Global Diseases

biological challenges of the 21st Century

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- *Man's only competitors for the dominion of the planet are the viruses – and the ultimate outcome is not foreordained.*

Joshua Lederberg

In brief...

- The new threats and challenges of infectious diseases in the 21st century have scarcely begun to be appreciated
- The sources of the threat:
  - Natural mutation; emergence from remote areas
  - Biological terrorism
- The threat is global

Solutions will require a far greater level of international cooperation and agreement than is now in place

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"Conquest" of the infectious diseases 1950s-70s

- Dramatic changes post WW II
  - Vaccines
  - Antibiotics
  - Nutrition
  - Housing
  - Sanitation
- Marked decline or elimination of many diseases
  - Smallpox, diphtheria, whooping cough, tetanus, polio, measles, *et alia*

- *"One can think of the middle of the 20th century as the end of one of the most important social revolutions in history, the virtual elimination of the infectious diseases as a significant factor in social life"*

Sir Macfarland Burnet

A cloud on the horizon

- June, 1981 – first cases of AIDS identified
- April, 1984 – HIV is identified
  - "the triumph of science over a dread disease"
  - "a vaccine will be available in 2 years"
- A world-wide pandemic in progress
  - No vaccine as of 2004
  - No curative drug as of 2004

HIV is not the only surprise

- 1989 Conference on Emerging Infections
- A short, partial list of a new inventory
  - SARS
  - Lassa fever
  - Ebola virus infection
  - BSE – "mad cow" disease
  - Creutzfeldt-Jakob disease (human BSE)
  - H5N1 influenza

Recent concerns in the Americas

- SARS – from Asia
- Monkeypox – from Africa
- West Nile encephalitis – from the Eastern Mediterranean
- Anthrax – from ?
- H5N1 – from Asia – the most alarming of all threats

Increasing numbers of emerging diseases Major causes

- Growth in urban populations
  - Population of cities
    - 1950 – 2 with more than 7,500,000
    - 2000 – 30 with more than 7,500,000
      7 with more than 15,000,000
  - Urban areas
    - 20 % in 1950
    - 67 % in 2020

Increasing numbers of emerging diseases Major causes

- Growth in urban populations
- Travel
  - Volume
  - Increased proportion of children
  - Remote area destinations

Increasing numbers of emerging diseases Major causes

- Growth in urban populations
- Travel
- Proliferation of hospitals in endemic areas
  - Major sites for disease distribution
  - Problem of blood borne diseases

Increasing numbers of emerging diseases Major causes

- Growth in urban populations
- Travel
- Proliferation of hospitals in endemic areas
- Industrialization and internationalization of food supply

Biological Weapons

- A threat, largely ignored until 1995
  - Too difficult to grow organisms
  - Technologically difficult to disseminate
  - Seldom used because of an inherent moral barrier

1995 Watershed events
USSR Bioweapons Program

- A secret program – unknown until the 1990s
- 1992 – Ken Alibek, Deputy Director of USSR bioweapons program, defects
- Bioweapons program consisted of 60,000+ persons in 50 different labs.

"On May 8, 1980, WHO announced that smallpox had been eradicated..Soon after, smallpox was included in a list of biological weapons targeted for improvement in the 1981-85 Five -Year Plan...

Where other governments saw a medical victory, the Kremlin perceived a military opportunity...the military command issued an order to maintain an annual stockpile of 20 tons (of smallpox virus)."

Alibek, 1998

1995 Watershed Events
Aum Shinrikyo -- Japan

- Religious cult releases Sarin gas in Tokyo subway
  - Cult - previously unknown to intelligence
  - Thousands of members, well-funded
  - Tried to aerosolize anthrax and botulinum toxin throughout Tokyo at least 8 times
  - Organized team to go to Congo to obtain Ebola virus
- Concern – unknown, non-state sponsored organization, acting without concern for moral deterrents

Russia today

- More than half of the scientists are no longer working in the old biological weapons labs. Many have gone abroad
- The major production lab for smallpox virus, at Sergiyev Posad, remains a secret facility
- The major viral weapons research lab continues work on smallpox, Ebola, et al
- Former Vice-Minister of Health Burgasov admits (2002) aerosolized smallpox was released on Voz Island in 1971 for studies

New World Coming

"While conventional conflicts will still be possible, the most serious threat to our security may consist of unannounced attacks on American cities by sub-national groups using genetically engineered pathogens."

U.S.Commission on National Security/21st Century
15 September 1999

Biological Agents of Greatest Concern

- Smallpox
- Anthrax
- Plague
- Tularemia
- Botulinum Toxin
- Hemorrhagic fevers
  Ebola, Marburg, etc.

Agents that, if used, could threaten the integrity of civil government

Basic elements in preparedness

- Detection
  - Health centers and hospitals prepared to report promptly a disease outbreak, esp.
    - Hemorrhagic disease
    - Disease with rash
    - Paralytic illness
  - Epidemic disease response unit at national/state level ready to investigate unusual outbreaks
  - New approaches in surveillance--unproven
    e.g. syndromic surveillance, drug usage, etc

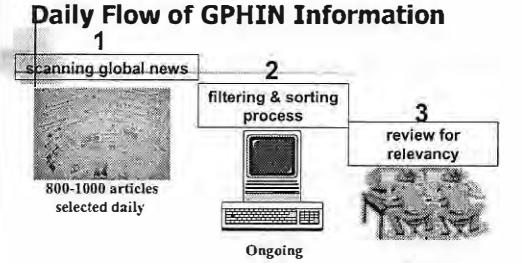
Basic elements in preparedness

- Diagnosis
  - National lab capability and/or established link with WHO collaborating lab
- Response
  - Notification to WHO as appropriate
  - Isolation of patients
  - Vaccination or antibiotics

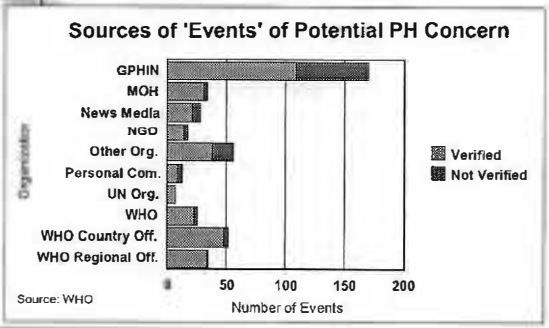
Basic elements in preparedness

- International Health Regulations
- International -- WHO
  - Global Outbreak Alert and Response Network GOARN
    - 120 technical institutions participating
    - 2000-02 -- Responded to 34 events in 26 countries
    - Coordination of SARS and H5N1 threats
  - Global Public Health Information Network – GPHIN

Daily Flow of GPHIN Information



Number of Reported Outbreaks by Source of Initial Reporting.
01 Jan 2001 to 31 Dec 2002. (n=439)



Barriers to global disease containment

- Lack of appreciation of the new threats posed by microbes in the 21st century
- Failure to recognize that the most critical problems are not national but international
- Provision of adequate resources
- Willingness to welcome joint participation in problems at the earliest possible date

Disease problems today are no longer national problems. With the increasing capacity for new diseases to emerge and spread, diseases everywhere are a problem for all mankind. We have only begun to take the first few, tentative steps to address these 21st century problems. The need is urgent and the time is late.