University of Jordan

Faculty of medicine

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Medical Committee
The University of Jordan

Global health

Slide # : 2

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Designed by Esraa Al-Salamin , dedication to Ghaida khraisat.

بسم الله الرحمن الرحيم

- الحمد لله رب العالمين والصلاة والسلام علي سيدنا محمد الصادق الوعد الأمين ، اللهم أخرجنا من ظلمات الجهل والوهم ، إلى نور المعرفة والعلم..

Emerging & Re-emerging Infectious Diseases

Infectious Diseases a Challenge to Global Health

Outline Of Presentation

- Infectious diseases- trends
- Definition of emerging & re-emerging diseases
- Factors contributing to emergence
- Examples
- Public health response

Infectious Disease

1900 - Leading Causes of Death

- Tuberculosis
- Pneumonia and Influenza
- Heart Disease
- Diarrhea / Enteritis
- Cerebrovascular Disease
- Nephritis / Nephrosis
- Unintended Injury
- Cancer
- Diphtheria
- Typhoid Fever

1992 - Leading Causes of Death

- Heart Disease
- Cancer
- Cerebrovascular Disease
- COPD
- Unintended Injury
- Pneumonia / Influenza
- Diabetes Mellitus
- HIV/AIDS
- Suicide
- Homicide / Legal Intervention

Infectious Disease- Trends

- Receded in Western countries 20th century
- Urban sanitation, improved housing, personal hygiene, antisepsis & vaccination
- Antibiotics further suppressed morbidity & mortality

Infectious Disease- Trends

- Since last quarter of 20th century- New & Resurgent infectious diseases
- Unusually large number- Rotavirus, Cryptosporidiosis, HIV/AIDS, Hantaviraus, Lyme disease, Legionellosis,

  Hepatitis C……

Infectious Diseases: A World in Transition

AIDS
Avian Influenza
Ebola
Marburg
Cholera
Rift Valley Fever
Typhoid
Tuberculosis
Leptospirosis
Malaria
Chikungunya
Dengue
JE
Antimicrobial resistance

UP

DOWN

Guinea worm Smallpox

Yaws

Poliomyelitis

Measles

Leprosy

Neonatal tetanus

Definition

- Emerging infectious disease

  Newly identified & previously unknown infectious agents that cause public health problems either locally or internationally

Definition

- Re-emerging infectious disease

  Infectious agents that have been known for some time, had fallen to such low levels that they were no longer considered public health problems & are now showing upward trends in incidence or prevalence worldwide

Factors Contributing To Emergence

AGENT

- Evolution of pathogenic infectious agents (microbial adaptation & change)
- Development of resistance to drugs
- Resistance of vectors to pesticides

Factors Contributing To Emergence

HOST

- Human demographic change (inhabiting new areas)
- Human behaviour (sexual & drug use)
- Human susceptibility to infection (Immunosuppression)
- Poverty & social inequality

Factors Contributing To Emergence

ENVIRONMENT

- Climate & changing ecosystems
- Economic development & Land use (urbanization, deforestation)
- Technology & industry (food processing & handling)

CONTD.

- International travel & commerce
- Breakdown of public health measure (war, unrest, overcrowding)
- Deterioration in surveillance systems (lack of political will)

Uncontrolled Urbanization & Population Displacement

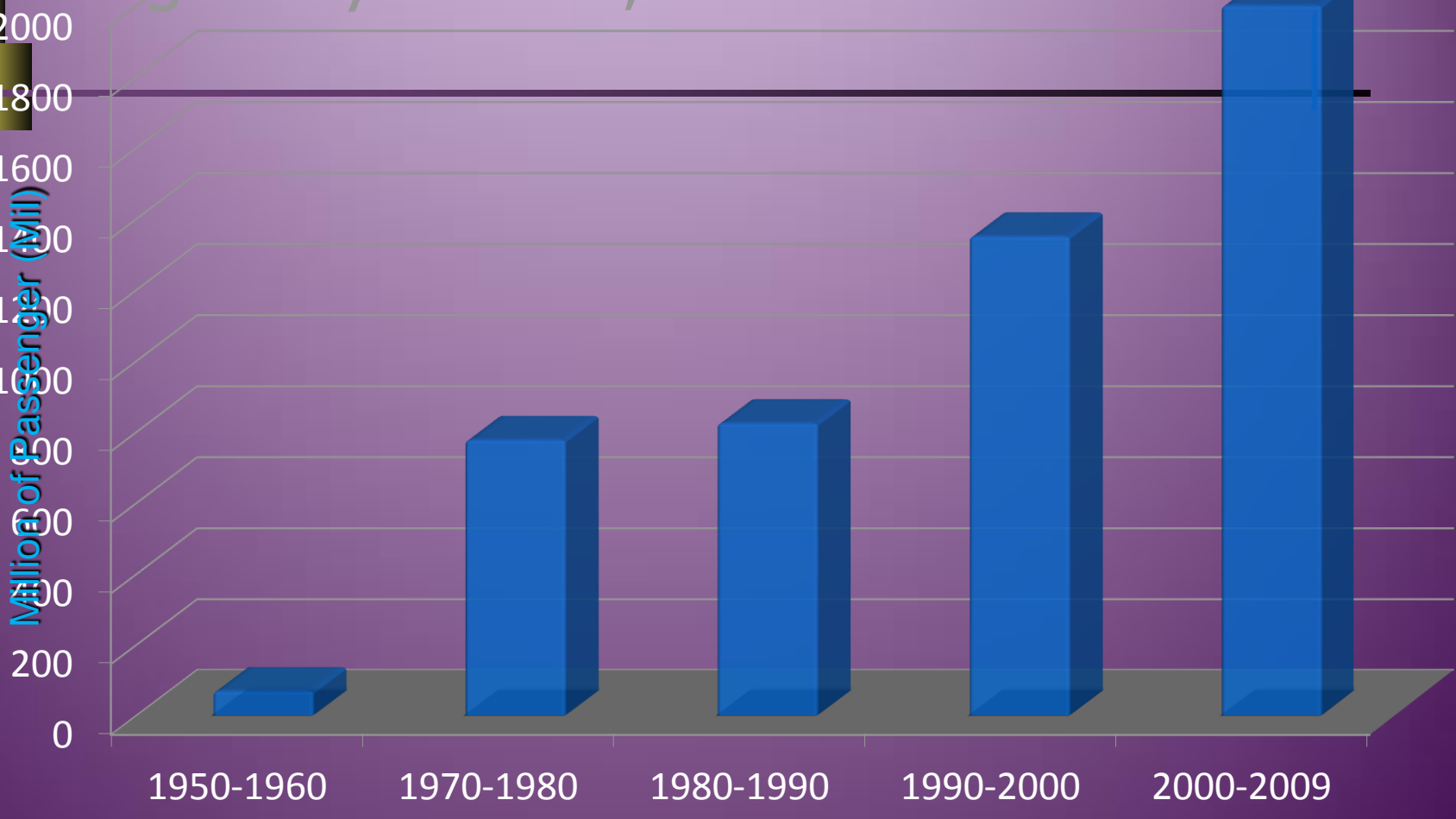
- Growth of densely populated cities- substandard housing, unsafe water, poor sanitation, overcrowding, indoor air pollution (>10% preventable ill health)
- Problem of refugees & displaced persons
- Diarrhoeal & Intestinal parasitic diseases, ARI

  Lyme disease (B. burgdorferi)- Changes in ecology, increasing deer populations, suburban migration of population

Human Behaviour

- Unsafe sexual practices (HIV, Gonorrhoea, Syphilis)
- Changes in agricultural & food production patterns- food-borne infectious agents (E. coli)
- Increased international travel (Influenza)
- Outdoor activity.

Average annual number of global airline passengers by decade, 1950-2010



IATA 2010

Antimicrobial Drug Resistance

- Causes:
- Wrong prescribing practices
- non-adherence by patients
- Counterfeit drugs
- Use of anti-infective drugs in animals & plants

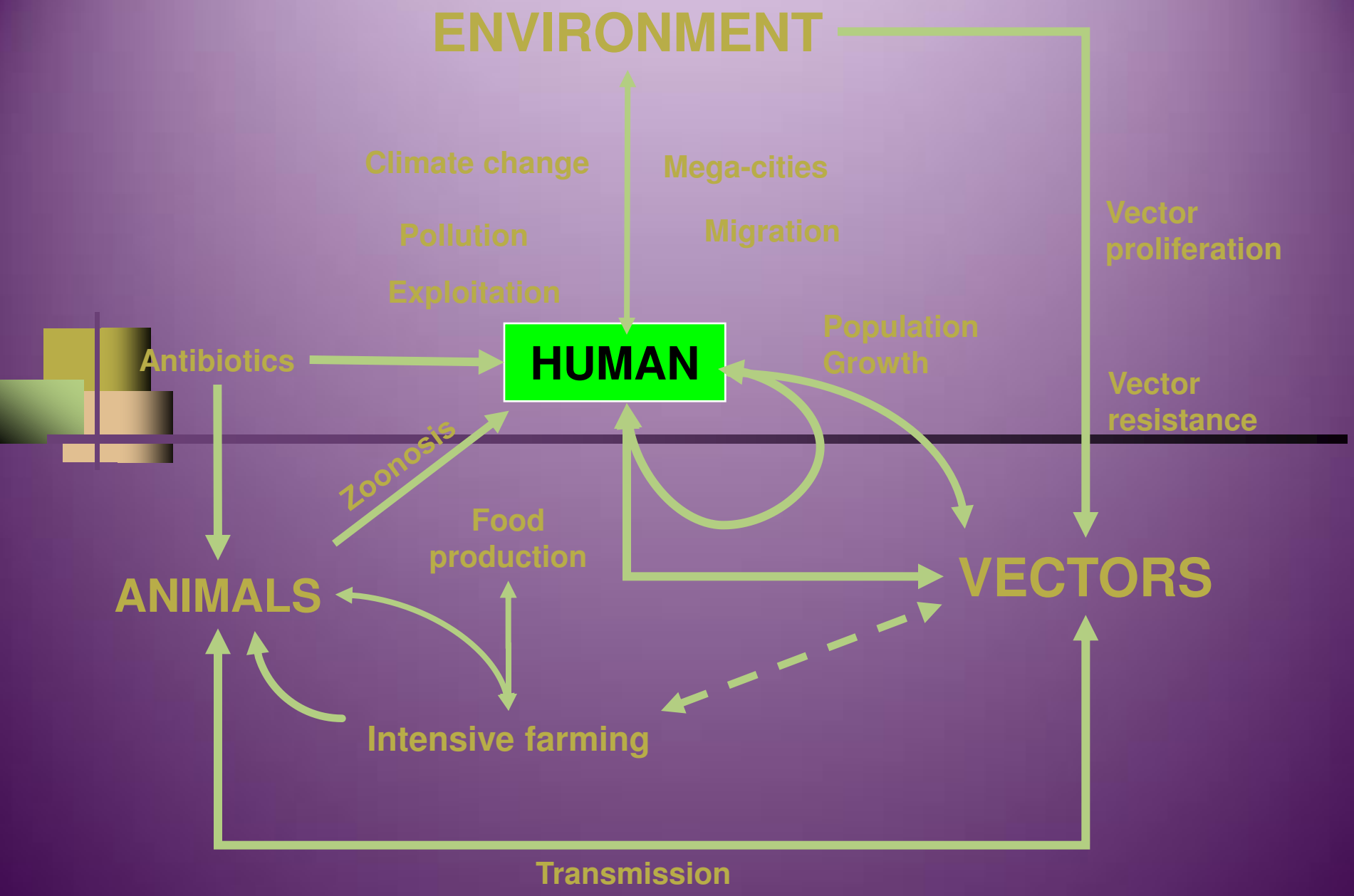
CONTD.

- Loss of effectiveness:
- Community-acquired (TB, Pneumococcal) &

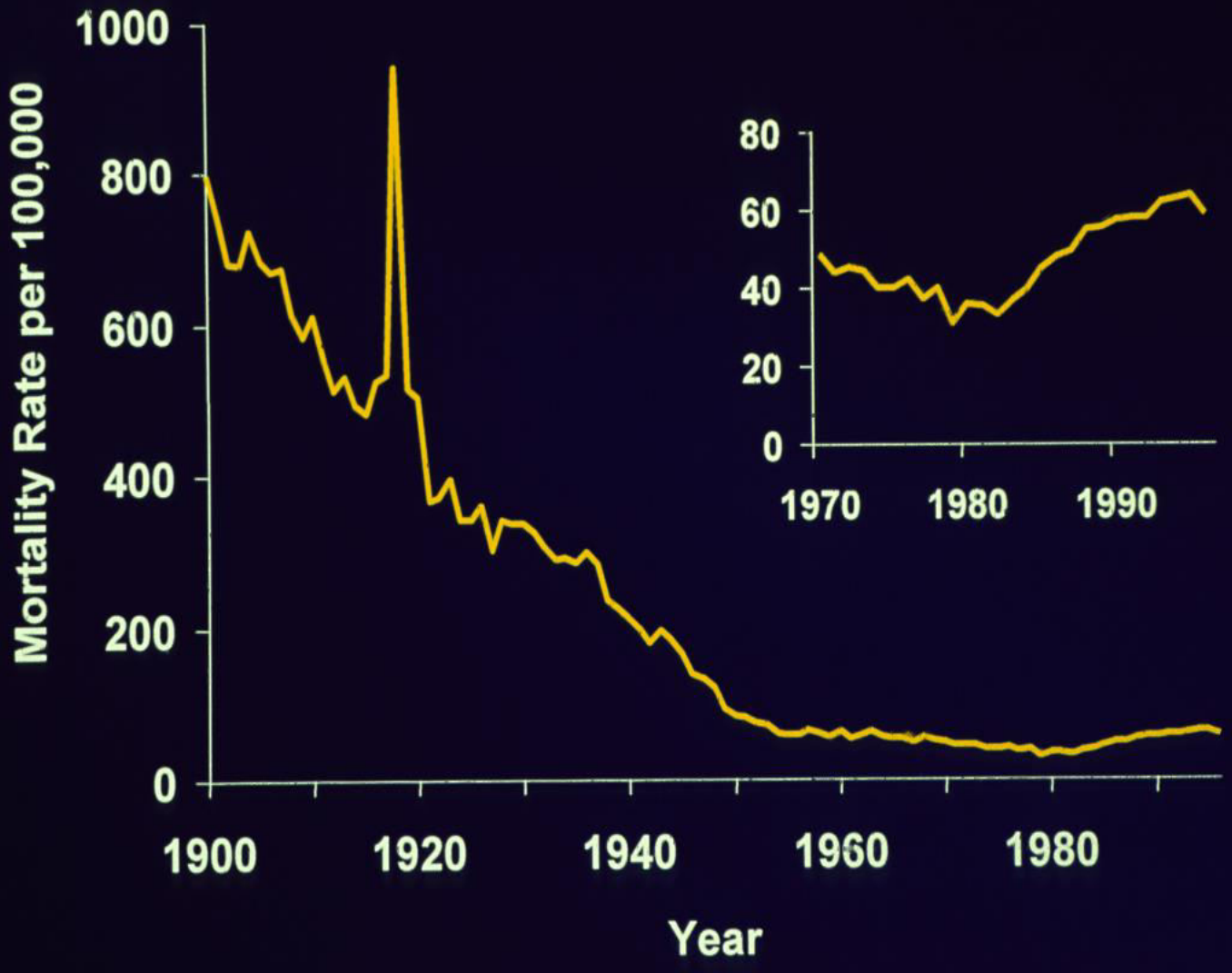
  Hospital-acquired (Enterococcal, Staphylococcal
- Antiviral (HIV), Antiprotozoal (Malaria), Antifungal

Antimicrobial Drug Resistance

- Consequences
  Prolonged hospital admissions
  Higher death rates from infections
  Requires more expensive, more toxic drugs
  Higher health care costs


ENVIRONMENT
Climate change
Pollution
Exploitation
Mega-cities
Migration
Vector proliferation
Antibiotics
HUMAN
Population Growth
Vector resistance
Zoonosis
Food production
ANIMALS
VECTORS
Intensive farming
Transmission

Infectious Disease Mortality in the United States, 1900 to 199(



Source: Armstrong *et al.*, *JAMA*;1999

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

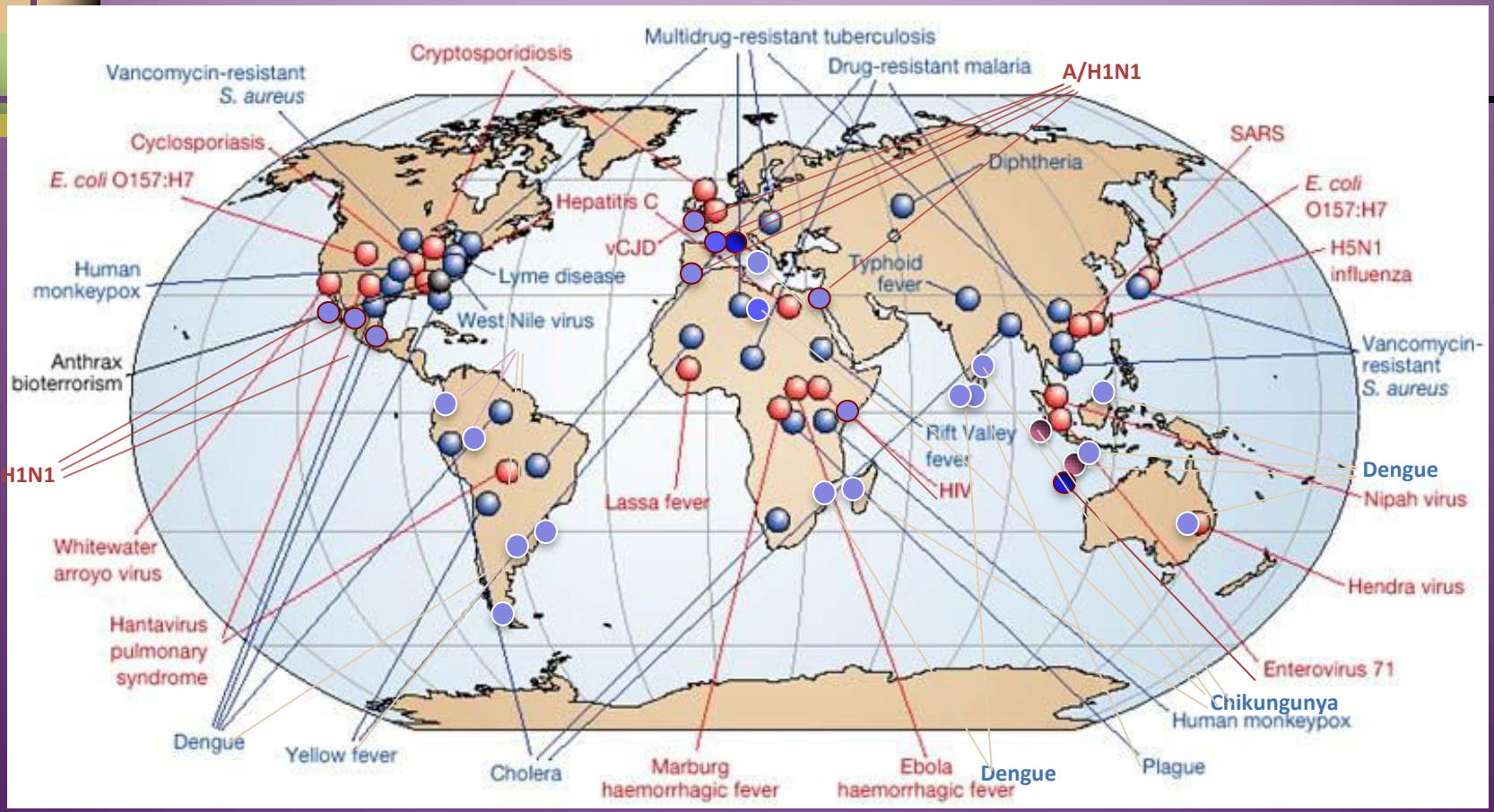
Pathogenic Microbes Identified as Threats to Humans Since 1973

- 1973 - Rotavirus
- 1977 - Ebola virus
- 1977 - *Legionella pneumophila*
- 1980 - HTLV 1
- 1981 -Toxin-producing *Staphylococcus aureus*
- 1982 - *Escherichia coli* O157:H7
- 1982 - *Borrelia burgdorferi*
- 1983 - HIV
- 1983 - *Helicobacter pylori*
- 1989 - Hepatitis C
- 1992 - *Vibrio cholerae O139*
- 1993 - Hantavirus
- 1994 - *Cryptosporidium*
- 1996 - nvCJD
- 1997 - HVN1

CIA, 2000

The Global Threat of Infectious Diseases

Emerging and re-emerging diseases

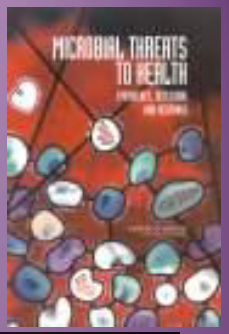


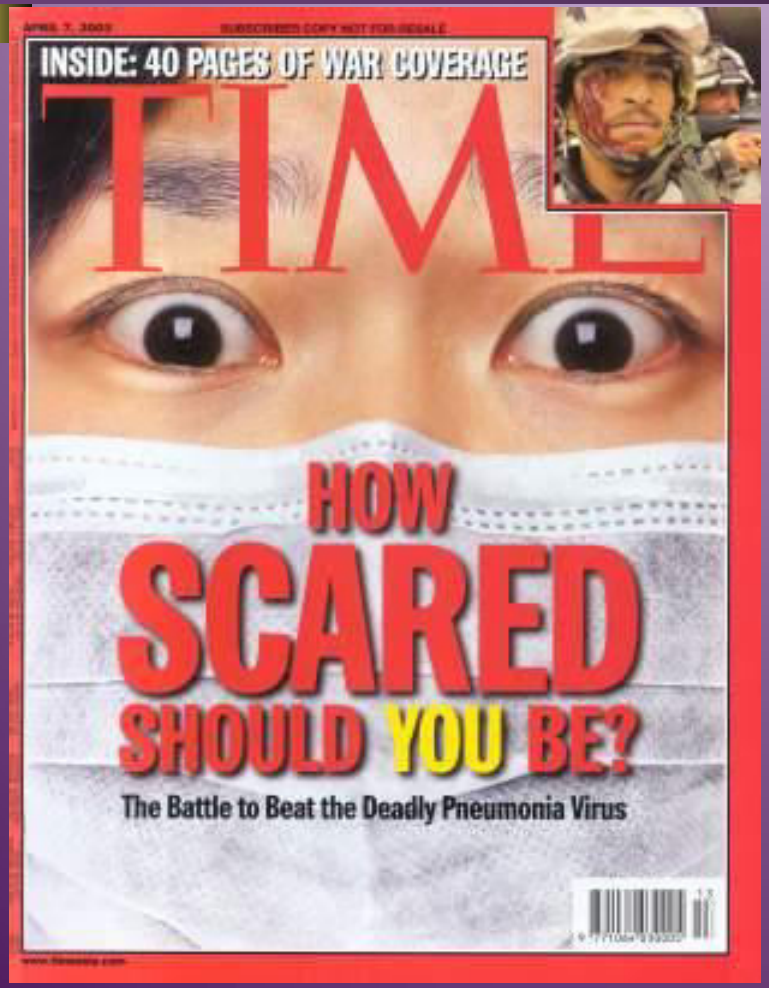
Emerging diseases

Re-emerging diseases

Adapted from Morens, Folkers, Fauci 2004 Nature 430; 242-9

Microbial Threats to Health





Major Infectious Disease Epidemics since 1980

- Dengue/DHF-1970s, SE Asia, global
- HIV/AIDS-1980s-Africa,global
- Drug resistant TB-1990s, US, global
- Cholera-1991-Americas
- Plague-1994-India, global
- Foot & Mouth disease-1995,2000- Taiwan & UK
- West Nile-1990s-Mediterranean, Americas
- BSE-1990s- UK, Canada, US
- Swine fever, 1996- Netherlands
- H5N1 influenza-1997- HK-global
- Nipah encephalitis-1998-Malaysia,Asia
- SARS-2002- Asia, global
- Chikungunya-2004-Africa, Asia
- H1N1 influenza-2009-Mexico?,global

Examples of Emerging Infectious Diseases

- Hepatitis C- First identified in 1989

  In mid 1990s estimated global prevalence 3%
- Hepatitis B- Identified several decades earlier

  Upward trend in all countries

  Prevalence >90% in high-risk population

CONTD.

- Zoonoses- 1,415 microbes are infectious for human

  Of these, 868 (61%) considered zoonotic

  70% of newly recognized pathogens are zoonoses

Emerging Zoonoses: Human-animal interface

Avian influenza virus

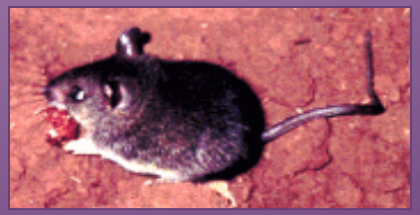
Bats: Nipah virus

Ebola virus

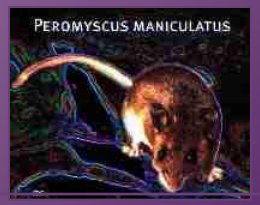
Marburg virus

Borrelia burgdorferi: Lyme

Deer tick (Ixodes scapularis)



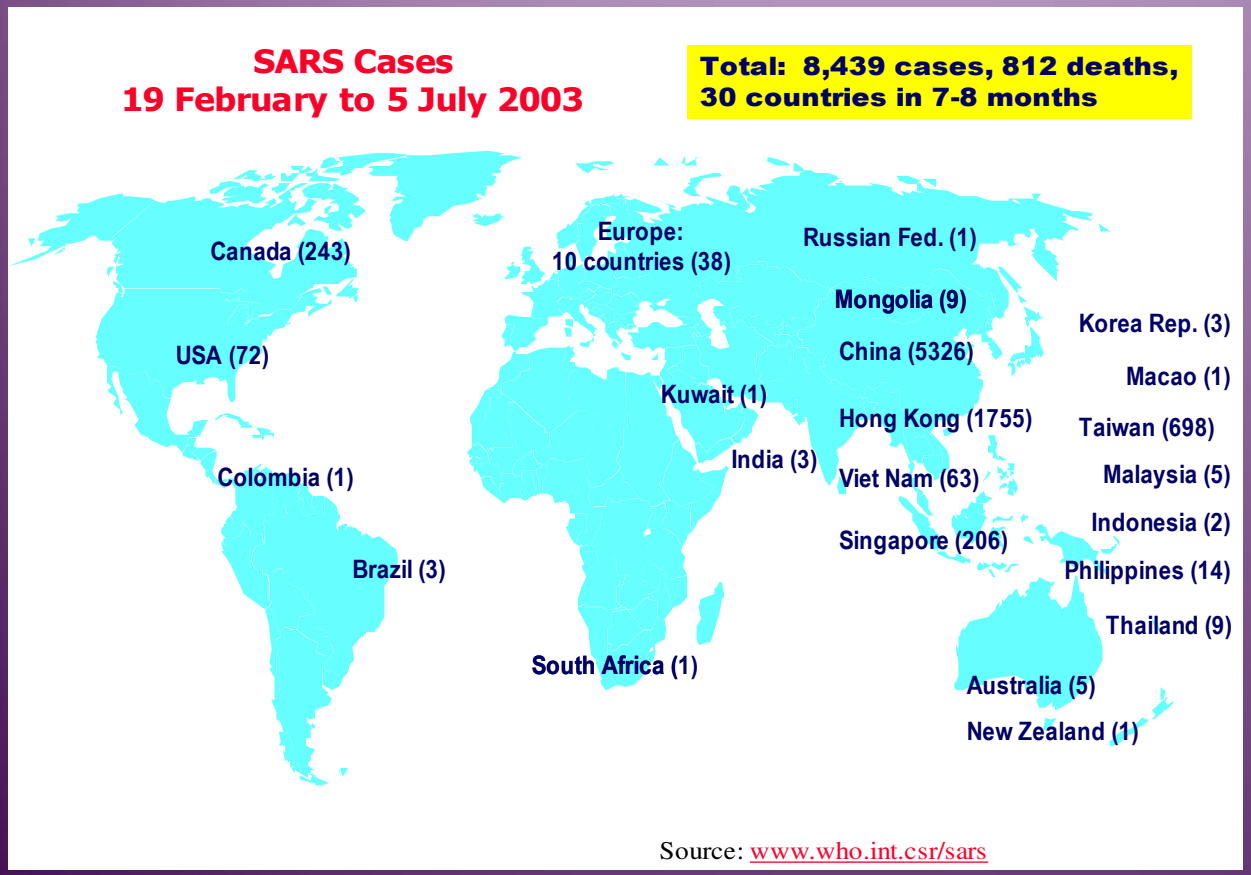
Mostomys rodent: Lassa fever



Hantavirus Pulmonary Syndrome

SARS: The First Emerging Infectious Disease Of The 21st Century

No infectious disease has spread so fast and far as SARS did in 2003



Source: www.who.int.csr/sars

Lesson learnt from SARS

- An infectious disease in one country is a threat to all
- Important role of air travel in international spread
- Tremendous negative economic impact on trade, travel and tourism, estimated loss of $ 30 to $150 billion

CONTD.

- High level commitment is crucial for rapid containment
- WHO can play a critical role in catalyzing international cooperation and support
- Global partnerships & rapid sharing of data/information enhances preparedness and response

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Highly Pathogenic Avian Influenza (H5N1)

- Since Nov 2003, **avian influenza** H5N1 in birds affected 60 countries across Asia, Europe, Middle-East & Africa
- >220 million birds killed by AI virus or culled to prevent further spread
- Majority of human H5N1 infection due to direct contact with birds infected with virus

Novel Swine origin Influenza A (H1N1)

- Swine flu causes respiratory disease in pigs – high level of illness, low death rates
- Pigs can get infected by human, avian and swine influenza virus
- Occasional human swine infection reported
- In US from December 2005 to February 2009, 12 cases of human infection with swine flu reported

Swine Flu
Influenza A (H1N1)

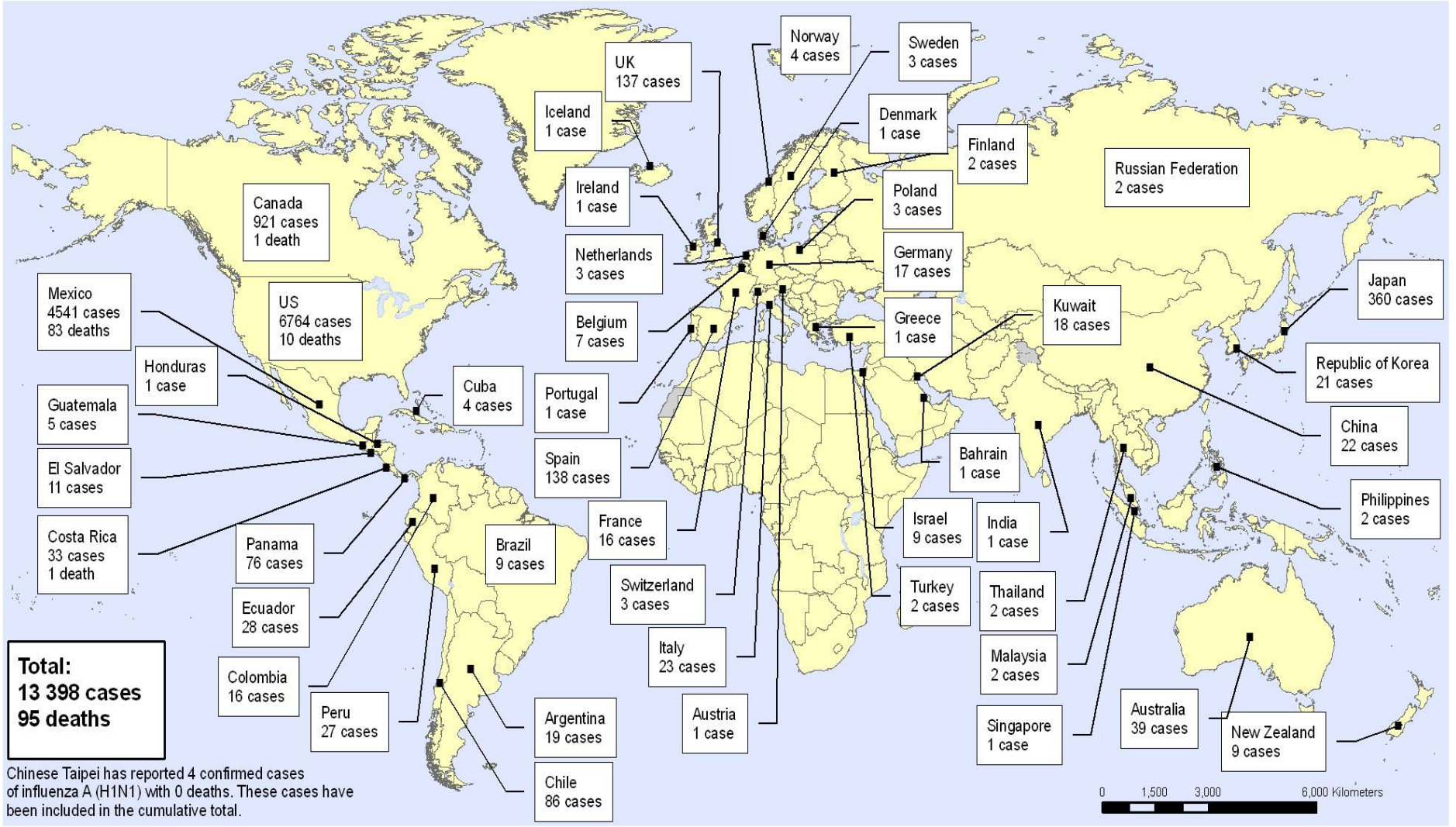
- March 18 2009 – ILI outbreak reported in Mexico
- April 15th CDC identifies H1N1 (swine flu)
- April 25th WHO declares public health emergency
- April 27th Pandemic alert raised to phase 4
- April 29th Pandemic alert raised to phase 5

Influenza A (H1N1)

- By May 5th more than 1000 cases confirmed in 21 countries
- Screening at airports for flu like symptoms (especially passengers coming from affected area)
- Schools closed in many states in USA
- May 16th India reports first confirmed case
- Stockpiling of antiviral drugs and preparations to make a new effective vaccine

New Influenza A (H1N1), Number of laboratory confirmed cases and deaths as reported to WHO

Status as of 27 May 2009 06:00 GMT



Chinese Taipei has reported 4 confirmed cases of influenza A (H1N1) with 0 deaths. These cases have been included in the cumulative total.

Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

World Health Organization

Map produced: 27 May 2009 06:30 GMT

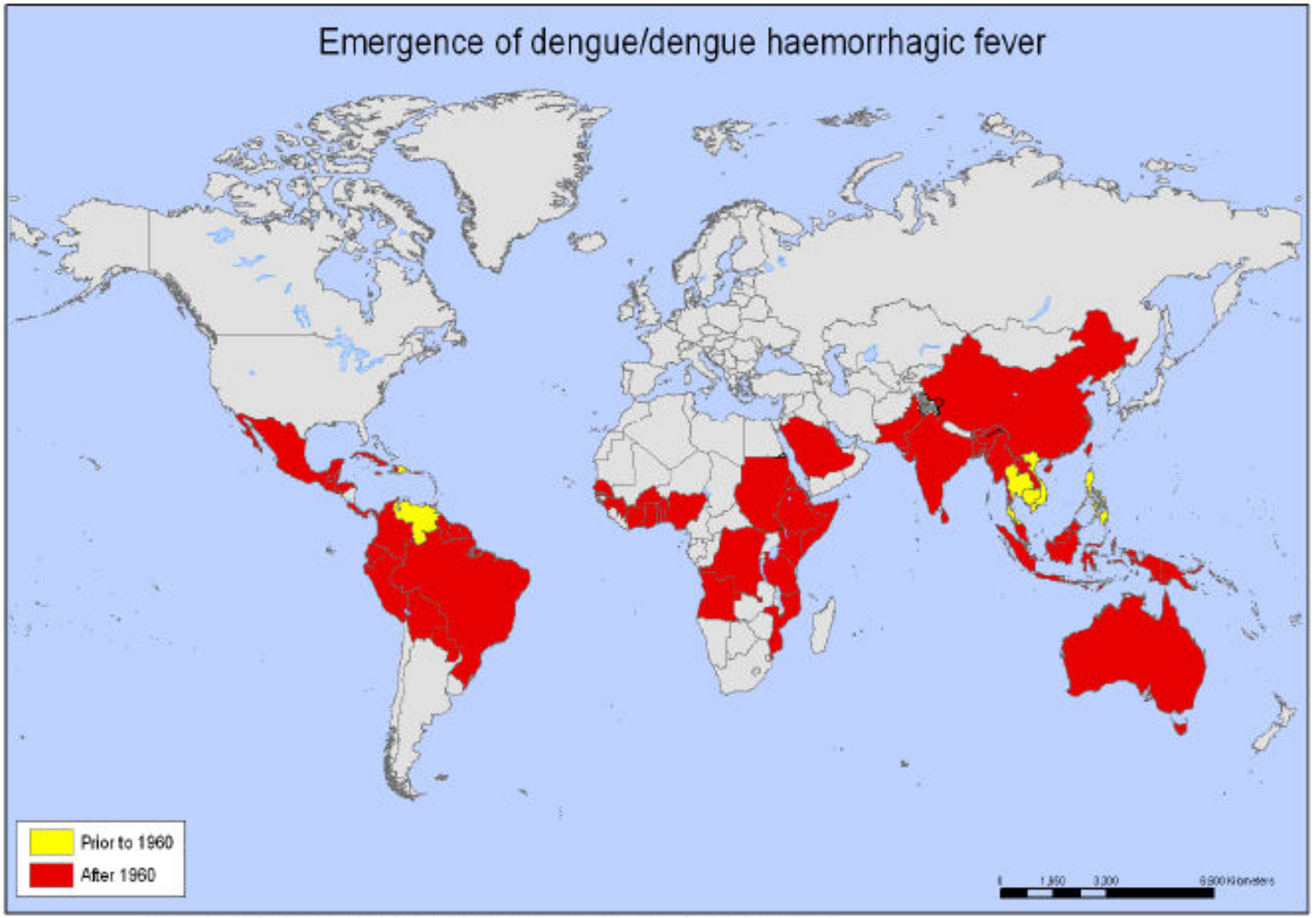
Pandemic HINI (Swine flu)

- Worldwide- 162,380 cases
  1154 deaths

- India- 558 cases
  1 death

Examples of Re-Emerging Infectious Diseases

- Diphtheria- Early 1990s epidemic in Eastern Europe(1980- 1% cases; 1994- 90% cases)
- Cholera- 100% increase worldwide in 1998 (new strain eltor, 0139)
- Human Plague- India (1994) after 15-30 years absence. Dengue/ DHF- Over past 40 years, 20-fold increase to nearly 0.5 million (between 1990-98)



World Health Organization

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: WHO
Map Production: Public Health Mapping and GIS
Communicable Diseases (CDS) World Health Organization

CHolera

- **Cholera:** An infectious disease characterized by intense vomiting and profuse watery diarrhea and that rapidly leads to dehydration and often death. Cholera is caused by infection with the bacteria Vibrio cholerae, which may be transmitted via infected fecal matter, food, or water.

cholera

- With modern sanitation, cholera is no longer as common as it once was, but epidemics still occur whenever people must live in crowded and unsanitary conditions, such as in refugee camps. The disease is treated with intravenous fluids and with antibiotics. Cholera has also been known as Asian cholera, due to its one-time prevalence in that area of the world.

Weekly epidemiological record: cholera articles

- The Weekly Epidemiological Record (WER) serves as an essential instrument for the rapid and accurate dissemination of epidemiological information on cases and outbreaks of diseases under the International Health Regulations and on other communicable diseases of public health importance, including emerging or re-emerging infections.

Cholera

- *Vibrio cholerae*
- Sub-Saharan Africa affected
  - Democratic Republic of Congo
  - Uganda
  - Rwanda
  - Burundi
  - Tanzania
  - Kenya
  - Sierra Leone
  - Cameroon
- Over a 3 month period in 1997 outbreaks in Kenya & Tanzania, over 400 killed
- Cases reported in 2000
  - Federated States of Micronesia
    - 954 cases / 9 deaths
  - Somalia
    - 2,232 cases / 230 deaths
  - Madagascar
    - 15,173 cases / 860 deaths

Dengue

- Most important mosquito-borne disease, worldwide
- *Aedes aegypti*
- Affected regions
  - Indian Subcontinent
  - Southeast Asia
  - Southern China
  - Central and South America
  - Caribbean
  - Mexico
  - Africa
- Symptoms similar to those of influenza

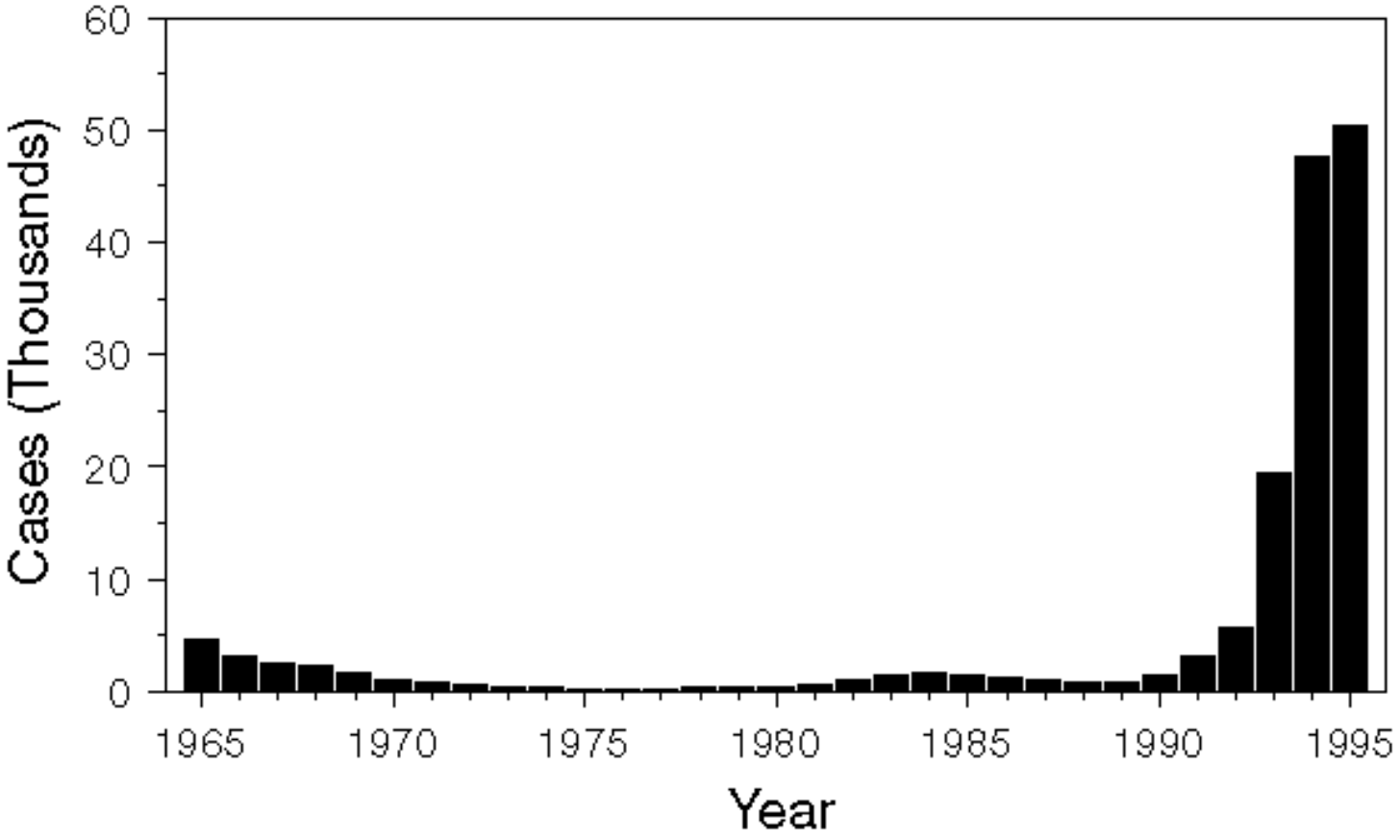
Diarrheal Diseases

- Organisms most frequently associated with diarrhea in young children / estimated percentage of cases seen at health centers in the developing countries
  - Rotavirus - 15-25%
  - Enterotoxigenic *Escherichia coli* - 10-20%
  - Shigella - 5-15%
  - Salmonella (non-typhoid) - 1-5%
  - *Campylobacter jejuni* - 10-15%
  - Cryptosporidium - 5-15% (PAHO, 2000)
- Oral rehydration therapy (ORT) is one way of combating diseases within this classification

Diphtheria

- *Corynebacterium diphtheriae*
- Good example of how political issues can influence the reemergence of a disease
- Very contagious and potentially life-threatening
- Large epidemics in the Soviet Republics, Algeria, China, and Ecuador.

FIGURE 1. Number of reported cases of diphtheria — New Independent States of the former Soviet Union, 1965–1995



Source: Morbidity and Mortality Weekly Report. (1996). August 16, 1996 / 45(32);693-697

Escherichia coli O157:H7

- Food-borne
- First recognized as a cause of illness in 1982 during an outbreak of severe bloody diarrhea
- Annually
  - 73,000 cases
  - 61 deaths
- Primarily transmitted via ingestion of meat that has not been properly cooked
- Person-to-person, contaminated drinking water, consumption of contaminated plant products (CDC, 2000[6])

Ebola

- Filovirus
- Fifteen global outbreaks since 1967 Breman, van der Groen, Peters, & Haymann (1997)
- Major human outbreaks
  - Sub-Saharan Africa
    - Kikwit
    - Zaire
    - Sudan
    - Gabon

Ebola Virus and the Global Community

Year	Location	Cases	Fatality
67	Germany	2	Unsure
76	Sudan	280	53
76	Zaire	318	90
77	Zaire	1	100
79	Sudan	34	65
89	U.S.	4	65
95	Zaire	393	79

Source: Benini, A. A, & Bradford, 2000

Hantavirus

- Also known as...
  - Sin Nombre virus (responsible for most hantaviral infections in the U.S.) Wells, et al, (1997)
  - Convict Creek virus
  - Muerto Canyon virus
- First recognized in 1993
  - Four corners region of the U.S.
  - Has been identified in the U.S. from CA to FL
- Mortality rate, 50%
- Associated disease
  - Hantavirus pulmonary syndrome (HPS)

Helicobacter pylori

- Bacterium
- Believed to be the etiologic agent in
  - 90% of duodenal ulcers
  - 80% of gastric ulcers
- Discovered as culprit in 1982
- Large portion of world population infected
- Related chronic disease
  - Gastric cancer

Listeriosis

- *Listeria monocytogenes*
- Common among individuals who work with animals
- Causes spontaneous abortion and stillbirth in domestic animals
- Primarily affects
  - Pregnant women
  - Newborns
  - Elderly
  - Immuno compromised adults (Canadian Institute of Public Health Inspectors, 2000)

Malaria

- Malaria is caused by a parasite called Plasmodium, which is transmitted via the bites of infected mosquitoes. In the human body, the parasites multiply in the liver, and then infect red blood cells.

Malaria

- Symptoms of malaria include fever, headache, and vomiting, and usually appear between 10 and 15 days after the mosquito bite. If not treated, malaria can quickly become life-threatening by disrupting the blood supply to vital organs. In many parts of the world, the parasites have developed resistance to a number of malaria medicines.

Malaria

- Key interventions to control malaria include: prompt and effective treatment with artemisinin-based combination therapies; use of insecticidal nets by people at risk; and indoor residual spraying with insecticide to control the vector mosquitoes

Malaria

- 300 million infected each year
- Regions
  - Asia
  - Africa
  - South / Central Americas
- >1 million deaths annually
  - Mostly infants and children (National Institutes of Health, 2000)

Tuberculosis

- Tuberculosis (TB) is caused by a bacterium called *Mycobacterium tuberculosis*. The bacteria usually attack the lungs, but TB bacteria can attack any part of the body such as the kidney, spine, and brain. If not treated properly, TB disease can be fatal.

Tuberculosis

- Chronic bacterial infection
- Principal infectious cause of death worldwide
  - Three million deaths annually
  - One-third of world population infected with *M. Tuberculosis* (OSHA, 2000)
- Outbreak locations
  - Jails / prisons
  - Hospitals
  - Nursing homes
  - Homeless shelters

Tuberculosis

- Estimated 15 million Americans with latent infections
- Minorities affected disproportionately [as is the case with many other infectious diseases]
  - 54% active *M. Tuberculosis* cases (1995) reported among African American and Hispanic populations
  - An additional 17.5% among Asians
- In some U.S. sectors, morbidity rates surpass those of poorest countries

Cases of *M. Tuberculosis* by Year of Diagnosis, 1953-1999

Source: Centers for Disease Control and Prevention, 2000[1]

West Nile Encephalitis

- Mosquito-borne infection
- Outbreaks evident in Egypt, Asia, Israel, South Africa, parts of Europe and Australia
- No recorded cases in the U.S. prior to 1999
- *Culex pipiens* mosquito (the common house mosquito) associated with West Nile virus
- Transmission: Bird ---> mosquito ---> human
  - American crows most commonly infected, yet confirmed in other species (State of New York, Department of Health, 2000)
  - May also infect other mammals such as horses
  - 62 cases 7 deaths

Institute of Medicine

- Demographic shifts
- Advances in technology / industry
- Economic development and change in land use patterns
- Travel / commerce
- Microbial adaptation / change
- Breakdown of the public health infrastructure

Drug Resistance

- Drug Resistance
  - Gonorrhea, malaria, childhood ear infections
  - Resistance is a factor in most nosocomial infections
  - More effective medications are needed
    - In some U.S. clinics, 30% of cases of gonorrhea resistant to penicillin or tetracycline or both
  - MDR-TB
- Inappropriate use of antibiotics is a salient factor in drug resistance

Infectious Diseases and Chronic Diseases

Emerging evidence that a substantial proportion of human cancers are caused by infectious diseases (~15%) (Valerie Beal, Speaker, 2nd International Conference on Emerging Infectious Diseases)

- 1911 - Rous Sarcoma
- 1932 - Shope Skin Tumor
- 1960 - Feline Leukemia
- 1978 - HPV, Skin Cancer
- 1981 - HBV, HCV, Liver Cancer
- 1981 - EBV, non Hodgkin's Lymphoma
- 1983 - HPV, Cervical Cancer

CDC's (center for disease control) Response to EIDs

- Goal I: Surveillance and Response
- Goal II: Applied Research
- Goal III: Infrastructure and Training
- Goal IV: Prevention and Control

Suggestions for Enhanced Public Health

- Public health education
- Continued collaborative efforts on the part of the international community
- Government funding for biomedical and educational efforts
- Recognition of infectious diseases that pose the greatest risk to public health
- As usual, more research is needed...

Solutions

Public health surveillance & response systems

- Rapidly detect unusual, unexpected, unexplained disease patterns
- Track & exchange information in real time
- Response effort that can quickly become global
- Contain transmission swiftly & decisively

GOARN

Global Outbreak Alert & Response Network

- Coordinated by WHO
- Mechanism for combating international disease outbreaks
- Ensure rapid deployment of technical assistance, contribute to long-term epidemic preparedness & capacity building

Solutions

- Internet-based information technologies

  Improve disease reporting

  Facilitate emergency communications &

  Dissemination of information
- Human Genome Project

  Role of human genetics in disease susceptibility, progression & host response

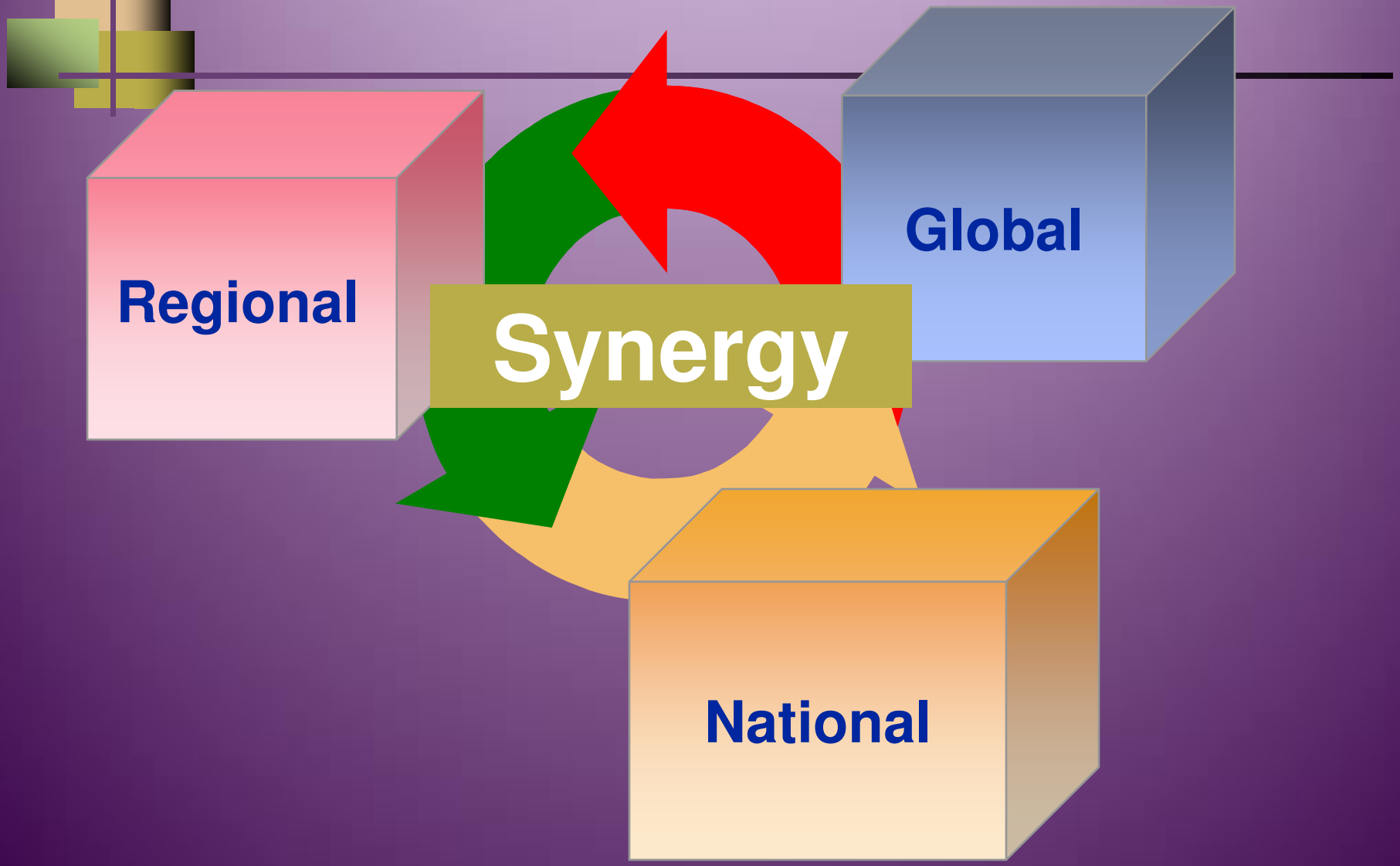
Solutions

- Microbial genetics

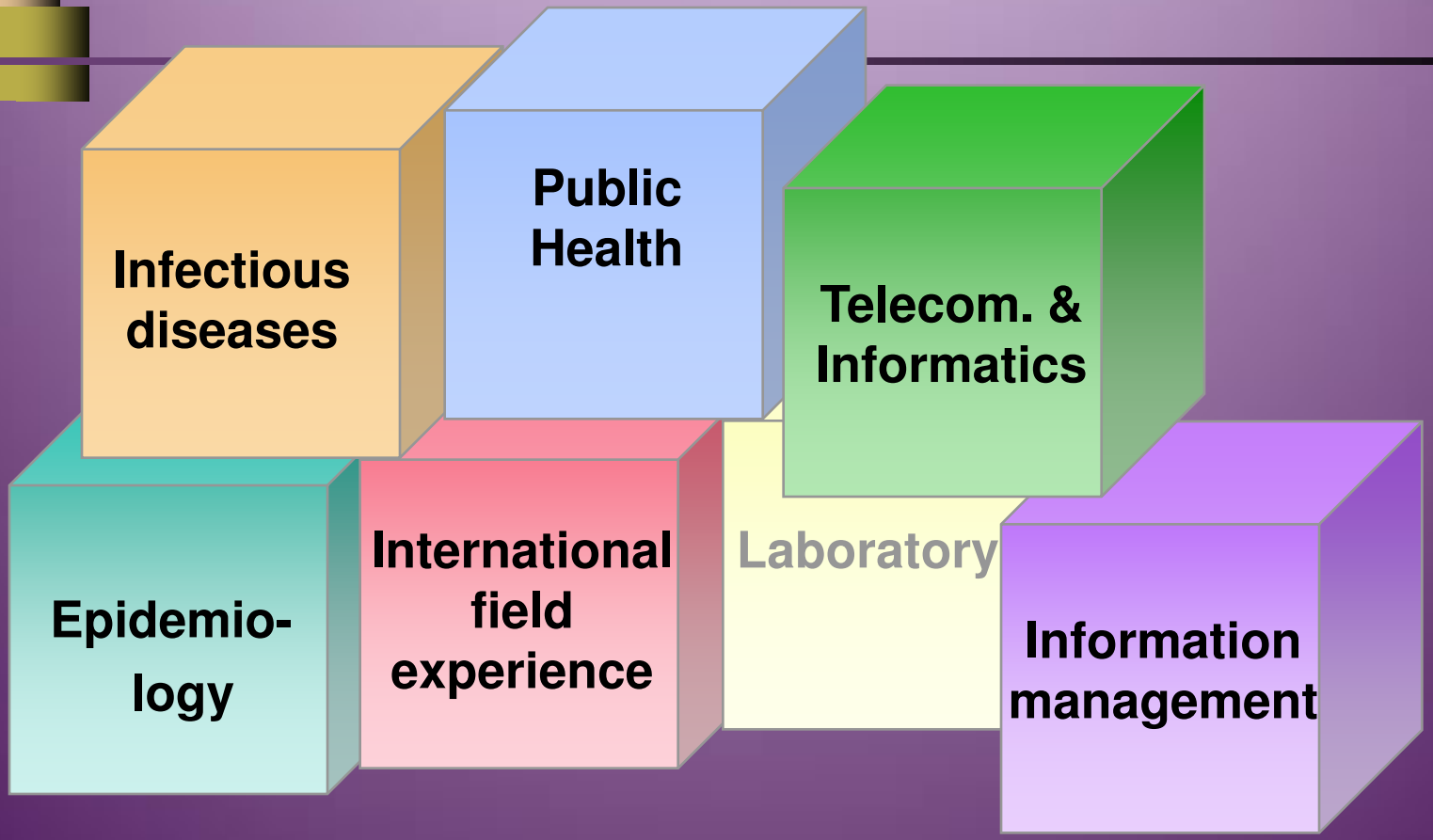
  Methods for disease detection, control & preventio
- Improved diagnostic techniques & new vaccines
- Geographic Imaging Systems

  Monitor environmental changes that influence disease emergence & transmission

Key tasks - carried out by whom?



What skills are needed?



Multiple expertise needed !

Conclusions

- Emerging infectious diseases are omnipotent and will continue to command attention.
  - EID's are most deleterious in
  - 1) developing nations and 2) among children, the elderly, females, and those with weakened immune systems
- EID's are controllable!

- It is the responsibility of the global community to continue to develop / refine public health infrastructures to deal with burgeoning crises.
- Initiatives must be developed in order to overcome social, religions, and regional barriers to prevention and control.

Global Disease Intelligence: A world on the alert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