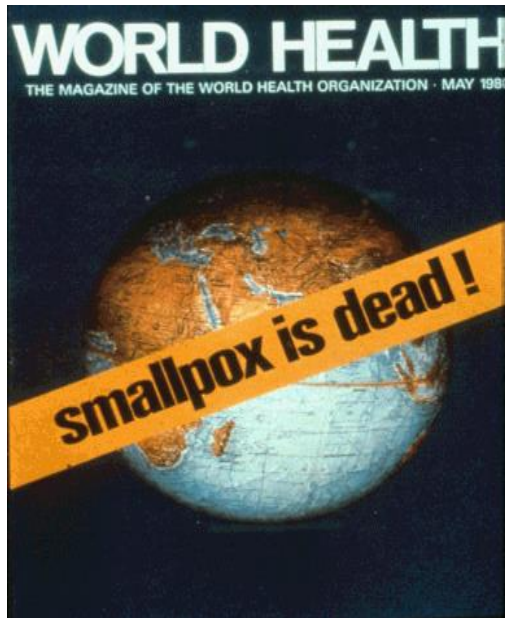




# **Emerging Infectious Diseases: Does Nature strike back?**

Malik Peiris  
Centre of Influenza Research  
HKU-Pasteur Research Pole  
The School of Public health  
The University of Hong Kong



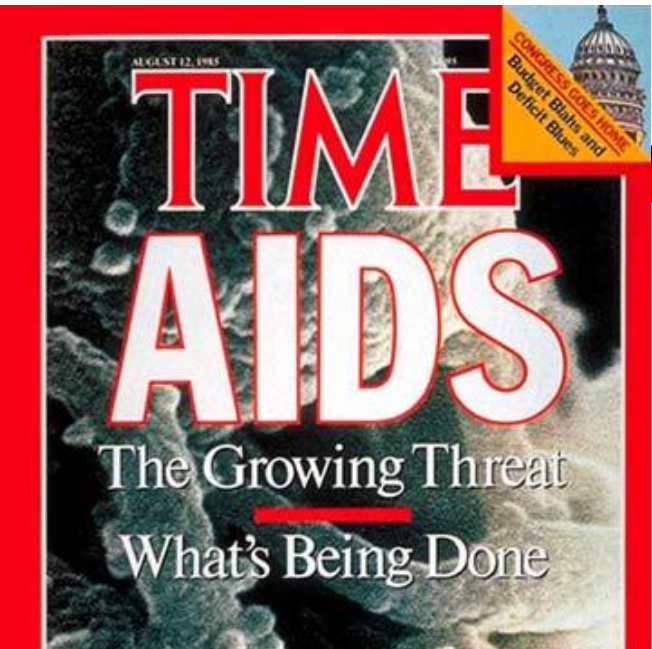
*“One can think of the middle of the 20<sup>th</sup> Century as one of the most important societal changes in history – the conquest and elimination of infectious diseases as a significant factor in society”*

*- McFarlane Burnet, 1962*



- “Human destiny is bound to remain a gamble, because at some unpredictable time and some unforeseeable manner, nature will strike back.”*

*Rene Dubos, 1959*



ns



# SUPER BUGS ATTACK!

In the struggle between humans and disease, the bacteria are fighting harder than ever. Can we still win?

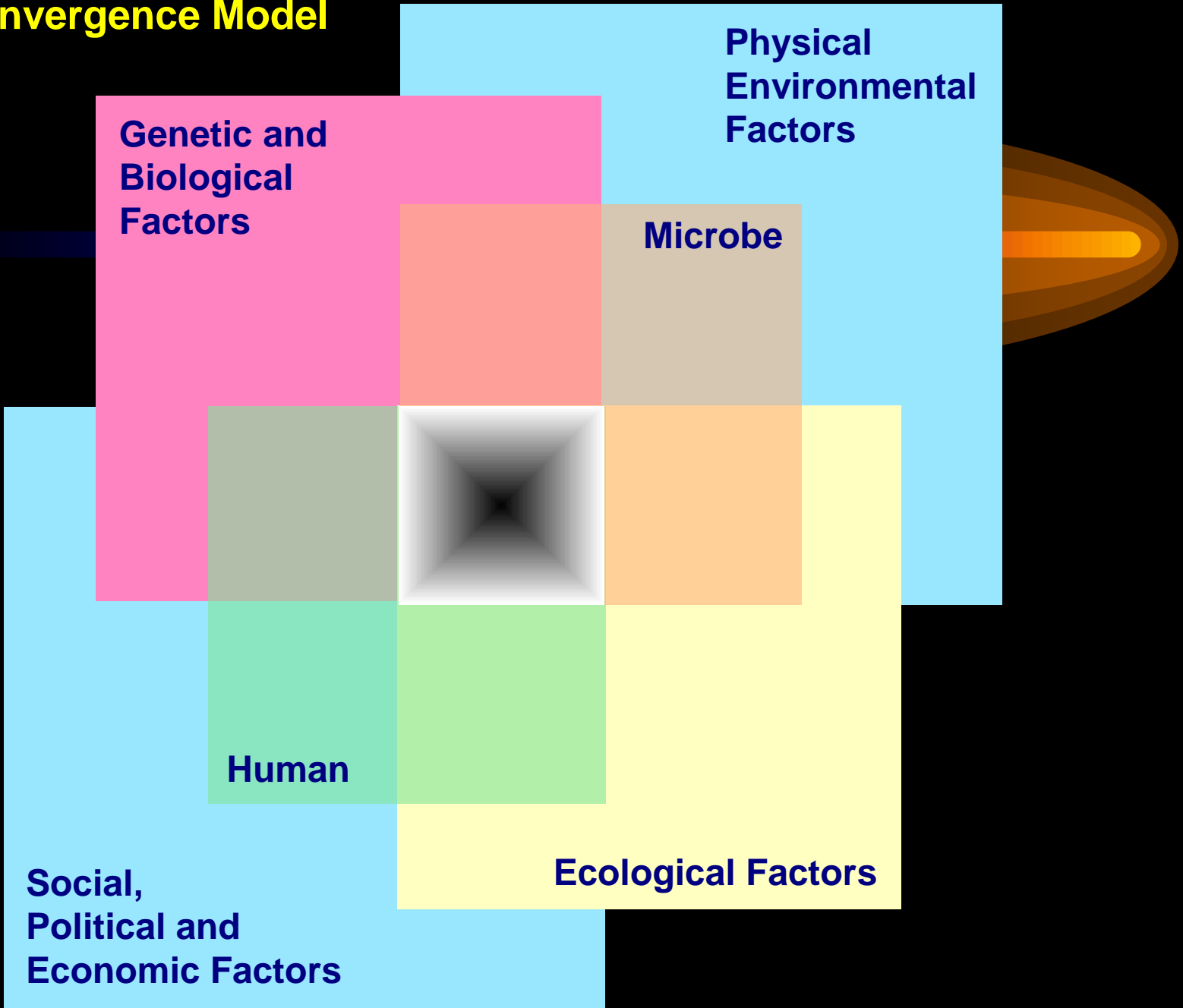
BY AUTHORS NAME HERE

Many are zoonoses

Most are RNA viruses



# The Convergence Model

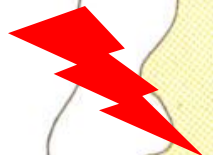


# One Health

- *“Collaborative effects of multiple disciplines working locally, nationally and globally to attain optimal health for people, animals and the environment.”*
  - *American Veterinary Association 2008*



# Sri Lanka



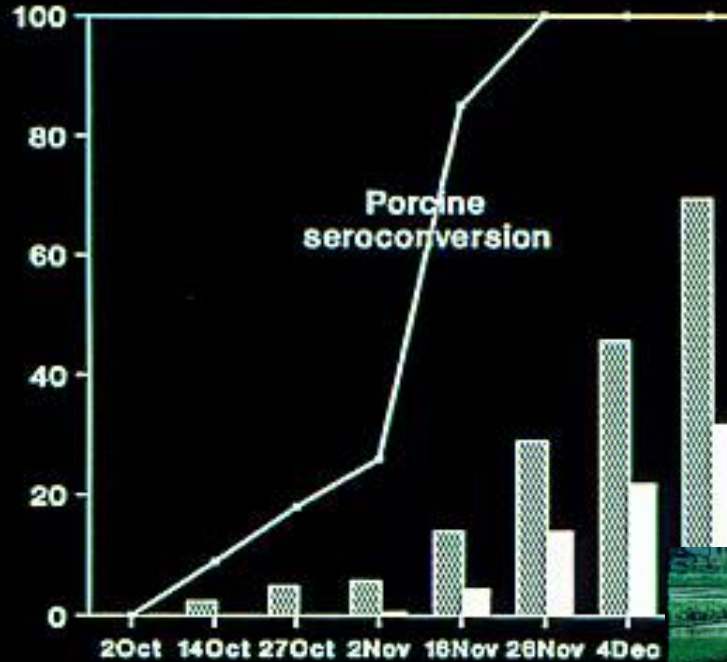
Jetavanaramaya dagaba  
 273-310AD



# Japanese Encephalitis - Sri Lanka: 1985-7

% PORCINE SEROCONVERSION

1987



Good intentions,  
Unintended consequences



But why now?

Peiris et al. T.Roy Soc Trop Me

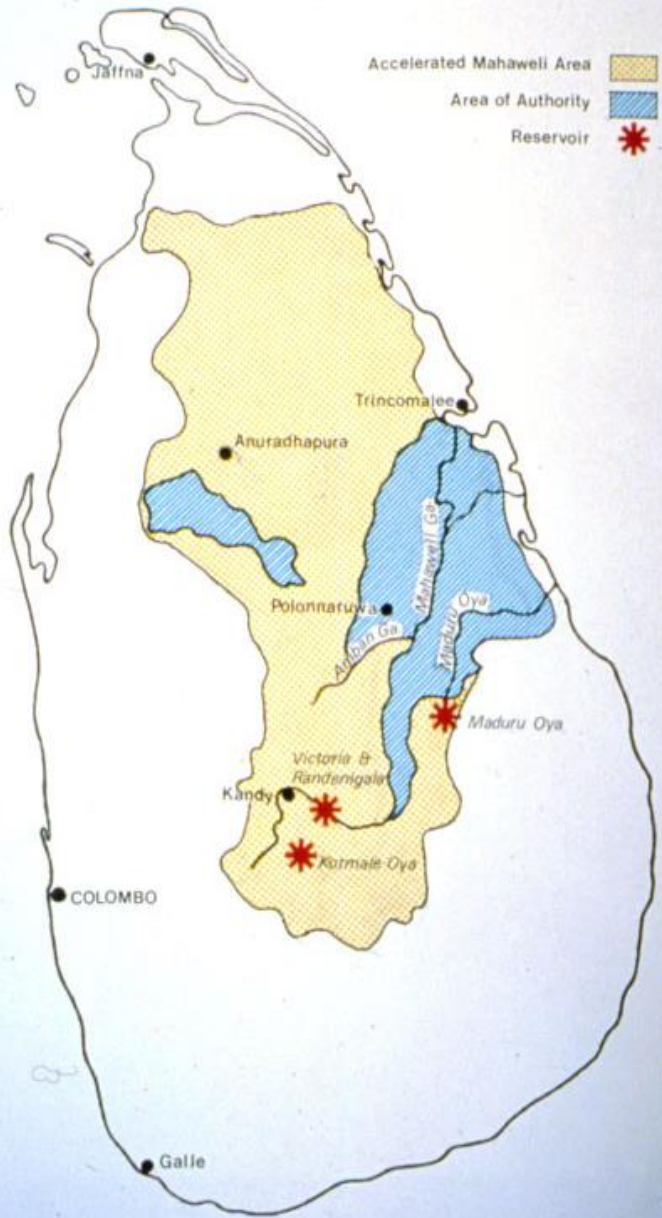
*Cx.tritaeniorhynchus*

4/10,959 (0.036%)

*Cx. Gelidus*, other



# Sri Lanka



**Risk-assess different agro-ecological areas to identify where pig production poses minimal JE risk –**

*Peiris et al Trans Roy Soc Trop Med Hyg 1993; 87: 541-8*

Maintain food production  
Minimise health risk

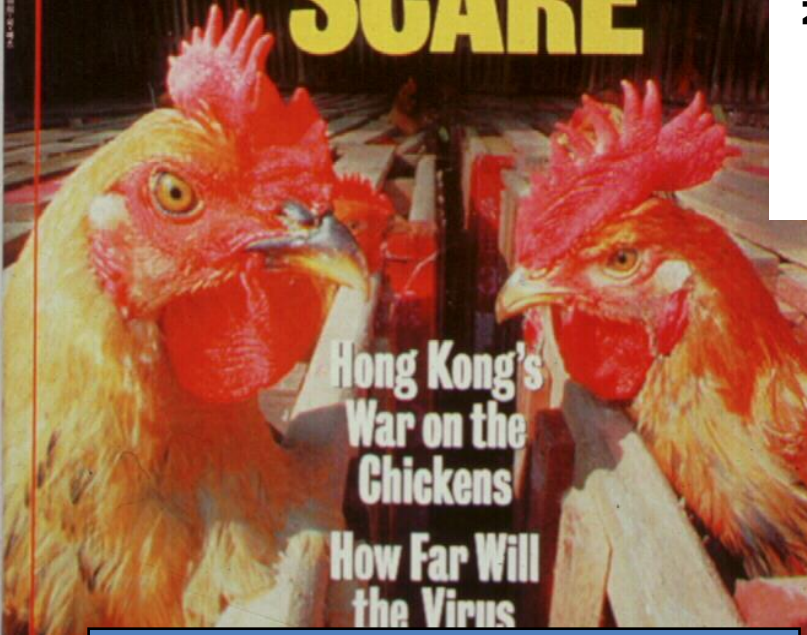
Emergence of a obscure nephropathy in areas covered by the irrigation scheme



# Newsweek

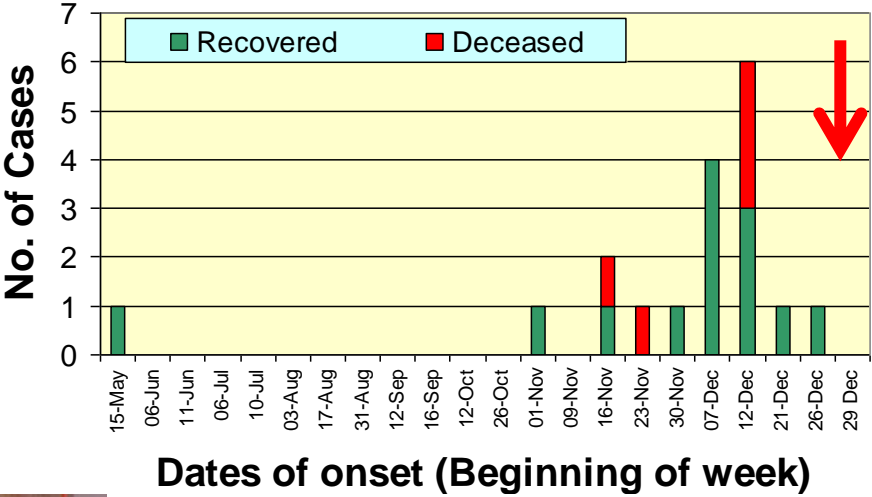
THE INTERNATIONAL NEWSMAGAZINE

## THE 'BIRD FLU SCARE



H5N1: First detected in Hong Kong 1997

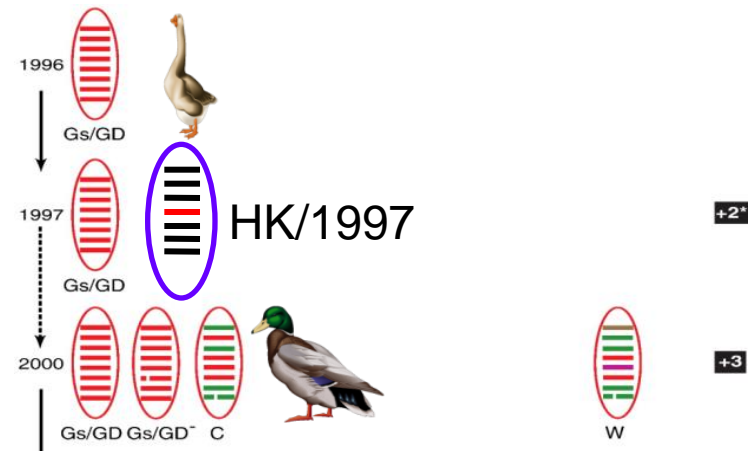
### Epidemic Curve of Influenza A (H5N1) Cases in HKSAR, May - Dec 1997



# Active surveillance

## Avian flu H5N1-Post 1997

- 2000 Reassortment in ducks
- 2001 Live poultry markets
- 2002 Farm outbreaks
- 2002 Wild birds



- Progressive implementation of evidence based interventions
- Avian flu task force:  
Convener Dr PY Leung

Live poultry markets **maintain, amplify AND  
DISSEMINATE** avian influenza viruses

**Cultural resistance to close all live poultry markets**



**Poultry farms**

**Wholesale poultry  
market**

**Retail poultry  
Market**

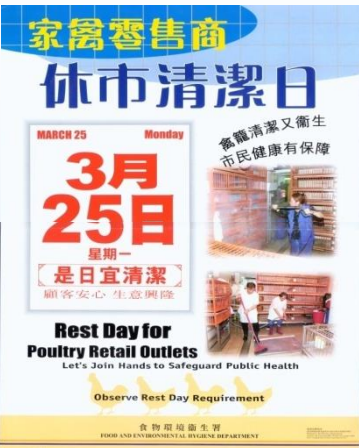
*Sims & Peiris Current Top Microbiol Infect 2012*

*Kung et al Avian Dis 2003; Lau et al EID 2007; Leung et al - 2012*

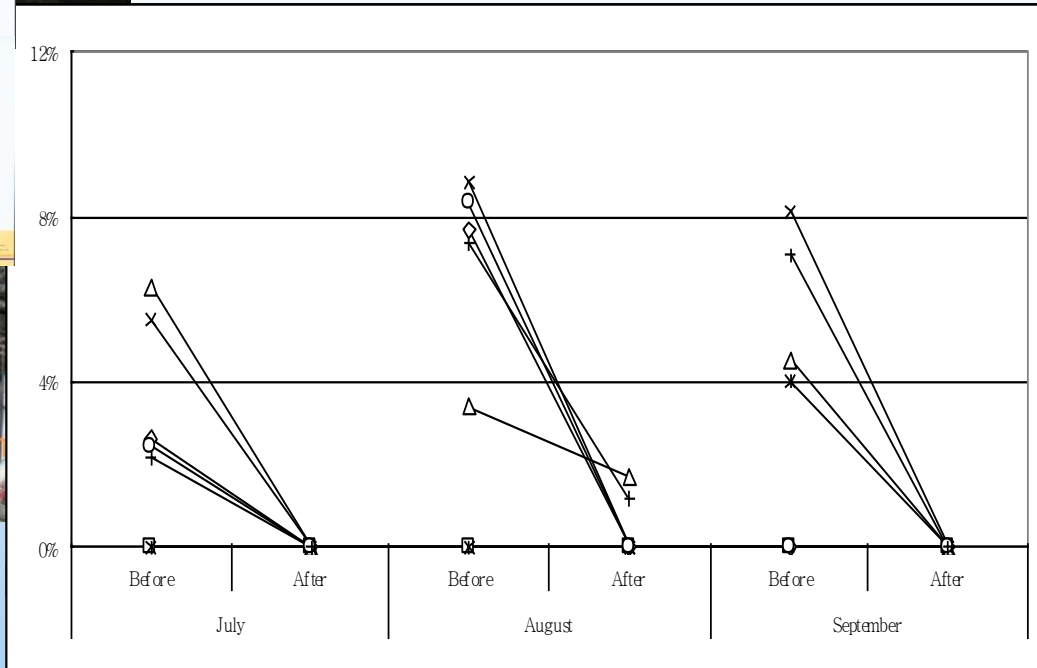
*Kung et al Emerg Infect Dis 2007*

# Live poultry markets maintain, amplify AND DISSEMINATE avian influenza viruses

**Cultural resistance to close all live poultry markets**



Poultry fa



Retail poultry Market

*Sims & Peiris Current Top Microbiol Infect 2012*

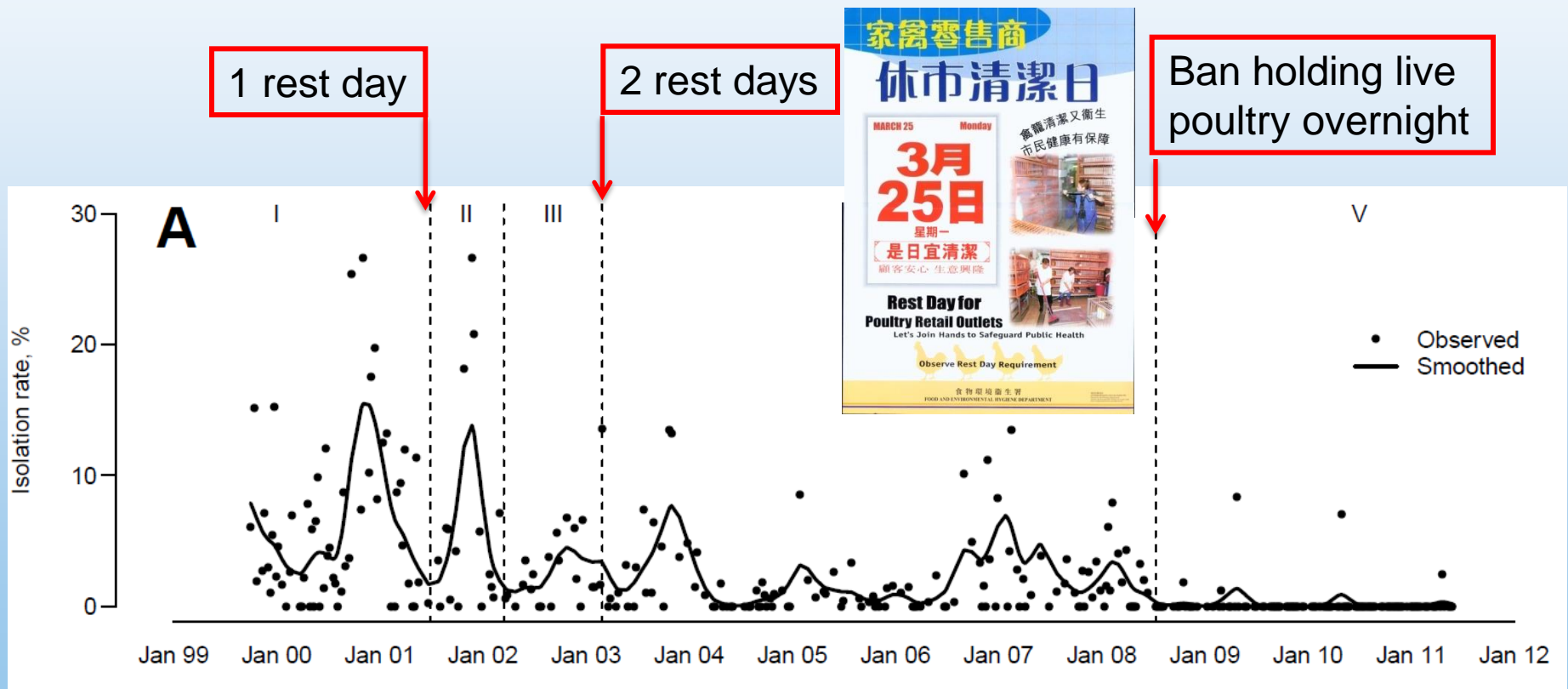
*Kung et al Avian Dis 2003; Lau et al EID 2007; Leung et al - 2012*

*Kung et al Emerg Infect Dis 2007*

# Evidence based interventions in live poultry markets

## *Isolation rates of H9N2 viruses in chicken*

1999-2011; monthly surveillance; 5-8 FEHD poultry markets; 53,541 samples



# Live poultry markets: A “dead-end” for the poultry, not for the virus.



**Poultry farms**



**Wholesale poultry market**



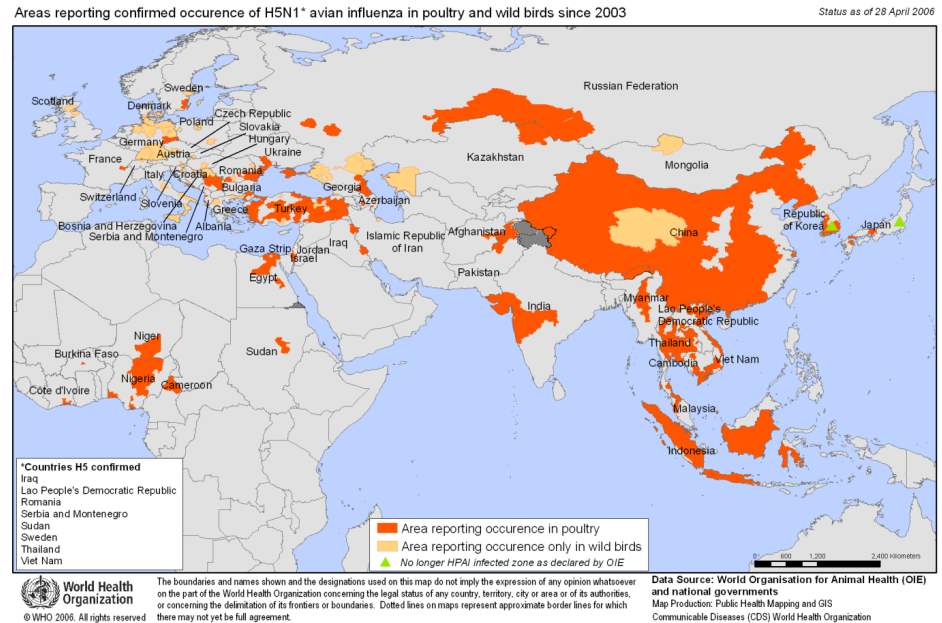
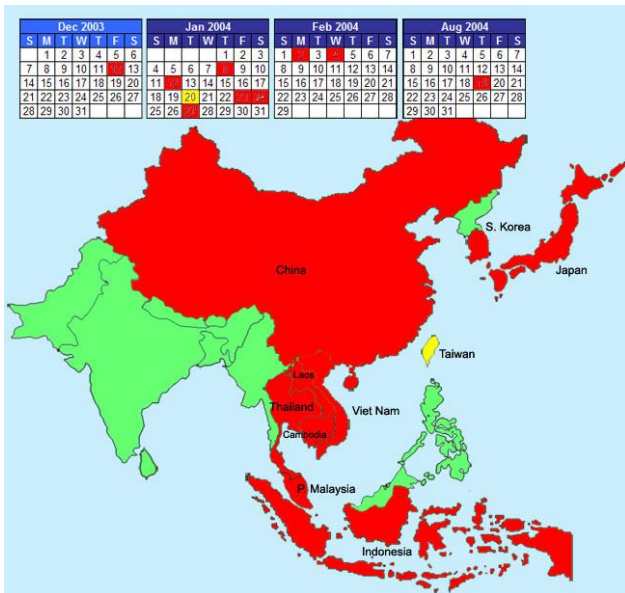
**Retail poultry Market**

*Sims & Peiris Current Top Microbiol Infect 2012*

*Kung et al Emerg Infect Dis 2007*

# 2004

# 2004 – to date



## Lessons

As of Aug 2012, 608 human cases, 359 deaths

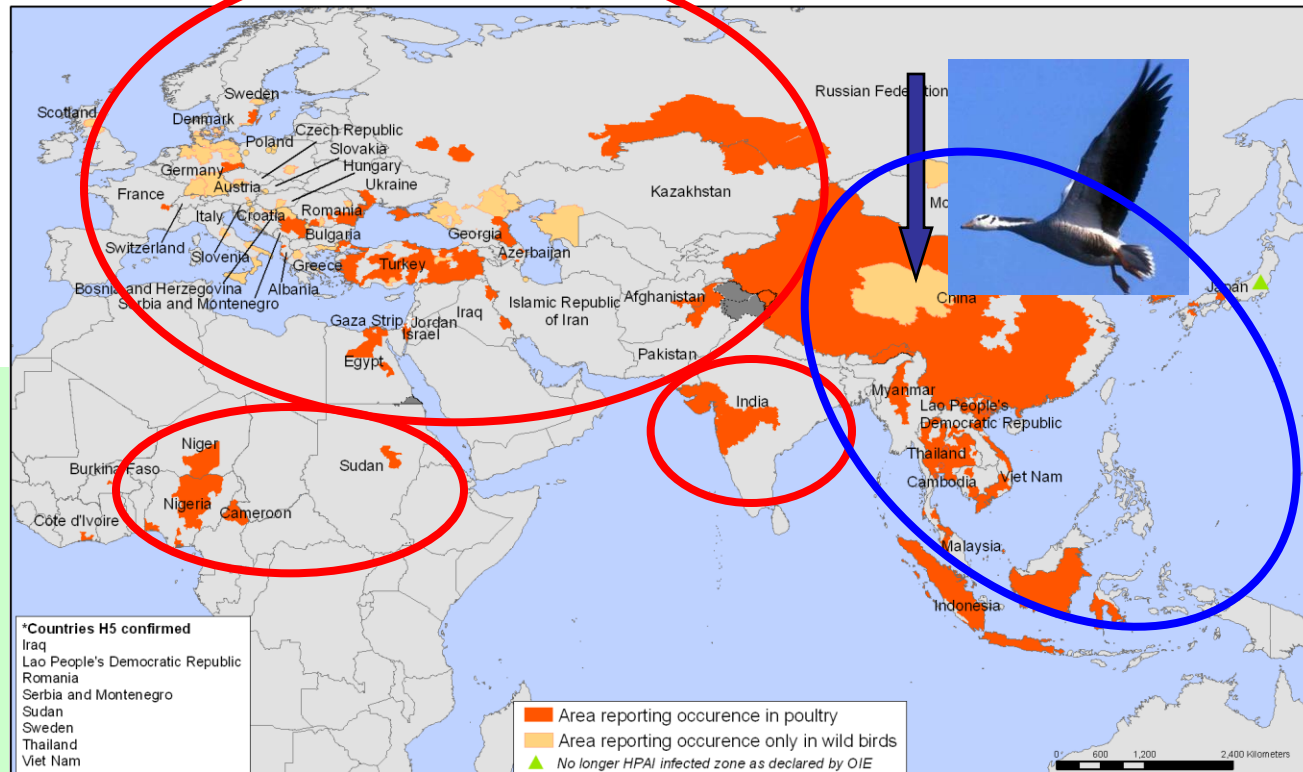
- Active surveillance, evidence-based intervention and applying a “One health” approach protected Hong Kong.
- Hong Kong: a “sentinel post” for the region.
- What if - - - - -?

# Qinghai Lake outbreak: April 2005

Qinghai Lake: April 2005  
 Bar headed geese, Brown headed gull  
 Great black headed gull, Great cormorant

Areas reporting confirmed occurrence of H5N1\* avian influenza in poultry and wild birds since 2003

Status as of 28 April 2006



“There is a danger that it may spread to the south Asian subcontinent .... And Europe”

Chen et al Nature July 17 2005



# “Pet-bird” trade and H5N1 avian flu in Hong Kong

## Wing and a prayer

**15** birds have been found with Fujian-like H5N1 in Hong Kong so far this year

**3** Scaly breasted munia

- Jan 3 Leighton Rd, Wan Chai
- Feb 21 Sing Woo Rd/Wong Nai Chung Gap Rd, Happy Valley
- Feb 27 Fu Cheong Estate, Sham Shui Po



**1**



**Crested goshawk**  
Jan 12 Shek Kip Mei Health Centre, Sham Shui Po

**1**

**White-rumped munia**  
Jan 18 Boundary St, Kowloon City

**1**



**Peregrine falcon**  
Jan 24 Chai Wan Kok St, Tsuen Wan

**1**



**Common kestrel**  
Feb 17 Pak Tin Estate, Sham Shui Po

**2**



**House crow**  
Jan 17 Lai On Estate, Sham Shui Po  
Jan 25 Yee Kok Crt, Sham Shui Po

**1**

**Blue magpie**  
Feb 7 Tai Po Rd, Sham Shui Po

**1**

**Chestnut munia**  
Feb 21 Prince Edward Rd West, Kowloon City

**1**



**Japanese white-eye**  
Jan 17 Kai Tak, Kowloon City

**2**



**Silver-eared mesia**  
Feb 9 Boundary St, Kowloon City



Ceremonial religious bird release → brings “merit”



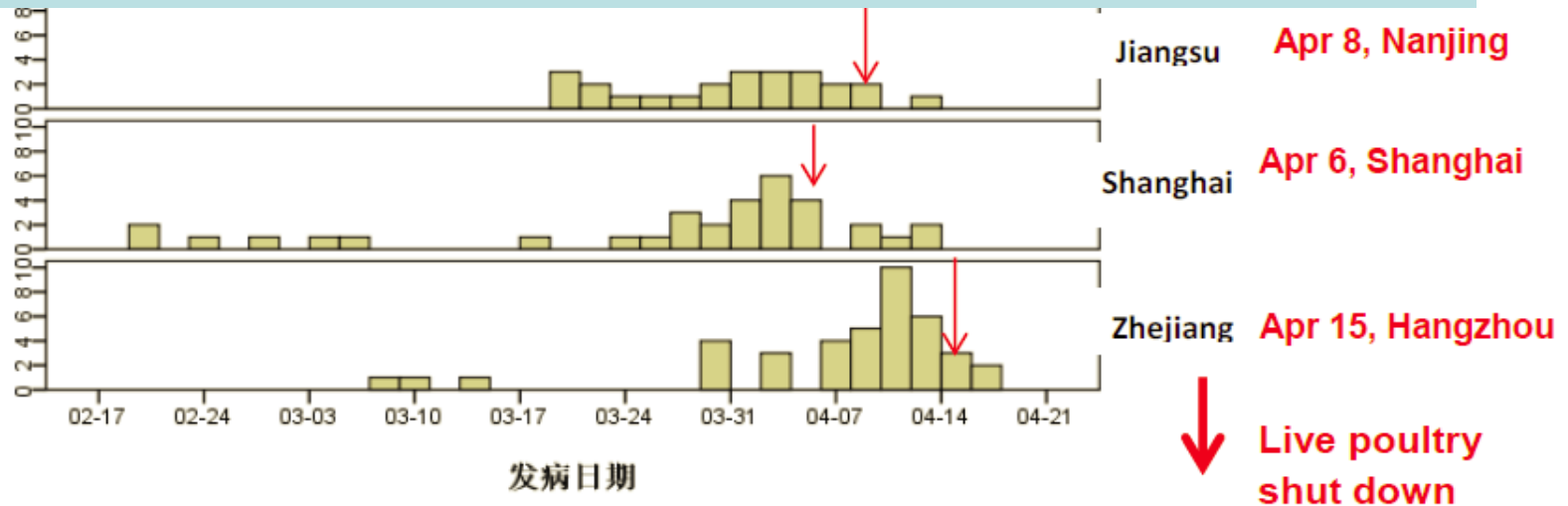
“fangsheng”

# Epi-curve of human H7N9 cases by province: (as of April 22, 2013)

How long will the live poultry markets stay closed?

- Cultural preference
- Food security

Case NO.



China-WHO Joint Mission on Human Infection with Avian Influenza A(H7N9) virus: April 2013

離境大堂入口  
Departure Hall Entrance



### 攜帶嬰幼兒食用配方粉出境新規定

(2013年3月1日起實施)

Quantity of Powdered Formula for  
Persons Departing from Hong Kong  
(with effect from 1 March 2013)



**1.8**  
公斤/kg

攜帶超額嬰幼兒食用配方粉出境

**即屬違法**

Departing with excessive powdered formula

**COMMITS AN OFFENCE**

每名16歲或以上人士，在每24小時計的首次出境時，將獲豁免，  
可攜帶相當于2罐，總淨重不超過1.8公斤配方粉。  
Those aged 16 or above are exempt on their first departure within a 24-hour period, and each  
may take 2 cans of powdered formula with a total net weight up to 1.8 kg out of Hong Kong.

### 城際直通車 Intercity Through Train

登車資料  
Boarding information

車次 Train no.      狀況 Status

**T 818**      現在可以登車  
Now boarding

**T 98**      現在可以登車  
Now boarding

下一班列車開出時間 Next departure

**T 810**      **16:35**

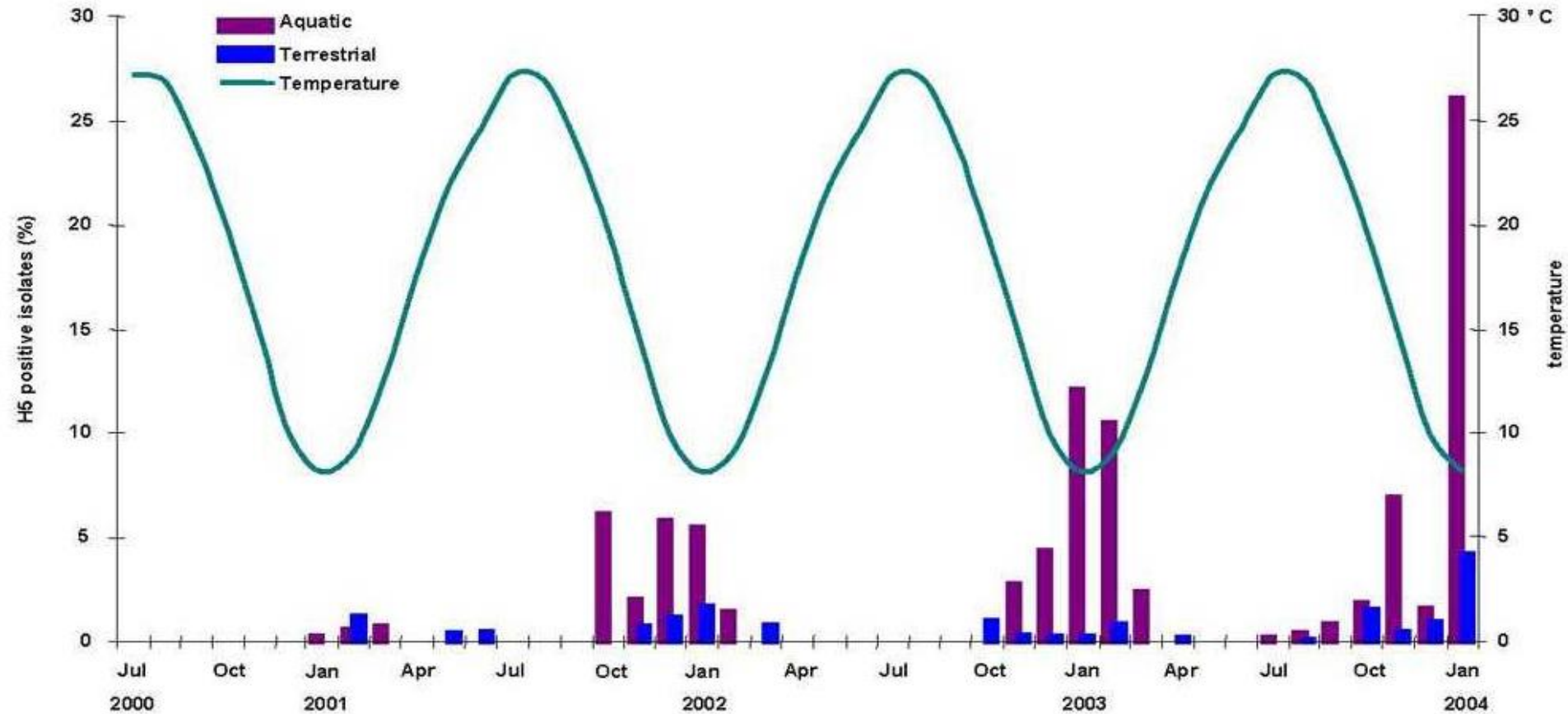
入閘時間  
Gate will open at      **1545**

離境大堂入口將於列車開出前10分鐘關閉  
The entrance to the Departure Hall closes 10 minutes before  
the scheduled departure time

EXIT 出口



# Surveillance of H5N1 viruses in “HEALTHY” poultry in live poultry markets in China (2000-2004)



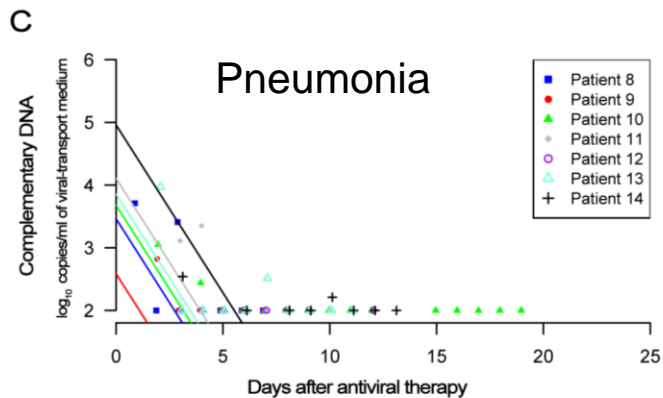
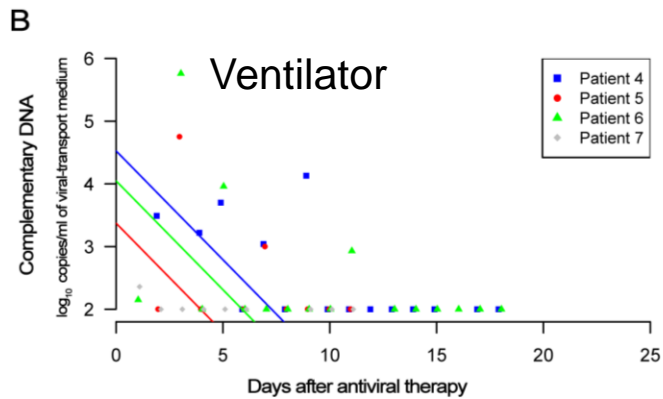
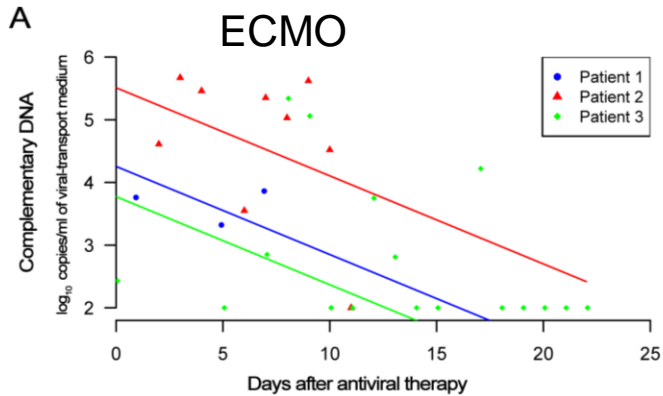
*Li et al Nature 2004; 430: 209-213*

# Transmissibility of A(H7N9) in ferrets

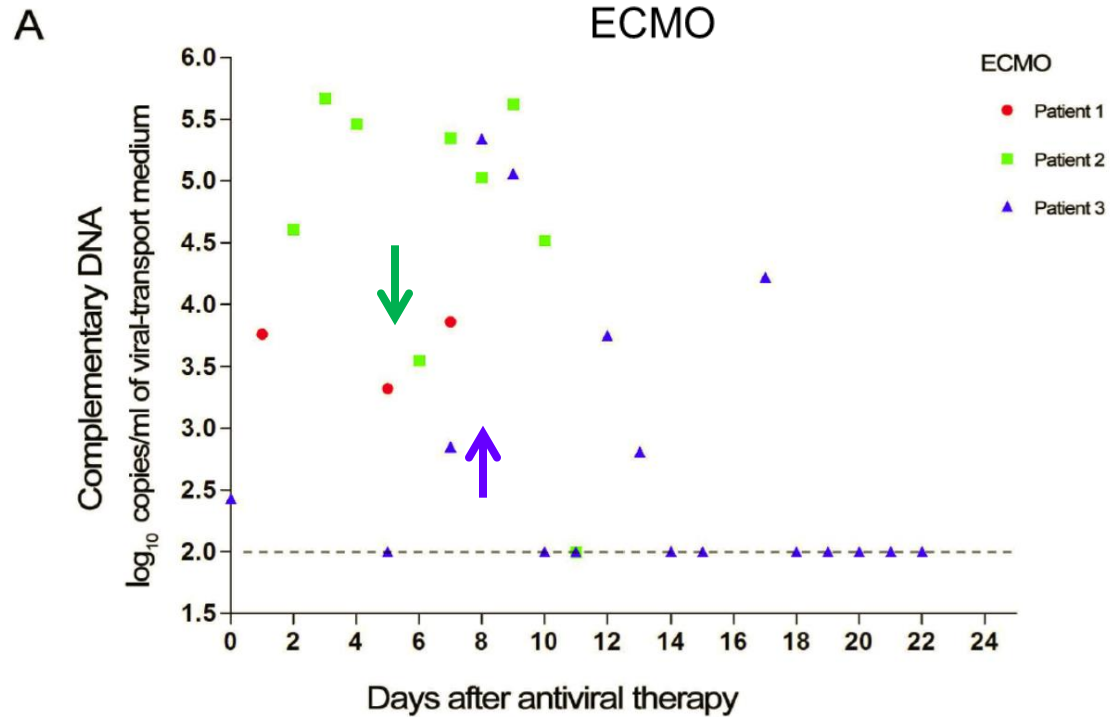
Ferret Groups	Virus*	Signs		Shedding of virus		Seroconversion‡ #animals (titers)
				# animals	onset†	
Inoculated	SH2	6/6	6/6	1,1,1,1,1,1	7,7,7,7,7,7	6/6 (320-640)
	CA07	6/6	6/6	1,1,1,1,1,1	5,6,6,6,6,6	6/6 (>1280)
Direct contacts	SH2	3/3	3/3	2,3,3	5,6,7	3/3 (320-640)
	CA07	3/3	3/3	1,1,2	6,6,6	3/3 (>1280)
Airborne exposed	H7N9 SH2	3/3	1/3	nd,nd,3	na,na,6	2/3 (320, 40, <10)
	pdmH1N1CA07	3/3	3/3	2,3,4	6,6,7	3/3 (>1280)

\* SH2: A/Shanghai/2/2013(H7N9), CA07: A/California/07/2009 (H1N1). †dpi, dpe. ‡ HAI titer of post-exposure sera at 14 dpi or 14 dpe for each animal, starting dilution at 1:10. nd, not detectable; na, not applicable.

# Viral load in throat swabs after commencement of antiviral therapy

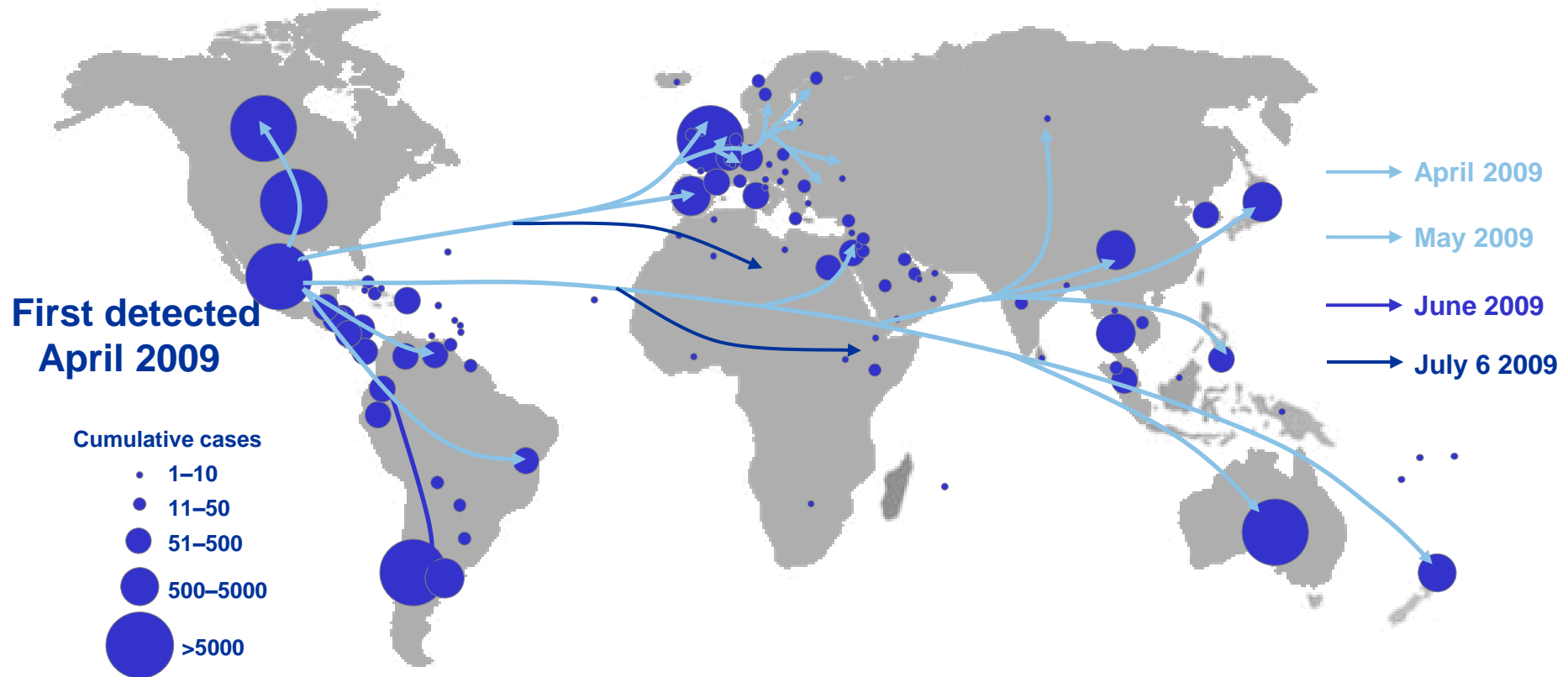


**Emergence of antiviral resistance correlates with rebound of viral load (2/14 patients).**



# In a few weeks, the 2009 H1N1 pandemic spread around the world affecting all countries

*\* Reports up to July 2009*



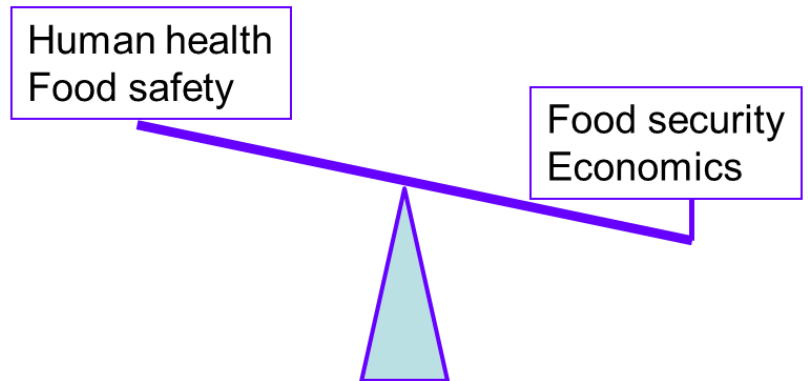


# Conclusions

- Proactive surveillance
  - short term pain / long term gain
  - stay “ahead-of-the-curve”

- Risk-assessment

- Animal health
- Human health



- Evidence-based interventions

“One Health” pays!!

# 軒轅黃帝

## The superior physician

- The **superior physician** helps before the early budding of the disease 上工救其萌芽
- The **inferior physician** begins to help when the disease has already developed; he helps when the destruction has already set in. And since his help comes when the disease has already developed, it is said of him that he is ignorant.  
下工救其已成，救其已敗，  
救其已成者，言不知三部，九之相失。

黃帝內經素問

Wong Dae Noi Ging Sou Men  
(2697-2597 BCE)

The Yellow Emperor's Classic of  
Internal Medicine



*Slide courtesy of Gabriel Leung*



**Research Fund Secretariat**  
Food and Health Bureau  
Hong Kong Special Administrative Region



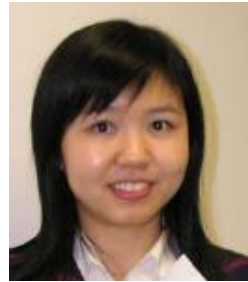
大學教育資助委員會  
University Grants Committee



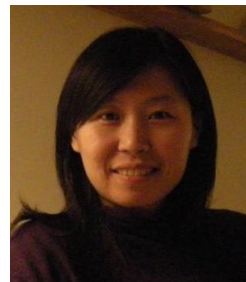
Yi Guan



Leo Poon



Renee Chan



H Yen



Michael Chan



Ben Cowling



Joe Wu

**School of Public Health; The University of Hong Kong  
Centre of Influenza Research / HKU Pasteur Research Pole**

Yi Guan, Leo Poon, Michael Chan, Renee Chan, H Yen,  
Huachen Zhu, Ken Shortridge

**Department of Pathology:** John Nicholls

**Depts of Agriculture & Food / Environmental Hygiene, Health:**

Les Sims, Trevor Ellis, Geraldine Luk, Miranda Lee (PY Leung)

**St Jude Children's Research Hospital, Memphis:**

RG Webster, R Webby



John Nicholls



Gabriel Leung

**Area of Excellence  
CONTROL OF PANDEMIC AND  
INTER-PANDEMIC INFLUENZA**

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EUROPEAN MANAGEMENT PLATFORM FOR EMERGING AND RE-EMERGING INFECTIOUS DISEASE ENTITIES

**CEIRS**

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