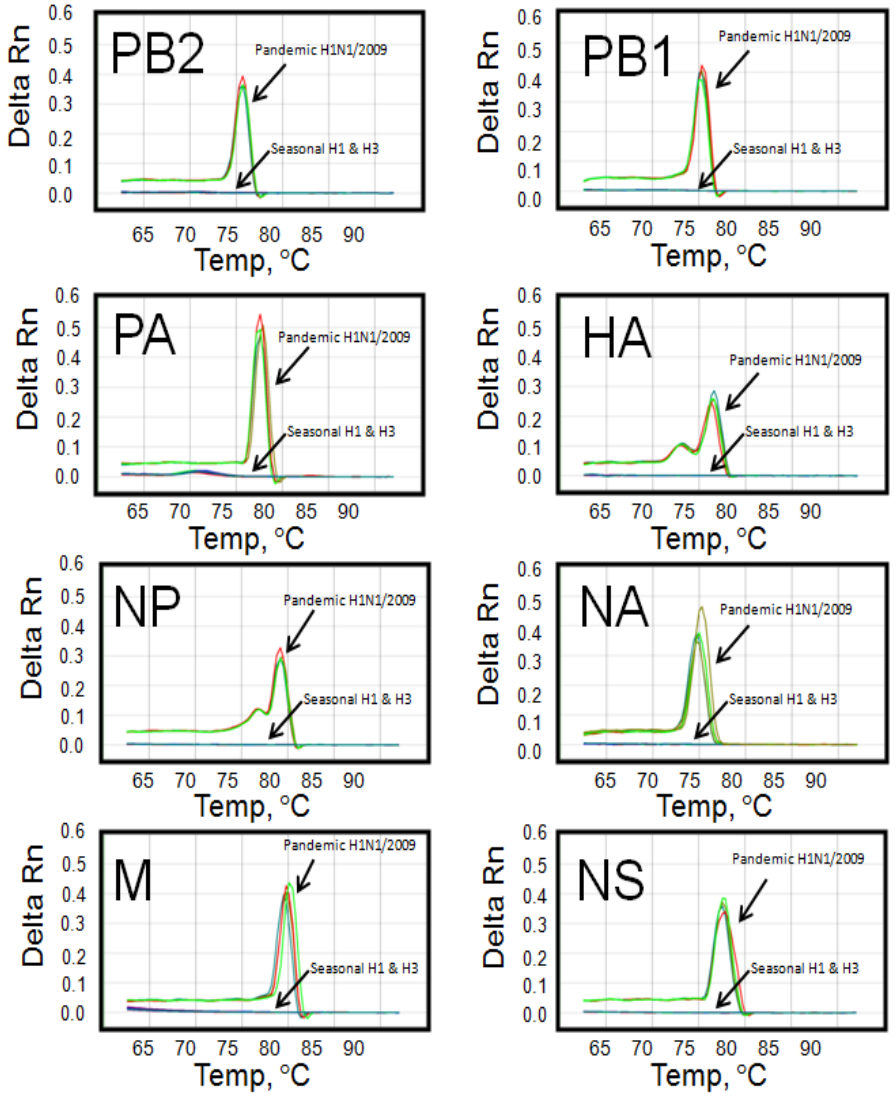
Vijaykrishna et al Nature 2011

Surveillance of swine in a Hong Kong abattoir: Jan 2011 – to Jan 2012

5409 swabs; On average 207 swabs per sampling occasion; 94 isolates (1.7% isolation rate)



Detecting genes derived from pandemic H1N1/2009



Poon et al., 2009, 2010, 2011

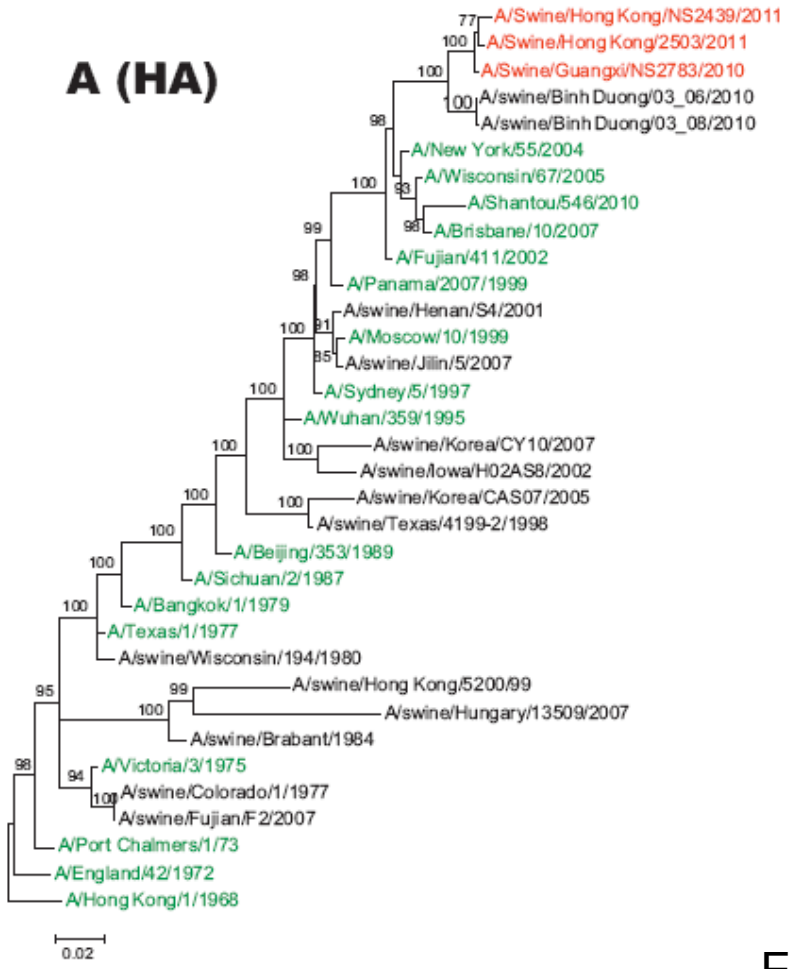
Detection and Risk Assessment
of Pandemic H1N1 Reassortants in Pigs

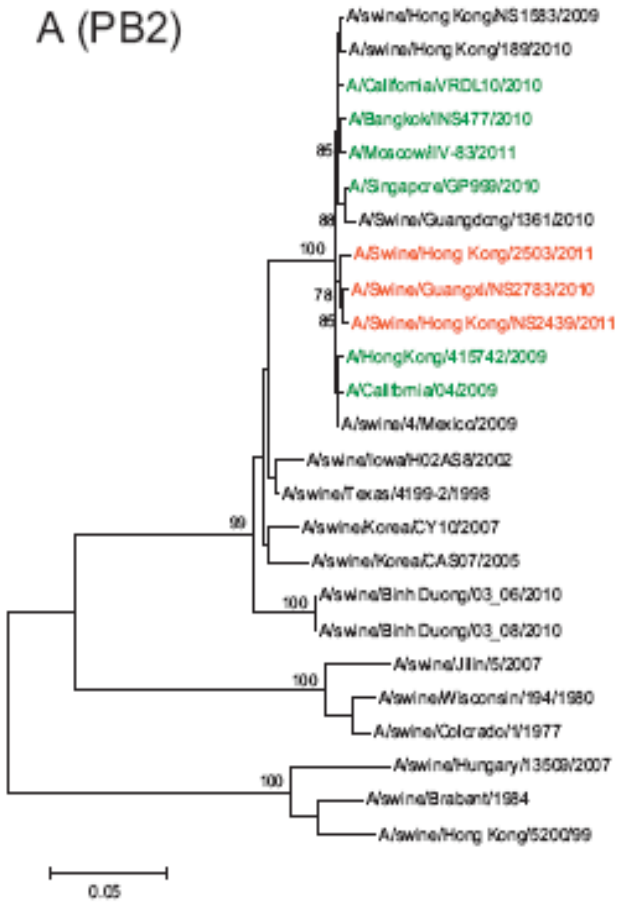
Surveillance: Jan 2011 – Jan 2012: Virus genotypes isolated

Subtype	Virus gene segment								No of Isolates
	PB2	PB1	PA	HA	NP	NA	M	NS	
H3N2	pH1N1	pH1N1	pH1N1	Human	pH1N1	Human	pH1N1	pH1N1	33
N1N2	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	Human/95	pH1N1	pH1N1	1
H3N2	pH1N1	pH1N1	pH1N1	Human	TR	Human	pH1N1	pH1N1	1
H1N2	pH1N1	pH1N1	pH1N1	TR	pH1N1	TR	pH1N1	TR	1
H1N2	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	TR	pH1N1	pH1N1	22
H1N2	TR	TR	TR	TR	TR	TR	TR	pH1N1	2
H1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	5
Other swine virus lineages and reassortants between them									29
TOTAL swine viruses isolated									**94**

94 isolates from 5409 specimens

Pandemic virus with human (2004) origin HA and NA



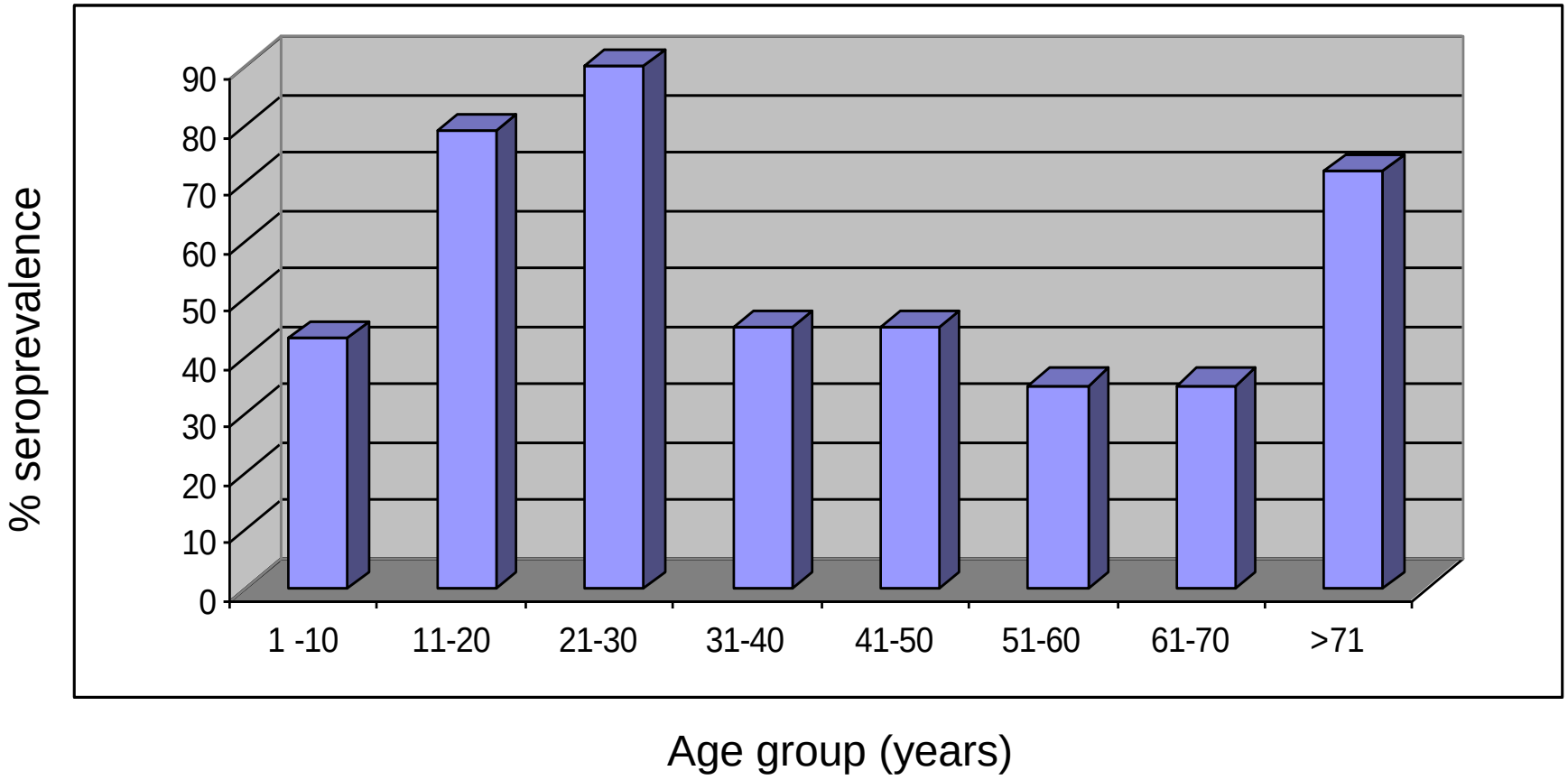


Fan et al J Virol 2012; 86(4):2375-8.

Herd immunity in humans

A/sw/Guangxi/NS2783/10 (H3N2)

Pandemic virus with human-origin H3N2 (from 2004)

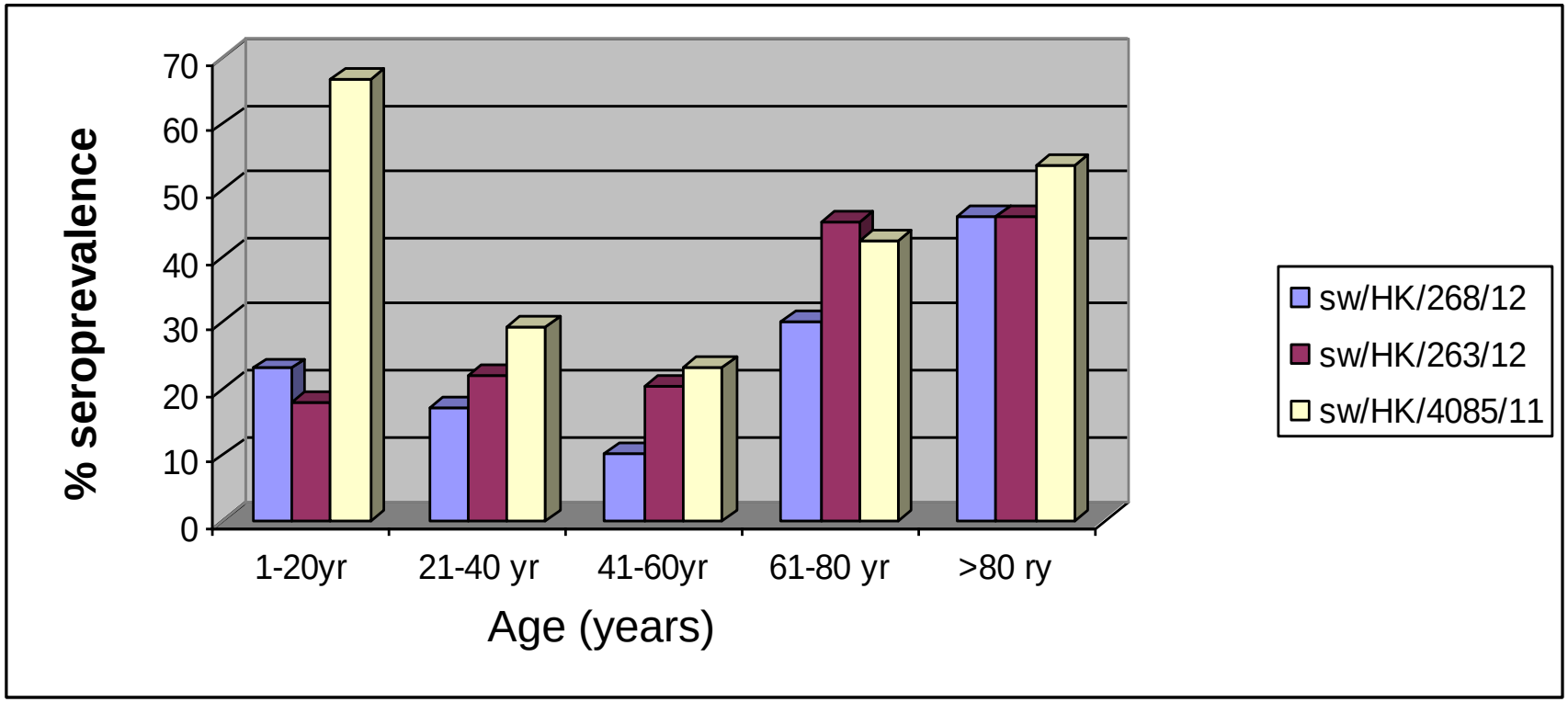


Surveillance: Jan 2011 – Jan 2012: Virus genotypes isolated

Subtype	Virus gene segment								No of Isolates
	PB2	PB1	PA	HA	NP	NA	M	NS	
H3N2	pH1N1	pH1N1	pH1N1	Human	pH1N1	Human	pH1N1	pH1N1	33
N1N2	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	Human/95	pH1N1	pH1N1	1
H3N2	pH1N1	pH1N1	pH1N1	Human	TR	Human	pH1N1	pH1N1	1
H1N2	pH1N1	pH1N1	pH1N1	TR	pH1N1	TR	pH1N1	TR	1
H1N2	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	TR	pH1N1	pH1N1	22
H1N2	TR	TR	TR	TR	TR	TR	TR	pH1N1	2
H1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	pH1N1	5
Other swine virus lineages and reassortants between them									29
TOTAL swine viruses isolated									94

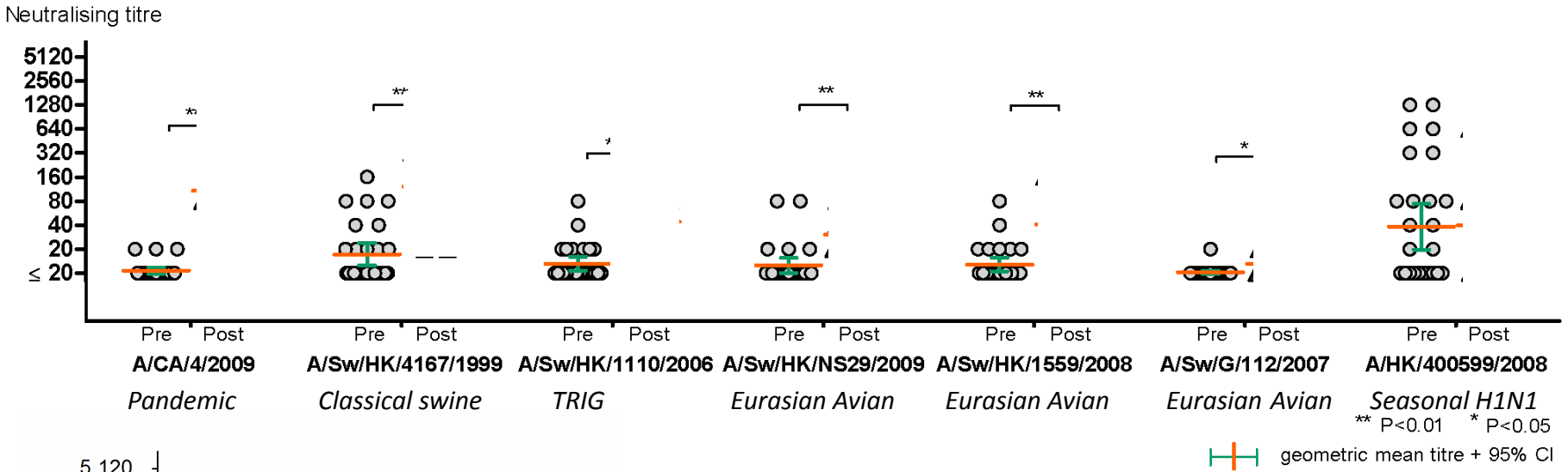
94 isolates from 5409 specimens

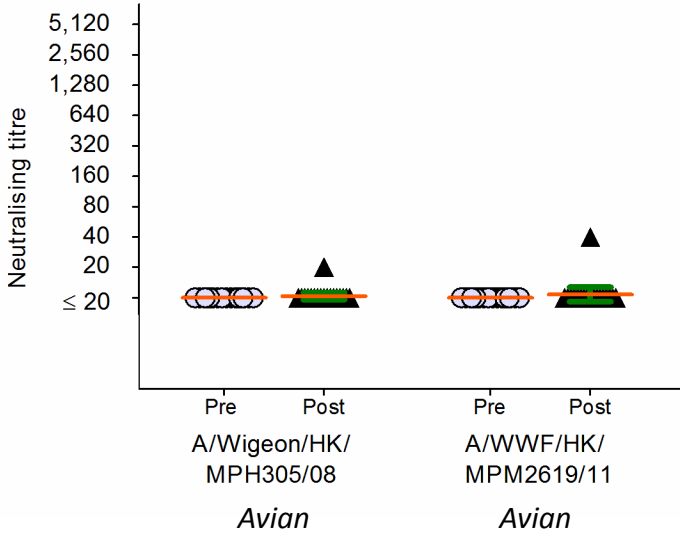
Herd immunity in humans



A/sw/HK/2681/12 (H1N1) TRIG virus with EA H1 and N1
A/sw/HK/263/12 (H1N2) TRIG virus with EA HA and M
A/sw/HK/4085/11 (H1N2) TRIG virus with pdm H1N1 NS

Sero-conversion to pandemic H1N1 is associated with broadened MN cross-reactivity to other swine H1N1 viruses, but not to avian H1N1 viruses





Perera et al EID 2011; 17: 1897-9

Evaluation of Competitive ELISA assays for swine sero-epidemiology

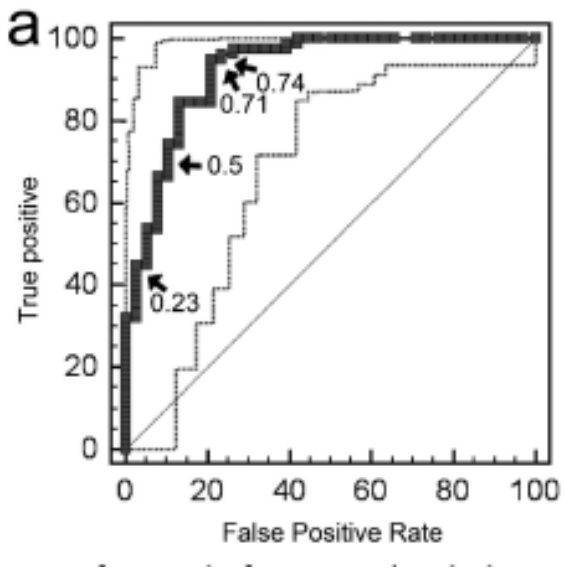
- Swine serum selected from 116 sera tested to a range of Triple reassortant (TRIG); Eurasian avian-like (EA), Classical swine viruses (CS).
- 78 sero-positive; 38 seronegative
- Viruses used in sero-epi panel
  - A/sw/HK/4167/99 (H1N1 (CS)
  - A/sw/HK/1304/03 (H1N2) (CS reassortant)
  - A/sw/HK/1110/06 (H1N2) (TRIG)
  - A/sw/HK/NS29/09 (H1N1) (EA)
  - A/sw/HK/1559/08 (H1N1) (EA reassortant)
  - A/Cal/04/09 (pdm H1N1) (pandemic)
  - A/sw/HK/5212/99 (H3N2) (EA)
  - Asw/HK/1128/03 (H3N2) (human-like)
  - A/sw/HK/2422/98 (H3N2 (human-like)

Tse M, Kim M et al Clin Vaccine Immunol 2012;

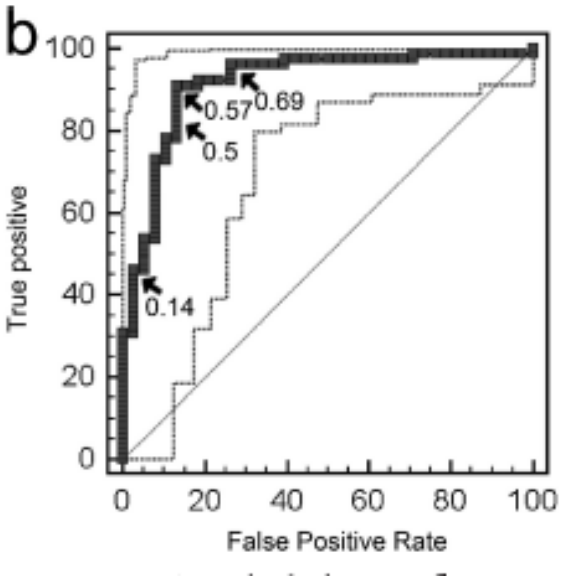
Test performance characteristics

	IDVet ID Screen	IDEXX AI MultiS Screen	IDEXX Influenza A Ab
Manufacturer's cut off			
Sensitivity	69%	82%	86%
Specificity	89%	87%	79%

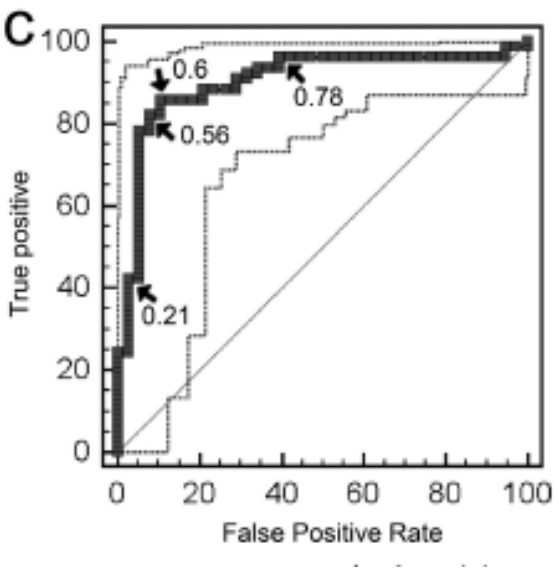
ROC curves



IDVet ID Screen



IDEXX Influenza A Ab

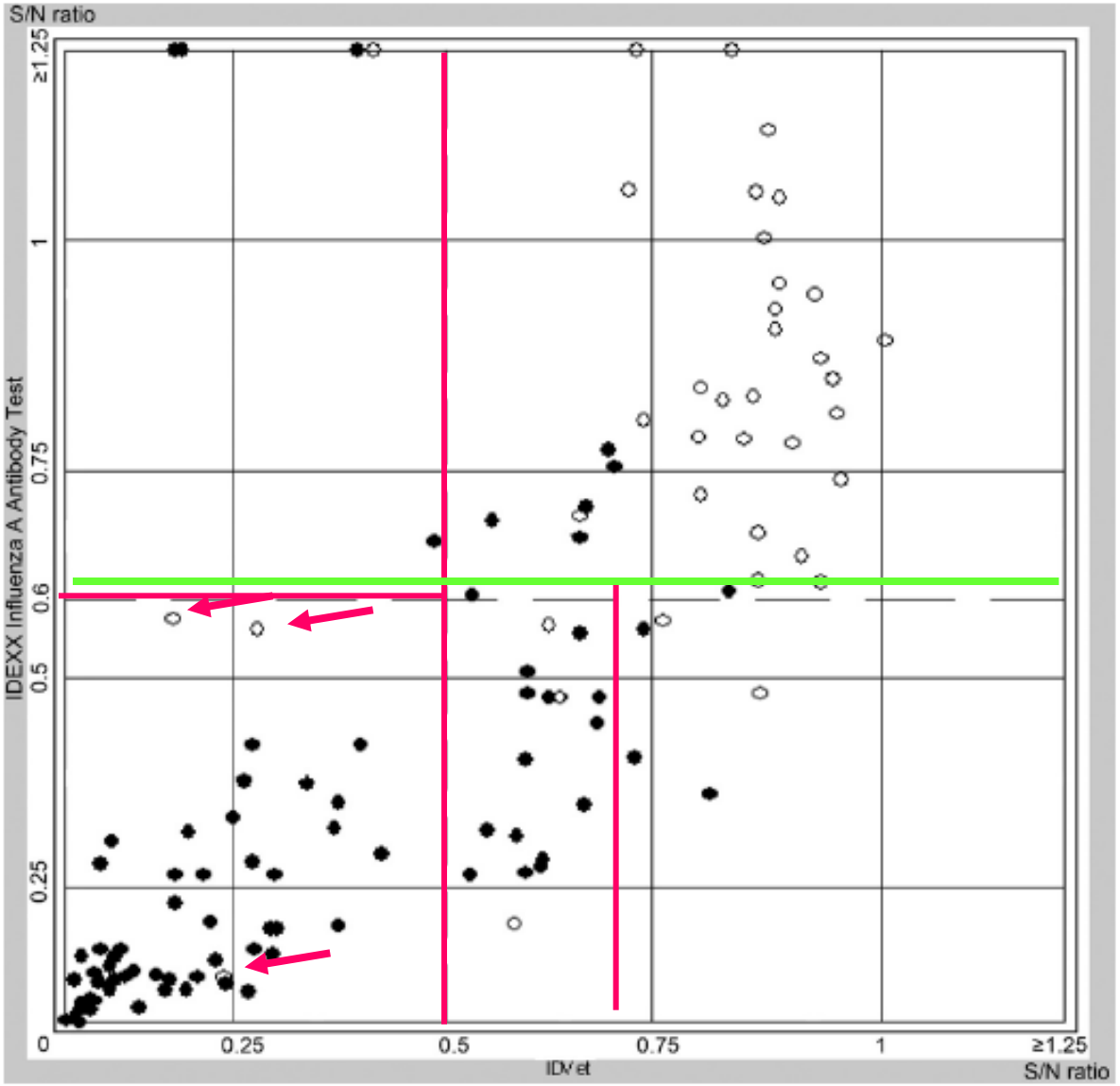


IDEXX AI MultiS Screen

Test performance characteristics

	IDVet ID Screen	IDEXX AI MultiS Screen	IDEXX Influenza A Ab
Manufacturer's cut off			
Sensitivity	69%	82%	86%
Specificity	89%	87%	79%
Optimized cut off for swine sera			
Sensitivity	95%	91%	86%
Specificity	79%	87%	89%

Scatter plot of ID Vet vs IDEXX Influenza A Ab tests



Relevant publications

Tse M, Kim M, Chan CH, Ho PL, Ma SK, Guan Y, Peiris JS. Evaluation of three commercially available influenza a type-specific blocking enzyme-linked immunosorbent assays for seroepidemiological studies of influenza a virus infection in pigs. Clin Vaccine Immunol. 2012 Mar;19(3):334-7.

Perera RA, Riley S, Ma SK, Zhu HC, Guan Y, Peiris JS. Seroconversion to pandemic (H1N1) 2009 virus and cross-reactive immunity to other swine influenza viruses. Emerg Infect Dis. 2011 Oct;17(10):1897-9.

Fan X, Zhu H, Zhou B, Smith DK, Chen X, Lam TT, Poon LL, Peiris M, Guan Y. Emergence and dissemination of a swine H3N2 reassortant influenza virus with 2009 pandemic H1N1 genes in pigs in China. J Virol. 2012 Feb;86(4):2375-8.

Zhu H, Zhou B, Fan X, Lam TT, Wang J, Chen A, Chen X, Chen H, Webster RG, Webby R, Peiris JS, Smith DK, Guan Y. Novel reassortment of Eurasian avian-like and pandemic/2009 influenza viruses in swine: infectious potential for humans. J Virol. 2011 Oct;85(20):10432-9.

Acknowledgements

- CEIRS Programme
- FEHD