What makes communicable diseases so special?

Lecture for Public Health in Action series

5th Nov 2014

Dr Chen I-Cheng Mark (ephcicm@nus.edu.sg)
Saw Swee Hock School of Public Health
National University of Singapore

Outline

- **A “personal introduction”**
- **What makes communicable diseases special?**
- **What are some of the implications?** **(50 min)**
- **What could be your contribution in an epidemic?**
- **A critique from a pandemic past**

- **Group work + Break** **(50 min)**

- **Presentations** **(40 min)**

- **Summary and clarifications** **(10 min)**

But first, a little about my “personal introduction” to what makes communicable diseases so special…

- **Working as a junior epidemiologist at the Communicable Disease Centre (CDC), Tan Tock Seng Hospital**
- **Call from Director CDC on afternoon of 14th Mar 2003…**

ALL DOCTORS PLEASE READ

MOH MED_Alert@MOH.GOV.SG on 13/03/2003 15:36:03

Please respond to MOH_MED_Alert@MOH.GOV.SG

To: MOH_MEDICAL_ALERT@MSG1.INTERNET.GOV.SG

cc: (bcc: Kum Ying Tham/MEDICAL/TTSH)

Subject: OUTBREAK OF ATYPICAL PNEUMONIA IN HONG KONG, VIETNAM AND GUANGDONG PROVINCE IN CHINA

CONFIDENTIAL

MH 34:03 Vol 14

13 March 2003

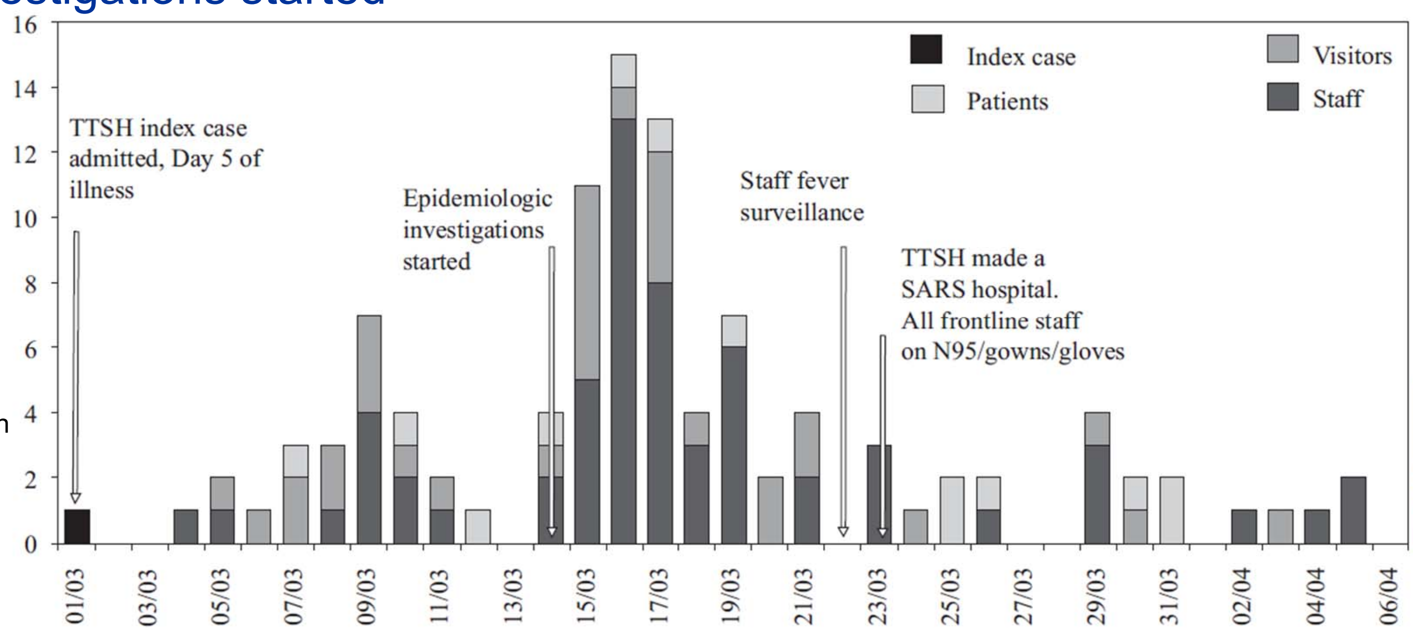
All Registered Medical Practitioners

OUTBREAK OF ATYPICAL PNEUMONIA IN HONG KONG, VIETNAM AND GUANGDONG PROVINCE IN CHINA

Severe Acute Respiratory Syndrome (SARS) in Singapore, March 2003

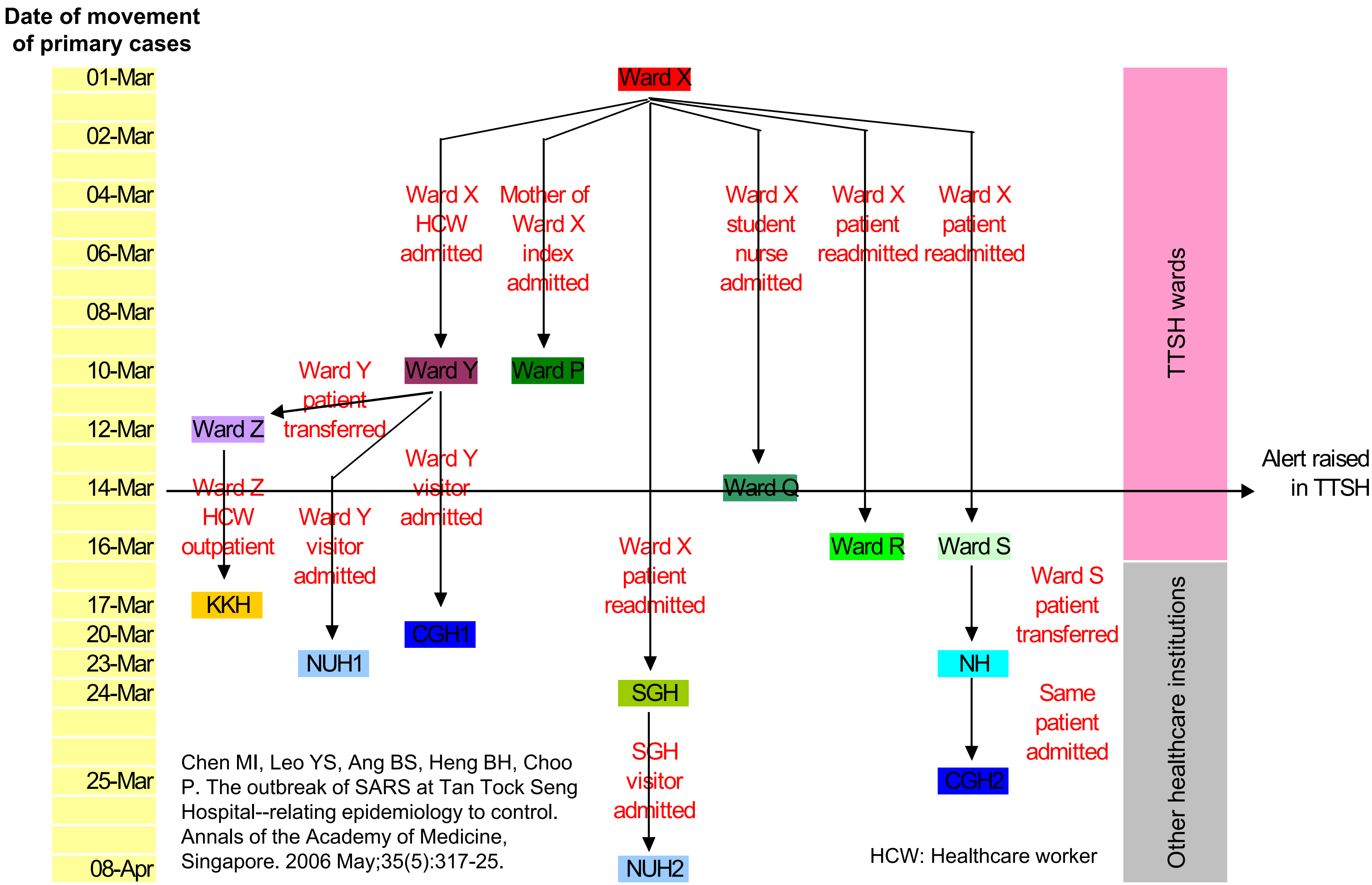
- **12th March 2003, Wednesday**
  - World Health Organisation issued an Alert for SARS
- **13th March 2003, Thursday**
  - Preliminary investigation: multiple sick staff in Tan Tock Seng Hospital (TTSH), some already admitted
- **14th March 2003, Friday**
  - Recalled sick staff in affected wards, admitted them to isolation rooms
  - Case investigations started

Epidemic curve of probable SARS cases infected in TTSH, March to April 2003



Chen MI, Leo YS, Ang BS, Heng BH, Choo P. The outbreak of SARS at Tan Tock Seng Hospital--relating epidemiology to control. Annals of the Academy of Medicine, Singapore. 2006 May;35(5):317-25.

SARS, up close and personal: transmission spreading within &from Tan Tock Seng Hospital



Chen MI, Leo YS, Ang BS, Heng BH, Choo P. The outbreak of SARS at Tan Tock Seng Hospital--relating epidemiology to control. Annals of the Academy of Medicine, Singapore. 2006 May;35(5):317-25.

SARS revisited: If in 2nd half of March 2003…

If you were standing in our shoes at the time…

- **What would be some of your main concerns?**
- **What would you want to know?**
- **What would be your priorities?**

- ***And how could you contribute?***

Outline

- **A “personal introduction”**
- **What makes communicable diseases special?**
- **What are some of the implications?** **(60 min)**
- **What could be your contribution in an epidemic?**
- **A critique from a pandemic past**

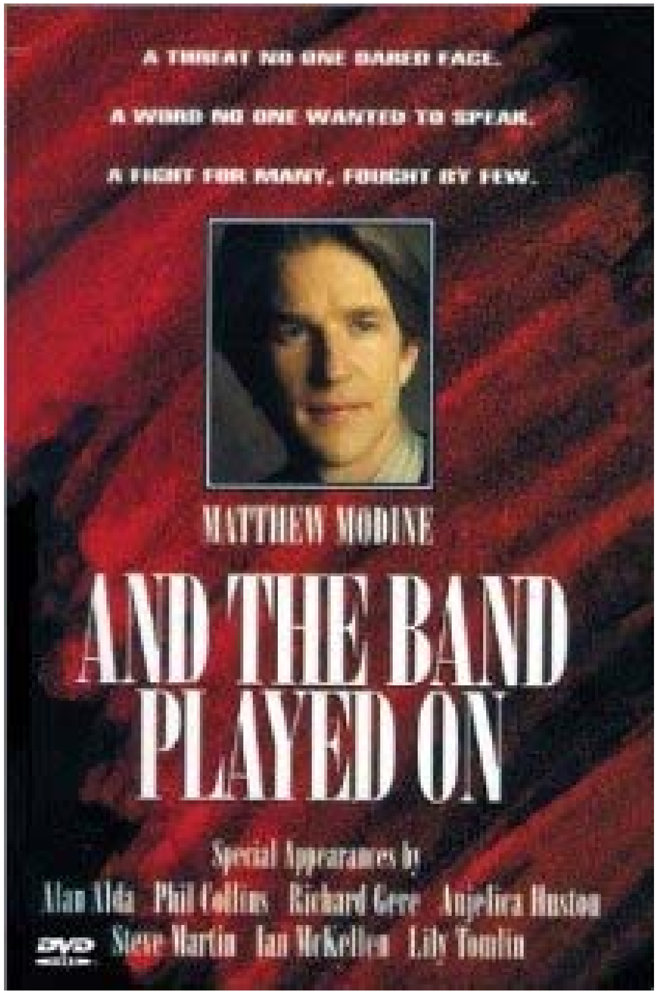
- **Group work + Break** **(45 min)**

- **Presentations** **(40 min)**

- **Summary and clarifications** **(10 min)**

So what makes communicable diseases special… as compared to
- ***obesity***
- ***diabetes***
- ***cancer***
- ***drowning etc?***

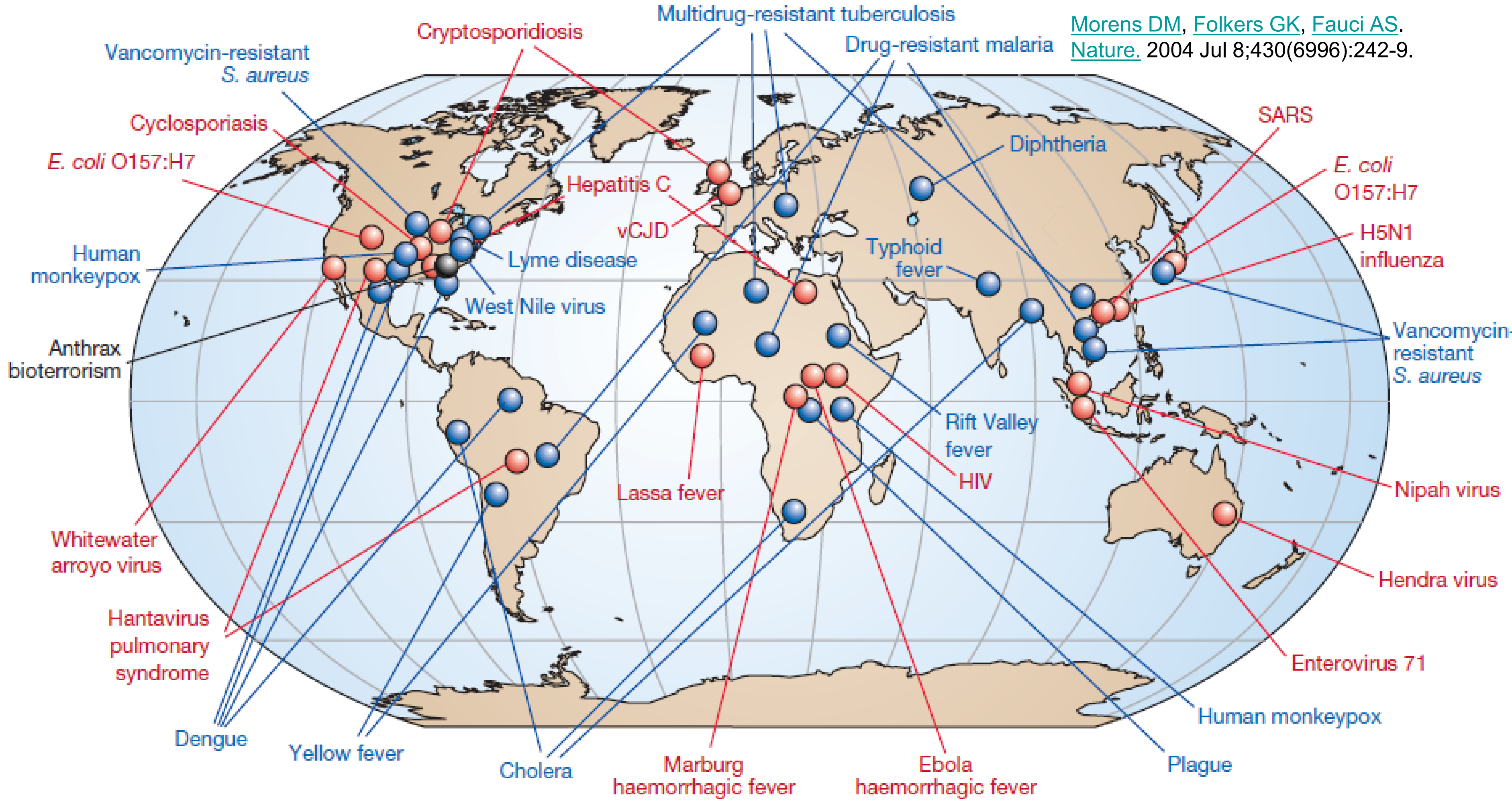
Much more exciting movies!



- Two movies that highlight important issues in dealing with communicable diseases…

New infectious agents will continue to emerge and evolve…

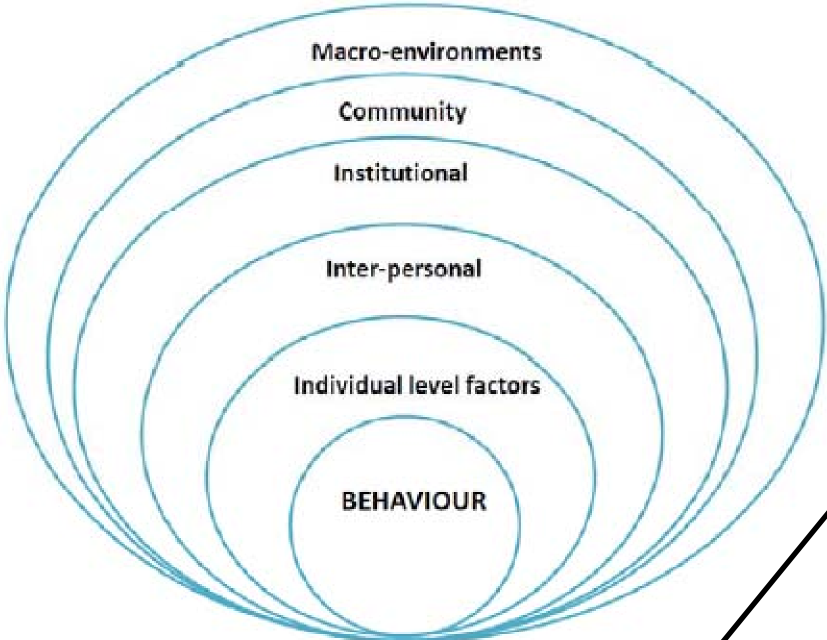
Morens DM, Folkers GK, Fauci AS. Nature. 2004 Jul 8;430(6996):242-9.



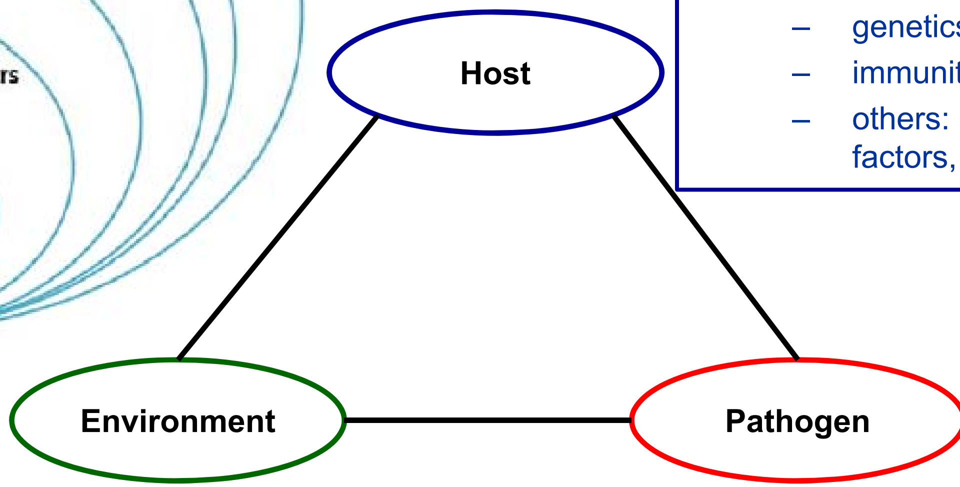
Global examples of emerging and re-emerging infectious diseases. Red represents newly emerging diseases; blue, re-emerging/resurging diseases; black, a 'deliberately emerging' disease

And each new one will have its own (and at times) unpredictable nature…

Complex **interactions** between host, pathogen, environment can affect impact of communicable diseases



Modified from Story et al 2008, Ann Rev of Pub Health, 29, 253-272, Glanz et al, Am J Health Promot 2005 ; 19(S):330-333, US Center for Disease Control and Prevention



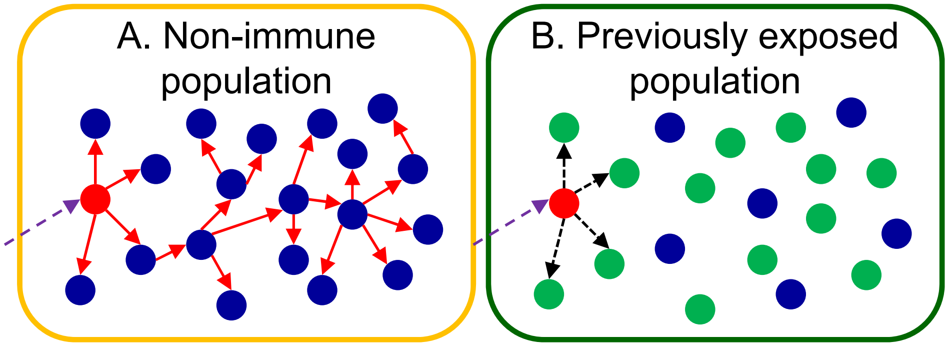
- **Socio-demographics**
  - age and gender, socioeconomics
- **Behaviour**
  - personal hygiene and choices, sexual practices
- **Biology**
  - genetics
  - immunity from exposure / vaccines
  - others: nutritional, co-morbid factors, access to treatment

- **Physical**
  - location, space / crowding, climate
- **Biological**
  - Vectors
  - Ecosystems
- **Social and political**
  - relationships and networks
  - health systems

- **Type and characteristics of infectious agent**
  - prion, virus, bacterium, protozoa, fungus
  - life cycle
  - pathogenicity
  - adaptation of pathogen to host and environment
  - infectiousness and infectious dose

Adapted from http://www.cdc.gov/osels/scientific_edu/ss1978/lesson1/Section8.html

Some examples of complex host, pathogen and environmental interactions



non-immune infectious immune
contact with cases outside population
pathway for onward transmission
contact without onward transmission

Contact with infectious cases starts an epidemic in A but not B.

How changes in a food-web might affect infectious diseases

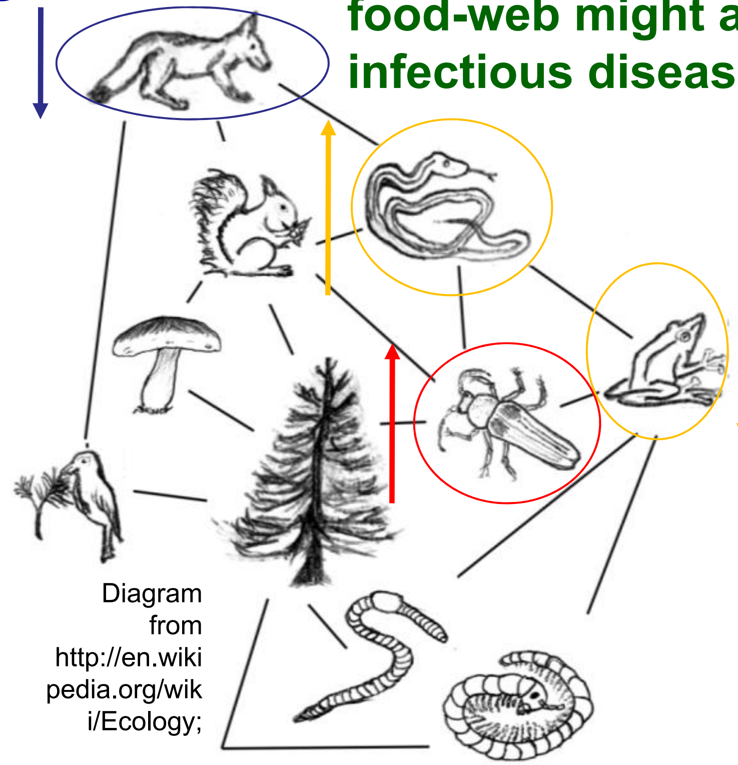
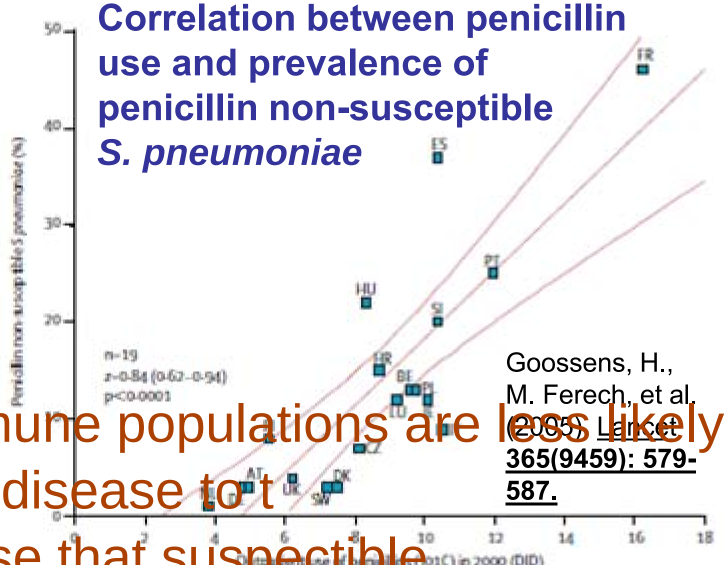


Diagram from http://en.wikipedia.org/wiki/Ecology;

Correlation between penicillin use and prevalence of penicillin non-susceptible *S. pneumoniae*



Goossens, H., M. Ferech, et al. (2005). Lancet **365(9459): 579-587.**

Pathogens adapt to interventions:

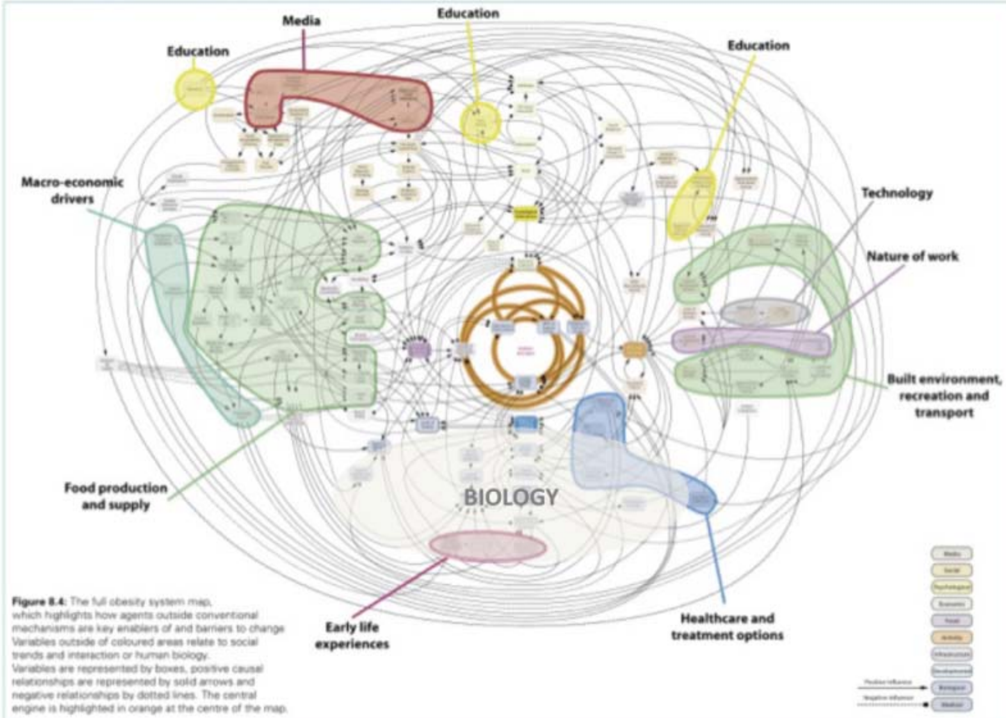
- higher antibiotic use → more drug resistance

- makes infections harder to treat

immune populations are less likely to undergo outbreak as it reduces the spreading of the disease to t those that suspectible

AT, Austria; BE, Belgium; HR, Croatia; CZ, Czech Republic; DK, Denmark; FI, Finland; FR, France; DE, Germany; HU, Hungary; IE, Ireland; IT, Italy; LU, Luxembourg; NL, Netherlands; PL, Poland; PT, Portugal; SL, Slovenia; ES, Spain; UK, England only.

Figure 8.4: The full obesity system map, which highlights how agents outside conventional mechanisms are key enablers of and barriers to change



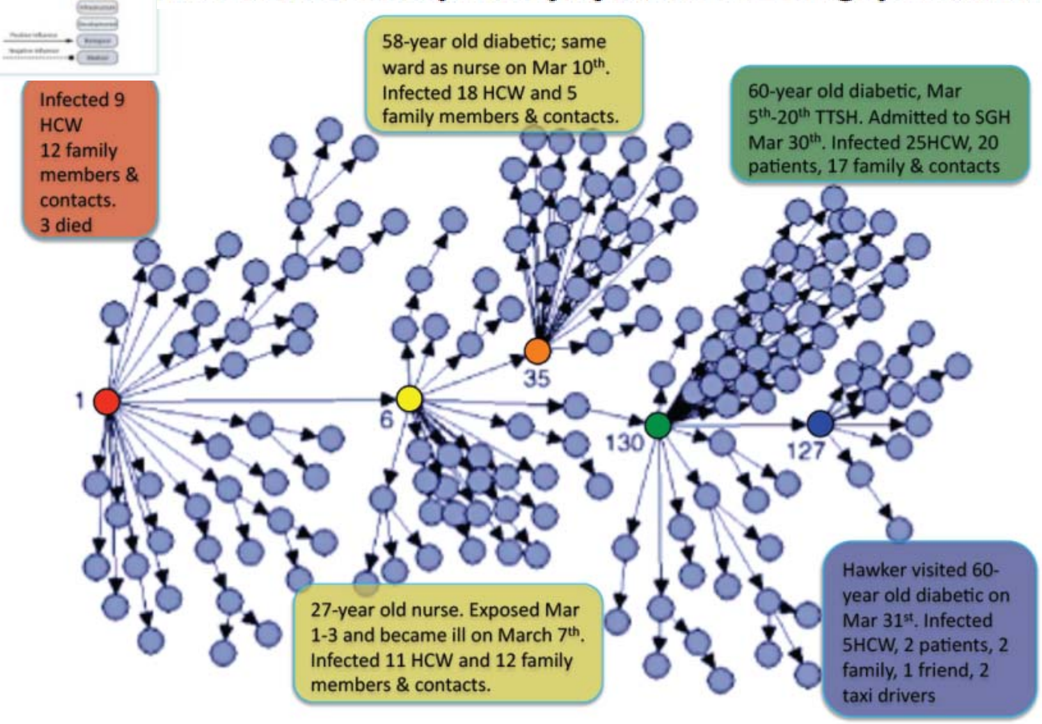
What's one key difference?

- **Many things contribute to obesity**
- **But does obesity itself cause obesity?**

CDC
MMWR
May 9, 2003 / Vol. 52 / No. 18

Reported by: *YS Leo, MBBS, Communicable Disease Center; M Chen, MBBS, BH Heng, MSc, CC Lee, MRCP, N Paton, MD, B Ang, M Med, P Choo, MBBS, SW Lim, Tan Tock Seng Hospital; AE Ling, MBBS, ML Ling, MBBS, BK Tay, MBBS, Singapore General Hospital; PA Tambyah, MBBS, YT Lim, FRCP, National Univ Hospital; G Gopalakrishna, MSc, S Ma, PhD, L James, M Med, PL Ooi, MSc, S Lim, MSc, KT Goh, MSc, SK Chew, MSc, CC Tan, FRCP, PhD, Ministry of Health, Singapore.*

Severe Acute Respiratory Syndrome — Singapore, 2003

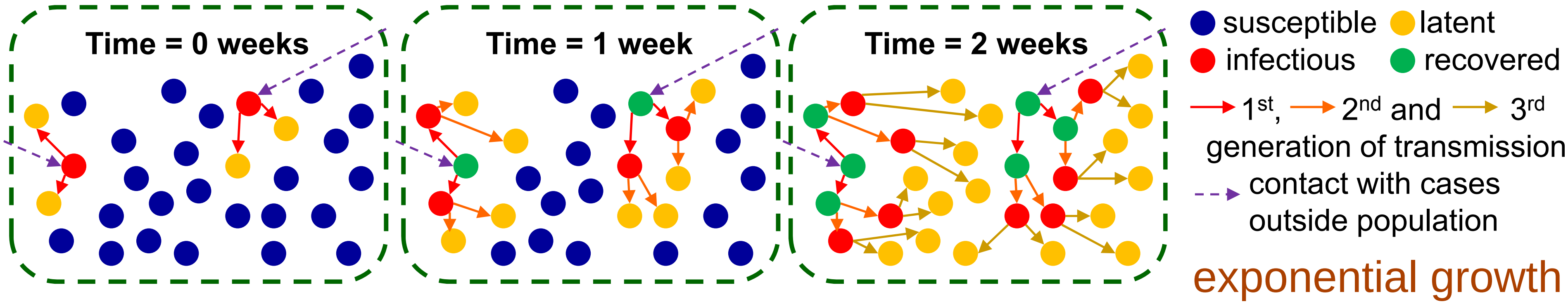


- **In SARS, cases of SARS were an *essential cause* for all new cases in the chain of transmission**

  This has some interesting consequences…

Cases are the cause of more cases: Dynamic nature of communicable diseases

- **Assume we have an "immunising" infection where:**
  - 1 infectious person transmits to two contacts (if they are *"susceptible"*)
  - ~1 week to produce the next generation of infections
- **Two individuals had contact outside population at time = 0**



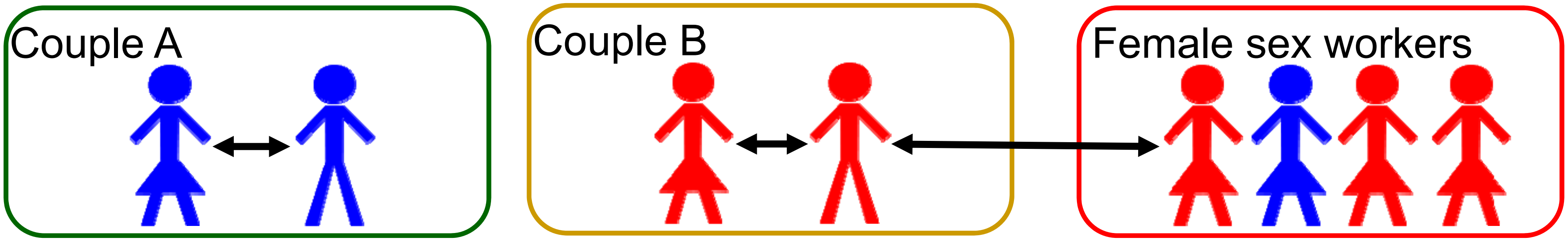
- **Incidence depends on number of cases the week before**
  - at time = 0 weeks: 2/30 = 6.7 per 100 persons
  - at time = 2 weeks: 8/30 = 26.7 per 100 persons

Only factor changing is no. of infectious individuals in week before

- **Rapid change of incidence and risk factors for infection**

Cases are the cause of more cases: Individual exposures have ***direct effect*** and ***indirect effect***s

- **Risk factors at the individual level can have indirect effects**
  - suppose two females in married couples, with no extra-marital sex
  - male partner in couple A is monogamous, but male partner in couple B has sex with sex workers with high prevalence of sexually transmitted infections
  - risk behaviour of male partner in couple B hence has ***direct effect*** of increasing his risk, and ***indirect effect*** of increasing risk for his female partner



- **Protecting individuals may require control measures in others / elsewhere**
- **Other examples:**
  - protect the elderly by vaccinating children in the same household
  - protect a village community from dengue infections due to behaviours at the village level in preventing mosquito breeding
  - protect the public by isolating and quarantining cases and contacts

public health requires invasive actions and questions so as to protect people around who has indirect effect.

Cases are the cause of more cases: effects can be accounted for through mathematical models

Concept of "Basic reproductive number":

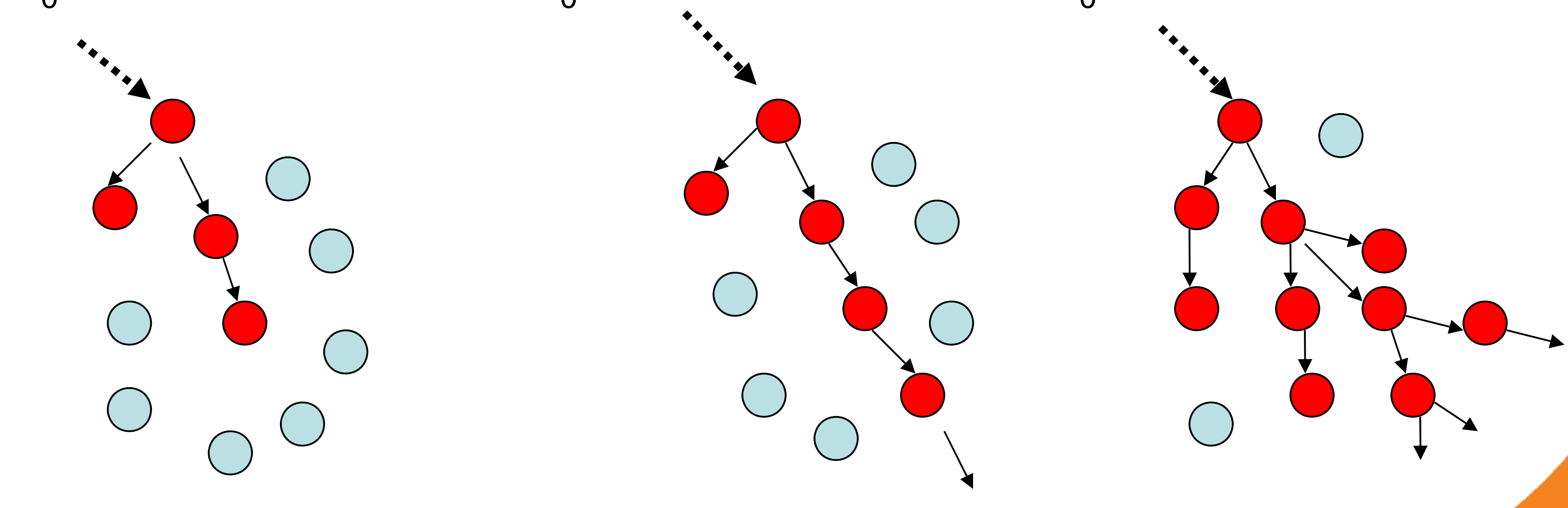
– average no. infectious cases produced by infectious case in a *fully susceptible population*

- **If R_0 < 1, some secondary cases occur, but infection dies out**
- **If R_0 = 1, cases propagate but no exponential growth occurs**
- **If R_0 > 1, no. of cases grows exponentially**

For a self-sustaining epidemic to occur, R_0 must be > 1.

And if in an outbreak we estimate R_0 is > 1, we can expect the disease to spread!

$R_0 = ¾ = 0.75$ $R_0 = 5/5 = 1.0$ $R_0 = 13/10 = 1.3$



Outline

- A “personal introduction”
- What makes communicable diseases special?
- What are some of the implications?
- What could be your contribution in an epidemic?
- A critique from a pandemic past

(60 min)

- Group work + Break (45 min)
- Presentations (40 min)
- Summary and clarifications (10 min)

Communicable diseases are special:

• new and evolving pathogens can be unpredictable

• complex interactions between host, pathogen and environment

• cases are the cause of more cases

Combination of above factors has several implications for the impact and control of communicable diseases.

Dealing with "unknowns"

- **In the initial phases of managing novel infectious disease threats, we have to deal with "not knowing" many things.**
  - Need to urgently determine many features of the new disease

Dealing with the unknown: critical questions of public health consequence for a new disease

Disease characteristic	**Relevance**
How do we identify infections?	To prevent transmission by infectious individuals
Are there infectious individuals with unrecognisable symptoms?	Determines the necessity of “contact tracing”
What treatments are effective?	How best to treat cases to reduce deaths
How severe is the infection? - what % need hospitalisation - what % need intensive care - what % die	Resources needs, pay-off for controlling spread, and final impact if not controlled
How long after infection before symptoms / infectiousness? *[incubation and latent periods]*	How fast “contact tracing” and other interventions need to be
How long does a person stay infectious?	Duration a person needs to be “isolated”
How transmissible is it?	How extensive contact tracing needs to be (e.g. close family versus entire workplaces etc)
How is the disease transmitted, and what is protective?	Determines type of precautions, e.g. masks, environmental cleaning etc

Spread of misinformation

Web-blogger claims alternative cure

- **Misinformation can spread faster, and be more believable than truth**
  - In absence of verifiable facts, myths often fill the gap
  - Also, some may choose the comfort of "false hope"

  But myths can have serious consequences…

Spread of misinformation in infectious diseases

Bloomberg Our Company | Professional | Anywhere

HOME QUICK NEWS OPINION MARKET DATA PERSONAL FINANCE TECH POLITICS SUSTAINA

SARS Myths Popped by Singapore's Lee -- Booze, Tobacco No Help

SARS Myths Popped by Singapore's Lee -- Booze, Tobacco No Help - May 1, 2003 07:29 EDT

Singapore, May 1 (Bloomberg) -- SARS: Indians are immune to it, while a pork-free diet, drinking copious amounts of alcohol and chain smoking cigarettes help keep it at bay.

At least, that's what Singapore's rumor-mongers would have us believe about severe acute respiratory syndrome, the disease that's killed at least 370 people and infected more than 5,660 worldwide.

- **So serious that Lee Hsien Loong (then deputy prime minister) had to come out to "kill off … rumours"**

Spread of misinformation in infectious diseases

- **Why does misinformation spread?**
  - lack of verifiable information on new disease
  - poor or inadequate communication by scientists and authorities
  - comfort of “false hope”
  - “smarter than expert” mentality
  - profiteering / political motivations
- **What are the consequences?**
  - false security in ineffective treatments / preventive measures
  - failure to get treated
  - difficulty to identify infectious cases for control
  - “virgin myth” in HIV: violence against women, spread of infection
  - vaccine myths, resulting in decreased uptake:
    - increased costs of vaccine programmes
    - epidemics of preventable infectious diseases like measles
    - current failures in polio-eradication

needed to counter such myths.

religious cover for political motivations which stalls such programs.

Speed of epidemic, capacity overwhelmed

Sports hall converted to treatment facility

- **Epidemic can spread more quickly than we can manage**
  - Infectious diseases can stress the health system in different ways: *Different types of hospital beds, lab facilities, availability of drugs and vaccines.*

Capacity issues faced during SARS

- **Patients stay several days after admission**
  - non-SARS patients under observation till SARS could be ruled out
  - SARS patients isolated till recovered
  - severe cases stay in intensive care for weeks
- **Faced serious capacity issues**
  - normally: 60 intensive care beds, 50 isolation rooms (max 2 beds each)
  - had existing patients in these beds
  - within 10 days, exceeded isolation bed capacity
  - similar pressures on intensive care beds
- **Solutions to capacity issues in TTSH**
  - converted “A class” single rooms for isolation
  - transferred existing patients to non-isolation rooms / other hospitals (at risk of spreading infection)
  - stopped elective surgeries to free up “surgical” intensive care beds for SARS patients
- **Consequences of inadequate capacity**
  - infectious SARS patients not isolated
  - cross-infection between infected and uninfected
  - patients who could be saved will die
  - breakdown of system, loss of confidence

BMC Health Services Research BioMed Central

Research article **Open Access**

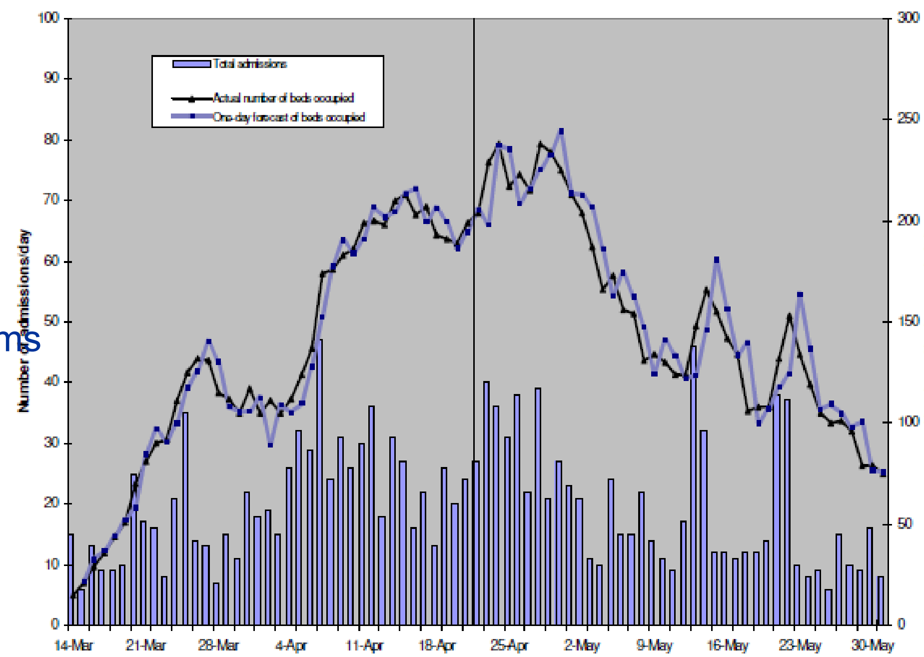
Using autoregressive integrated moving average (ARIMA) models to predict and monitor the number of beds occupied during a SARS outbreak in a tertiary hospital in Singapore

Arul Earnest*†1, Mark I Chen†1, Donald Ng†1 and Leo Yee Sin†2

Address: [1]Department of Clinical Epidemiology, Tan Tock Seng Hospital, Singapore and [2]Communicable Disease Centre, Singapore

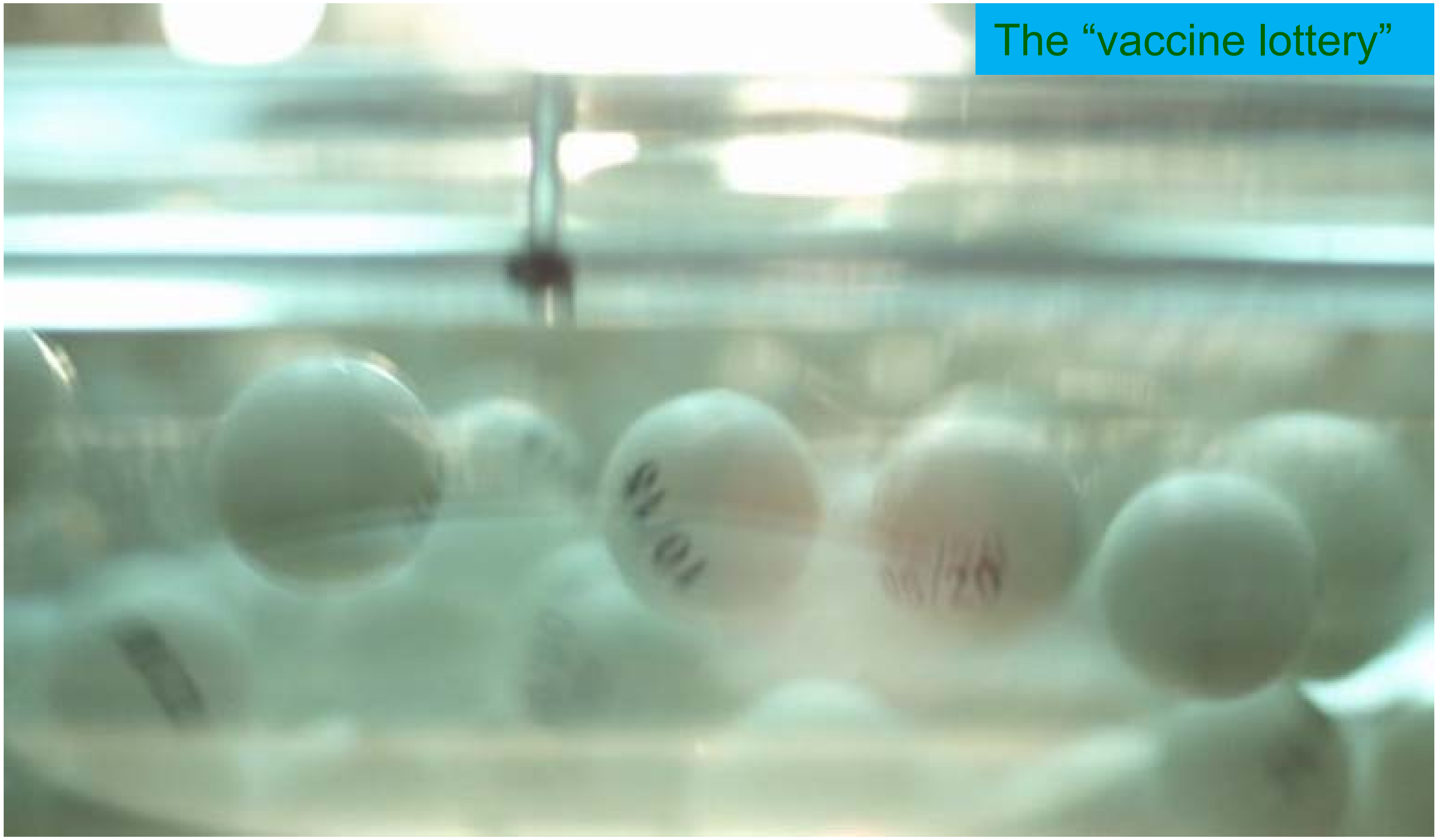
Email: Arul Earnest* - arul_earnest@hotmail.com; Mark I Chen - mark_chen@pacific.net.sg; Donald Ng - don2110@singnet.com.sg; Leo Yee Sin - yee_sin_leo@ttsh.com.sg

* Corresponding author †Equal contributors



semi natural ventilation to prevent spreading of air-borne.

Shortage of vaccines and treatment



- **Capacity for producing vaccines and treatment is limited, particularly for a novel infectious disease.**
  - Need ways optimize the impact of limited supplies
  - Must be seen as fair and acceptable
    - within countries
    - but also between countries

Addressing global inequities in access to vaccines and drugs

WHO epidemiologist in village in Southern China

- **Poorer countries often have lower priority to access vaccines and drugs**
  - Yet poor countries also more at-risk from new infectious diseases

Failure to resolve such international "inequities" has consequences.

Addressing global inequities in access to vaccines and drugs

- **Poor countries likely suffer more in severe pandemic[1]**
  - poorer health status (e.g. malnutrition)
  - poorer healthcare facilities
- **Pandemic drugs and vaccines too costly for poor countries**
  - other health priorities
  - price pegged to affordability in rich countries
- **Consequences of inequity**
  - extreme case: kidnapping, terrorism, war over access
  - failure to control leads to continued spread to neighbours
  - No incentive to cooperate
    - Global disease surveillance
    - Vaccine / drug development

How real are these issues?

theguardian

Ian MacKinnon, South-east Asia correspondent
The Guardian, Friday 24 August 2007

News | Sport | Comment | Culture | Business | Money | Life & style

News > World news

How one nation's fears delayed bird flu vaccine

Four times Indonesia has agreed to share samples of the bird flu virus with the World Health Organisation and four times Jakarta has reneged on the deal. The WHO's protracted battle with Indonesia over the H5N1 virus, the strain needed to develop a vaccine, underlines the difficulties of combating global health crises without international cooperation. Indonesia is the country hardest hit by human avian influenza, suffering 81 of the 192 fatalities reported in the past four years. However it is locked in a conflict with the WHO as to who would benefit from the development of any vaccine against a deadly pandemic.

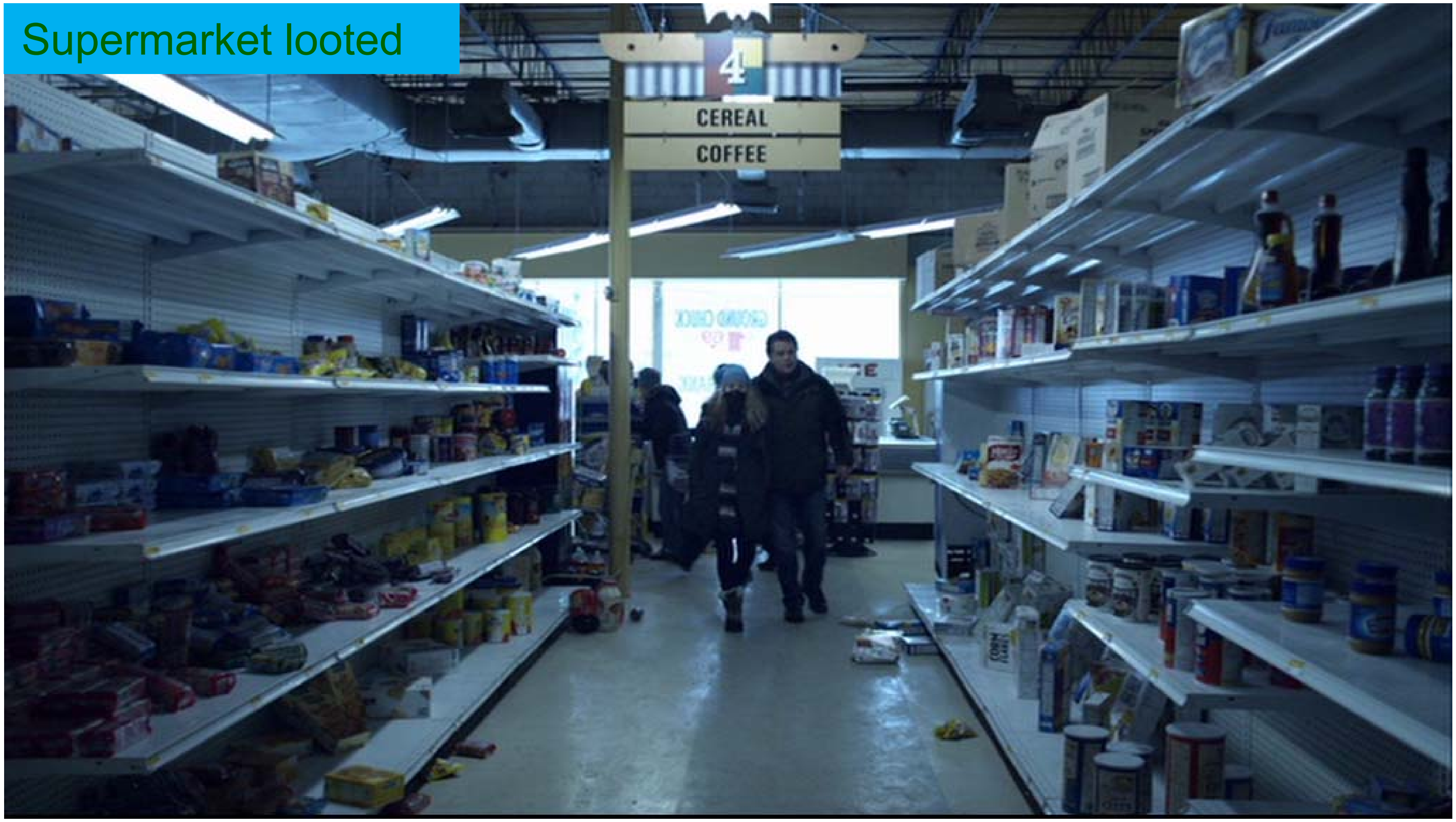
The Indonesian health ministry decided to withhold samples of the virus in December as it feared that any vaccine developed from its strains by pharmaceutical companies would be too costly for developing nations. The government said it wanted to retain control of the intellectual property rights connected with the virus's deadly strain and was angered on learning that an Australian drug manufacturer had developed a vaccine using the Indonesian H5N1 strain without permission.

1. Murray, C. J., A. D. Lopez, et al. (2006). "Estimation of potential global pandemic influenza mortality on the basis of vital registry data from the 1918-20 pandemic: a quantitative analysis." Lancet **368(9554): 2211-2218.**

Balancing individual rights and public safety

- **Protecting public safety may mean violating individual rights**
  - e.g. home quarantine of possibly infected contacts: loss of freedom and privacy, risk of transmission to uninfected household members
  - How far should government be allowed to go to protect public safety?
  - How able is a government to enforce such measures?

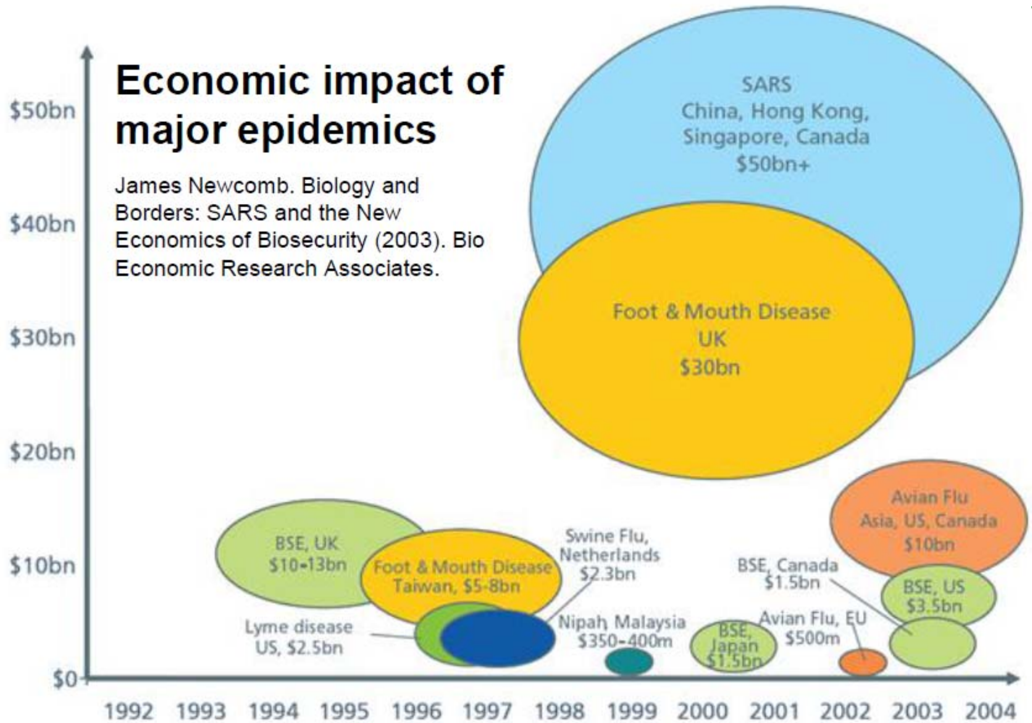
Wider socioeconomic costs, breakdown in social order



Supermarket looted

- **Wider socioeconomic costs and consequences**
  - Fear and uncertainty can lead to wider effects than direct impact from disease
  - In extreme case, can disrupt the social order

Wider socioeconomic costs, breakdown in social order



Wider socioeconomic costs

- **Health-related costs**
  - Direct costs: medical consults, hospitalisations, drugs, cost of control measures
  - Indirect costs: days of work lost from sick leave / deaths
- **Broader economic costs**
  - trade, tourism, business / investor confidence, employment
  - can far exceed health-related costs
  - Apr-Jun in 2003, Singapore economy contracted sharply by 4.2% yr-on-yr[1]

No widespread breakdown in social order during SARS but…

The New York Times

SARS Fears Shake Taiwan Medical Staffs

May 21, 2003

By DONALD G. McNEIL Jr.

TAIPEI, Taiwan, May 20— Even as SARS crops up in more hospitals here, the health care system is facing a new crisis: doctors and, particularly, nurses resigning en masse.

Nearly 160 doctors and nurses quit various hospitals this week, local newspapers reported, because they fear catching the disease and think hospital infection-control measures are still inadequate.

1. http://infopedia.nl.sg/articles/SIP_1529_2009-06-03.html

Outline

- A “personal introduction”
- What makes communicable diseases special?
- What are some of the implications? (60 min)
- What could be your contribution in an epidemic?
- A critique from a pandemic past

- Group work + Break (45 min)

- Presentations (40 min)

- Summary and clarifications (10 min)

Managing communicable diseases often involves multiple disciplines.

Show some examples of multi-disciplinary work before, during and after the 2009-H1N1 influenza A pandemic.

April 22, 2009 -- Updated 2138 GMT (0538 HKT)

MIXX | SHARE | EMAIL | SAVE | PRINT

CDC: Swine flu seen in 2 California children

STORY HIGHLIGHTS

- Rare swine flu diagnosed in 2 kids near San Diego, California, CDC reports
- In U.S., an average one person gets the disease every two years
- Infected kids have had no known contact with swine, each other
- Both kids recovered on their own

Next Article in Health »

By Theresa Tamkins

Health

CNN INTERNATIONAL .com/health

HOME | ASIA | EUROPE | U.S. | WORLD | WORLD BUSINESS | TECHNOLOGY | ENTERTAINMENT | WORLD SPORT | TRAVEL

Hot Topics » Cheating Death • H1N1 Flu • Health Care in America • Matters of the Heart • Allergies • Fit Nation • more topics »

The Centers for Disease Control and Prevention is investigating two cases of swine flu detected in children in the San Diego, California, area last week.

Swine flu is usually diagnosed only in pigs or people in regular contact with them.

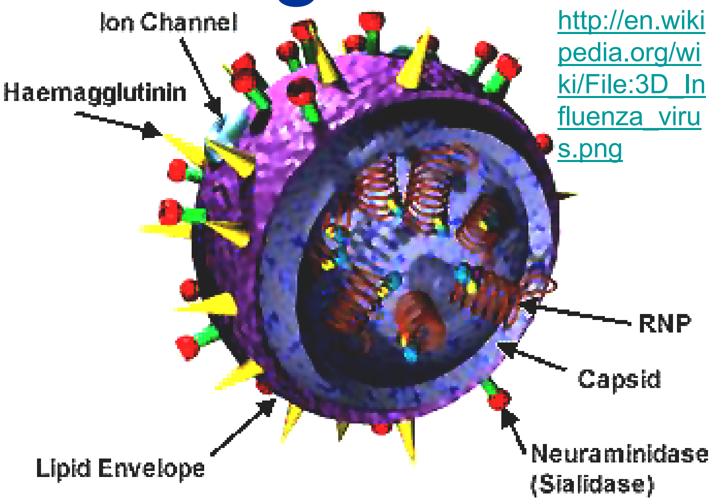
Swine flu is caused by a virus similar to the regular flu virus that circulates in people every year, but is a strain that is typically found only in pigs or in people who have direct contact with pigs.

The children were infected with a virus known as swine influenza A H1N1, which has a unique combination of genes not previously seen in **flu viruses** in either humans or swine - although it shares similarities with a virus that has been circulating in pigs since 1999.

Typically one person in the United States is infected with swine flu every one to two years, although there have been 12 cases in the three-year period between December 2005 and January 2009. Most of the time, people who get sick from swine flu have been in contact with pigs, and the virus doesn't spread from person to person. **Health.com: Can't stop coughing? 8 causes of chronic cough**

Heralded start of influenza A H1N1 global epidemic (pandemic)!

Background on influenza viruses



http://en.wikipedia.org/wiki/File:3D_Influenza_virus.png

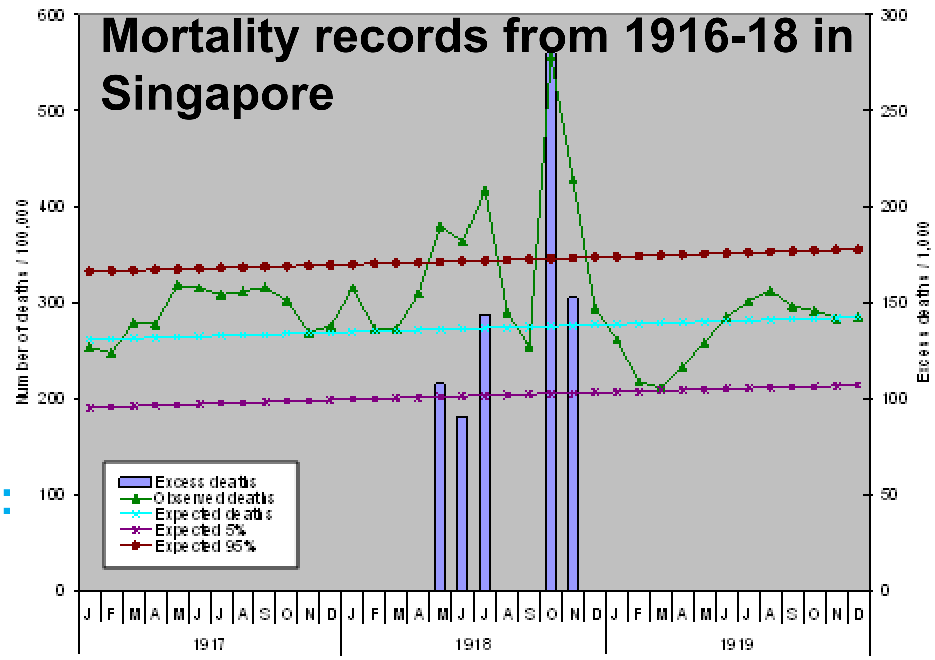
- **Three types: A, B, C**
  - A & B cause epidemics
  - Only A causes pandemics
- **Biology of infection**
  - Host immunity through recent vaccination or infection prevents or reduces severity of disease
- **Virus is prone to mutate:**
  - frequent mutations
  - swaps genes with other influenza viruses during "co-infection"
  - → evades immune recognition by previously infected hosts

- **Transmission:**
  - respiratory droplets and fomites
  - some evidence of air-borne spread
- **Disease course**
  - mild: runny nose, cough, fever etc
  - some develop complications, e.g. pneumonia, asthma, heart attack

Drugs and vaccines for influenza:

- **Vaccines**
  - vaccines specific to new strain takes months to produce
  - pre-pandemic vaccination with poorly matched strain not "cost-effective"
- **Antivirals**
  - used as "prophylaxis" to prevent infection
  - used to treat infections to prevent complications

Why the concern about influenza pandemics?



HISTORICAL REVIEW

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 13, No. 7, July 2007

Influenza Pandemics in Singapore, a Tropical, Globally Connected City

Vernon J. Lee,*†‡ Mark I. Chen,* Siew Pang Chan,* Chia Siong Wong,* Jeffery Cutter,§ Kee Tai Goh, and Paul Anath Tambyah¶#

- **3 flu pandemics in 20th century**
- **Monthly deaths in Singapore in 1918:**
  - clear surge in deaths over baseline
  - two distinct waves
- **Historical pandemic influenza mortality exceeds that of seasonal influenza**

	Total excess deaths	Singapore population estimate	Excess deaths per 100,000
Average year, seasonal influenza *(1996-2003)*	693	4,680,600	14.8
• 1918 pandemic	2,870	369,800	776
• 1957 pandemic	680	1,445,900	47
• 1968 pandemic	543	2,012,000	27

Findings consistent from multiple countries.

Lee, V. J., M. I. Chen, et al. (2007). Emerg Infect Dis **13(7): 1052-7.**
Chow, A., S. Ma, et al. (2006). Emerg Infect Dis **12(1): 114-21.**

Using health economics to priortise treatment groups

- **For pandemic influenza, treatment options exist**
  - stockpiles needed because production capacity will not meet demand in a global epidemic
  - but stockpiles have finite lifespan, can't predict when pandemics occur
  - not cost-effective to stockpile treatment doses for 100% of population because:
    - not 100% of population infected
    - cost vs benefit equation
  - health economics used to guide:
    - how much to stockpile
    - who should get treatment to maximise cost-benefit and lives saved

it is cost-effective to stockpile to treat everybody; or even high-risk groups.

Economics of Neuraminidase Inhibitor Stockpiling for Pandemic Influenza, Singapore

Vernon J. Lee,* Kai Hong Phua,† Mark I. Chen,* Angela Chow,‡ Stefan Ma,‡ Kee Tai Goh,‡ and Yee Sin Leo*

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 12, No. 1, January 2006

Risk and age group, y	Strategy option	Mean lives saved compared with no action	Mean benefit compared with no action (million $)
Low risk, age <1–19	No action	Deaths: 17	Cost: 122
	Only Rx †	8	87
	12 wk ‡	11	–315
	24 wk ‡	14	–717
Low risk, age 20–64	No action	Deaths: 42	Cost: 507
	Only Rx	21	382
	12 wk	29	–808
	24 wk	36	–1,999
Low risk, age >65	No action	Deaths: 185	Cost: 57
	Only Rx	60	28
	12 wk	108	–43
	24 wk	148	–115
High risk, age >1–19	No action	Deaths: 92	Cost: 186
	Only Rx	45	94
	12 wk	63	83
	24 wk	78	66
High risk, age 20–64	No action	Deaths: 220	Cost: 443
	Only Rx	109	235
	12 wk	153	175
	24 wk	189	100
High risk, age ≥ 65	No action	Deaths: 547	Cost: 117
	Only Rx	179	44
	12 wk	321	24
	24 wk	438	0.1

Based on 1957-like influenza pandemic

The NEW ENGLAND JOURNAL of MEDICINE

Oseltamivir Ring Prophylaxis for Containment of 2009 H1N1 Influenza Outbreaks

Vernon J. Lee, M.B., B.S., M.P.H., Jonathan Yap, M.B., B.S., Alex R. Cook, Ph.D., Mark I. Chen, M.B., B.S., Ph.D., Joshua K. Tay, M.B., B.S., Boon Huan Tan, Ph.D., Jin Phang Loh, M.Sc., Seok Wei Chew, B.Sc., Wee Hong Koh, B.Sc., Raymond Lin, M.B., B.S., Lin Cui, Ph.D., Charlie W.H. Lee, M.Sc., Wing-Kin Sung, Ph.D., Christopher W. Wong, Ph.D., Martin L. Hibberd, Ph.D., Wee Lee Kang, M.B., B.S., M.Med., Benjamin Seet, M.B., B.S., M.P.H., and Paul A. Tambyah, M.D.

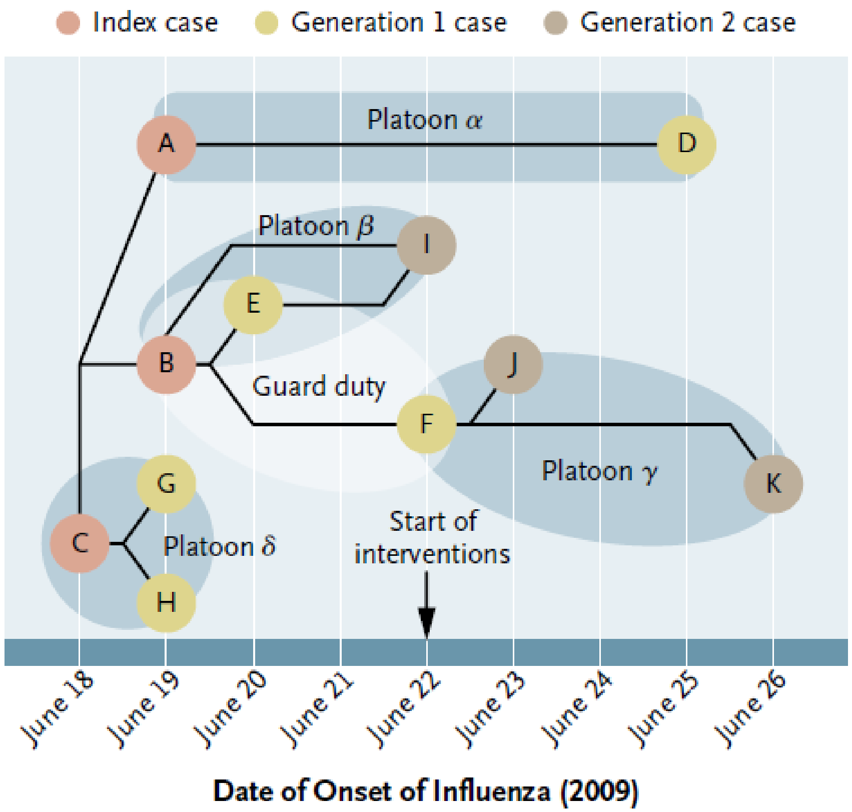
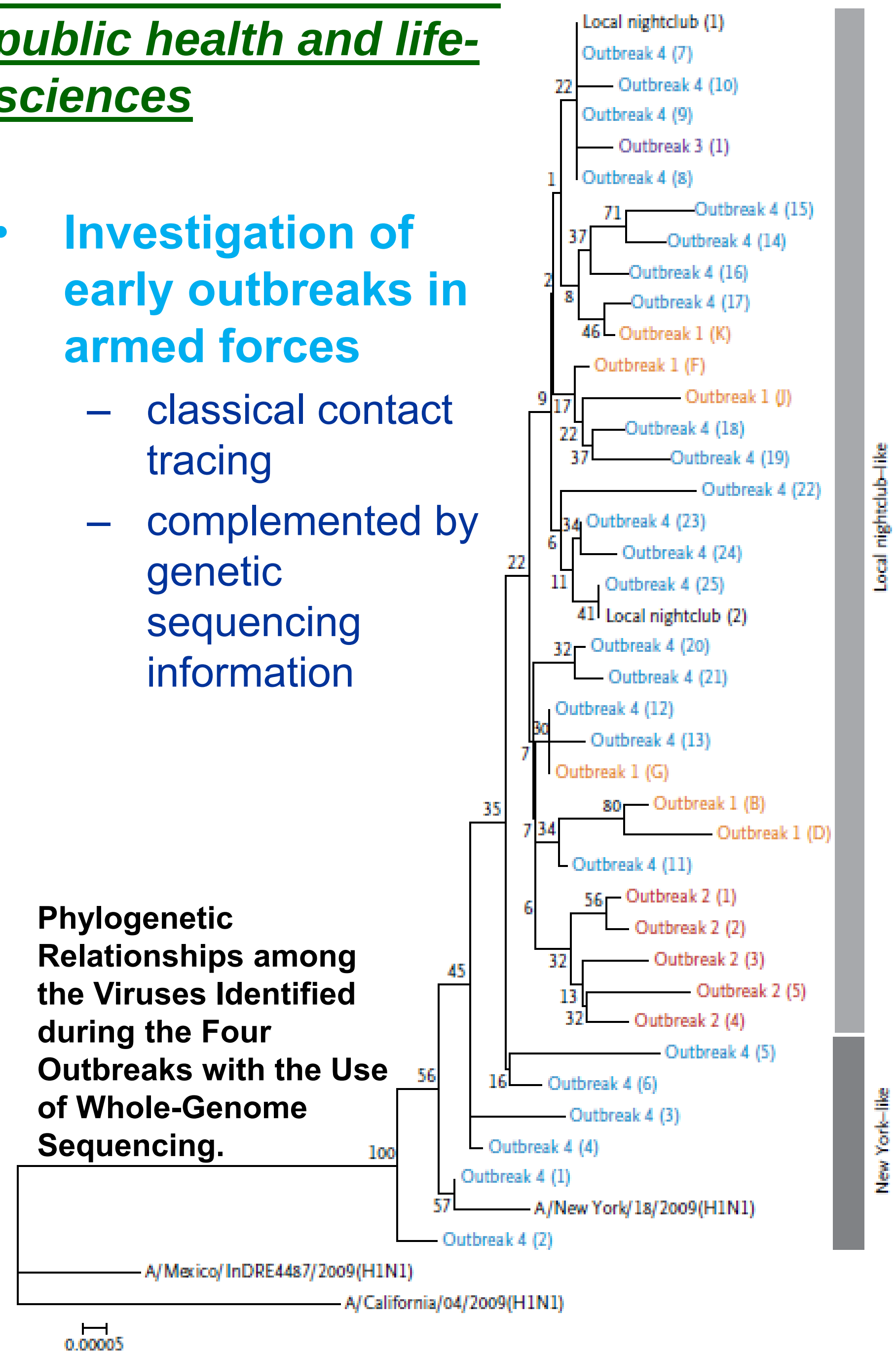


Figure 1. Timing of Events and Cases during Outbreak 1, According to Date of Onset of Influenza.

Generations 1 and 2 are the first and second generations, respectively, of 2009 H1N1 influenza spread from the three presumed index cases.

Collaboration between public health and life-sciences

- Investigation of early outbreaks in armed forces
  - classical contact tracing
  - complemented by genetic sequencing information

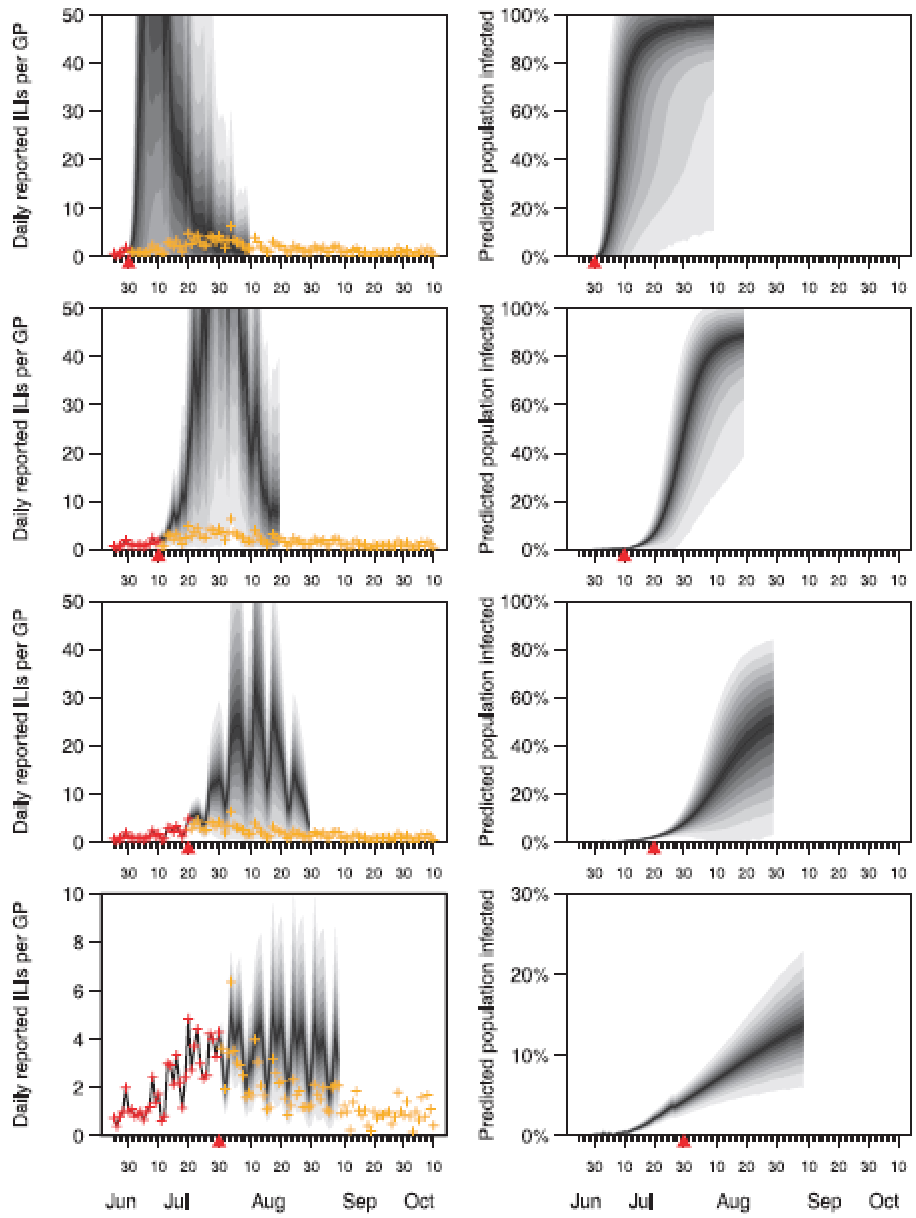


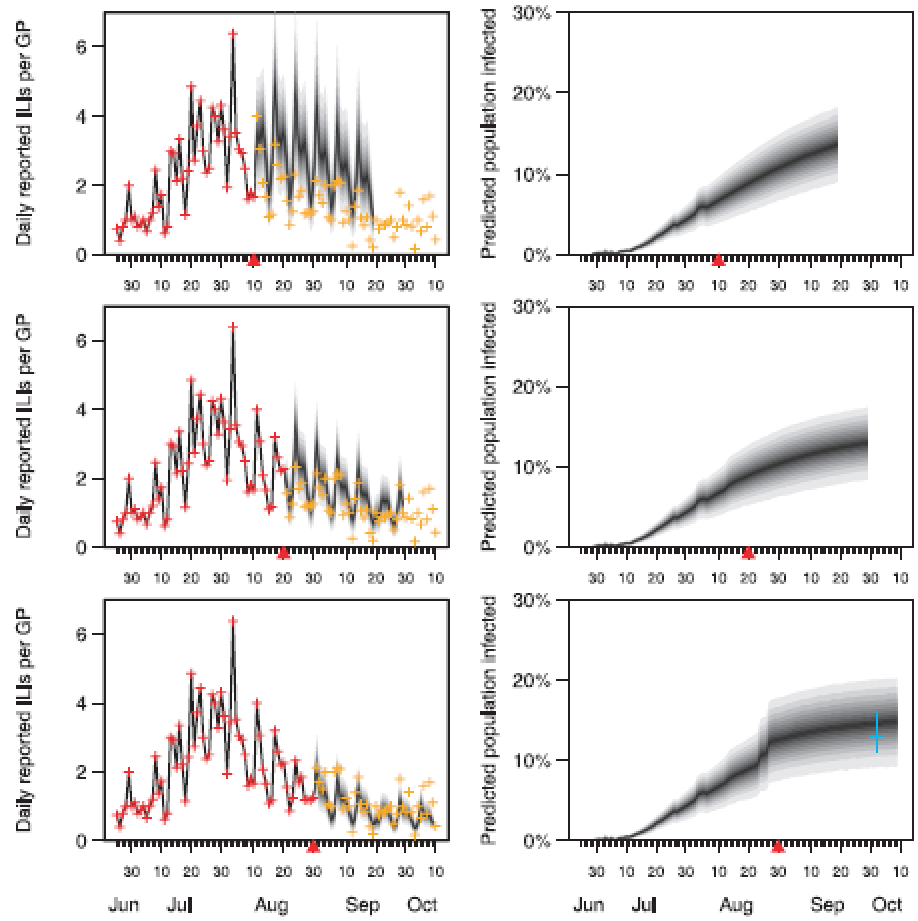
Phylogenetic Relationships among the Viruses Identified during the Four Outbreaks with the Use of Whole-Genome Sequencing.

Real-Time Epidemic Monitoring and Forecasting H1N1-2009 Using Influenza-Like Illness from General Practice and Family Doctor Clinics in Singapore

OPEN ACCESS Freely available online
PLoS one

Jimmy Boon Som Ong[1], Mark I-Cheng Chen[1,2,3], Alex R. Cook[4]*, Huey Chyi Lee[4], Vernon J. Lee[3,5,6], Raymond Tzer Pin Lin[7], Paul Ananth Tambyah[8], Lee Gan Goh[8,9]





A role for maths and stats

- **Statistically fitted a math model to data as epidemic progressed:**
  - informs when the epidemic would peak
  - plan what resources needed & when

Work of the media in an epidemic


sph A SINGAPORE PRESS HOLDINGS WEBSITE

thesundaytimes

Website to track H1N1 outbreak here

July 26, 2009 Sunday

It also predicts the likely number of such infections here in the near future

By Debbie Yong

The website was set up by (clockwise from left) Assistant Professor Vernon Lee at NUS' Centre for Health Sciences Research; Tan Tock Seng Hospital's Communicable Disease

Keeping track of the H1N1 outb
mouse away.


The Courage Fund

- introduction
- board of trustees
- objectives of courage fund
- the courage fund schemes
- healthcare humanity awards
- bursary awards
- financial reporting
- frequently asked questions
- press releases
- personal messages

Donations

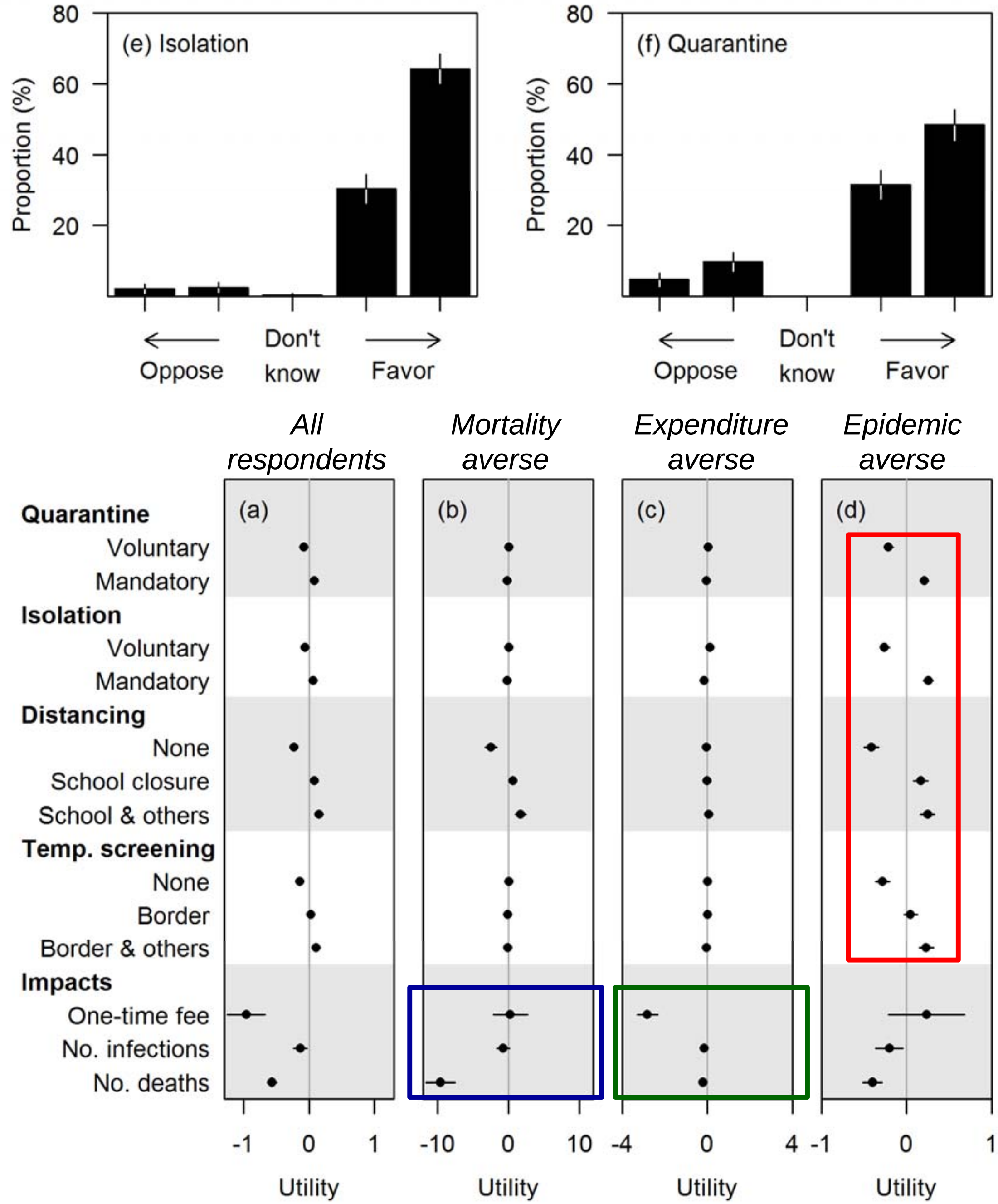
Public	$15.544 mil
Government Pledge	$ 1.000 mil
Government Dollar Match	$15.544 mil

- **Work featured in ST!**
- **Role of media**
  - recruit participants for research minor role
  - inform public, fight misinformation, reassure public
  - facilitate control
    - explain the measures in detail
    - justify measures to get buy-in
  - get additional support
  - get feedback (through new media)?

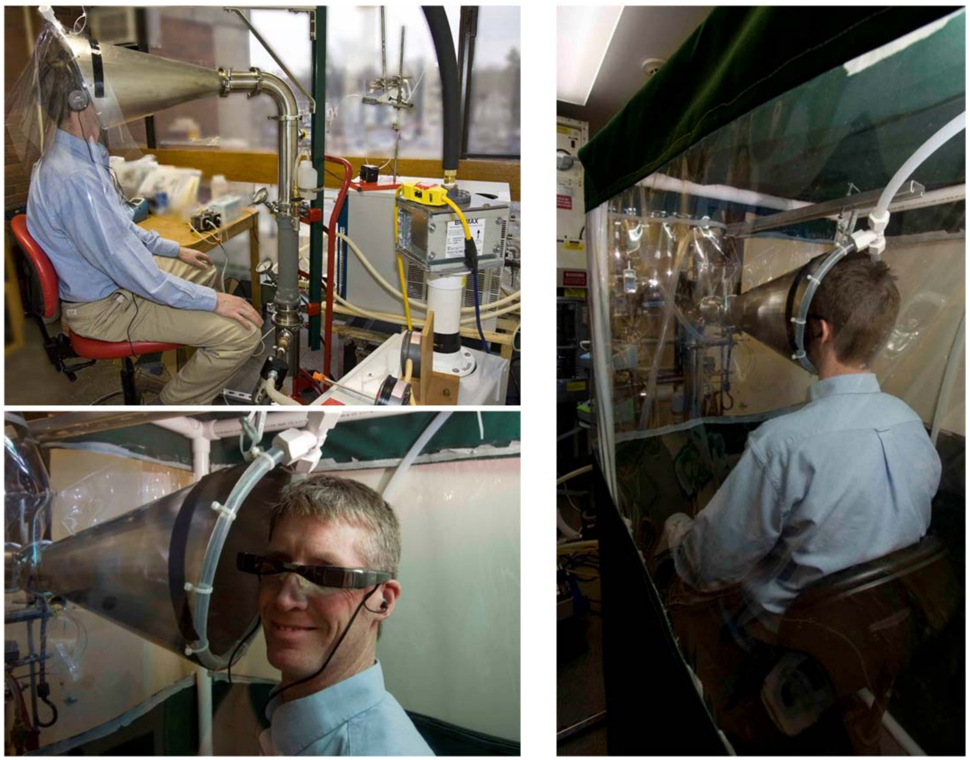
Getting societal perspective

- **Post-pandemic work**
  - realised that decisions often reflect "expert's" view
  - critical gap was knowing what "society" prefers
- **Did public survey**
  - obtained preferences on common epidemic control measures
  - analysed their views on priorities for managing an epidemic under different scenarios e.g.
    - deaths caused by infection
    - willingness to put up with different measures
    - willingness to pay a fee to control the epidemic

Manuscript in review.



Working with engineers to understand and prevent transmission



Pictures of the 'Gezundheit' machine currently installed at University Health Centre.

- **Collaborative study on influenza transmission**
- **Multinational, involves:**
  - Engineers
  - Epidemiologists
  - Microbiologists
- **Subject with influenza sits in chamber for 30 minutes**
- **Measures amount of virus particles in "droplets" coughed out and in air exhaled**
- **Opens up avenue for environmental interventions based on sterilizing and delivering air**

Outline

- A "personal introduction"
- What makes communicable diseases special?
- What are some of the implications?
- What could be your contribution in an epidemic?
- A critique from a pandemic past

(60 min)

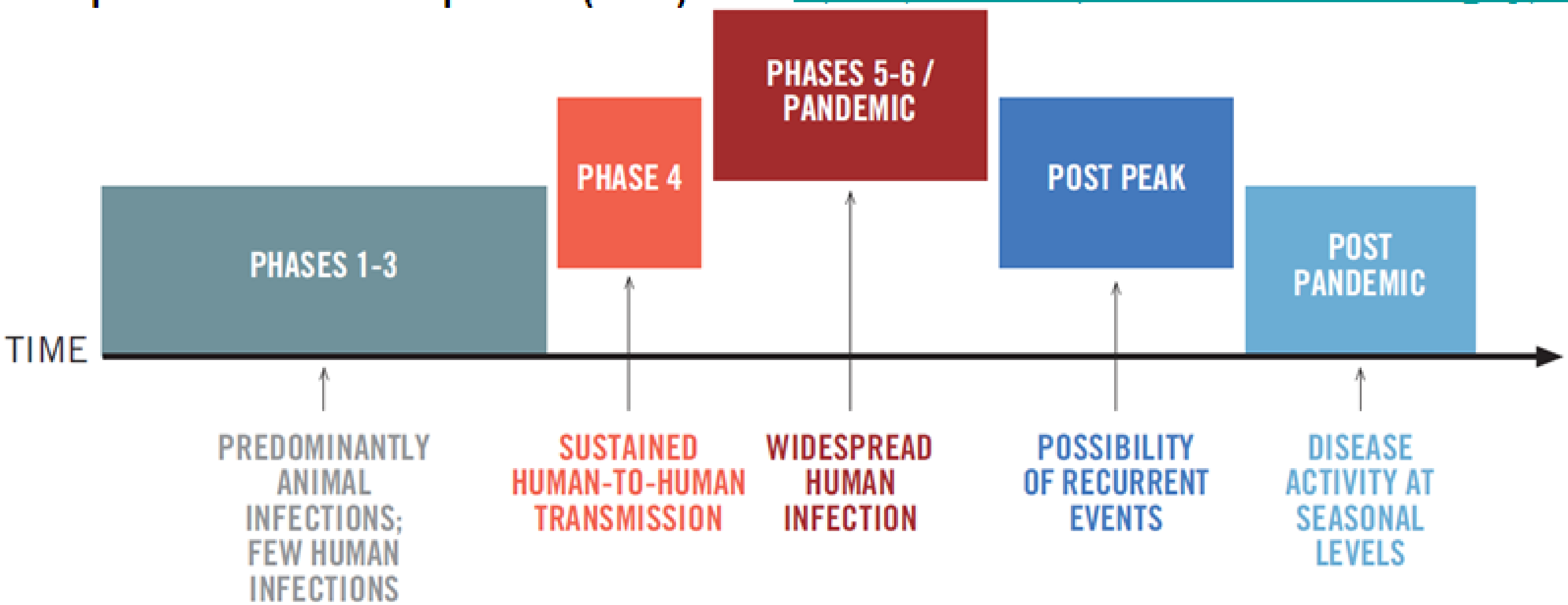
- Group work + Break (45 min)
- Presentations (40 min)
- Summary and clarifications (10 min)

Managing communicable diseases often involves multiple disciplines.

Show some examples of multi-disciplinary work we did during the 2009-H1N1 influenza A pandemic.

So what was the WHO plan?

WHO pandemic influenza phases (2009) http://whqlibdoc.who.int/publications/2009/9789241547680_eng.pdf

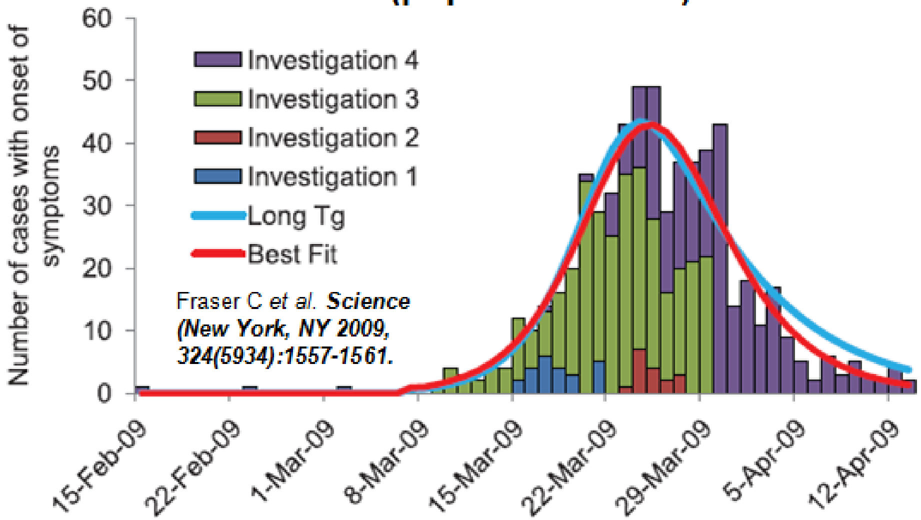


Actions	*Strengthen preparedness*	***Contain-ment***	***Mitigation*** *of impact*	*Prepare for next wave*	*Restoration of health / social fx^{n}s*

- **World Health Organization (WHO) produced a Guidance Document for Pandemic Influenza Preparedness and Response**
- **Motivated by:**
  - highly lethal avian influenza A H5N1 outbreaks across Asia
  - experience of and lessons from SARS
- **National level plans drawn up by many countries including Singapore**

So what happened in 2009 in Mexico?

Outbreak in La Gloria (population 1575): 616 had ARI



- **Outbreak in La Gloria, Mexico**
  - small community with early cases
  - 39% had respiratory illness; R_0 ~ 1.58
  - clear that *"sustained human-to-human transmission"* had occurred
  - results published in May 2009, <1 mth after cases in USA reported
- **Influenza pandemic imminent**
  - already phase 4 when detected in Apr '09

inter-regional spread of the virus

Age distribution of laboratory-confirmed human cases of new influenza A (H1N1) virus infection and deaths in Mexico, data as of 20 May 2009

Age group (years) –	No. of laboratory-confirmed cases	No. of laboratory-confirmed deaths	Case-fatality ratio (%)[a]
0–9	1046	6	0.6
10–19	943	4	0.4
20–29	754	21	2.8
30–39	413	17	4.1
40–49	306	12	3.9
50–59	183	10	5.5
≥60	68	4	5.9
Unknown – Inconnue	21	0	–
Total	**3734**	**74**	**2.0%**

[a] Based only on laboratory-confirmed cases and deaths reported

World Health Organization. ***Weekly epidemiological record, 84(21):185-189.***

- **More from Mexico**
  - data on early cases published in May 2009
  - disease seemed severe
  - 2 deaths / 100 infections

  (But… ***based only on lab confirmed cases***)

And what then happened in 2009 in Singapore?

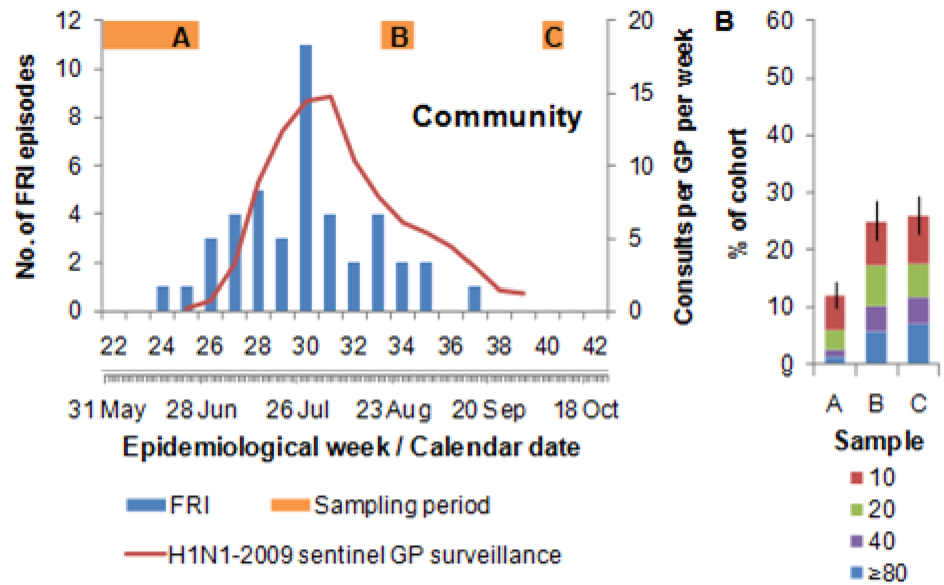
- **Influenza A H1N1-2009 soon spread to Singapore**
  - first imported case in late May 2009
  - MOH used "containment" measures:
    - screened cases with travel to affected countries
    - isolated cases, traced their contacts
  - community transmission around middle of June 2009
- **Conducted studies to assess transmission and severity**
  - enrolled 838 persons from community
  - took blood at 3 time-points + 2 weekly symptom reviews
  - looked for change in antibodies to the H1N1-2009 virus
  - used this to estimate how got infected:

    13% of adults by end of epidemic not a large number.

JAMA The Journal of the American Medical Association April 14, 2010, Vol 303, No. 14 >

2009 Influenza A(H1N1) Seroconversion Rates and Risk Factors Among Distinct Adult Cohorts in Singapore

Mark I. C. Chen, PhD; Vernon J. M. Lee, MBBS; Wei-Yen Lim, MBBS; Ian G. Barr, PhD; Raymond T. P. Lin, MBBS; Gerald C. H. Koh, MBBS; Jonathan Yap, MBBS; Lin Cui, PhD; Alex R. Cook, PhD; Karen Laurie, PhD; Linda W. L. Tan, BSc; Boon Huan Tan, PhD; Jimmy Loh, MSc; Robert Shaw, BSc; Chris Durrant; Vincent T. K. Chow, PhD; Anne Kelso, PhD; Kee Seng Chia, MBBS; Yee Sin Leo, MBBS



BUT only ~20 documented lab confirmed deaths in Singapore in the same period.

"Infection fatality ratio" (deaths / infections) was very low: ~2 per 100,000
Similar estimates obtained in other developed country settings.

lifestyle is not going to change dramatically.

When good intentions are not enough…

Council of Europe condemns "unjustified scare" over swine flu

BMJ 2010;340:c3033

Adrian O'Dowd

+ Author Affiliations

- **WHO has come under criticism for "unjustified scare"** over-reaction

The Council of Europe has heavily criticised the World Health Organization, national governments, and EU agencies for their handling of the swine flu pandemic.

The parliamentary assembly of the council—the international organisation that protects human rights and the rule of law in Europe—published a draft of a report that reviewed how the H1N1 pandemic was handled.

National governments, WHO, and EU agencies had all been guilty of actions that led to a "waste of large sums of public money, and unjustified scares and fears about the health risks faced by the European public," says the report.

- **Managing pandemics and epidemics is complicated:**
  - involves making quick decisions with limited and imperfect data
  - meeting and managing public expectations and perceptions

Outline

- A “personal introduction”
- What makes communicable diseases special?
- What are some of the implications?
- What could be your contribution in an epidemic?
- A critique from a pandemic past

(60 min)

- Group work + Break (45 min)

- Presentations (40 min)

- Summary and clarifications (10 min)