The Current Status of the Epidemiologic Transition

There are still job opportunities in Infectious Diseases and Tropical Medicine

CAPT John W. Sanders, Medical Corps, US Navy
Commanding Officer, Naval Medical Research Center
“The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government.”
Global Health:
Noncommunicable Diseases

• “25 by 25.”
  – The UN and WHO have called for a 25% reduction by 2025 in mortality from noncommunicable diseases among persons between 30 and 70 years of age, in comparison with mortality in 2010

• Share of total mortality from NCD increased from 57% 1990 to 65% in 2010

• About 80% of NCD deaths occur in low- and middle-income countries

The Epidemiologic Transition

In 1971, Abdel Omran proposed the theory of an “epidemiologic transition” suggesting that all societies progress through three stages of disease:

- “the age of pestilence and famine”, characterized by high, fluctuating mortality rates with life expectancies under 30 years;

- “the age of receding pandemics”, characterized by rising life expectancies to over 50 years, but a persistent heavy burden from infectious diseases;

- “age of degenerative and man-made diseases” during which life expectancy increases further, the burden of infectious diseases declines considerably, and degenerative diseases, such as cancer and cardiovascular disease, become more prevalent.
“Closing the book...”

- 1965—The Surgeon General of the United States reportedly says it is time to “close the book” on infectious diseases
- 1978—In “Health for All 2000” plan, WHO predicted Infectious Diseases could be managed
Only true for the “developed world,” and maybe not permanently.…

- Infectious Diseases account for >25% of deaths worldwide and >40% of deaths in developing countries
Leading Infectious Killers
Millions of Deaths, Worldwide
All Ages, 1998 Estimate

- **ARI**
- **AIDS**
- **Diarrhoeal diseases**
- **TB**
- **Malaria**
- **Measles**

Legend:
- Yellow: Over age five
- Red: Under age five
Trends in life expectancy at birth for select geo-economic regions between 1965 and 2000

Source: World Bank
Why Haven’t They Transitioned?

• Government Failure/ Failure to Apply Proven Strategies
  – 2.5 M deaths due to vaccine preventable diseases
  – Economic failure
  – Misappropriation of resources

• Bad Luck
  – Emergence of new Dz’s
    • 25 M deaths due to HIV
  – Re-emergence of old Dz’s
    • Drug resistant malaria, TB
    • Insecticide resistant mosquitoes

• Personal Choices
  – Tobacco (Eastern Europe)
  – Sexual risks
  – IV drug abuse
Impact of Infectious Diseases

- **Mortality**
  - ~18 million deaths per year

- **Morbidity**
  - Stunted growth/development

- **Economic**
  - For every 1 year of life expectancy added, labor productivity increases 4%
  - SARS in 2003
    - 8,096 cases / 774 deaths (26 countries)
    - $30 100 Billion in costs
    - $4 12 million per case
  - Agriculture—billions of $ in lost revenue
    - Salmonella in tomatoes (California)
    - Bovine Spongiform Encephalopathy “Mad Cow Disease” (Great Britain)
    - Rift Valley Fever (Egypt)

- **Social Destabilization**
  - HIV orphans in Africa

- **Potential war trigger**
  - Social Chaos
  - Weapons of Mass Destruction
Infectious Diseases: Threats to Security

- Biologic Weapons
- Emerging and Re-emerging diseases
Emerging Infectious Diseases

- Over the past 30 years, more than three-dozen new diseases identified
  - Ebola
  - Hantaviruses
  - Legionnaires’ disease
  - Nipah encephalitis
  - SARS
  - HIV/AIDS

- Surge in “old diseases”
  - Global tuberculosis mortality rising for the first time in 40 years
  - Malaria in new areas (Central Asia and Eastern Europe)
  - Dengue strains spreading throughout the world
  - Chikungunya virus spreading across Asia (Americas next!)
Risks for Emergence of Disease

- Population and demographics
  - Current world population = 7.12 billion people in the world
    - projected 8 or 9 billion by 2025
  - Urbanization
    - 1st time in history that more people live in cities than in rural areas
    - overcrowding in cities often without adequate clean water, sanitary facilities, and public healthcare
  - Changing agricultural practices
    - Animal husbandry in urban locations bring more people into contact with livestock than when farms were rural.
    - Increase in pig and chicken farming in China has allowed more exchange of avian and human influenza viruses.

- Globalization
  - International Commerce
    - Increasing free trade, especially agriculture, allows for transport of microbes and disease-causing insects
  - International travel
    - Allows for persons incubating diseases to move around the globe before they even realize they are sick.

- Population dislocation and migration
  - Refugee camps

- Climate Change???
The Spread of SARS

- Between November 2002 and July 2003
  - 8,096 known cases
  - 774 deaths (a case-fatality rate of 9.6%)

Within a matter of weeks in early 2003, SARS spread from the Guangdong province of China to rapidly infect individuals in some 37 countries.
Spread of Avian Influenza
“When the world is collectively at risk, defense becomes a shared responsibility of all nations.”

—Dr. Margaret Chan, Director General, World Health Organization; World Health Day 2007
Continuum of Infectious Diseases Research

Identification of Pathogens and Problems
Characterization of Pathogen and Threat
Development Candidate Countermeasures
Testing of Promising Countermeasures
Licensure and Deployment of Countermeasures

Case Reports
Basic Science Studies
Surveillance
Laboratory Research
Phase I, II, III trials

Laboratory Investigations
Epidemiological studies

Threat Assessment
Focused Product Oriented Research

Advanced Development/Licensure
Overseas Lab Mission

- To detect infectious disease threats of military or public health importance and to develop and test products and mitigation strategies against those threats.
  - Detect emerging infectious disease threats
    - Pandemic Influenza, Febrile Disease Surveillance
    - Outbreak Investigations
  - Build the capacity for host nations to conduct surveillance
    - Training (outbreak, epidemiology, lab techniques)
    - Technical Transfers (ALERTA, lab equipment, etc.)
  - Execute biomedical research on infectious diseases of “military importance” (host nation public health)
    - Vaccines, medicines, diagnostics
  - Support the U.S. diplomatic mission in Peru and Latin America
Examples of Tropical Medicine Problems and Current Efforts
Evaluating the Effect of Ecological Changes on Disease Transmission

Changes in Vegetation in the Gold Mining Zone in River Huaypetuhe, Province of Manu, Madre de Dios - Peru

Huaypetuhe 1986

Huaypetuhe 2000
Ecological change...
...and habitat loss
Rabies outbreak in Madre de Dios, Peru
Brucellosis Treatment Trials
Leishmaniasis Studies

LEISHMANIASIS

12 million people infected
350 million people at risk

Visceral
Cutaneous / Mucocutaneous

[Image of world map highlighting areas affected by Leishmaniasis]
Vector Control Studies
Response to Disasters

• August 15, 2007 @ 18:40
• 8.0 magnitude earthquake
  Shaking for nearly 2 minutes
  More than a dozen >5 magnitude aftershocks
• Primary effect in Ica Region
  Ica, pop. 120,000  25% of buildings destroyed
  Pisco, pop. 68,000  80% of buildings destroyed
  Chincha Alta, pop. 134,000
• Casualties
  514 dead
  1,366 seriously injured
  >35,5000 homes destroyed
  >100,000 persons homeless
• NAMRU-6 became evaluation team and public health response unit for US government.