

# Infectious Diseases in NC *Overview*

Task Force on Prevention

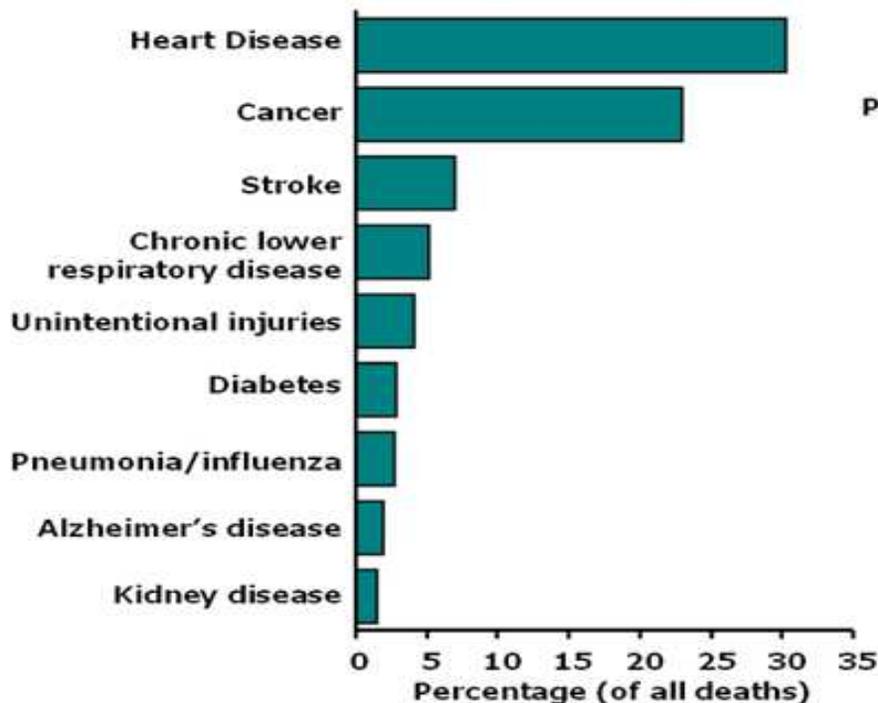
NC Institute of Medicine

Friday, March 27, 2009

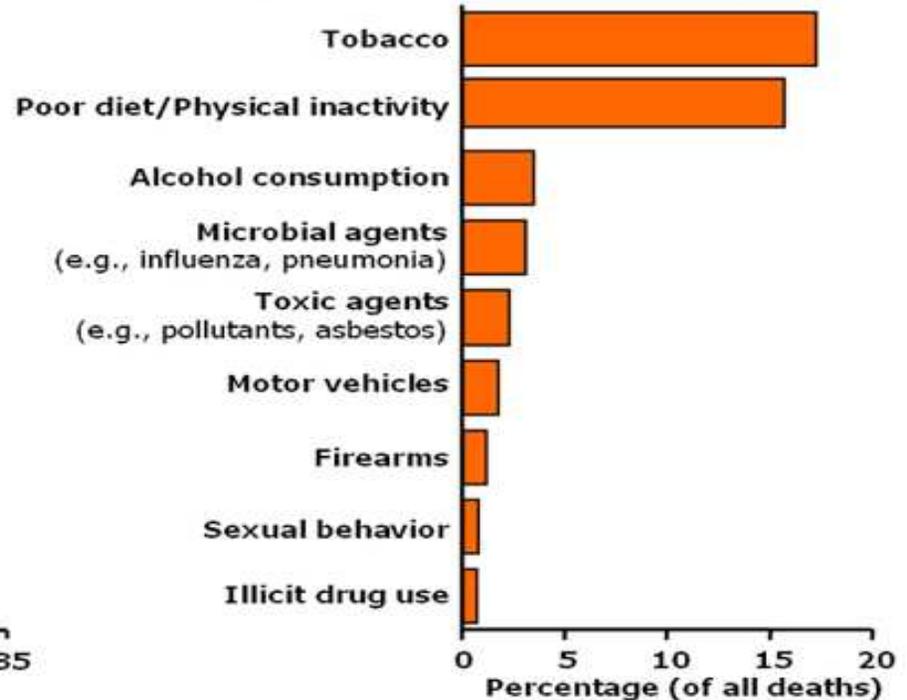
*J. Steven Cline, DDS, MPH  
Deputy State Health Director  
NC Division of Public Health*

# The Real Threats to Our Health

**Leading Causes of Death\***  
United States, 2000



**Actual Causes of Death†**  
United States, 2000

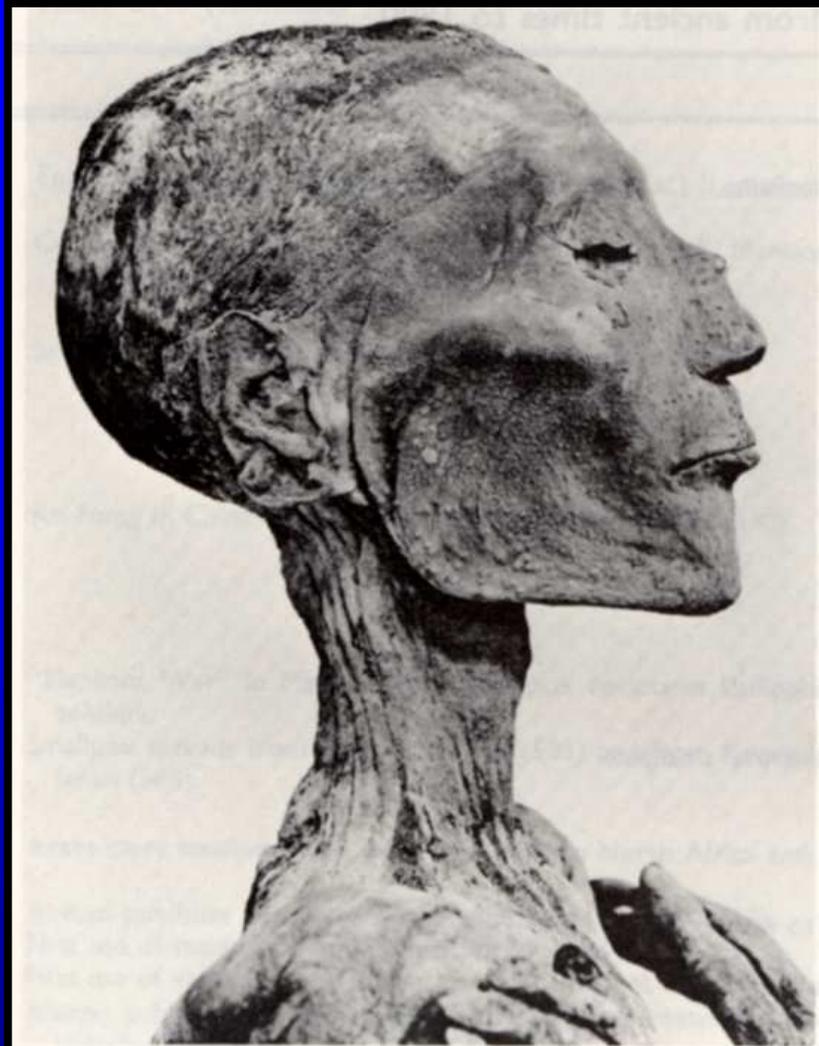


\* Miniño AM, Arias E, Kochanek KD, Murphy SL, Smith BL. Deaths: final data for 2000. National Vital Statistics Reports 2002; 50(15):1-120.

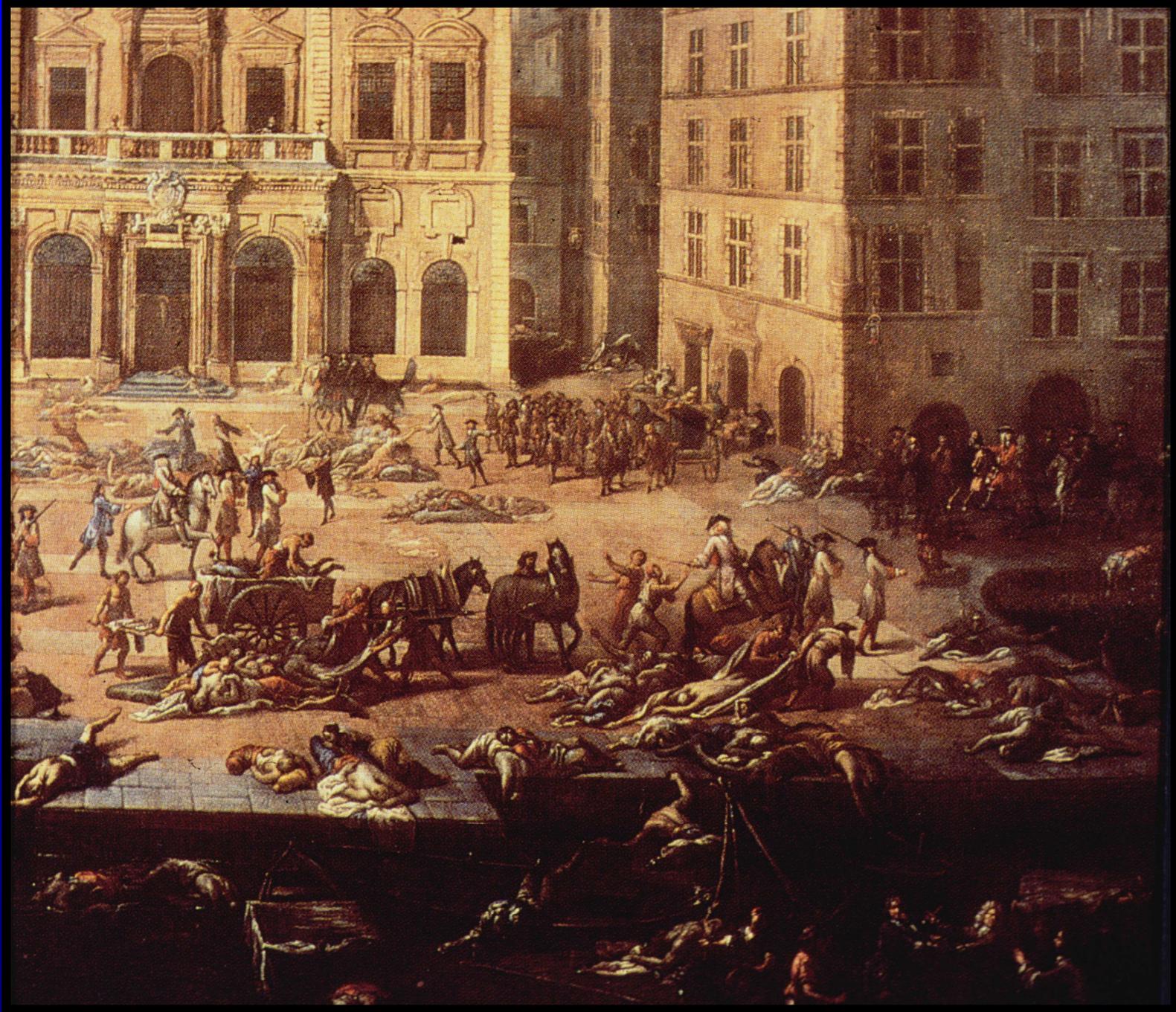
† Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. JAMA. 2004;291(10):1238-1246.

# Outline

- History of Infectious Diseases
- Principles of Communicable Diseases
- Public Health Surveillance
- Investigation and Control Measures
- Trends in Reportable Diseases
- Emerging Infections



**Plate 5.1.** The mummified head of Ramses V of Egypt (died 1157 BC) showing the pustular eruption that may have been due to smallpox. (From Smith, 1912.)





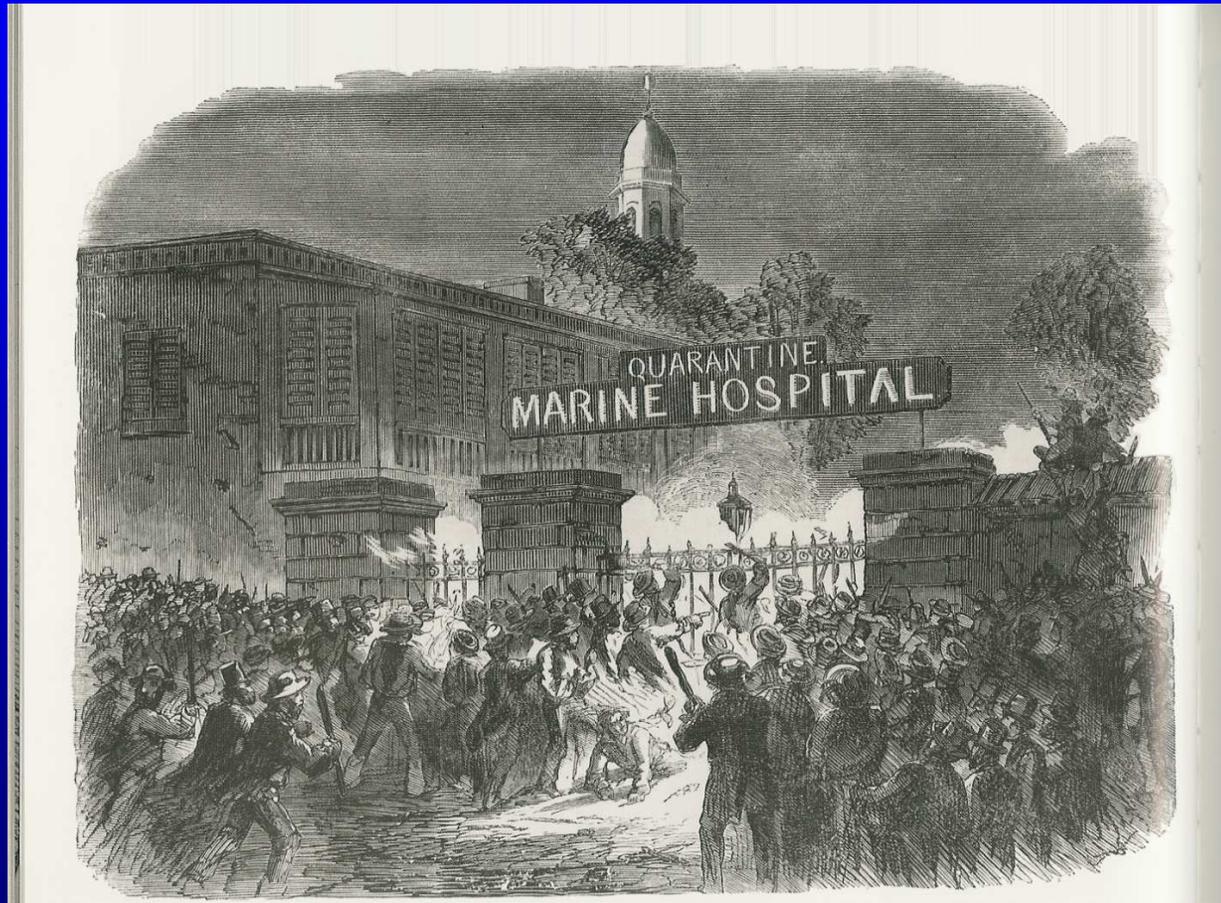
# Origin of Public Health

- 1832, Asian Cholera strikes the West
- Dr. John Snow British pioneer in the new science of epidemiology, suspected London's public water supply
- 1849, Cholera was a waterborne disease from polluted public water
- Control Measure: removed the handle from the Broad Street pump

# US Public Health Service

- 1798, Marine Hospital Service
- Formed because of devastating epidemics brought in by sailors to port cities: quarantine hospitals
- Old World diseases attack immunologically naïve New World residents
  - Philadelphia 1793, 10% mortality from Yellow Fever

# Staten Island, NY 1858 Yellow Fever Quarantine



# US Public Health Service

- 1878, Port Quarantine Act
- 1890, Interstate quarantine
- 1902 PHS officially begins
- Once its own federal agency, PHS now dispersed among Commissioned Corps officers within DHHS

# The Centers for Disease Control and Prevention



## Humble Beginnings

Malaria Control in War Areas  
(MCWA), Atlanta 1942

Typhus control project

- building rat traps through the night

1946, renamed National  
Communicable Disease Center

# State and Local Public Health

- State Health Departments
  - 1855, Louisiana (quarantine in New Orleans)
  - 1869, Massachusetts responds to “The Shattuck Report” of 1850
    - smoke control, food safety, health education
- Local health departments formed to combat “sanitary nuisances”
  - Port cities: Yellow Fever, Malaria
  - Guilford County, NC 1911: Hookworm

# Hookworm in Guilford County, NC 1911, First County Health Department Created





# History of Smallpox Vaccination†

- 1805 - Growth of virus on the flank of a calf in Italy
- 1864 - Publicity about vaccine production at a medical congress
- After WWI - Most of Europe, smallpox free
- After WWII - Transmission interrupted in Europe and North America
- 1940's - Stable freeze – dried vaccine perfected by Collier

†Henderson DA, Moss M, Smallpox and Vaccinia in *Vaccines*, 3<sup>rd</sup> edition, 1999

# History of Smallpox Eradication†

- 1950 - Pan American Sanitary Organization decides to undertake eradication hemisphere-wide
- 1959 - World Health Assembly adopts goal to eradicate smallpox
- 1966 - World Health Assembly decides to intensify eradication and provide more funds

† Henderson DA, Moss B, *Smallpox and Vaccinia in Vaccines*, 3<sup>rd</sup> edition, 1999

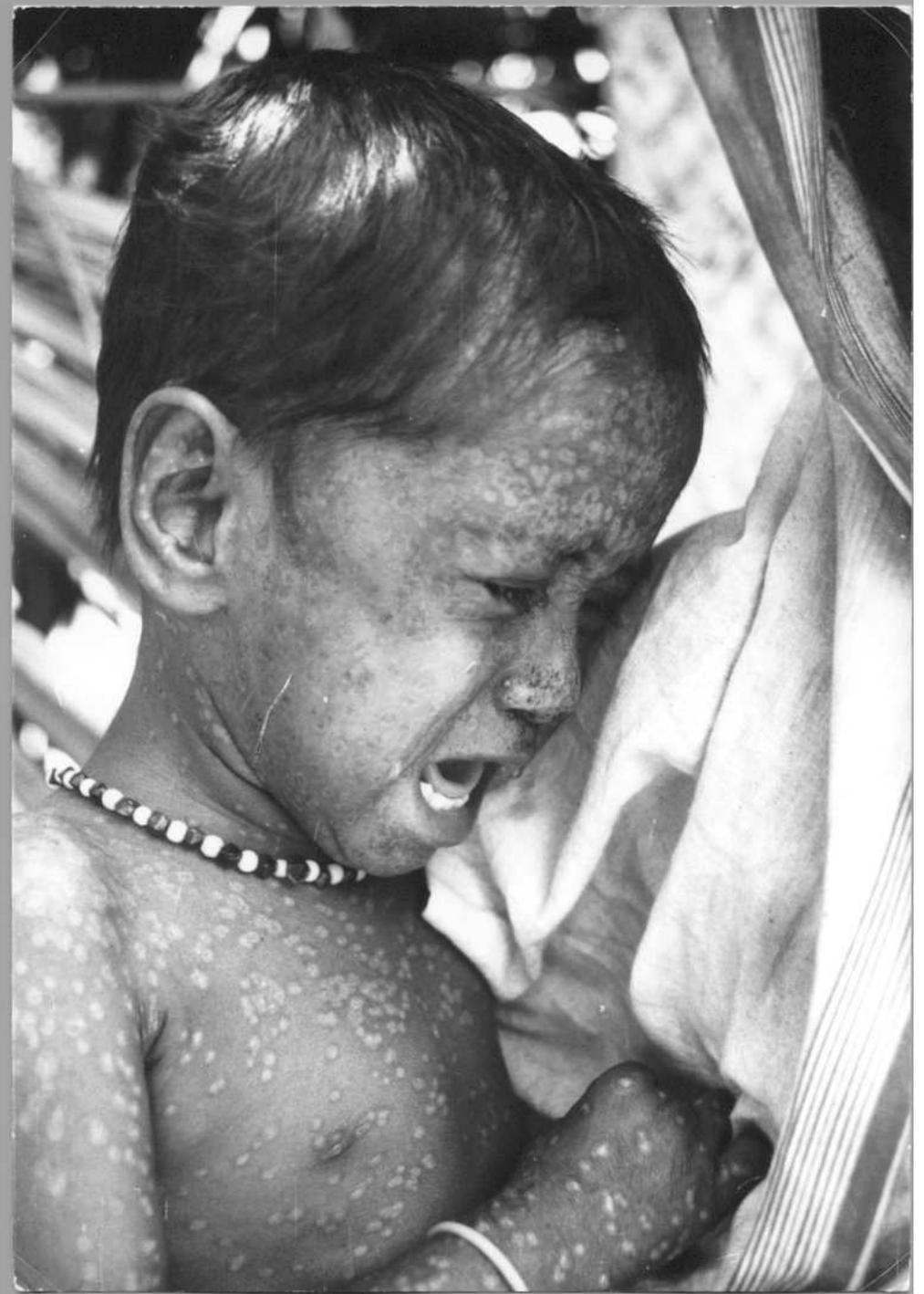
**Rahima Banu**

**...a 3 year old girl from  
Kuralia village, Bhola  
Island, Bangladesh**

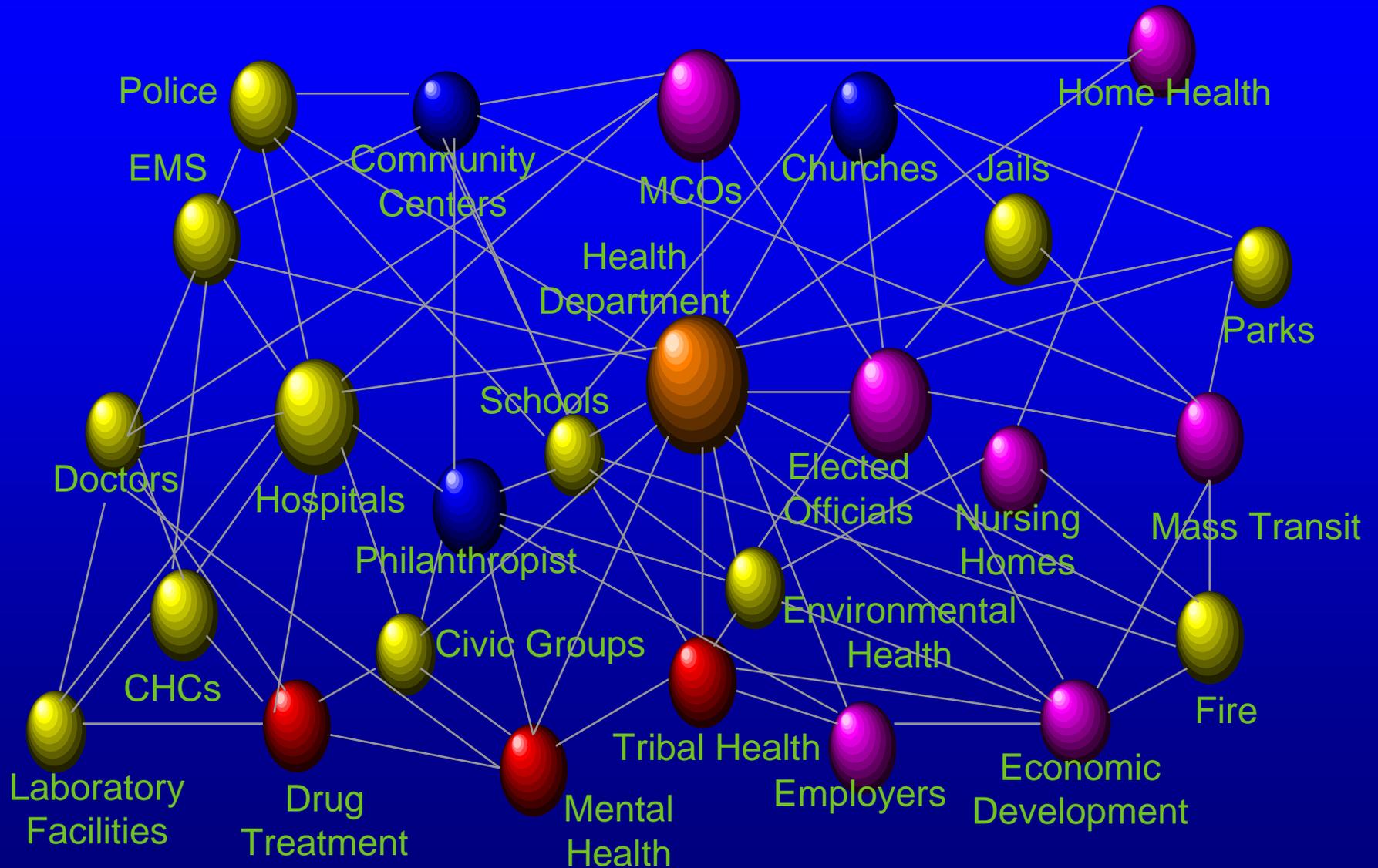
**onset: 16 Oct 75**

**The last natural case of  
variola major in the  
world...**

photo by Pierre Clauquin



# A Public Health System Is Complex



# *Principles of Communicable Disease*

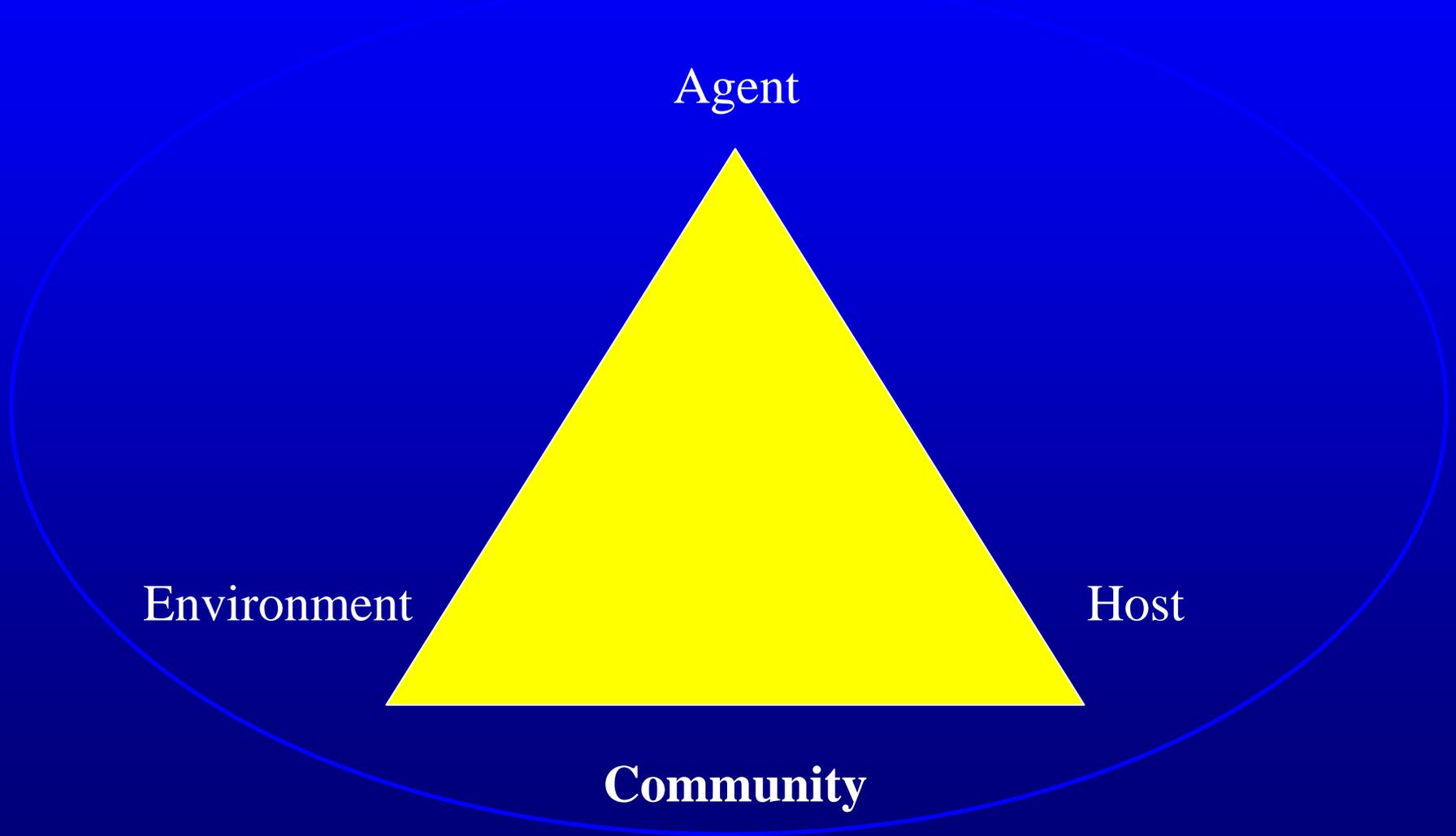
*Credits: K. Simeonsson, MD, MSPH*

# “Communicable Disease”

An illness due to a specific infectious agent that arises through transmission of that agent or its products from an infected person, animal or inanimate source, to a susceptible host, through an intermediate plant or animal host, vector, or the inanimate environment.

(Adapted fr. Dictionary of Epidemiology, Last, 2001)

# Epidemiologic Triad



# Modes of Transmission

- Direct
  - direct contact
  - droplet spread
- Indirect
  - Vector
  - common vehicle
  - airborne

# Direct Transmission: Droplet



# Indirect Exposure: Common vehicle?



# Indirect Exposure: Common Vehicle

- Inanimate object that facilitates transmission of an infectious agent
  - Food
  - Water
  - Medical equipment
  - Toys
  - *Kitchen equipment*



# **Estimated Impact of FBI on Nation**

**76 million illnesses**

**323,000 Hospitalizations**

**5,000 deaths**

# Indirect Exposure: Vector

A living animal (arthropod)  
capable of transmitting  
infectious agent from one  
host to another

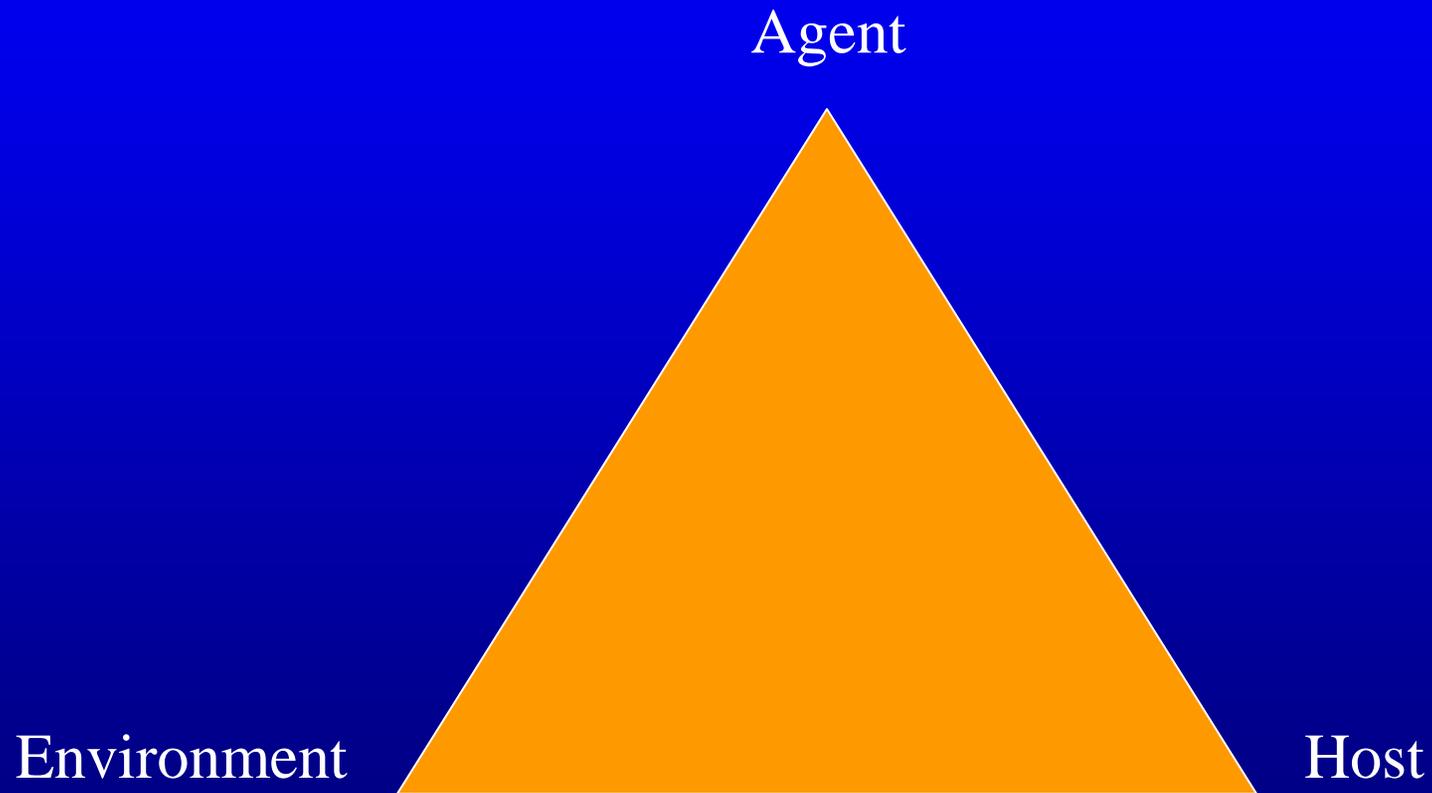
- biological transmission
- mechanical transmission



# Vector Borne Diseases of Concern in NC are:

- Bacterial Diseases
  - Lyme Disease
- Rickettsial Diseases
  - Rocky Mountain Spotted Fever
  - Ehrlichiosis
- Viral Diseases
  - WNV
  - LaCrosse Encephalitis
  - Eastern Equine Encephalitis

# Approaches to Prevention



# Immunization Programs

## Salk Polio Vaccine 1955



# Vaccine Preventable Diseases

## (\* those not reportable in NC)

Anthrax  
Diphtheria  
Hepatitis A  
Hepatitis B, acute  
*Haemophilus influenzae* type b  
(Hib) – all invasive disease  
\*Human Papillomavirus (HPV)  
\*Influenza (Flu) – only ped  
deaths  
\*Japanese Encephalitis (JE)  
Lyme Disease  
Measles  
Meningococcal  
Monkeypox  
Mumps

Pertussis (Whooping Cough)  
\*Pneumococcal  
Poliomyelitis (Polio)  
Rabies  
\*Rotavirus  
Rubella (German Measles) and  
rubella congenital syndrome  
\*Shingles (Herpes Zoster)  
Smallpox  
Tetanus (Lockjaw)  
Tuberculosis  
Typhoid Fever, acute  
\*Varicella (Chickenpox)  
Yellow Fever

# Public Health Surveillance: Definition

- Ongoing, systematic
  - Collection
  - Analysis
  - Interpretation
  - Dissemination of disease data
- Information for ACTION!

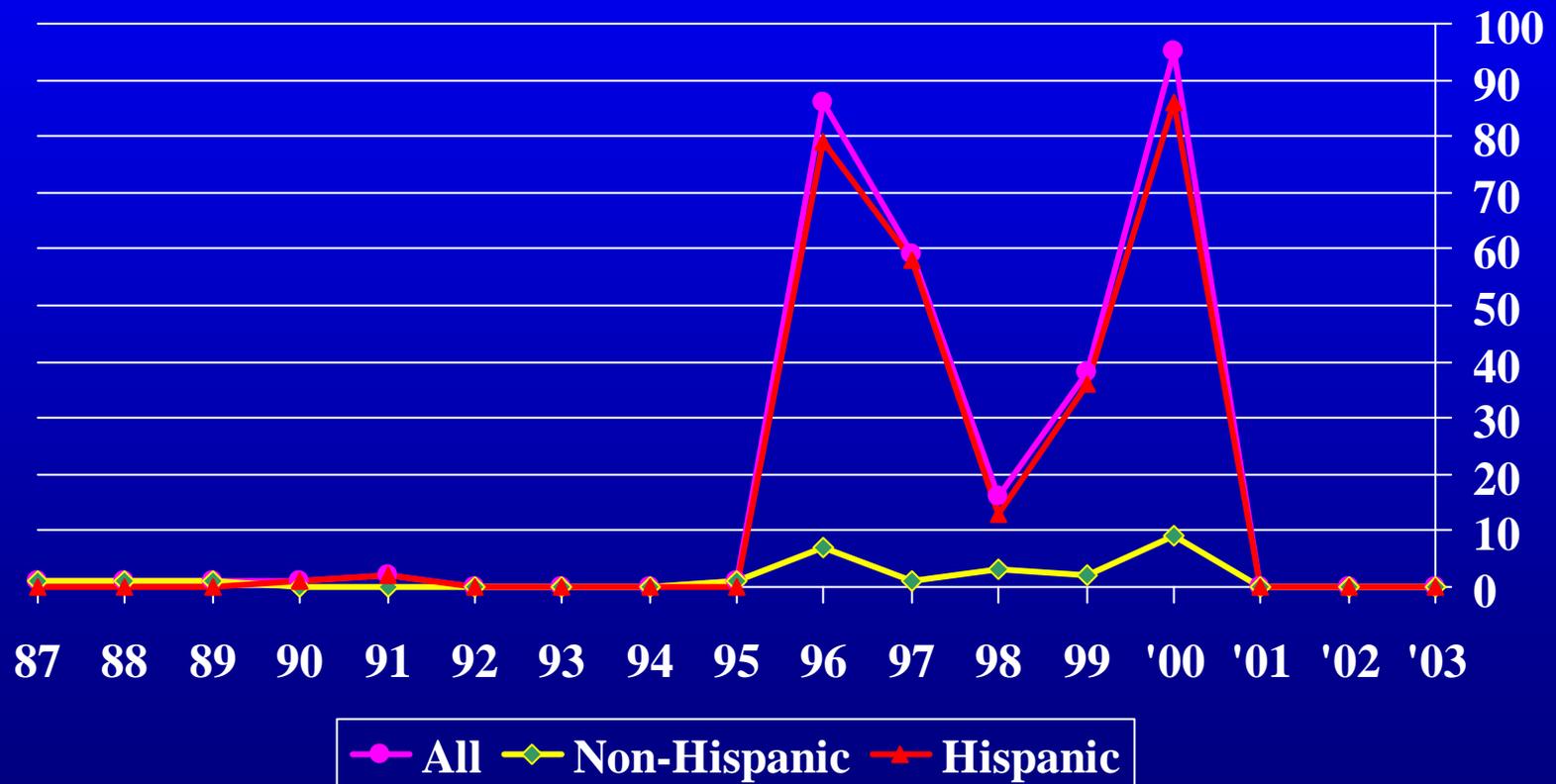
# NC Public Health Law

- NC Statutes
  - Laws passed by the legislature and signed by the governor
  - Chapter 130A, NC Public Health Laws
  - URL: [www.ncleg.net/statutes/statutes.html](http://www.ncleg.net/statutes/statutes.html)
- NC Rules
  - Elaboration and explanation of statutes
  - Force of law, easier to modify
  - NCAC Title 15A, Chapter 19, Subchapter A

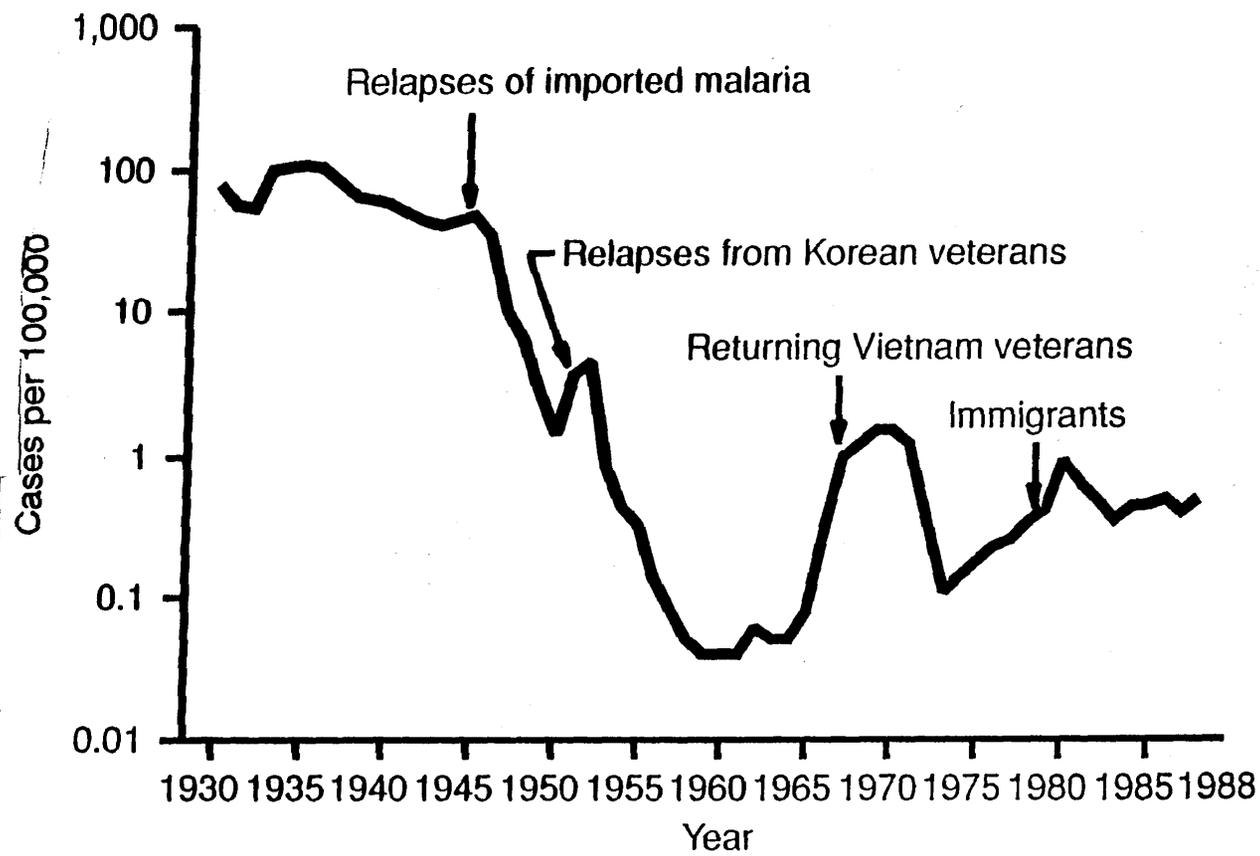
# Reportable Diseases and Conditions

- List is modified as needed
- Perceived public health importance
  - High potential for spread
  - Serious and/or severe illnesses
- Effective control measures available
- Special study

# Rubella - NC 1987-2003

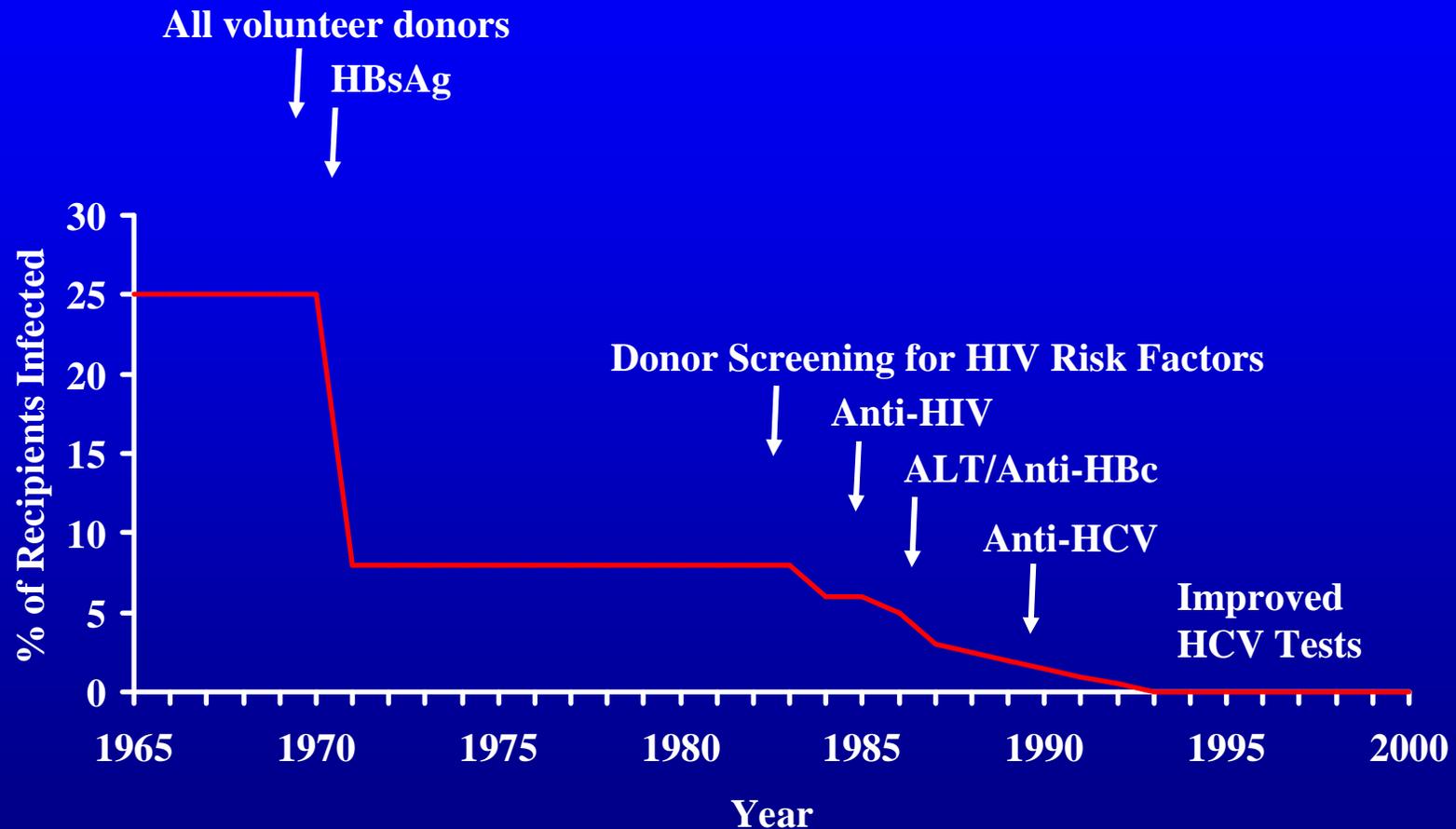


N=301. Hispanic cases: 80% aged 17-29 years old



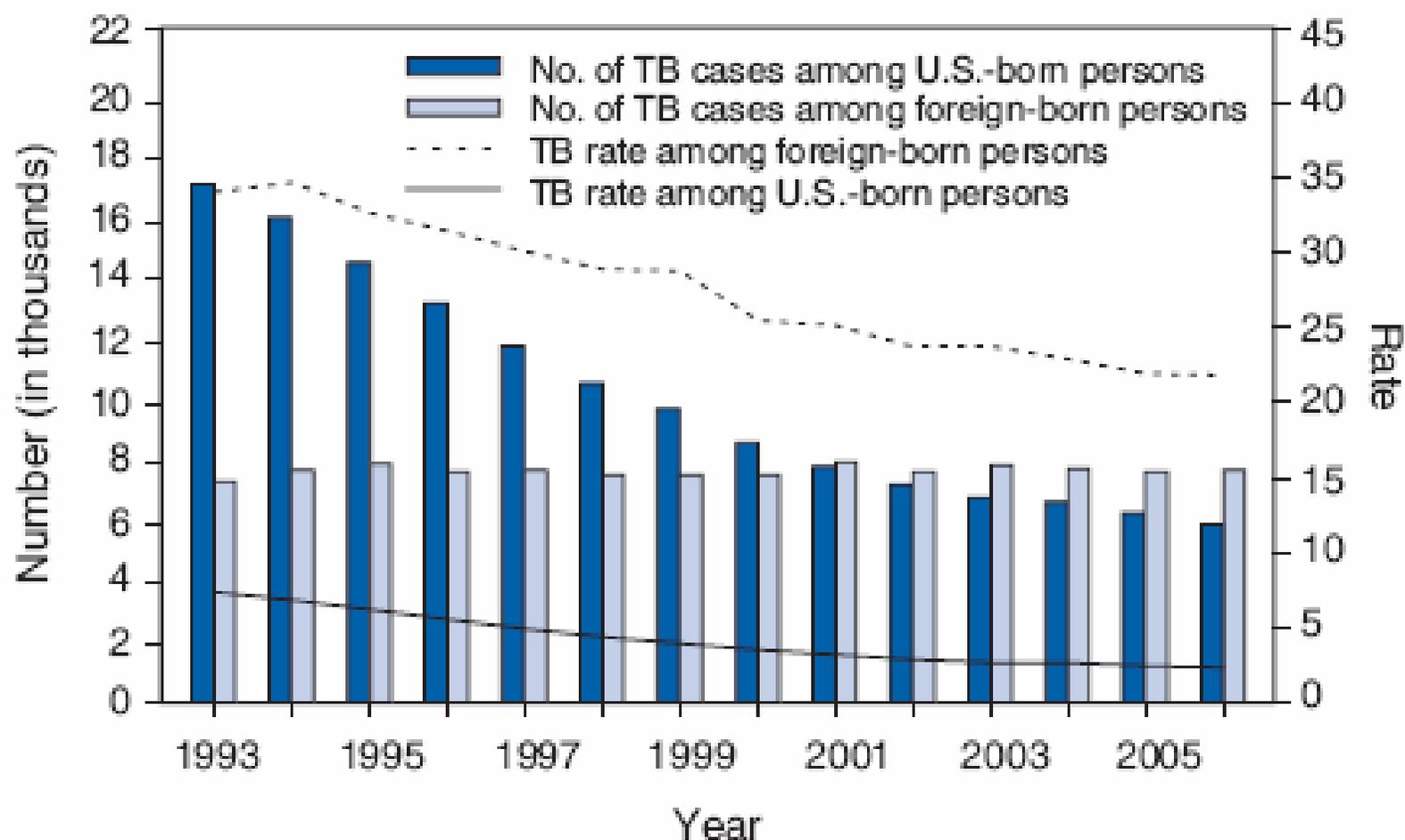
**Figure 1-4** Malaria rates, by year—United States, 1930–1988.

# Posttransfusion Hepatitis C



Adapted from HJ Alter and Tobler and Busch, Clin Chem 1997

**FIGURE 2. Number and rate\* of tuberculosis (TB) cases among U.S.- and foreign-born persons, by year reported — United States, 1993–2006†**

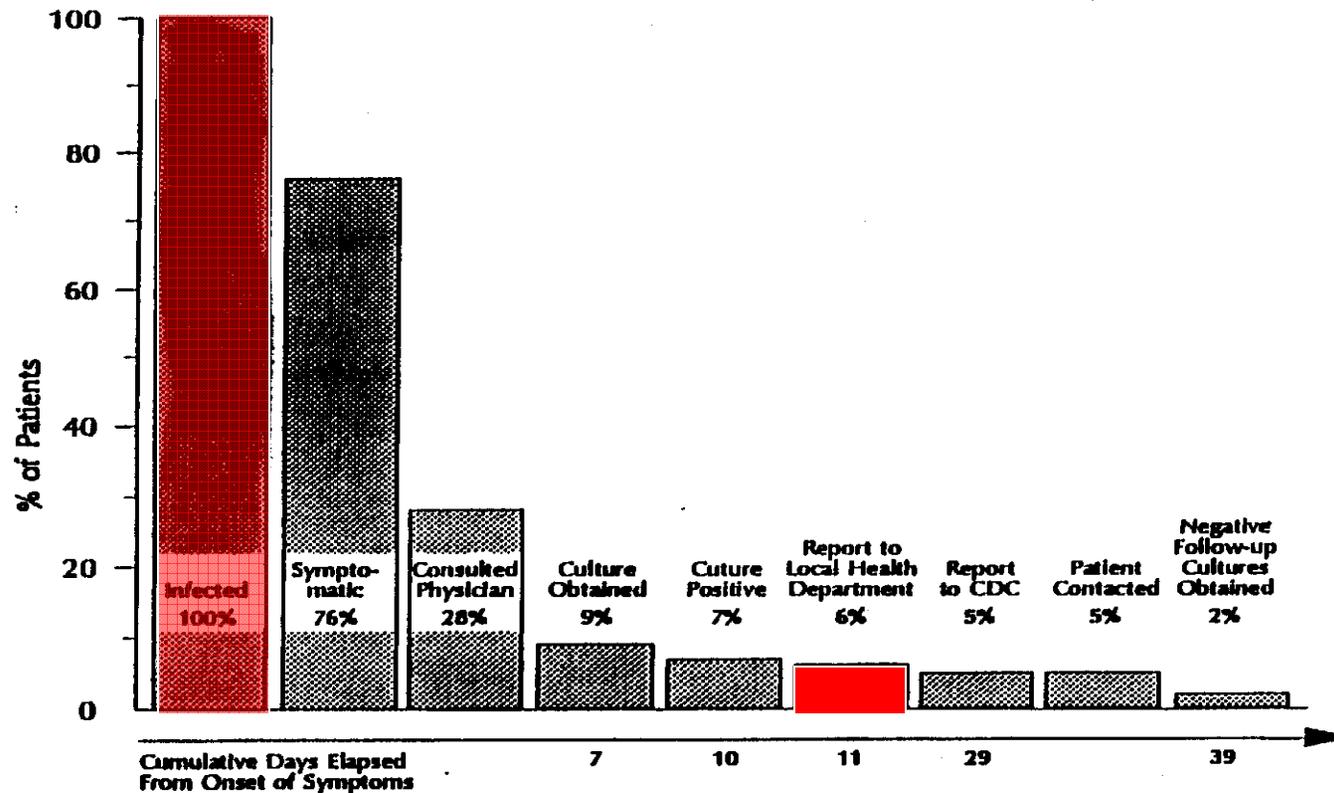


\* Per 100,000 population.

† Data for 2006 are provisional.

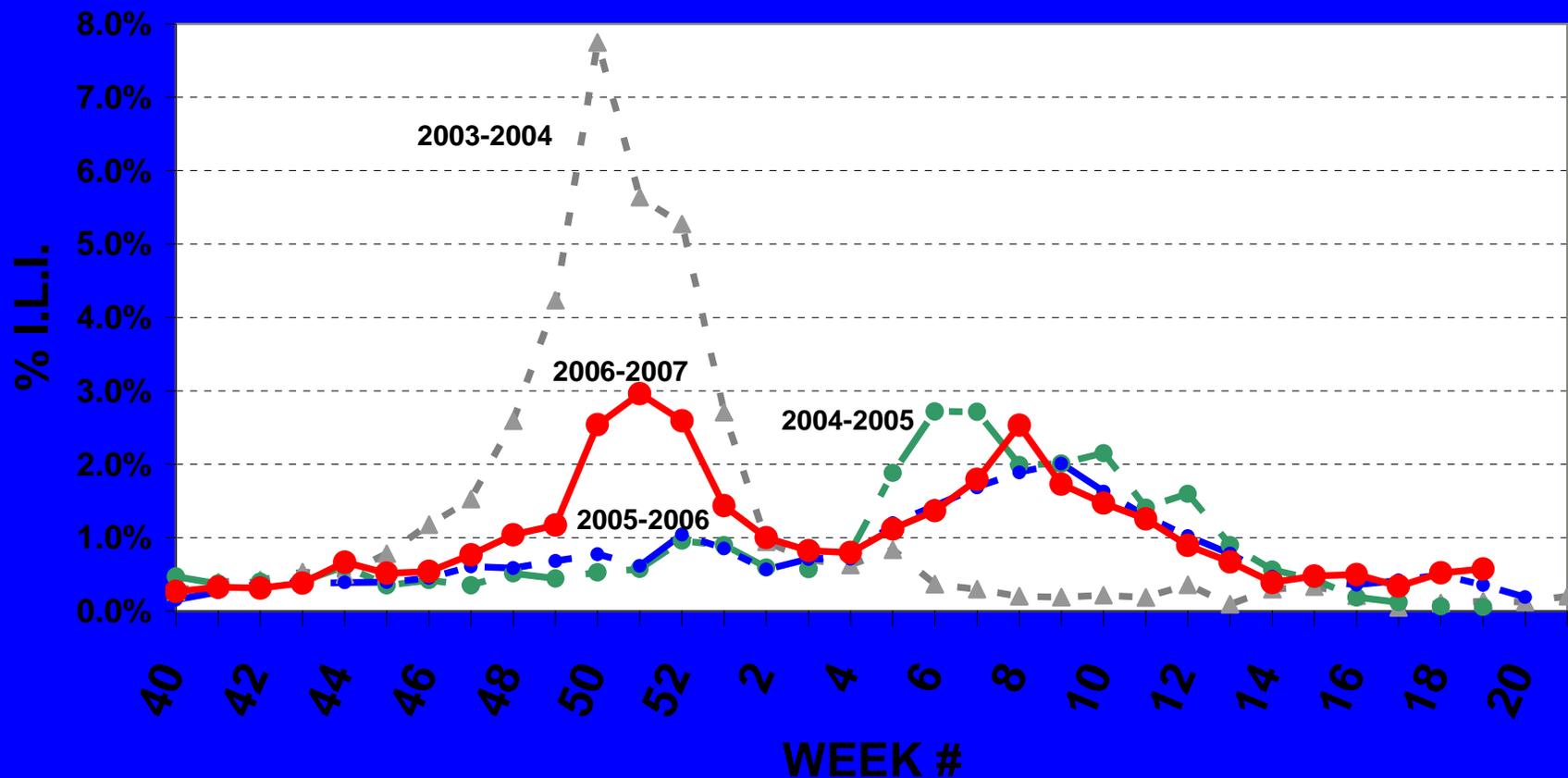
While it is the intention of the laws and regulations of each state that every case of a reportable disease be reported, the reality is otherwise. For rare, serious diseases of public health importance such as rabies, plague, or botulism, the percentage of cases actually reported may approach 100%. On the other hand, for some other diseases such as aseptic meningitis, reporting has been found to be as low as 5%. Figure 5.7 illustrates the typical fall-off from infection through disease reporting for shigellosis.

**FIGURE 5.7**  
**Completeness of case identification, reporting,**  
**and investigation of shigellosis**



# Sentinel Surveillance Network For Influenza-Like Illness

INFLUENZA SURVEILLANCE, NC  
October 2003 - May 2007



# NC Public Health Information Network (NC PHIN)

Early Detection:  
Suspected Cases

Health  
Alert  
Network

Alerting & Paging

Confirmed Cases

NC EDSS

EMS

Wildlife

Vet Lab

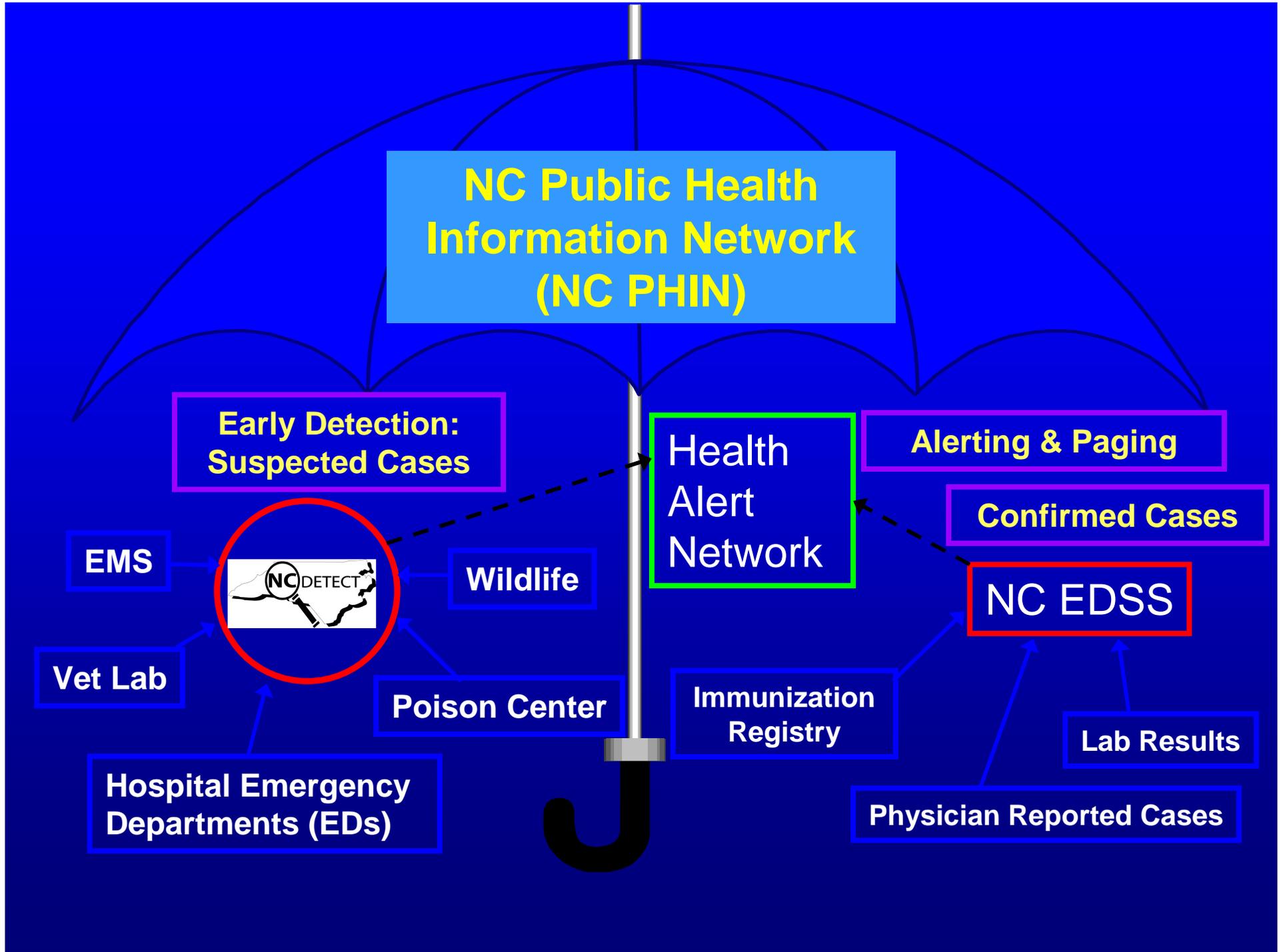
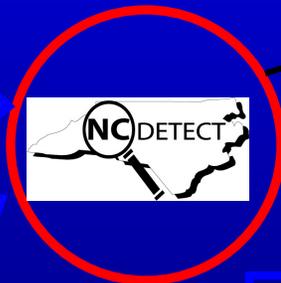
Poison Center

Immunization  
Registry

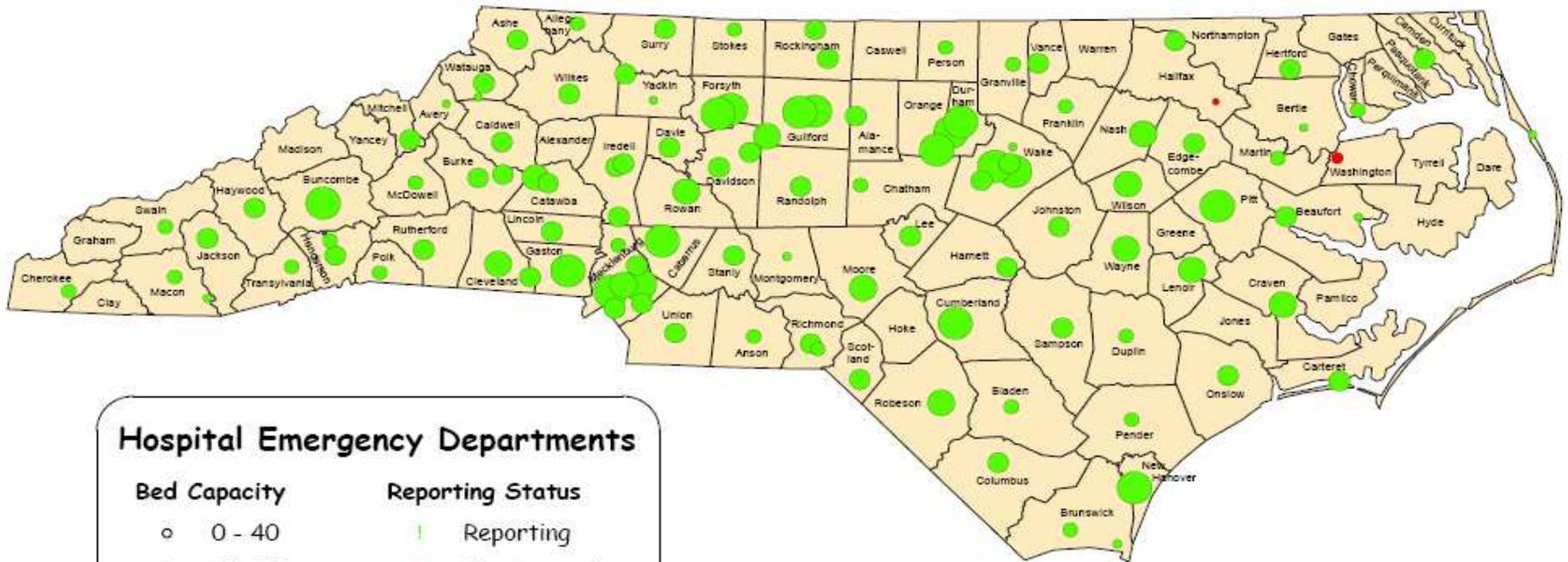
Lab Results

Hospital Emergency  
Departments (EDs)

Physician Reported Cases



# Hospital Emergency Departments Reporting to NC DETECT by General Bed Capacity As of January 7, 2008 (109 hospitals reporting)



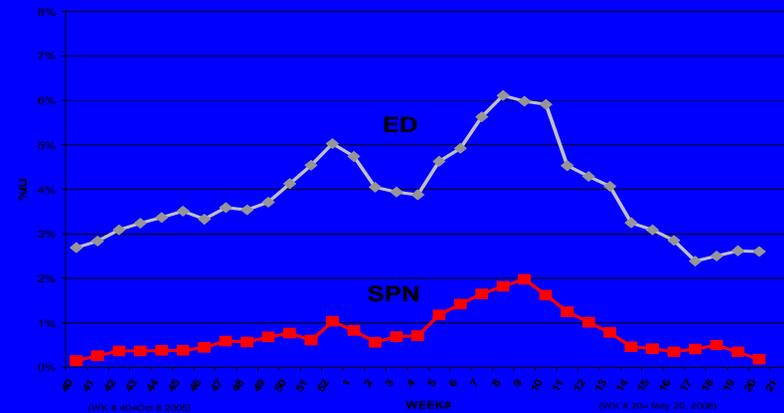
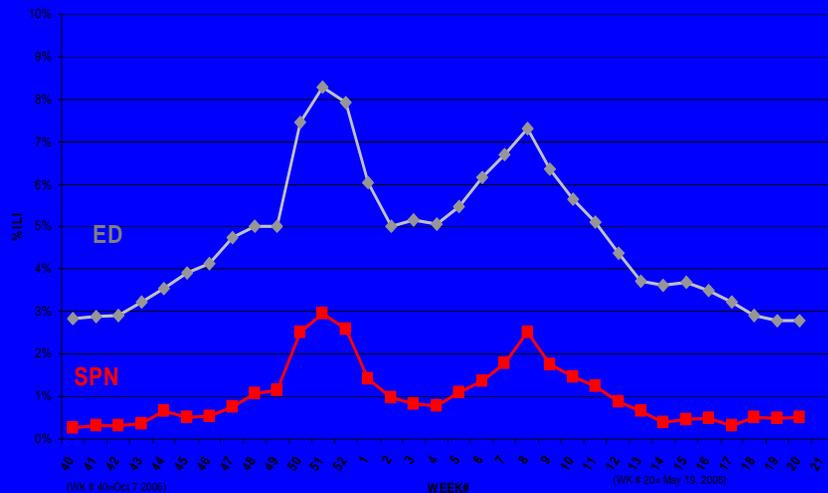
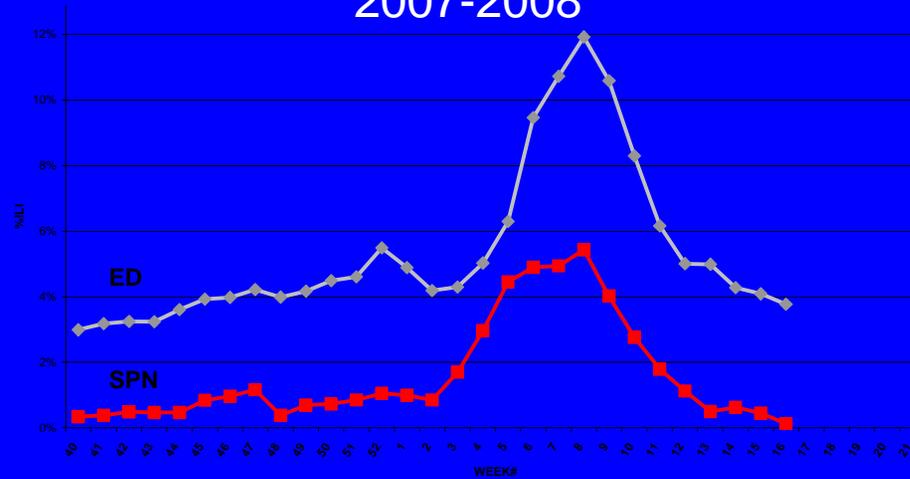
**Hospital Emergency Departments**

Bed Capacity	Reporting Status
○ 0 - 40	○ Reporting
○ 41 - 70	○ Not Reporting
○ 71 - 110	○ County
○ 111 - 300	
○ more than 300	



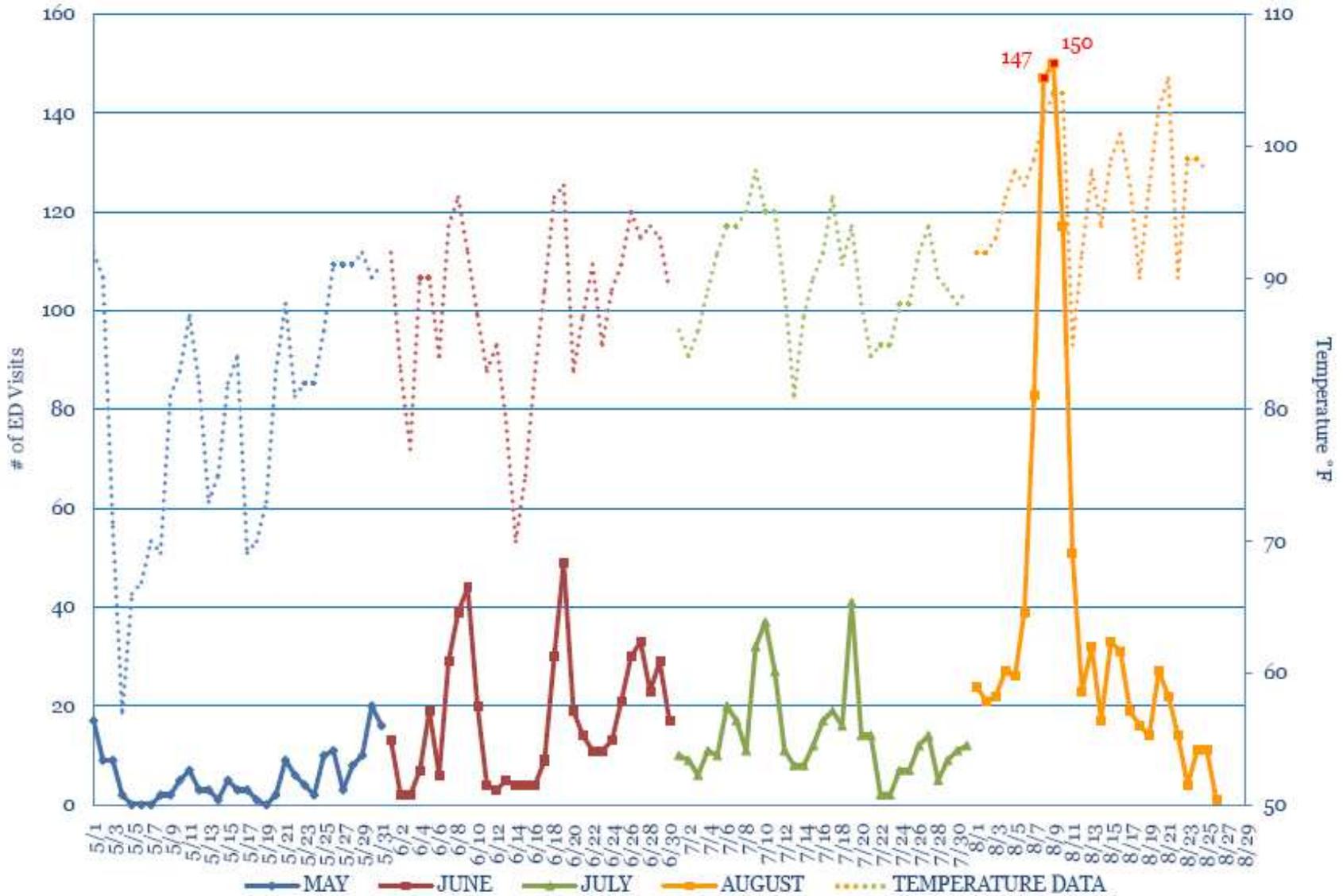
# Influenza-Like Illness surveillance NC – Hospital ED and Provider Network

2007-2008



SPN: 73 volunteer practitioners report weekly their patient workload, using LI case definition: "fever and cough or sore throat."  
 ED: As of 05/19/2007, 103 hospitals report daily ED visits electronically through NC DETECT system, using LI case definition: "LI cases must include any case with the term "flu" or "influenza" or have at least one fever term and one influenza-related symptom."

## Number of ED Visits Related to Heat Exposure North Carolina, 01 May - 27 August 2007



NOTE: dotted lines represent temperature data which are plotted on the secondary y-axis.

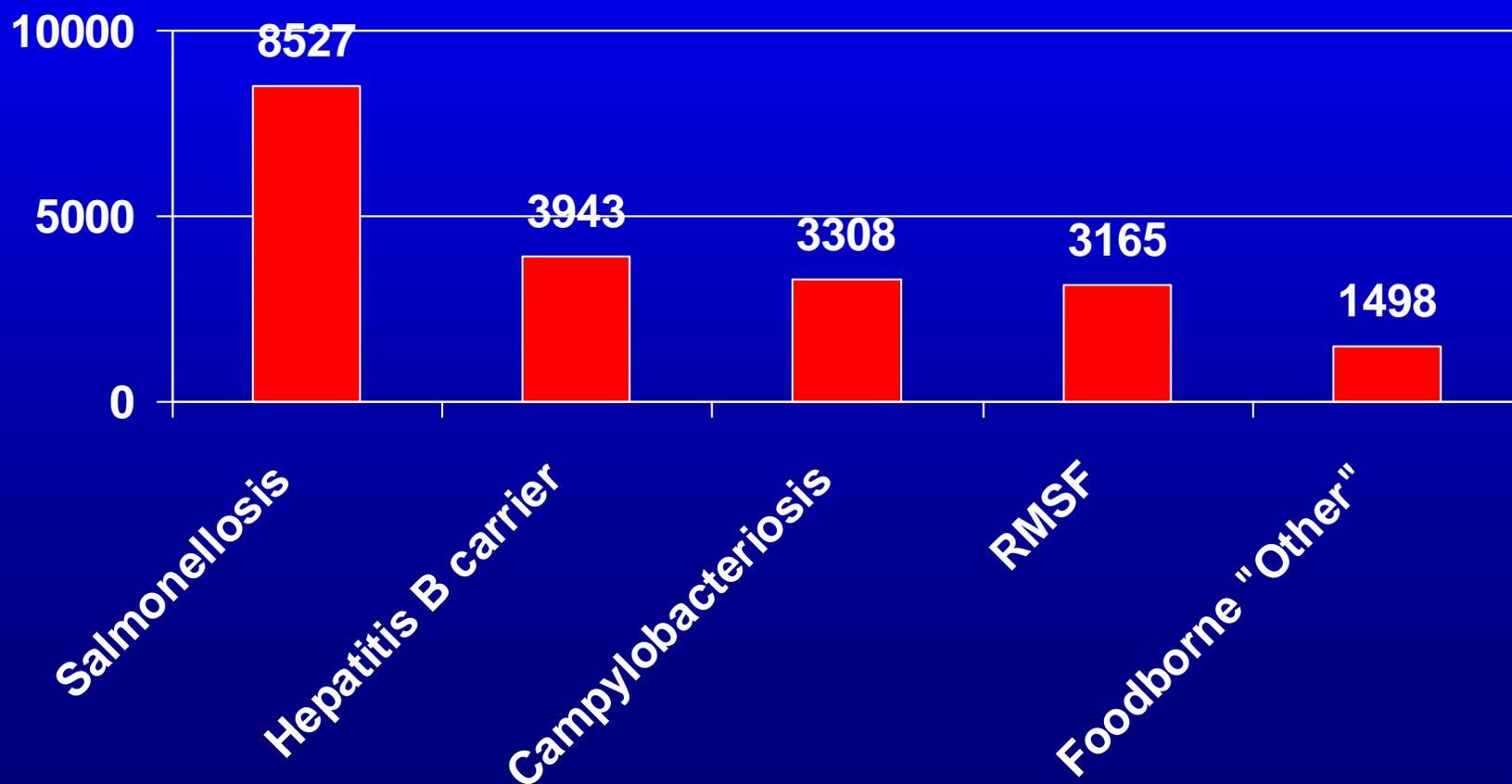


Rhonda S. Roberts

NC DHHS Injury & Violence Prevention Branch; Data Source: NC DETECT & State Climate Office of North Carolina

27 August 2007

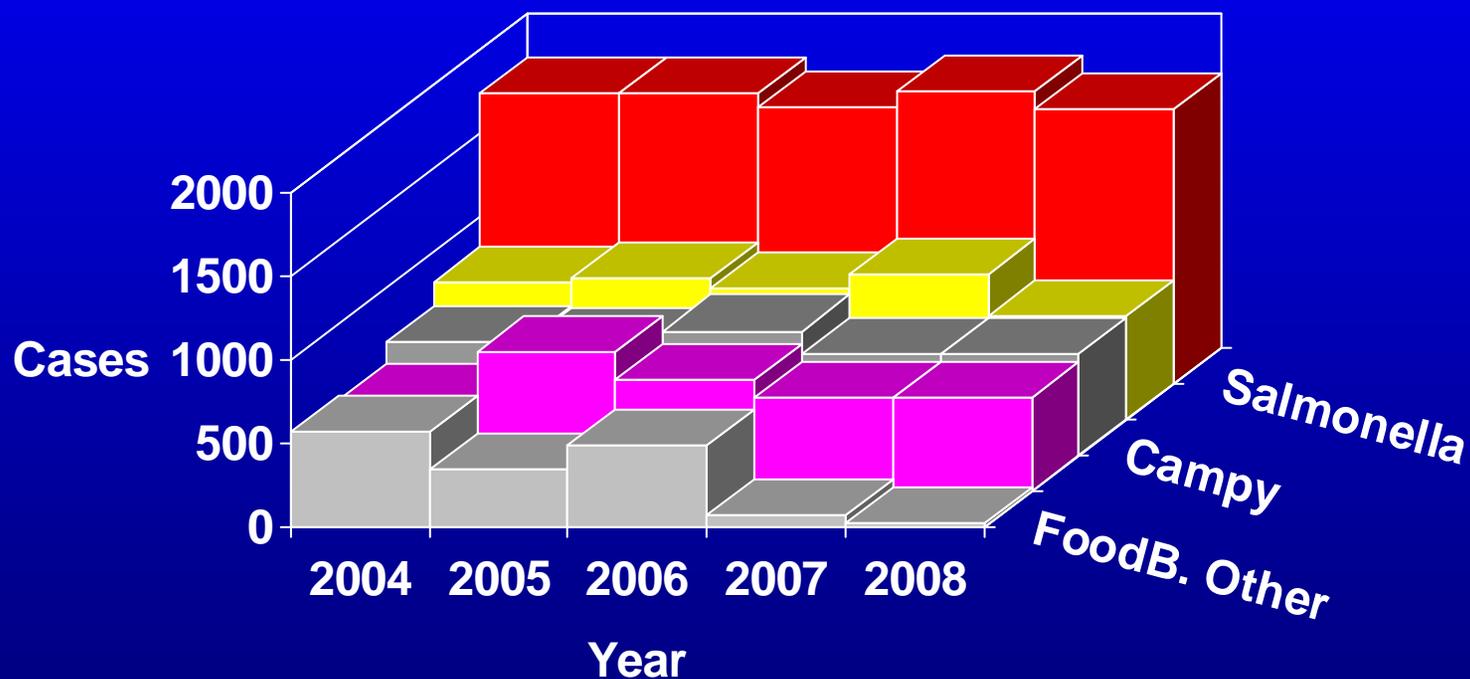
**Reportable Diseases – North Carolina**  
**Highest case count by disease**  
**(excluding STD/HIV)**  
**Case with onset in 2004-2008**



# Reported Cases by year of disease onset

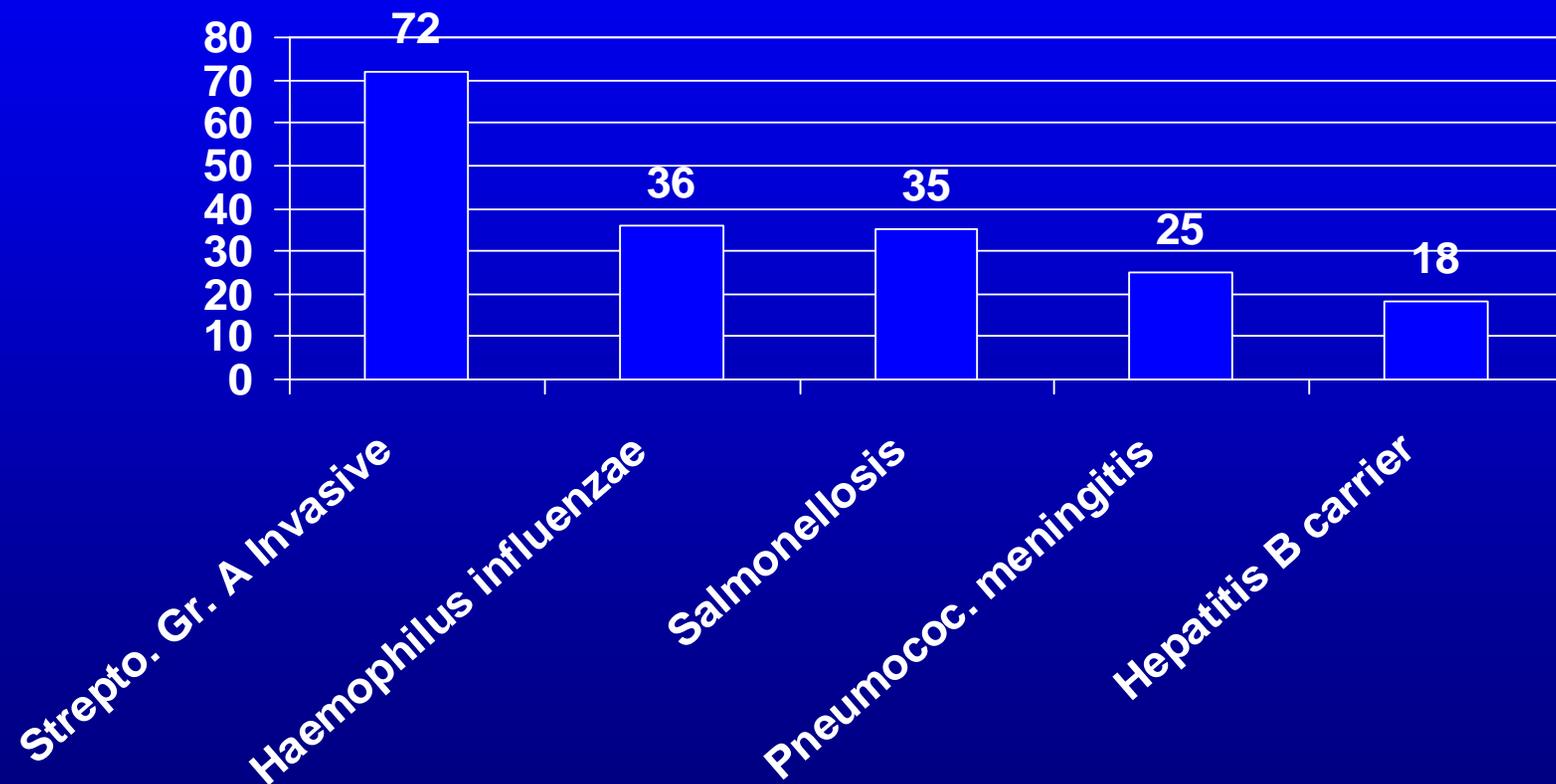
## Five most commonly reported diseases and conditions

### NC, 2004-2008



FoodB. Other
  RMSF
  Campy
  Hepatitis B carrier
  Salmonella

# Reportable Diseases causing highest mortality North Carolina, cases with onset in 2004-2008



## Highest number of deaths for reportable diseases NC, 2004-2008\*

	<b>Group A Streptococcal infection, Invasive</b>	<b>Haemophilus influenzae</b>	<b>Salmonellosis</b>	<b>Pneumococcal meningitis</b>	<b>Hepatitis B carrier</b>
<b>Number of reported deaths (rank)</b>	<b>72 (#1)</b>	<b>36 (#2)</b>	<b>35 (#3)</b>	<b>25 (#4)</b>	<b>18 (#5)</b>
<b>Number of reported cases</b>	<b>698</b>	<b>332</b>	<b>8527</b>	<b>173</b>	<b>3943</b>
<b>Rank by number of reported cases</b>	<b>#9</b>	<b>#14</b>	<b>#1</b>	<b>#18</b>	<b>#2</b>
<b>Case fatality rate at date of report</b>	<b>10.3%</b>	<b>10.8%</b>	<b>0.4%</b>	<b>14.5%</b>	<b>0.5%</b>

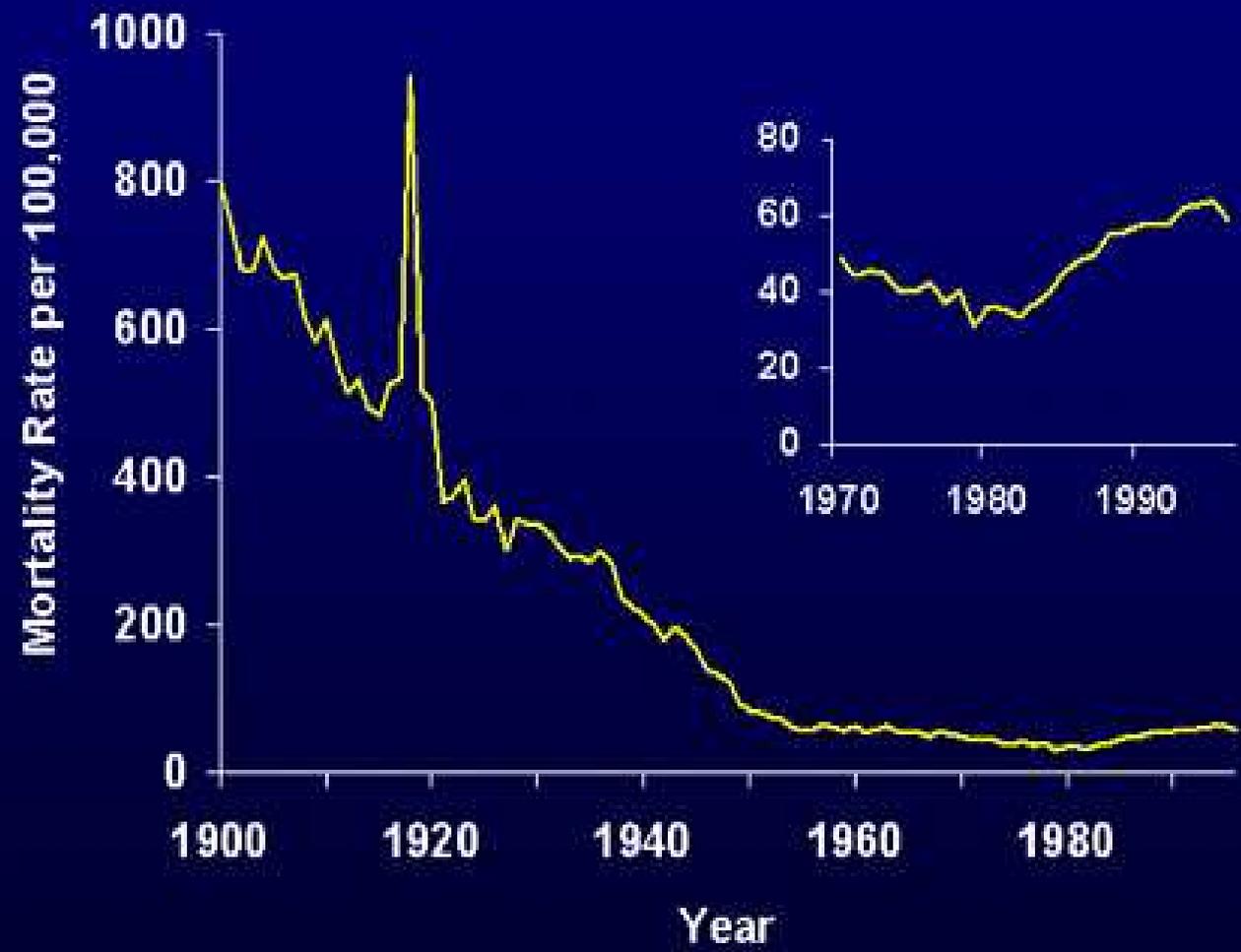
(\* By year of disease onset)

# Summary

Present Challenges

Future Directions

# Infectious Disease Mortality in the United States, 1900 to 1996

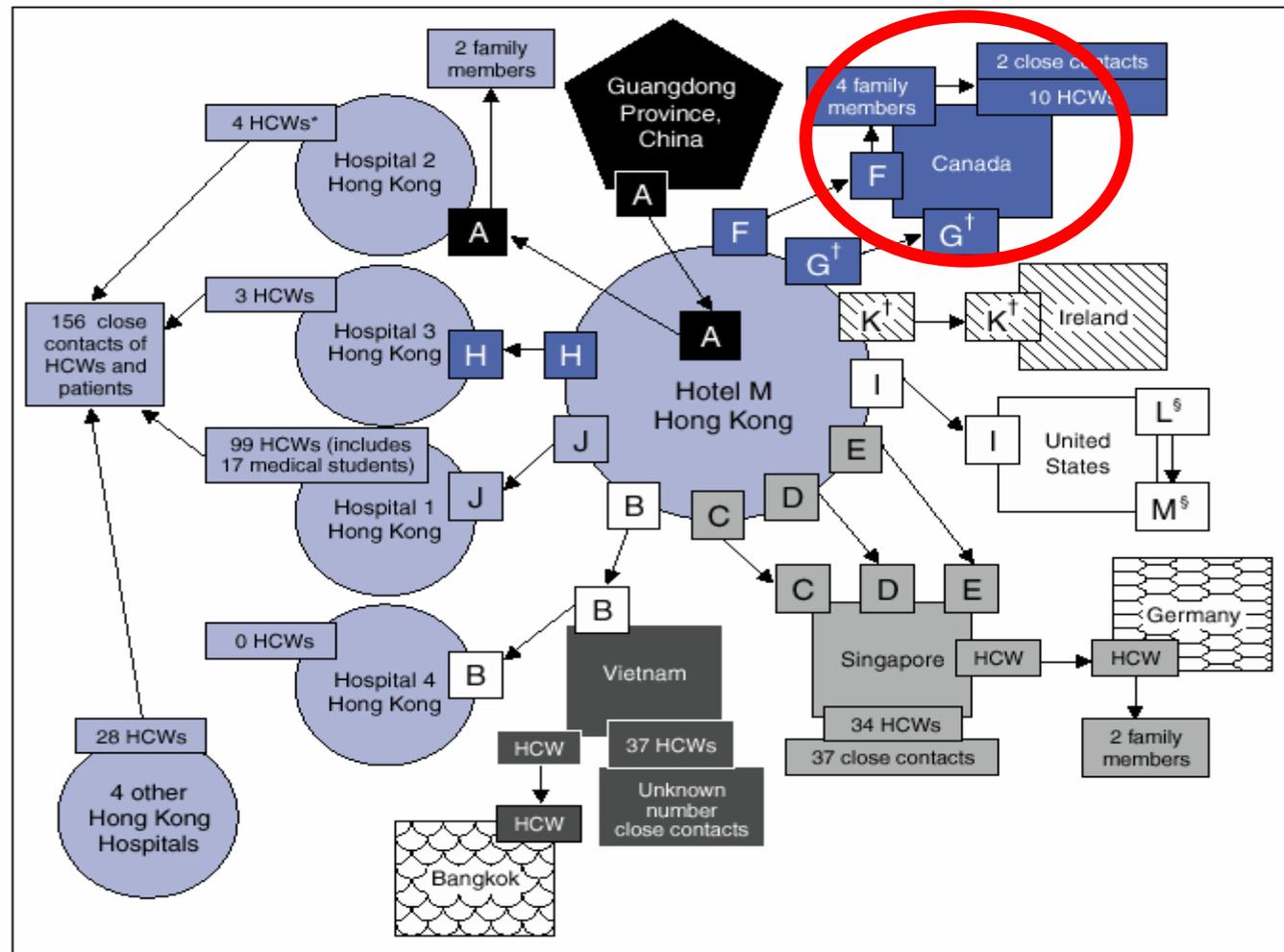


# Evolution of Public Health Priorities

- Sanitation
- Nutrition
- Contagious Diseases/Infections
- Antibiotics and Vaccines
- Leading Causes of Death - Lifestyle
- Emerging Infections – WNV, SARS, Flu
- Bioterrorism – Anthrax, Smallpox

# Disease Investigation-SARS, 2003

FIGURE 1. Chain of transmission among guests at Hotel M — Hong Kong, 2003



\* Health-care workers.

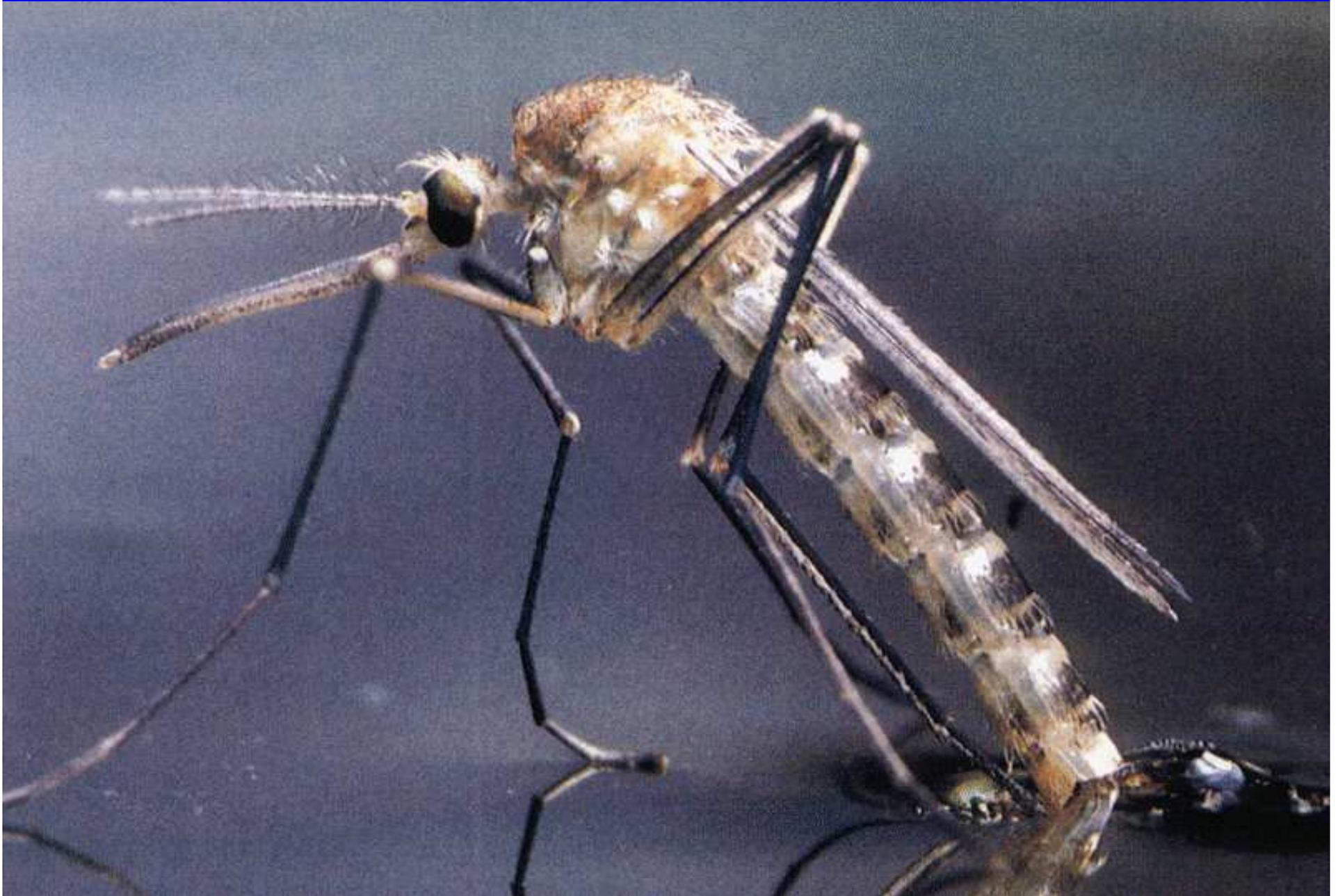
† All guests except G and K stayed on the 9th floor of the hotel. Guest G stayed on the 14th floor, and Guest K stayed on the 11th floor.

§ Guests L and M (spouses) were not at Hotel M during the same time as index Guest A but were at the hotel during the same times as Guests G, H, and I, who were ill during this period.

# Zoonotic Diseases

- Zoonosis - When a pathogen from a non-human animal results in human disease
- Common occurrence – 60% of all human infectious diseases shared with animals
- 6 of the 10 Bioterrorism Select Agents
- Examples: bubonic plague, yellow fever, West Nile fever, rabies, HIV, SARS

# Culex Mosquito WNV Vector



# Bioterrorism

- An intentional release of an infectious agent or biologically derived toxin with the intent of causing or imposing the threat of illness or death.



**AVOID INFECTIOUS  
AGENTS** *Ph...*



**BEN GARGENT**...  
© 1972/2001 The United States  
Centennial Film Exekute

Smallpox Eradicated 1977  
NC Plan for Mass Vaccination 2002



# Global Health-Global Poverty

## EMERGING INFECTIOUS DISEASES<sup>®</sup>

EID  
Online  
www.cdc.gov/eid

October 2007

Global Poverty



CDC  
SAFER. HEALTHIER. PEOPLE.

# Infectious Diseases Important to the Prevention Task Force

- **HIV/STD** (already covered)
- **Vaccine Preventable Diseases** ( Inﬂuenza, Pertussis, Hepatitis B, Meningococcal)
- **Vectorborne** (Lyme Disease, RMSF, Arbovirus Infections)
- **Foodborne** (Salmonella, Campy, all Others)

# Infectious Diseases in NC

## Overview

*Thank You*

