Digital Public Health and Government

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I will discuss…

- Importance of digital public health and government
- Potential areas of digital public health and government
- My research experience re: digital public health in government

Importance of digital public health and government


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LESSONS FROM SARS CRISIS(1)

- Infectious diseases do not respect national boundaries – global security depends on the competence of local responses in countries around the world: we need global networking
- Honest, accurate, and timely information is essential for early warning, for making effective government health policy, for mobilizing the entire population to fight health threats, we need paradigm shift and go digital
- Effective responses depend on well functioning health systems, which shall be an information–based system: we need go digital

LESSONS FROM SARS CRISIS(2)

- Creating National and Global Health Surveillance Early Warning and Laboratory Networks must be given high priority: we need go digital
- Investing in global public health, beyond just SARS or AIDS, and go digital, would protect every country from emerging diseases, save millions of lives, and improve the quality of life of billions of people.

What is digital government?

- Fundamental changes in information processing and communication has dramatically affects government philosophical , institutional, and legal arrangements.
- Initial phase of digital government that focus on putting information on web/cost saving has been passed.
- New challenges are to deal with political conflict, bureaucratic inertia, multiple vested interest groups, shared power in government system.
- We need paradigm shift
- we need go digital.

What is public health?

- Public health is everyday, every where, every body.
- Public health is “organized community efforts aimed at the prevention of disease and promotion of health.
- The mission of public health is defined as “the fulfillment of society’s interest in assuring the conditions in which people can be healthy.”

Why digital public health and government?

- Government's three core functions in public health are:
  - Assessment
  - Policy Development
  - Assurance
- Public health is health of public.
- In today's global village, global health means global public health, means global digital health. Examples: SARS and Avian Flu
- Therefore, digital government cannot without digital public health

Potential areas of digital public health and government

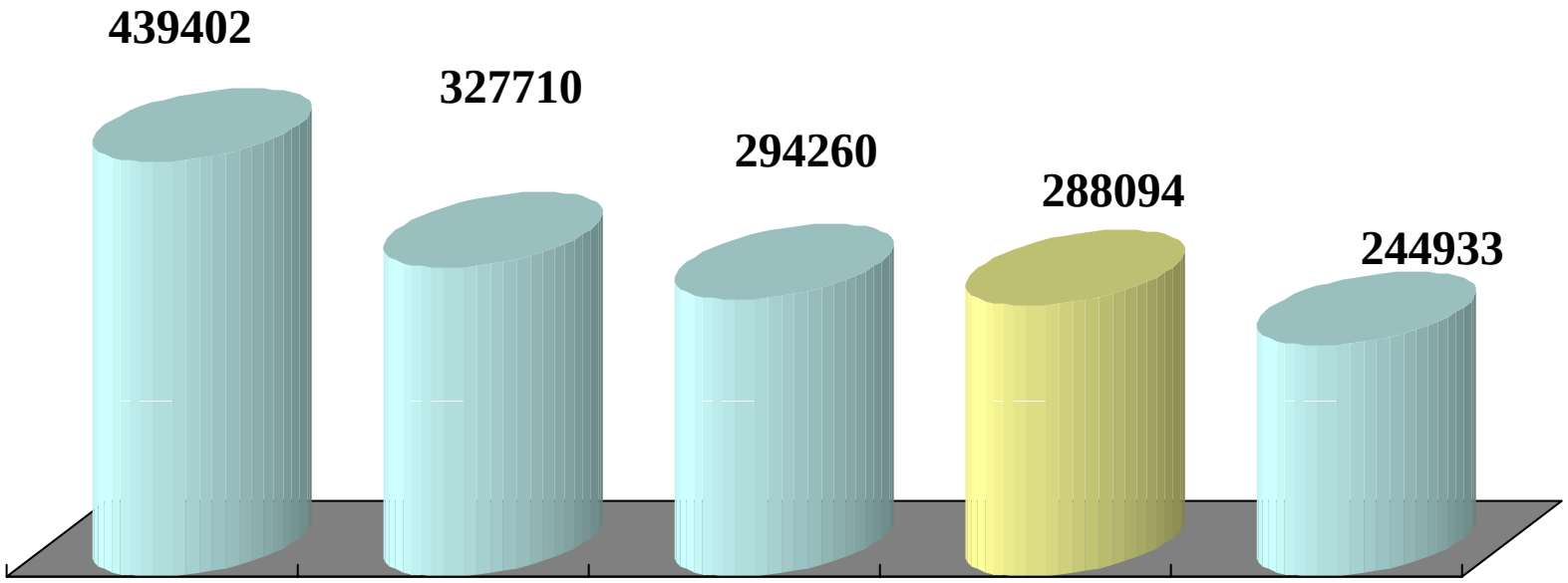
Potential areas

- Assessment
  - Health status monitoring
  - Communicable diseases surveillance
    - Routine: AIDS, STD, vaccine preventable diseases, etc.
    - Syndrome surveillance
- Policy development
  - Evidence based public health policy making
- Assurance
  - Risk communication
  - Public health opinion lab

某省资料

不同系统提供的1998年出生人数

Number of Birth from Different Sources - Province X



Courtesy from Dr. Ray Yip

My research experience re: digital public health in government

My research experience

- Assessment
  - Health& China's sustainable development: health status model
  - Syndrome surveillance
  - Foresight Project: predicting communicable disease trends
  - Hospital competence in public health emergency response
- Policy development
  - Advocating evidence based public health decision making
  - Proposal for public health opinion lab
- Assurance
  - Supercourse
  - Training in risk communication for hospital managers
  - Public health education

Health& China's sustainable development: health status model(1)

- China's economic rise is closely related to Chinese health status
  - 30 ys of health accumulations: LE ↑ fm 35 y in 1949 to 67.9 y in 1981(33 ys), provided rich healthy resources
  - 30 ys of health achievements: Major ID: under control. 20% of a nation's economic increase is depended on ↑ human productivity due to reduction of mortality and morbidity
  - 20 ys of health sacrifice: Minimum Health investment during economic rise period.

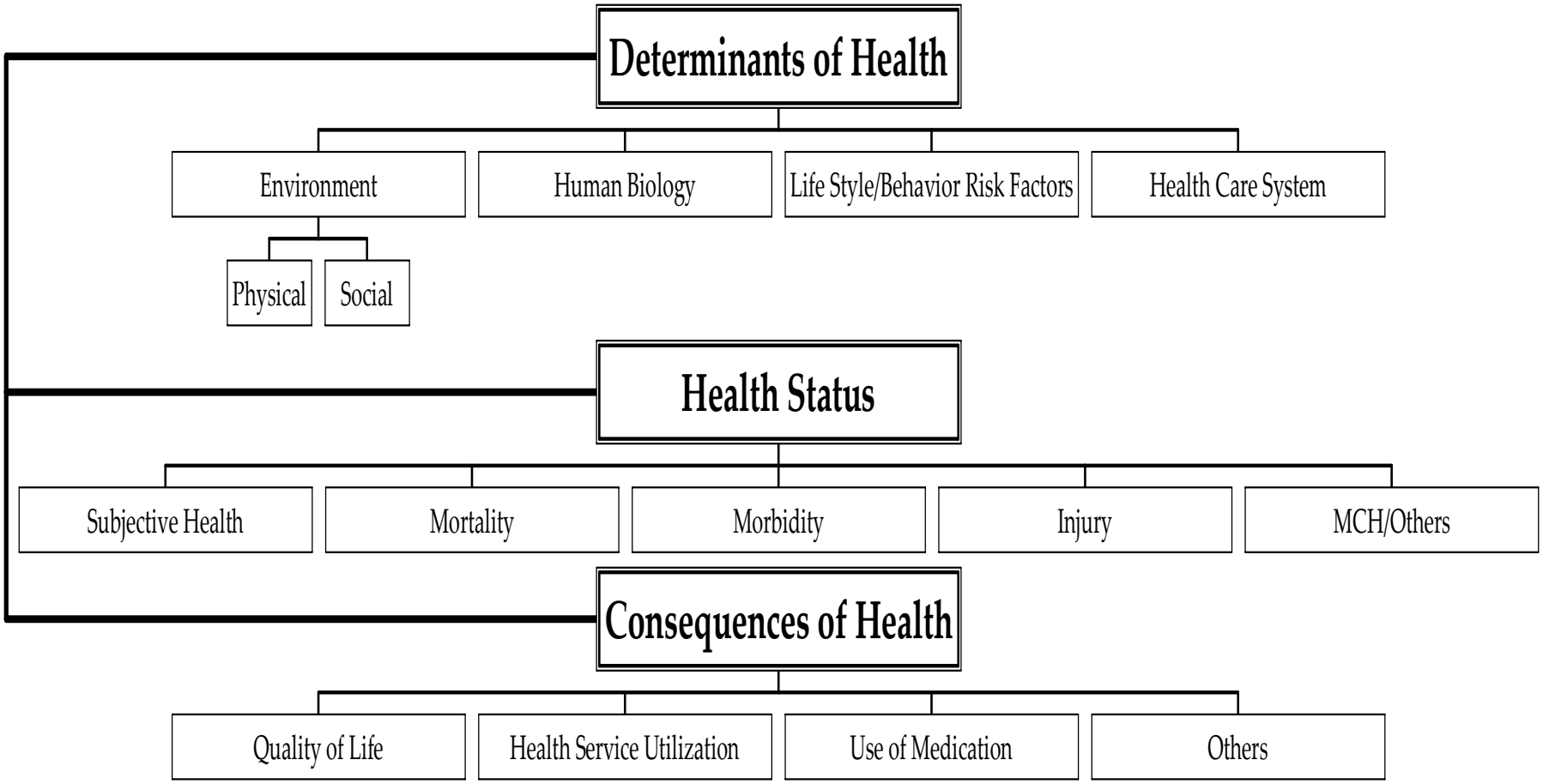
Health& China's sustainable development: health status model(2)

- China do not have sufficient health resources to support sustainable development currently
- Consequences of 20 ys health overdraw are coming:
  - Double threats by ID and Non-ID
  - Aged without wealth
  - Huge pop., Unbalanced gender distribution, low pop. quality.

Health& China's sustainable development: health status model(3)

- China's sustainable development depends on whether we can manage Chinese health because national health resource is the base for China's sustainable development
- No national vital statistics system is the major obstacle to the modernization of health resource management in China
- No data on health resources ,no modernization of health management, go digital is the key.
- Health data is highway of health management.

Health Model



My research experience re: digital public health in government

- Assessment
  - Health& China's sustainable development: health status model
  - Syndromic surveillance
  - Foresight Project: predicting communicable disease trends
  - Hospital competence in public health emergency response
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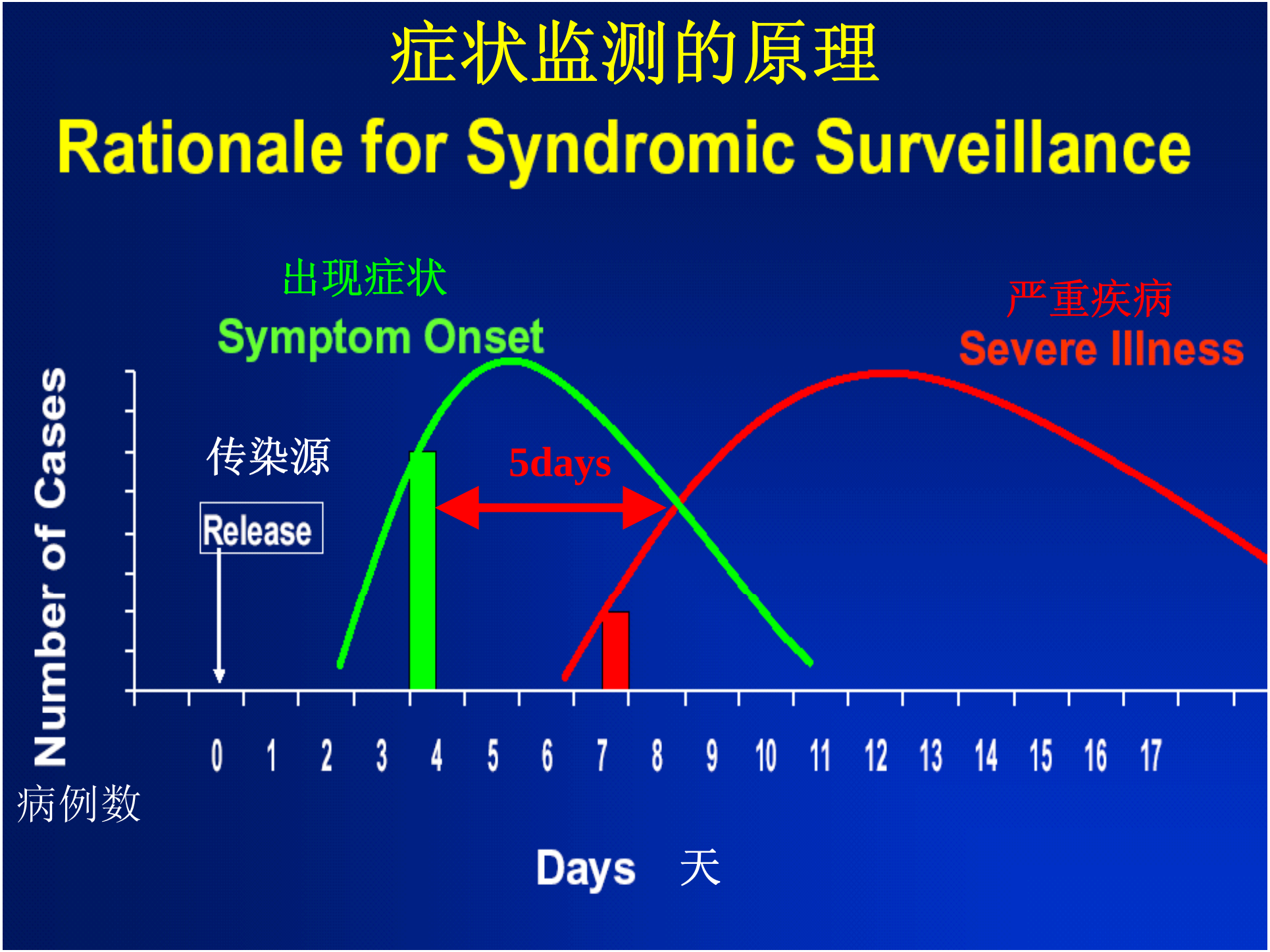
Syndromic surveillance

- My experience of syndromic surveillance began in 1999 when we were preparing for BT
- One of the first to introduce syndromic surveillance to China
- Did a pilot study in Beijing
- Provided consultations for projects currently working in Beijing and Shanghai

症状监测的原理

Rationale for Syndromic Surveillance



120 Syndromic Surveillance model design and implementation in Beijing

Goals

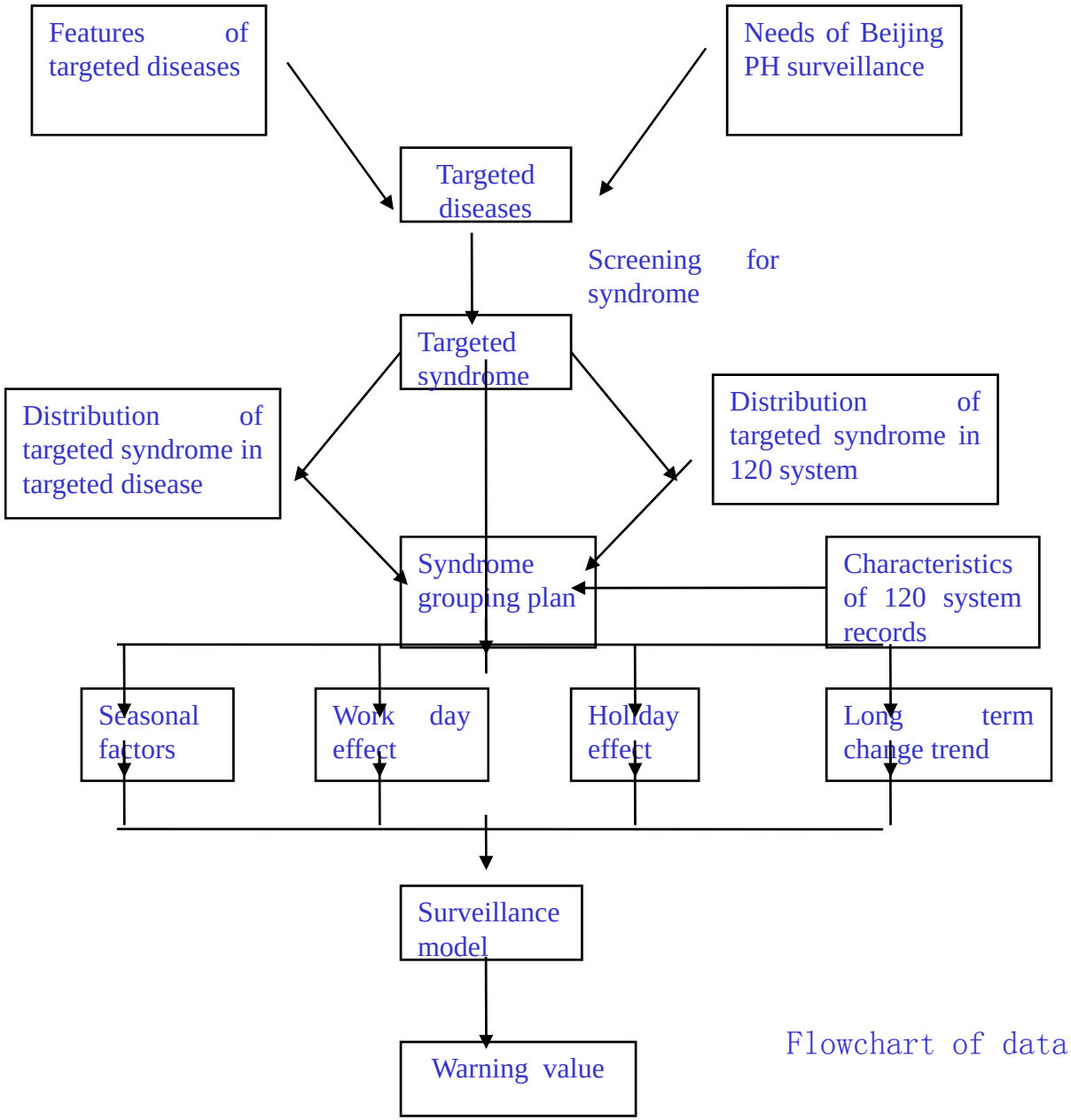
- To timely recognize the outbreak of public health emergencies
- To understand the extent and transmission model of the outbreak
- To identify the high risk population, and
- To provide timely and effective intervention information.

Objectives

- To set up a syndromic surveillance system based on Beijing 120 system's chief complain data
- To assess the system's feasibility
- To assess the sytem's early warning functions in public health emergencies, and
- To accumulate base line data.

Methodology

- Review and analyse the existing database in 120 system
- Identify targeted diseases (events), targeted syndromes, and targeted syndrome groups
- Data collection
- SAS software，GIS
  - Detecting abnormal phenomenon
- Analysis, investigation, and evaluation



Flowchart of data analysis

Oct.12,2006

Analysis of existing database

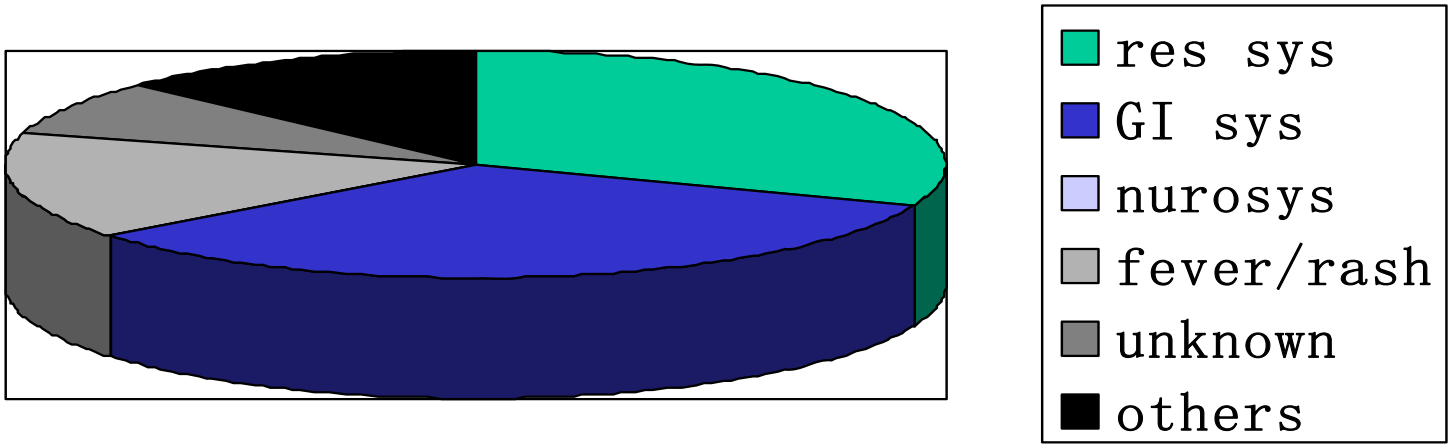
120 call records

- format：computerized database
- 200 – 400cases / day * 1year
- Related info：Name, sex, age, address, telephone, call time, chief complain

Patient records

- format：paper and computerized database
- 200 – 400cases / day * 4years
  Related info：Name, sex, age, address, telephone, call time, chief complain, and primary diagnosis

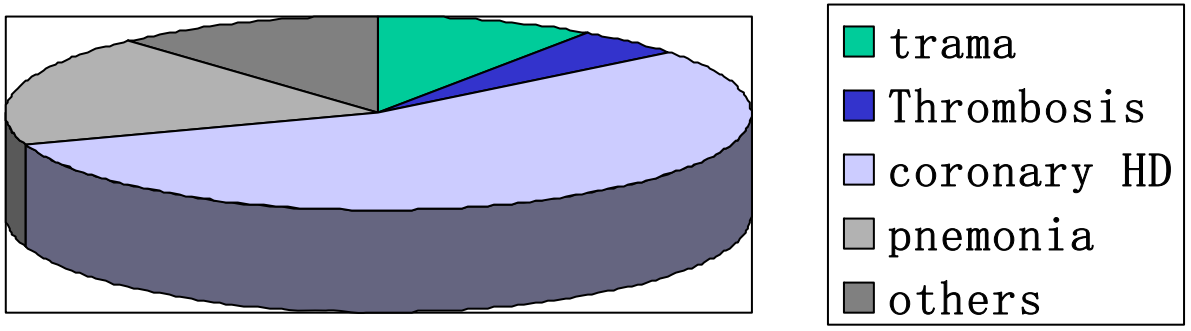
Analysis and classification of the existing database



Analysis and classification of the existing database: Chief complain/primary diagnosis

胸痛

Chest pain



Identification of targeted events

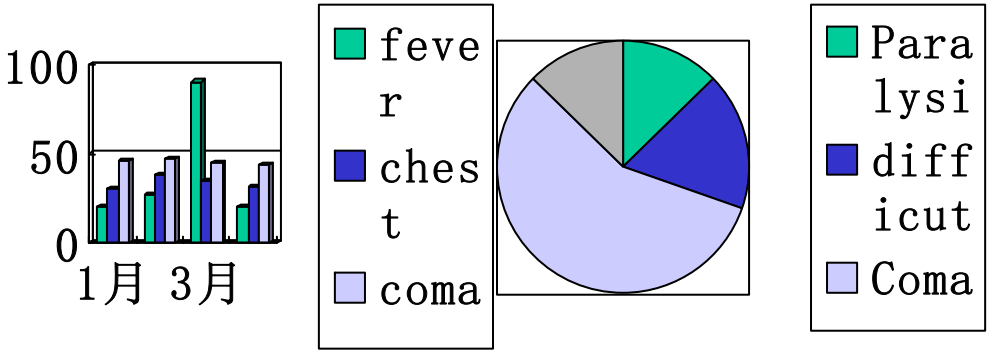
- Need for PH surveillance

Combined with

- Data from 120 system

- SARS
- Seasonal diseases
- Other public health emergencies
- 2008 Olynpic

1y、5ys、10ys……



Example of combining data and needs

Coma on road ?

Identification of targeted events

- Outbreak of infectious diseases

  SARS，Meningitis…
- BT

  anthrax, smallpox
- Food Poising

  Bacteria and toxin…

Population at risk in PH emergency situations

Types pf PH emergencies	Example	Population at risk
Food poisoning	poisoning	More than 100 persons
Water pollution	Bacteria and others	More than 1000 persons
Occupational poisoning	苯，氯化氢	Less than 100 persons
BT	anthrax	Several to 10000 persons
Radiological pollution	Hospital originated	More than 1000 person
Acute infectious disease outbreak	SARS	More than 1000 persons
	Kidney hemorrhage syndrome	More than 100 persons
	Infectious diarrhea	More than 100 persons
	Plague	varies

Targeted diseases and diseases required differential diagnosis (total 24 types)

Food poisoning	葡萄球菌食物中毒
	沙门氏菌食物中毒
	肉毒中毒
Other poisoning	毒鼠强中毒
	急性有机磷农药中毒
Water pollution and infectious disarrange	细菌性痢疾(菌痢)
	霍乱
	大肠杆菌胃肠炎*
	大肠杆菌O157:H7胃肠炎
BT	肺炭疽、皮肤炭疽**
Oct.12,2006	皮肤炭疽、肠炭疽**
	IGD 流行性脑脊髓膜炎（流脑）

Syndrome (systemic syndrome) distribution for targeted diseases and diseases required differential diagnosis

disease	total (N)	fever (%)	chill (%)	Muscle pain (%)	weakness (%)
急性有机磷中毒	1687	3.4	—	—	29.2
毒鼠强中毒	2299	0.7	—	—	34.5
肉毒中毒	543	1.8	—	—	30.9
葡萄球菌食物中毒	5114	14.3	0.2	0.1	2.9
沙门氏菌食物中毒	4420	69.8	19.6	4.3	5.9
霍乱	1216	6.5	0.2	0.2	1.4
菌痢	2246	60.6	21.3	18.6	3.2
大肠杆菌胃肠	1102	26.4	15.3	3.9	15.3

Number of diseases that have common syndrome > 0 and ⩾20%

syndrome	Syndrome occurrence > 0 disease # (N=24)	Syndrome occurrence ⩾20%diseases # (N=24)
headache	24	17
vomiting	24	16
fever	23	18
nausea	22	13
Abdominal pain	22	12
diarrage	21	10
weakness	20	11
头晕	18	4

Identification and classification of targeted syndrome

	fever	Respi syndrome（咳嗽、呼吸困难等）	GI syndrome（恶心、呕吐、腹泄、腹痛）	Neuro syndrom（头痛、抽搐、意识改变、昏迷）	skin（皮疹、出血）
SARS	●	●			●
麻疹	●			●	●
流脑	●		●	●	
菌痢			●		
霍乱	●	●	●		●
炭疽			●	●	
毒鼠强					

Data collection

- Call records
- Data input from ambulance

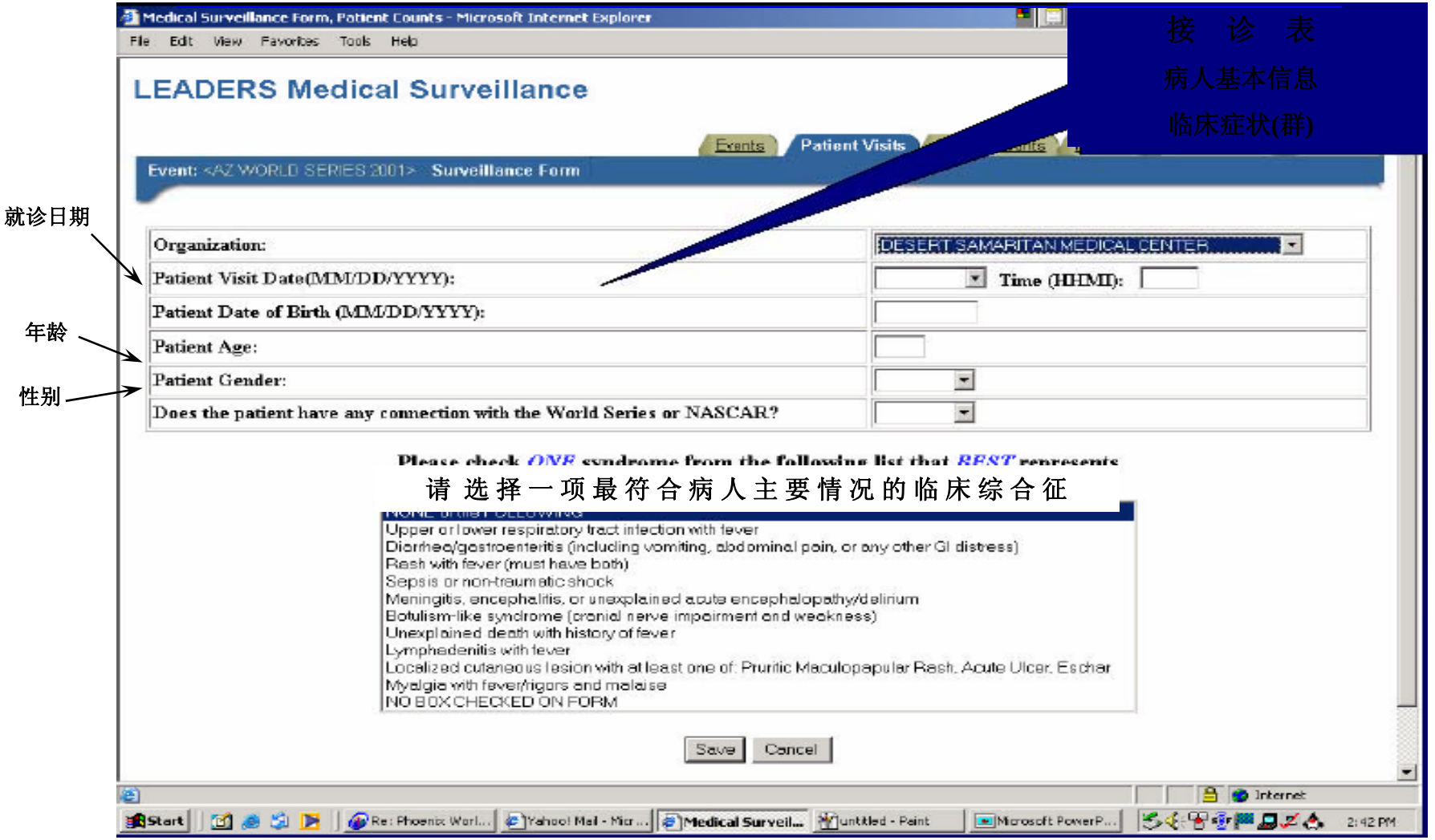
  time: call time

  place: address/post code/telephone number

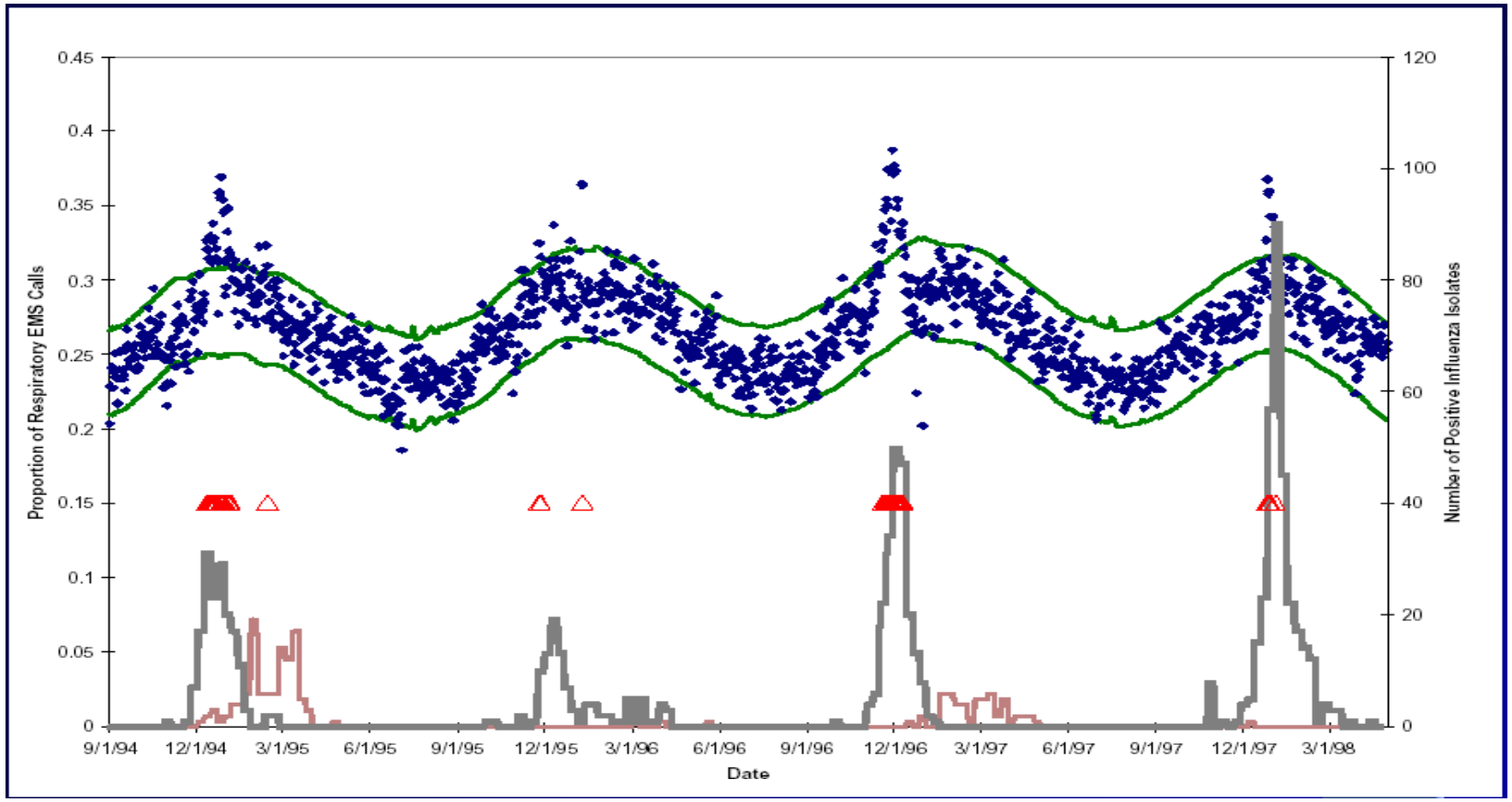
  person: name, age, sex

  event: chief complain, primary diagnosis
- 120 system database

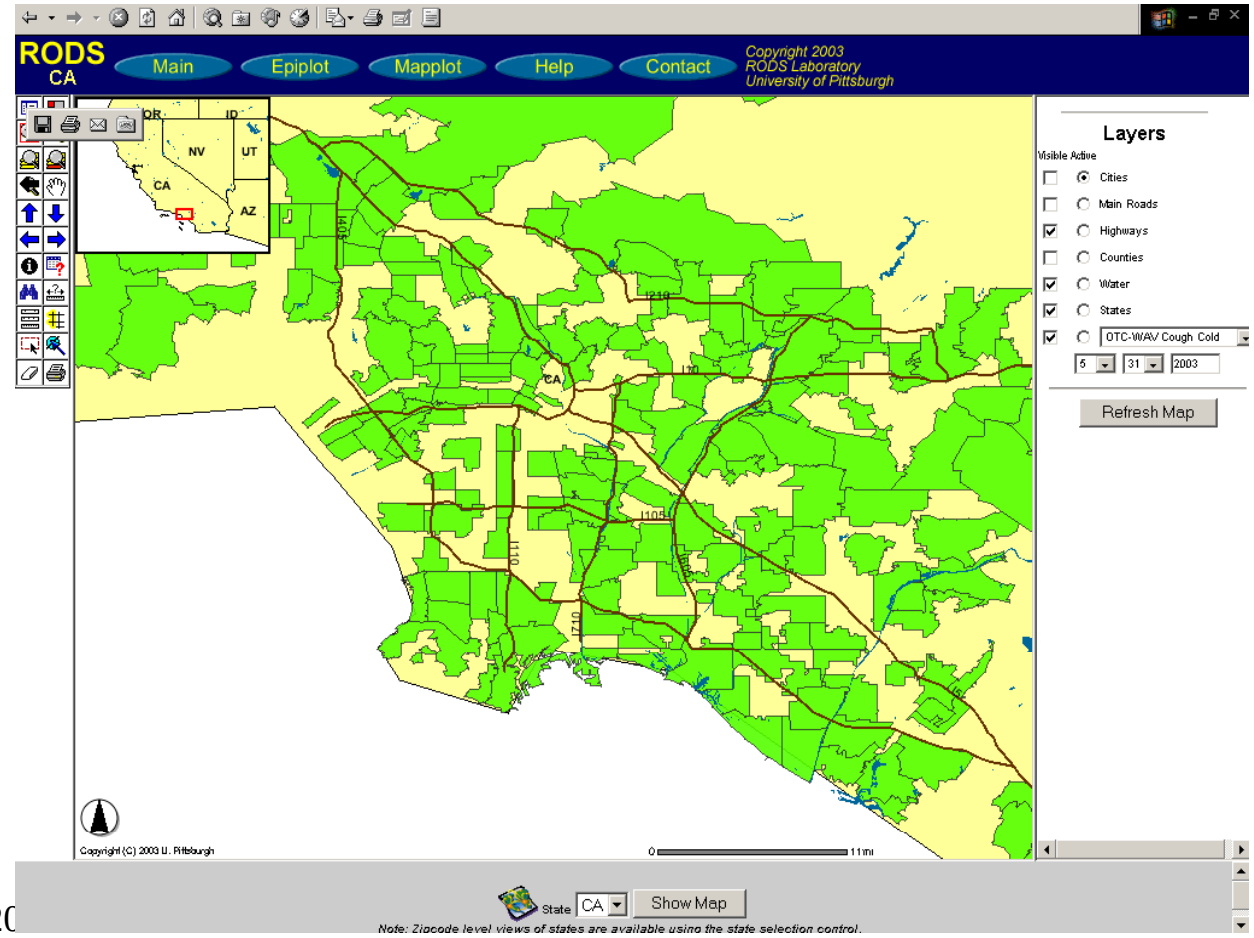
Data collection



Data analysis and detection of abnormal situations



GIS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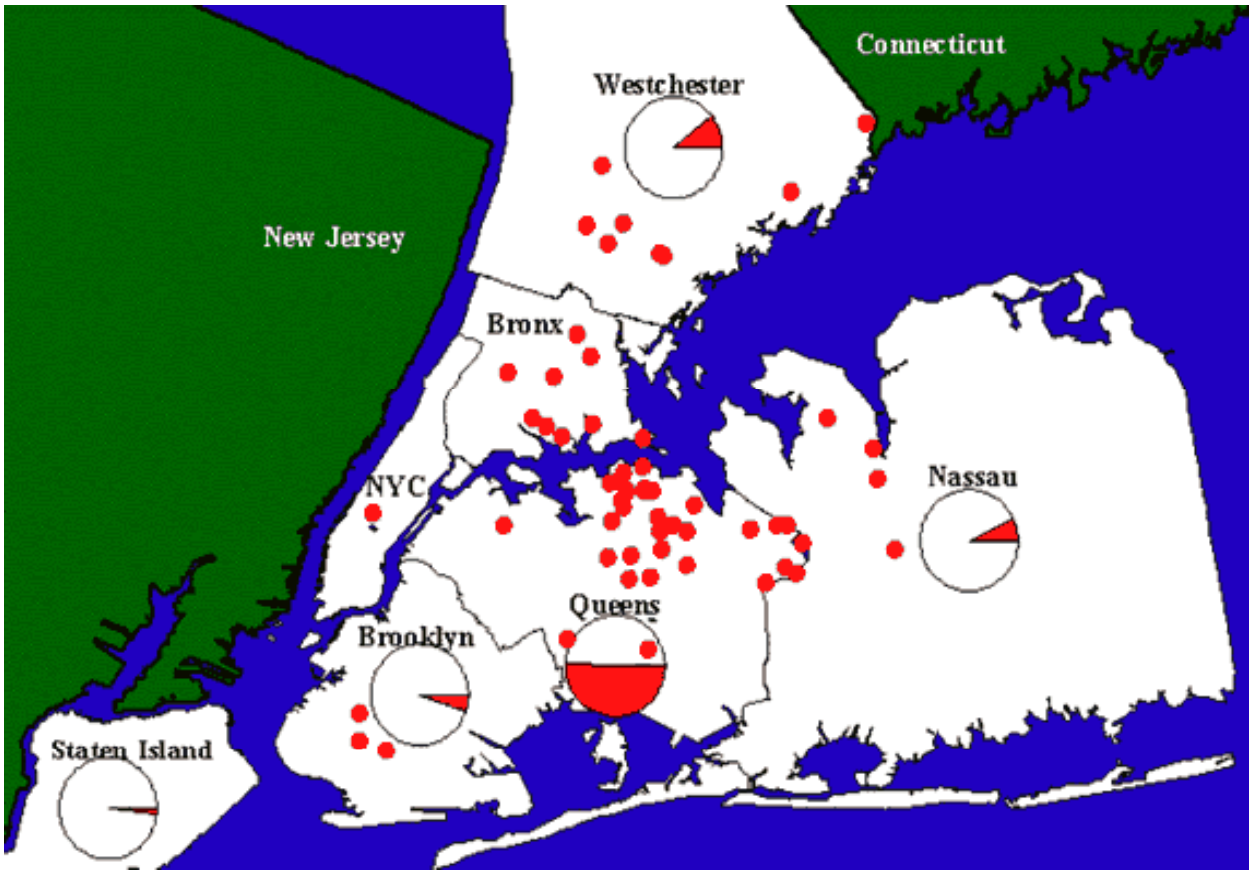
GIS


Connecticut
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Bronx
NYC
Nassau
Queens
Brooklyn
Staten Island

Investigation

- Analyze patient's records
- Connect to ER to get further information
- Connect to patient and his/her family
- Connect to CDC

Advantage of 120 syndrome surveillance

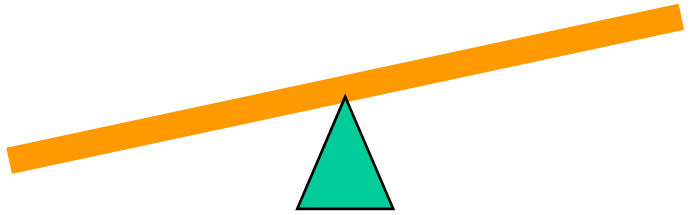
- Can cover an area of 4–7 km, 28 network points
- Accumulated a lot of historical data
- Ambulance input can have on–time syndromic surveillance
- Quality of ambulance staff is better than USA's one
- Low cost

Difficulties need to deal with

- Different database formats
- Background noice: chronic disease acute onset, which is not targeted diseases.
- Setting warning value

sensitivity and timeliness

specificity



Common problems in designing a syndrome surveillance system in China

- No clear understanding of meaning and functions of syndrome surveillance
  - As a research project
  - Use traditional surveillance thinking
  - Use administrative approach
  - No involvement of stakeholders
  - No knowledge and skills to mobilize stakeholders

My research experience re: digital public health in government

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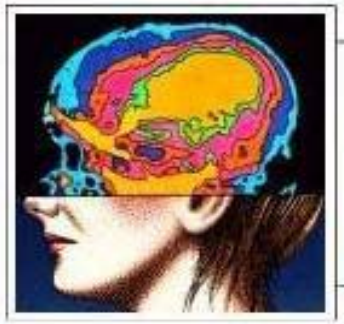
Foresight Project

A novel and simple approach to anticipating likely future infectious disease trends and needs for surveillance and countermeasures: application in China

Angus Nicoll, Jianshi Huang, Yang Gonghuan, Zhaohui Xie,

Jeff Gilbert, Francette Dusan, Kim Le

Foresight projects so far



Brain Science, Addiction and Drugs

Detection and Identification of Infectious Diseases

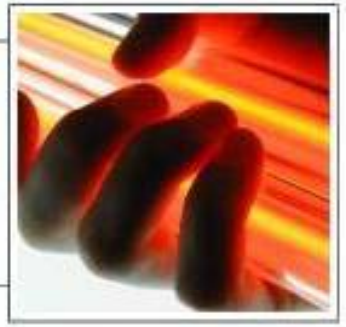
Intelligent Infrastructure Systems

Obesity

Cognitive Systems

Flooding and Coastal Defence

Cyber Trust and Crime Prevention



Exploiting the Electromagnetic Spectrum

Infectious Diseases Project - Aims

To produce a challenging and long–term vision for the detection and identification of infectious diseases across plants, animals and humans.

The vision should take account of:

- the evolving risk of diseases;
- changing user requirements;
- cutting edge science.

Project key facts

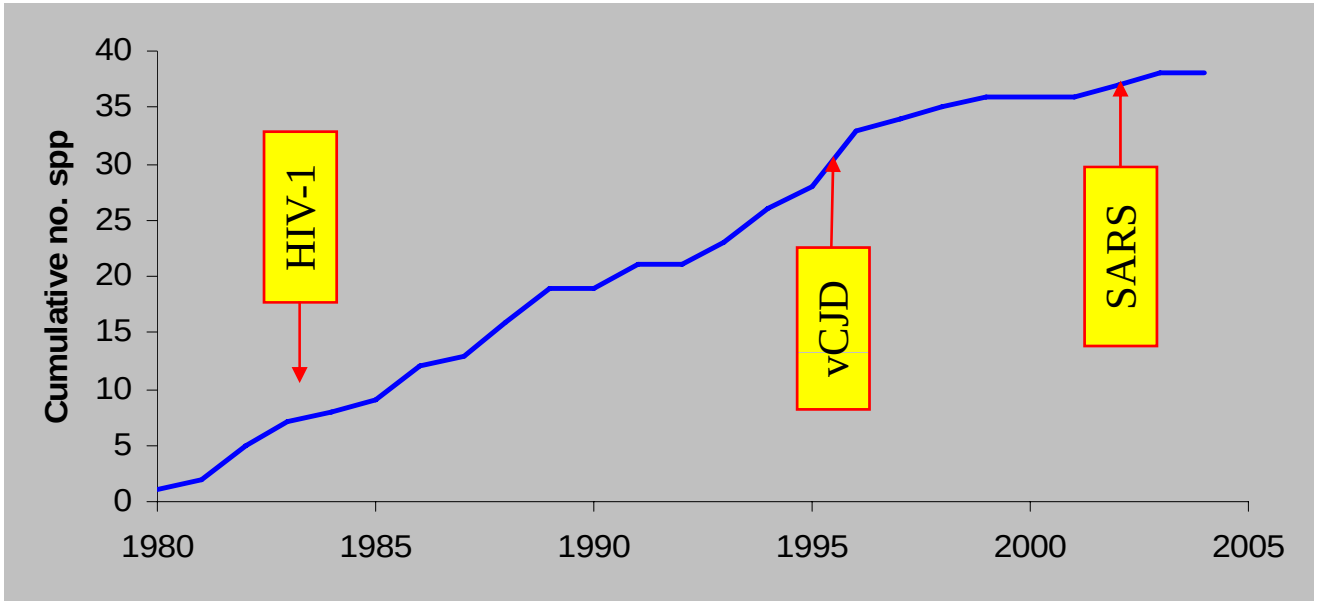
- Started Sept 2004 – Findings launched April 2006
- Close oversight by Sir David King, Chief Scientific advisor, who reports directly to the UK Prime Minister
- The project produced independent scientific analysis – to inform policy development
- The work cost £1,000,000

Project key facts

The work involved:

- Around 400 experts from 30 countries – including around 40 from China
- International stakeholders also involved: WHO, OIE, ECDC, FAO, the Gates Foundation
- Several UK Ministries and Agencies were involved: Health, DFID, DEFRA, Defence, the Home Office and the Health Protection Agency

Reviewed recent experience of newly reported emerging human pathogens



- 25 (66%) are RNA viruses
- >80% have animal reservoir/origins; broad range
- Diversity of transmission routes and drivers of emergence

Future Science

10 areas of science of relevance to detection, identification and monitoring systems were reviewed:

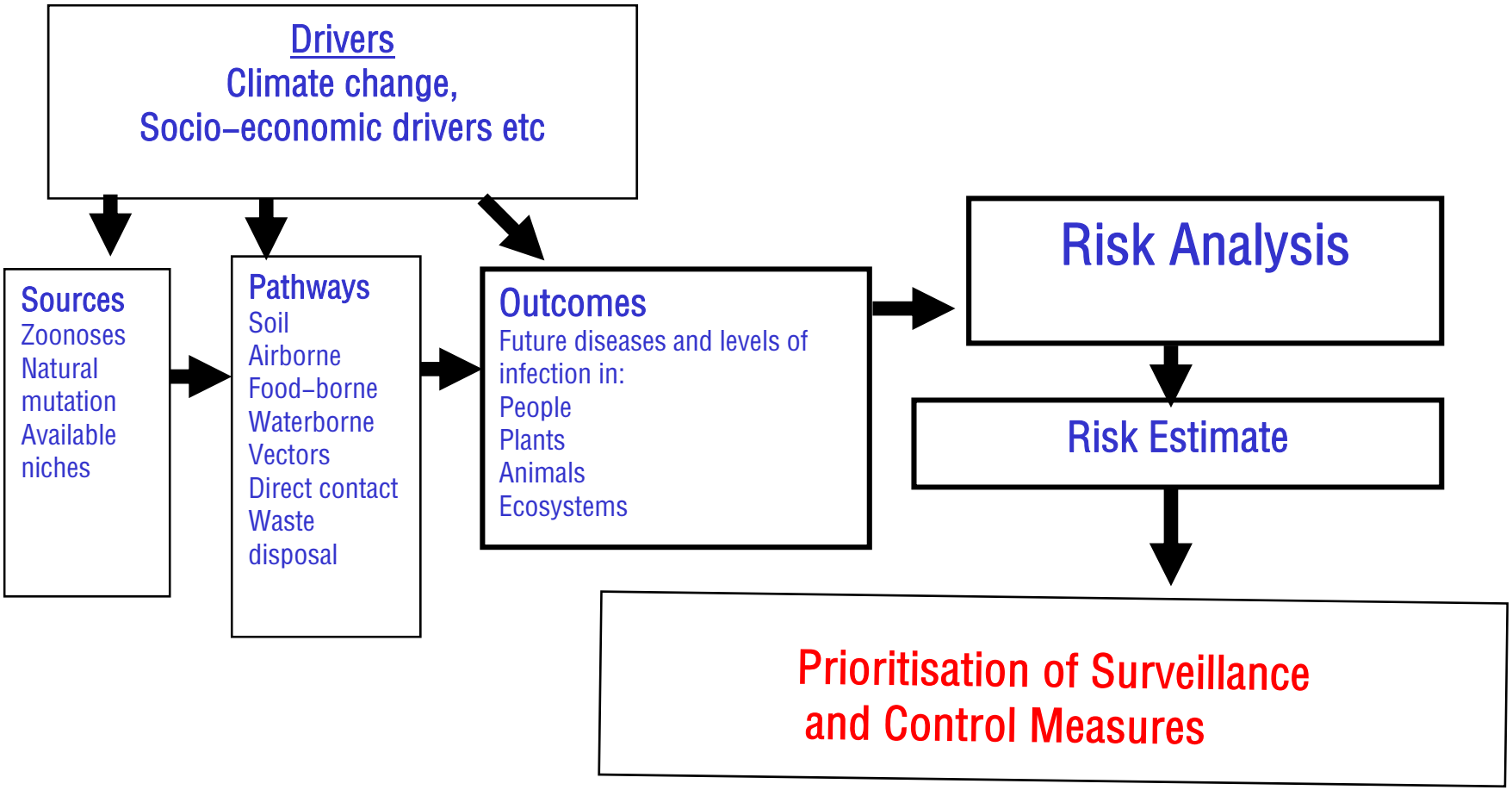
- Intelligent sensor networks
- Data mining and fusion
- Non–invasive scanning and screening
- Genomics and bioinformatics
- Biosensors and biomarkers
- Interrogation of natural signals/biomarkers
- Predictive and real–time epidemiological modelling
- Earth observation
- Host genetics and engineering
- Immune signatures for detecting and identifying infectious diseases

China Study – 2005–2006

Aims were:

- To analyse possible future threats and how they might be different to today
- To consider the factors driving change in risk So that the most likely future trends would be predicted and then
- Surveillance could be mounted for early detection
- Countermeasures or mitigation could be devised

Basic Risk Model for Infectious Disease Risks



China Study – Methods

China was selected as a country to perform detailed analysis. The work involved 36 leading Chinese experts in the Drivers.

Step One: Matrices were devised for groups of animal and human infectious diseases as to how they related to key groups of drivers

China Study – Methods

There were nine groups of drivers:

1 Governance and social cohesion
2 Demography and population change
3 Technology and innovation and their governance
4 Conflict
5 Agriculture and land use change
6 Economic factors (income, prosperity, employment)
7 Trade and market related factors
8 Transport and tourism
9 Human activity and social pressures

China Study – Methods

One Set of Drivers – Demography and population change

- Immigration
- Urbanisation
- Ageing population
- Gender imbalance
- Dietary and occupation changes (affecting exposure and susceptibility of population to disease risks)
- Population movements (e.g. from rural to urban or from developing to developed world)

China Study – Methods

Another Set of Drivers Agriculture and Land Use Change

Changes in animal husbandry methods, e.g. intensive rearing methods or closer missing of animal and human populations as part of urbanisation

- Greater genetic uniformity in animal and plant populations; less 'biodiversity', less varied crop mosaics
- More intensive farming systems
- Development of new crops
- New developments in production economics involving greater movement of animals and hence more exposure to diseases such as Foot & Mouth
- More frequent proximity of different farming systems
- Changing patterns of land use due to new disease treatments

China Study – Methods

Step One: Constructing the Matrices

Important Animal and Human Diseases Groups were selected

Human Diseases:
Antimicrobial Resistance
Blood borne infections Hepatitis B & C
Gastrointestinal Disease (Food Poisoning)
Health care associated infections
HIV
Other Sexually Transmitted Diseases
Malaria
Respiratory – Acute Influenza (seasonal and pandemic) / SARS
Parasitic Diseases (Shistosomiasis etc)
Tuberculosis
Vaccine preventable diseases (childhood)
Novel infections

China Study – Methods

Step One: Constructing the Matrices

Important Animal and Human Diseases Groups were selected

Animal Diseases (used exemplars):

- Foot and Mouth Disease – Economic
- Avian Influenza – Economic & Zoonosis
- Classical Swine Fever – Economic
- Bovine Spongiform Encephalopathy – Economic & Zoonosis

China Study – Methods

Step One: Constructing the Matrices

Animal and Human Diseases were matched against the Drivers

China Study – Methods

Step Two: Chinese experts were asked to predict what they thought was going to happen in the drivers, not the infectious diseases

Standardised face to face interviews by trained interviewers from Peking Union Medical College

China Study – Methods

Step Three: The consensus from the experts on the changes in the Drivers were applied back to the groups of infectious diseases so as to derive likely trends in these infections

Results – Changes in the Drivers

- Thirty–seven of the 96 risk elements, including social cohesion, information openness and new surveillance methods, were predicted to have positive effects on infectious disease prevention and control in China.
- Twenty–six risk elements, including urbanization and lifestyle changes, were predicted to negatively affect infectious disease prevention and control.
- Twenty–two elements, for example immigration and ageing population, were determined to have uncertain effects.

Results

Some Important factors affecting future risks:

Increasing movements of people, animals and animal products

More and greater migrations of people

Increasing tourism

Increasing amounts of animal waste

Changing sexual lifestyles

Changing public attitudes

Increasing genetic uniformity of crops and livestock

Rising wealth and levels of education

Outputs

Predicting changing risks not actual trends

So outputs Guidance to technical specialists – what trends to look for with surveillance

- Guidance to policy makers – where you will need countermeasures or mitigation (damage limitation)

Needed Improvements in Methodolgy

- Defining each driver in the questionnaire might have improved consensus by providing experts with a common baseline for predictions.
- An alternative way to force consensus at the second stage of analysis could also be considered to distinguish uncertainty from disagreement.
- Limiting the first panel to experts in social drivers, excluding health experts, and asking them to predict the future of the driver without its effect on disease,

Needed Improvements in Methodolgy

- Having a second panel of health experts to translate these predictions to effects on infectious disease.
- A mixed expert panel and asking for predictions in drivers and diseases from the beginning is the encouragement of a more interdisciplinary approach to analysis.

Conclusions

- A useful technique
- Demonstrates changing risks and diseases in China
- Paticular vulnerability in health service sector
- Methodology needs improving
- Could be applied to Europe

Acknowledgements

- Dr David Concar – British Embassy Beijing
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- Derek Flynn & Joyce Tait – Foresight
- Alan Smith & Elizabeth Hoile – HPA
- Julie Hall – WHO Beijing

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Supercourse China

http://www.supercourse.cn

The Supercourse has 18000 faculty from 151 countries who create a Library of Lecture with more than 3,000 lectures on the Internet with quality control, and cutting edge cognitive design. China's project began in 2003

Thank You!

Q & A