Emerging and Re-emerging Infectious Diseases and Major Factors Contributing to their Emergence

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Emerging infectious diseases

• An emerging infectious disease is a one that is caused by a **newly discovered infectious agent** or by a **newly identified variant** of a known pathogen, which has emerged and whose **incidence in humans** has increased during the last two decades and is **threatening to increase** in the near future.

• This term also refers to that disease which was formerly confined to one geographic area, has now **spread** to other areas.
Re-emerging infectious Diseases

• The diseases which was previously controlled but once again has risen to be a significant health problem.

• Recently, decreased compliance with vaccination policy has also led to re-emergence of diseases such as measles and pertussis, which were previously under control.

• The use of deadly pathogens, such as smallpox or anthrax, as agents of bioterrorism is an increasingly acknowledged threat.
Impact of infectious Diseases

- **14th century** - Europe - Plague kills 20-45% of the world’s population
- **1831** - Cairo - 13% of population succumbs to cholera
- **1854-56** - Crimean war – deaths due to dysentery were 10 times higher than deaths due to casualties
- **1914 – 1918** - Influenza Epidemic death: 40 million; (World War I) death during WWI: 8-10 million worldwide
Emerging or re-emerging infectious disease outbreaks, 1990-2015

Country with crises during 1990-2014
- Marburg & CCHF
- Influenza H5N1
- Lassa fever
- Monkeypox
- Nipah & Hendra
- Rift Valley Fever
- SARS or MERS CoV
- Yellow fever
- Polio virus
- West Nile
- Plague
- Tularemia
- Malaria
- Trypanosomiasis
- Ebola
Economic Damages of EIDs

Estimated costs (in $ bn)

Not only Economic impact
✓ Social disruption
✓ Animal resources

- **SARS**
  - China, Hong Kong, Singapore, Canada
  - $30-50 bn

- **H1N1**
  - Worldwide
  - $45-55 bn

- **H5N1 Avian Flu**
  - Worldwide
  - $30 bn

- **MERS-Cov**
  - Middle East, South Korea
  - $30 bn

- **Plague**, India
  - $2.3 bn

- **BSE**
  - UK
  - $5 bn
  - USA, Canada
  - $6.5 bn

- **Rift Valley fever**
  - Kenya, Tanzania, Somalia
  - $1 bn
  - Sudan
  - $100 m

- **Nipah**
  - South East Asia
  - $650 m

- **West Nile**
  - USA
  - $500 m-$1 bn/year

- **Lyme disease**
  - USA
  - $200 m

- **Rift Valley fever**
  - Somalia
  - $100 m

- **EBOLA**
  - West Africa
  - $5 bn

Figures are estimates and are presented as relative size.
EIDs at the Human Animal interface

Chronology of events during EID event/outbreak

Number of Cases

Animal outbreak
Human outbreak
Wildlife

Domestic animal Amplification

Human Amplification

spill over

TIME (days)
Factors responsible for emerging or re-emerging of infections

I- Ecological changes and Agricultural development

• Global warming-climatologists project temps to increase up to 5.8°C by 2100.

• Influencing waterborne, vector borne disease transmission

• Exposures to pet and wild animals
Relative risk of an EIDs

Hot Spots: global distribution of relative risk of an EID event caused by zoonotic pathogens from wildlife
Factors responsible for emerging or re-emerging of infections

II- Changes in Human demographics and behaviours

• More people concentrated in cities—often without adequate infrastructure.
• More populations with weakened immune system: elderly, HIV/AIDS, cancer patients and survivors, persons taking antibiotics and other drugs.
• Increases in children in daycare: working woman with kids under 5 was 30% in 1970, is 75% in 2000.
• Fast paced Lifestyles: increase in convenience items and more stress
• High-risk behavior: Drug use and unprotected sex.
Growing urbanization: 44 megacities in 2020

- Tokyo
- Mexico
- New York
- Sao Paulo
- Delhi
- Mumbai
- Los Angeles
- Rio de Janeiro
- Buenos Aires
- Paris
- Kampala
- Jakarta
- Lagos
- Cairo
- Beijing
- Osaka, Kobe
- Shanghai
- Metro Manila
- Jakarta
- Lima
- Bogota
- Belo Horizonte
- Lima
- Rio de Janeiro
- Sao Paulo
- Buenos Aires

Biodiversity

- Selected major wilderness areas
- Selected terrestrial biodiversity hotspots

- 30 millions habitants and more
- 15-29.9 millions habitants
- 10-14.9 millions habitants
- 7-9.9 millions habitants
Factors responsible for emerging or re-emerging of infections

• III-International travel and Commerce.
• 365 days to circumnavigate the globe...now it takes 36 hours.
• 36 h faster than disease incubation.
• Transportation of products is an increased concern.
• Transport of livestock facilitates movements of viruses and arthropods.
Global interconnectivity

3 billions passengers per year.
2 Millions flights per week
Factors responsible for emerging or re-emerging of infections

- **IV- Technology and industry**
- **New diagnostic technology**
- **Modern mass production** increased the chance of **accidental contamination** and amplifies the effect of such contamination.
Factors responsible for emerging or re-emerging of infections

V-Microbial Adaptation and Change

- Antimicrobials for livestock growth enhancement and over prescription of antimicrobials by Drs. (convenience).
- Increased antibiotic resistance with increased use of antibiotics in humans and food animals.
- Increase virulence.
- Jumping species from animals to humans.
Factors responsible for emerging or re-emerging of infections

VI- Breakdown of public health measures

- **Lack of basic hygienic infrastructure** (safe water, safe foods, etc..)

- **Inadequate vaccinations** (measles, diphtheria)

- **Discontinued mosquito control efforts** (dengue, malaria)
Factors responsible for emerging or re-emerging of infections

VII- Intent to Harm

- **Bioterrorism**: Anthrax in US 2001
- Potential agents: Smallpox, Botulism toxin, Plague, Tularemia, ....
Factors responsible for emerging or re-emerging of infections

VIII- War and Famine

• War refugees are a full 1% of the global population.
• War refugees are forced onto new areas where they are exposed to new microbes from vectors and people.
• War and famine are closely linked.
• Tracking 16 countries with “food emergencies”, showed that 9 were because of civil unrest.
PREVENTING EMERGING INFECTIOUS DISEASES
A Strategy for the 21st Century
Prevention of Emerging Infectious Diseases Will Require Action in Each of These Areas

- Surveillance and Response
- Applied Research
- Infrastructure and Training
- Prevention and Control
Preventing Emerging Infectious Diseases

Surveillance and Response
Detect, investigate, and monitor emerging pathogens, the diseases they cause, and the factors influencing their emergence, and respond to problems as they are identified.
Preventing Emerging Infectious Diseases

Applied Research

• Provide answers to questions about the disease’s causes, transmission, diagnosis, prevention, and control.

• Integrate laboratory science and epidemiology to increase the effectiveness of public health practice.
Emerging Infectious Diseases: a Research Approach
Preventing Emerging Infectious Diseases

Infrastructure and Training

• Strengthen public health infrastructures to support surveillance, response, and research and to implement prevention and control programs.
• There is a need to have modern equipped laboratories to recognize emerging infectious agents.
• Provide the public health work force with the knowledge and tools it needs.
Preventing Emerging Infectious Diseases

Prevention and Control

• The culmination of all of these efforts is the prevention and control of infectious diseases.

• Ensure prompt implementation of prevention strategies about emerging diseases to investigate and control the outbreaks.
Global and national Collaborations against EIDs
Conclusion

• Since we live in a global village, we cannot afford to be complacent about the tremendous economic, social and public health burden of these diseases. Effective surveillance is the key for early diagnosis and containment.

• There is a need to develop epidemiology improved diagnostic facilities, a strong public health structure, epidemic preparedness and rapid response.
The Research Center for Emerging and Reemerging Infectious Diseases
(The National Referral Laboratory for Plague, Tularemia, and Q Fever)
تصمیم متخذه کمیسیون بودجه دایر به موافقت با استخراج آقای دکتر
منصور شمسا کارشناس اپیدمیولوژیک

کمیسیون بودجه مجلس شورای ملی پس از جلسه نظر کمیسیون استخراج مجلس سنا نسبت به
استخراج آقای دکتر منصور شمسا کارشناس اپیدمیولوژیک جهت بنگاه باستور موافقت نموده

تصمیم فوق که در تاریخ ۱۳۴۴/۵/۴ از طرف کمیسیون بودجه مجلس شورای ملی اتخاذ شده

است صحتی به دست می‌آید و به موجب قانون بودجه سال ۱۳۴۴ اجرا می‌شود.

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