



**SCHOOL OF PUBLIC HEALTH**  
UNIVERSITY AT ALBANY State University of New York

University at Albany  
Center for Public Health Preparedness

**Grand Rounds Series**

**Epidemiology and Surveillance  
of Emerging Infections**

Thursday, June 8, 2006  
10:00 – 11:00 a.m.

**Speaker**

**Stephen S. Morse, PhD**  
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Columbia University

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## Some Famous Microbial Invaders in History

- The Black Death (plague, 1348)
- Smallpox
- “The Columbian Exchange” (smallpox, syphilis)
- Cholera (19<sup>th</sup> Century and after)
- 1918 Influenza

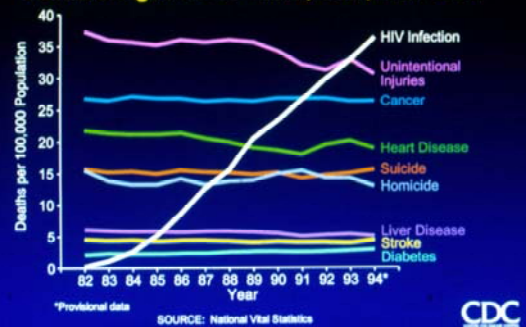
## Infectious Diseases in the Present

- In much of the world, infectious diseases remain major causes of disease and death
- Infections not previously recognized also appear (“Emerging infections”)
- Forgotten infections reappear (“Re-Emerging infections”)

## Emerging Infections

- Those rapidly increasing in incidence (number of new cases) or geographic range
- Often novel (a previously unrecognized disease)
- Anthropogenic (human action) causes often important in emergence

## Death Rates from Leading Causes of Death in Persons Aged 25-44 Years, USA, 1982-1994



## Global Examples of Emerging and Re-Emerging Infectious Diseases



Courtesy NIAID (Dr. Anthony Fauci)

## Emerging Infections: Some Recent Examples

- Ebola, 1976 –
- HIV/AIDS
- BSE & Variant CJD, ca. 1986 –
- Hantavirus pulmonary syndrome, 1993
- Hemolytic uremic syndrome, 1990’s –
- Nipah, 1998 –
- West Nile, US, multistate, 1999 –
- SARS 2003 –
- Influenza (including H5 in Asia 2003 –)

## The Emerging Infections “Two-Step”

Step 1: Introduction

Step 2: Establishment/dissemination

## Step 1: Introduction

- Many are zoonotic
- The “zoonotic pool” is a rich source of potential emerging pathogens
- Changes in environment may increase contact, with greater chance or frequency of introduction
- Also important role of food animals

## Some Emerging Infections and Their Natural Hosts

Ebola, Marburg viruses Nipah, Hendra viruses	Bats
HIV-1 HIV-2	Chimpanzees Mangabey monkey
Influenza (incl. H5N1)	Wild waterfowl, other birds
SARS	Bats
<i>E. coli</i> O157:H7	Cattle

## New Opportunities for Pathogens: Ecological Changes

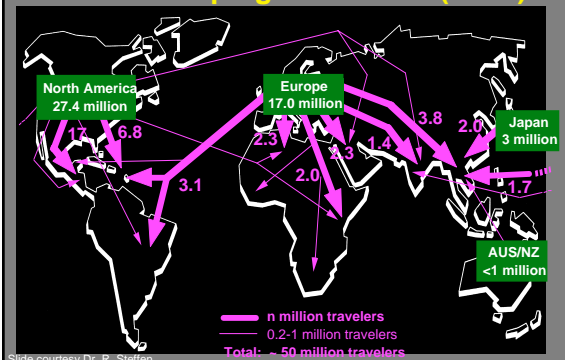
Agriculture	Hantaan, Argentine Hemorrhagic Fever, Nipah, West Nile (Israel), possibly pandemic influenza
Food handling practices	SARS, H5N1 influenza, HIV?, Enteropathogenic <i>E. coli</i>
Dams, changes in water ecosystems	Rift Valley Fever, other vector borne diseases, Schistosomiasis
Deforestation, reforestation	Kyasanur Forest, Lyme disease
Climate changes	HPS, vector borne diseases

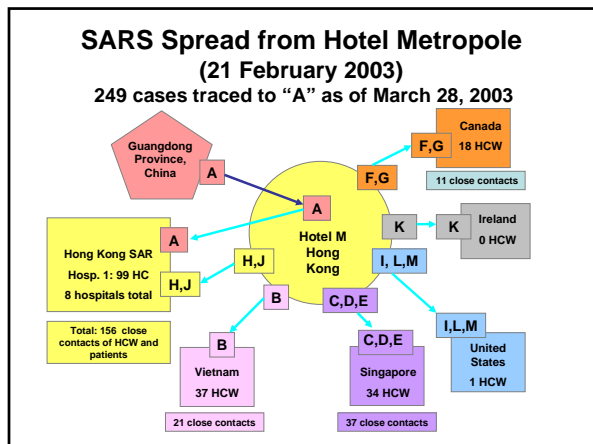
## Step 2: Establishment/dissemination

Opportunities increasing for both steps:

- Changes in land use
- Rural to urban migration
- Internal displacement
- Globalization of people and goods, travel, international migration
- Medical technologies

## Travelers from industrialized areas to developing areas 1993 (WTO)





### Hospitals as Amplifiers

Ebola	Secondary cases through contaminated injection equipment (Africa)
HIV	Transfusion, contaminated injection equipment
Lassa Fever	Secondary cases through contact with infected individuals (Africa)
SARS	Secondary cases through contact with infected individuals

- ### Factors in Infectious Disease Emergence
- Ecological Changes
    - Including economic development, land use
  - Human Demographics, Behavior
  - International Travel and Trade
  - Technology and Industry
    - Food processing
    - Health care
  - Microbial Adaptation and Change
  - Breakdown in Public Health Measures ("Re-Emerging Diseases")

- ### Traditional Surveillance
- Case reports, sometimes laboratory confirmation
  - Usually disease specific
  - May be active or passive
  - Will discuss influenza surveillance later, as a specific example
    - One of the most developed systems
  - May be good for known diseases, but generally not for the unknown

- ### "Unconventional" Surveillance
- "Syndromic surveillance"
  - "Unexplained deaths"
  - ProMED proposal (a modified syndromic system)

- ### Syndromic Surveillance
- Definitions vary
  - In past, meant looking for clinically recognizable disease syndromes (e.g., ProMED proposal, 1996)
  - Now, often defined as systems that use "non-diagnostic" data, often automated

## Some Examples of “Classic” Infectious Disease Syndromic Surveillance Systems

- Smallpox (rash + fever)
- Polio: Acute flaccid paralysis (AFP)

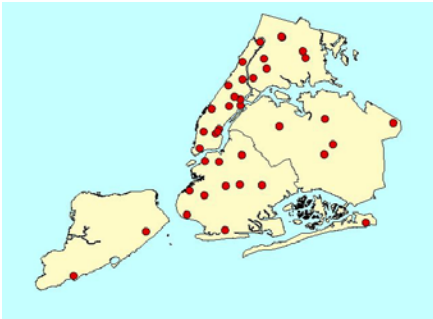


## ProMED Proposal (Health Policy 38:135-153, 1996)

- Worldwide network of Centers with regional clinical base and capacity for lab identification and epidemiology
- Focused on a few clinically recognizable syndromes:
  - Encephalitis
  - Acute respiratory distress with fever
- Minimum “basket” of lab capabilities specified
- Ability to refer unknowns up the chain to larger laboratories
- Network connected via communications and personnel training

## Today’s Syndromic Surveillance (NYC DOHMH)

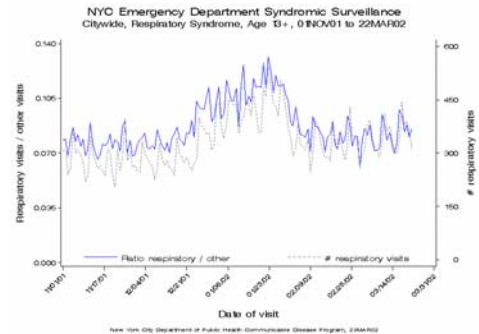
- 911:
  - Are there significantly more calls for flu-like syndromes?
- Emergency Rooms:
  - Are more patients than usual presenting with suggestive symptoms?
- Pharmacies:
  - Increase in prescriptions for antibiotics or sales of OTC cold remedy drugs



NYC ERs: 38 facilities, ~ 6,500 daily visits  
90-95% daily completeness

slide courtesy of NYC DOHMH

## ER Respiratory Visits

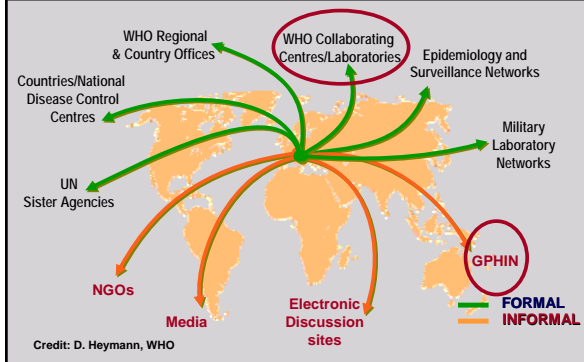


## ProMED-mail: A Prototype Outbreak Reporting System

**ProMED-mail: [www.promedmail.org](http://www.promedmail.org)**

- Moderated listserv
- Free to all
- Started 1994
- Approximately 30,000 subscribers in >155 countries

## Partnership for global alert and response to infectious diseases: network of networks (WHO)



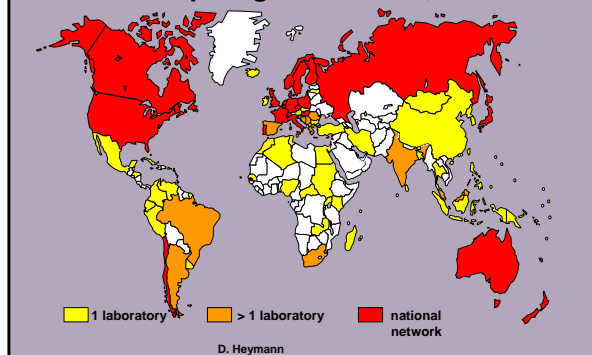
## Some Suggestions for Improvement

- Identify potential hotspots
  - Areas of greatest human migrations or incursions on natural environments
  - Most intensive human-animal interfaces, including both natural and agricultural settings
  - Transportation hubs?
- For developing countries where clinicians are limited, local people might be trained to recognize and report some types of local outbreaks
- More effectively link veterinary and human disease monitoring systems
- Define triggers for public health response

## Influenza Surveillance Components

- WHO (National Influenza Centers: 112 labs from 83 countries)
- U.S.: National Respiratory and Enteric Virus Surveillance System (NREVSS) Collaborating Laboratories (US, 86 labs in 43 states)
  - 122 Cities Mortality Reporting System
  - U.S. Influenza Sentinel Physicians Surveillance Network
  - State and Territorial Epidemiologists Reports (“influenza-like illness”)

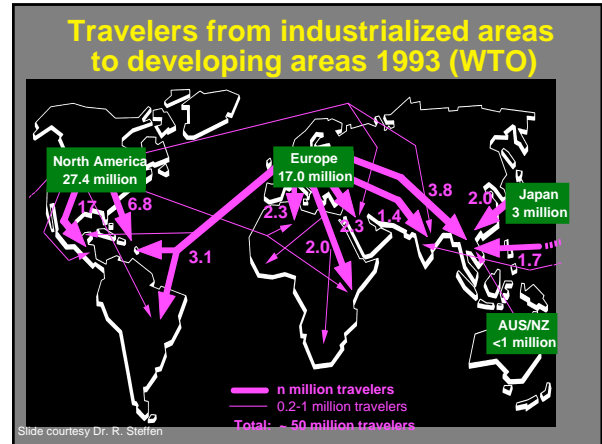
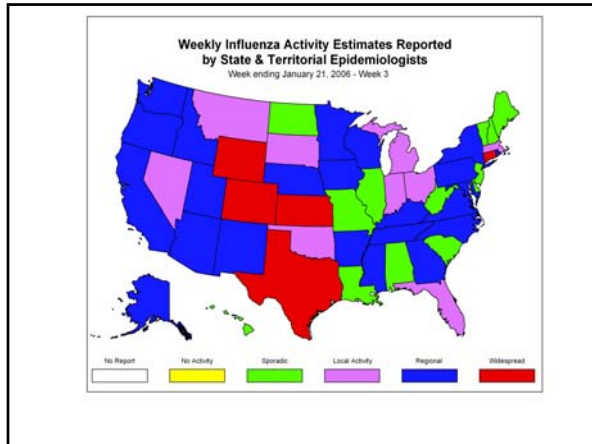
## FluNet: Global Surveillance of Human Influenza: Participating laboratories, 2003



## Clinical Recognition (Sentinel Physicians Network)

“Influenza-like illness” (“ILI”):

- Fever at least 100° F  
AND
- Cough OR Sore throat  
AND
- No other known cause
- Ultimate diagnosis: Lab testing (also needed for strain identification)



- Summary Points:**
- Surveillance with vigilance
  - Communication between countries/experts
  - Honesty in reporting, even things that may be embarrassing or pose economic threats
  - Trusted central repository
  - Ability to take world-wide action
  - Support for economically disadvantaged

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