Learning Objectives
1. Describe the threat of emerging and new infectious agents
2. Identify the contributing factors for emerging and new IDs
3. Identify the public health response to emerging and new IDs

1966 CDC assessment of US Health
1. Diseases eradicated in the US (bubonic plague, malaria, smallpox)
2. Diseases almost eradicated (typhoid, polio, diphtheria)
3. Health problems where technology exists for effective control (syphilis, TB, HPV-related cancers, gonococcal infections, tetanus)
4. Technology in early stage or non-existent (leukemia, some respiratory diseases, strokes)

Historic Perceptions of IDs
“It is time to close the book on infectious diseases, declare the war against pestilence won, and shift national resources to such chronic problems as cancer and heart disease.”

U.S. Surgeon General William H. Stewart 1967 address to a White House gathering of state and territorial health officers
Emerging and New Infectious Diseases

- New pathogens that were previously not identified became widespread after HIV infection (AIDS) due to damaged immune systems.
- Previously known diseases, but less frequent, continue to occur with increased incidence and/or showed changes in their epidemiological characteristics
  - E.g. TB, Cryptococcosis, PCP

Opportunistic Infections with HIV

- The following are the largest contributors to newly emerging infections
  - Tuberculosis: Risk of primary progressive TB and lifetime risk of progressive disease with HIV infection 5x that of without HIV.
  - Cryptococcosis: meningitis with this rare infection became the hallmark of HIV/AIDS
  - Kaposi Sarcoma: Caused by HHV-8 increased dramatically
  - Pneumocystis carinii Pneumonia: Hallmark of AIDS before the discovery of HIV
  - Other Infections: Cytomegalovirus, Varicella Zoster, Mycobacterium avium

Emerging & Re-emerging IDs

- New appreciation for IDs since 1980s
  - AIDS and related diseases (TB)
  - Lyme disease
  - Ebola & Marburg Hemorrhagic Fever
  - Dengue
  - Hantaviruses
  - West Nile-like Encephalitis
  - Avian Flu/H1N1
  - SARS
  - MDR & XDR tuberculosis
  - Cholera
  - Zika
Zika Virus Infection

- Viral infection recently implicated in Microcephaly and Guillain-Barré Syndrome
- Zika virus isolated in 1947 in monkeys in Zika Forest in Uganda
- First recognized in humans in 1952 in Uganda and Zaire; Large outbreak in 2007 in Yap Island in Micronesia
- 1.5 million infected in Brazil with ~5,280 cases of Microencephaly; Epi link is "a smoking gun"
- Thus far, 41 Microencephaly out of 462 confirmed cases (8.87%); Epidemiological link is "a smoking gun"
Ebola & Marburg Hemorrhagic Fever
- Recently emerging viruses of primates
- High infectivity and mortality rates
  - Ebola in Zaire in 1976 with CFR of 78%
  - MHR in Angola in 2005 with CFR of 88%
  - Ebola in W. Africa in 2014-15 with CFR of 53%
- Human-to-human, recent phenomenon
- Both infection highly transmissible through body fluids, mainly blood
- Infection is reduced by universal precaution
- Immune serum developed from survivors is used to boost immunity after infection

Hantaviruses
- First noted in Korean war (1951) as KHF
- 3,000 troops infected with CFR of 5%
- Etiologic agent not identified until isolated from striped mouse in 1976
- In 1993, 100 cases were noted in NM, AZ, CO, UT with CFR of 5%
- Disease was characterized by interstitial pneumonitis with pulmonary failure

Severe Acute Respiratory Syndrome (SARS)
- Epidemic started in 2003 in China
- Caused by the SARS Coronavirus
- Started in live civet cat "wet market" dealers
- Soon 8,450 infected in 26 countries with 850 deaths (CFR=10%)
- Infectious during symptomatic phase only
- Effective PH measures, 1) Isolation of the sick and quarantine of healthy contacts, 2) Universal precautions, and 3) Effective surveillance controlled the epidemic
Cholera (Example of re-emergence)
- Epidemic occurred in S. America in 1991 after >100 years of absence
- A new strain of cholera, \textit{V. cholera} 0139, emerged with no cross-immunity with the classic \textit{El Tor V. cholera} 01
- Soon >2x10^5 cases occurred in SE Asia and 20x10^3 cases in Africa
- CFR in Africa 60% while in S. America it was 1%, the difference being due to oral hydration and good diagnosis in the latter

Emerging Infections & Promoters
- Some of the factors favoring emergence
  - \textbf{SARS}: Human contact with exotic animals
  - \textbf{Anthrax}: Bioterrorism
  - \textbf{Hantavirus}: Climate change ↑ mice pop.
  - \textbf{Dengue}: ↑ Global travel, Urbanization
  - \textbf{Ebola, Marburg}: ↑ Contact with primates
  - \textbf{Influenza}: Integrated pig-duck agriculture
  - \textbf{E. coli} 0157:H7: Global distributions of food
  - \textbf{Malaria}: ↑ Population, ↓ use of insecticide
  - \textbf{Cholera}: El Niño climate change
  - \textbf{MDR TB}: Rx Misuse, Crowding prisons
  - \textbf{Rift Valley Fever (RFV)}: Dams, Irrigation

Factors in the emergence of IDs
- Population growth
- Speed and ease of travel
- Economic changes
  - Dam building
  - Relocation of animals
  - Expansion into new areas
- Bioterrorism
- Inadequacy of public health infrastructure
- Global climate change
- War and Societal disruption (Swine Flu, 1918-19)
- Increase in Day Care and Nursing Homes
- Antibiotic use and Abuse
Factors in the emergence of IDs
(...continued)

- Increased susceptibility of the human host
  - AIDS, Cancer, Immune-compromising conditions
  - Nutritional deficiencies
  - Chronic diseases
- Construction of Dams (over 75 meters high)
- Agricultural use of antibiotics in animal feed
- Change in the ecosystem from manmade activities
  - Pesticides
  - Deforestation
  - Genetically modified foods
Societal Issues in the emergence of IDs

- Poverty
- Malnutrition
- Unsafe Water
- Aging of population
- Refugee populations
- Human behavior
- Urbanization

Climate Change—Greenhouse Gases (CO₂, CH₄, NO, and water vapor)
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PHS Response (IOM, 1991)
- Need for increased surveillance
- Expansion of nosocomial infection surveillance
- Development of computerized database on ID surveillance, vaccine and drug availability
- Increased research on factors leading to emerging disease, expansion of the EIS program
- Funding for program for PH and epi training
- Development of a means of stockpiling vaccines
- Ensuring availability of critical antibiotics
- Licensing and developing new pesticides for IDs
- Focus on education to enhance behavioral changes
Conclusion

- New infectious agents continue to emerge and old ones to re-emerge with brute force due to environmental changes, population growth, and intentional cultivation of organisms for various purposes.

- Increased awareness of new infections and efficient public health surveillance are the first line of defense.

- Strengthening the public health system and implementing the IOM recommendation is critical for human survival.