How To Deal With Emerging And Re-Emerging Infectious Diseases Globally?

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Abstract

The emergence of new infectious diseases, re-emergence of old infectious diseases and persistence of intractable infectious diseases, all led to persistence and even increase in infectious diseases in many parts of the world. Important Emerging diseases are Acquired Immuno Deficiency Syndrome (AIDS), SARS, Influenza, Hepatitis, Ebola hemorrhagic fever, Bloody diarrhea – by Escherichia coli, Cholera, Legionella pneumonia and Lymes disease. Important Re-emerging diseases are Tuberculosis, Dengue fever, Malaria, Meningococcal meningitis, West Nile fever, Bubonic plague and Hanta virus pulmonary syndrome. The factors responsible for emergence and re-emergence of these diseases are changes in human demographics, changing human behavior, increased international travel and commerce, changes in genetic make-up, inappropriate land use and irrigation projects, and inappropriate and inadequate health infrastructure, especially in developing countries. The key components of the response are Surveillance and outbreak verification, Prevention and control programs / strategies, Capacity building of Public Health infrastructure and Research.

INTRODUCTION

Infectious diseases remain among leading causes of death worldwide despite remarkable advances in medical research and treatments. According to World Health Organization 2004 World Health Report, infectious diseases accounted for about 26% of the 57 million deaths worldwide in 2002.[1] In addition, nearly 30% of all disability adjusted life years (DALYs) could be accounted to infectious diseases.[1] It was thought that it might be possible with interventions available to 'close the book' on infectious diseases and shift public health measures to chronic diseases.[2] But emergence of new infectious diseases, re-emergence of old infectious diseases and persistence of intractable infectious diseases, all led to persistence and even increase in infectious diseases in many parts of the world.

DEFINITIONS

EMERGING INFECTIOUS DISEASES

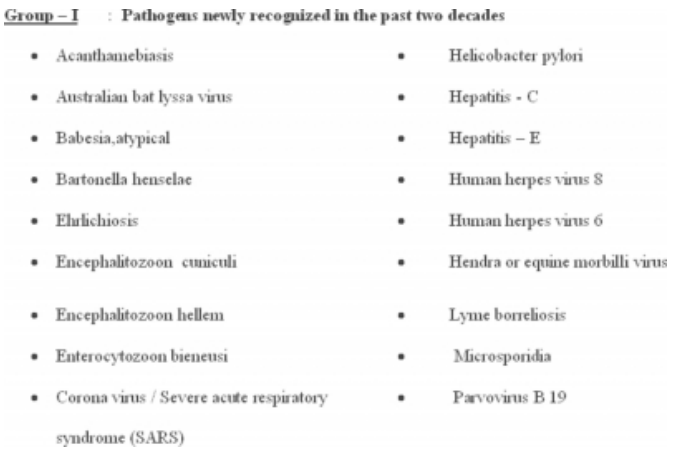
It includes outbreaks of previously unknown diseases or known diseases whose incidence in humans has significantly increased in the past two decades.[3]

RE-EMERGING INFECTIOUS DISEASES

These are the known diseases that have reappeared after a significant decline in incidence.[3]

LIST OF EMERGING & RE-EMERGING DISEASES

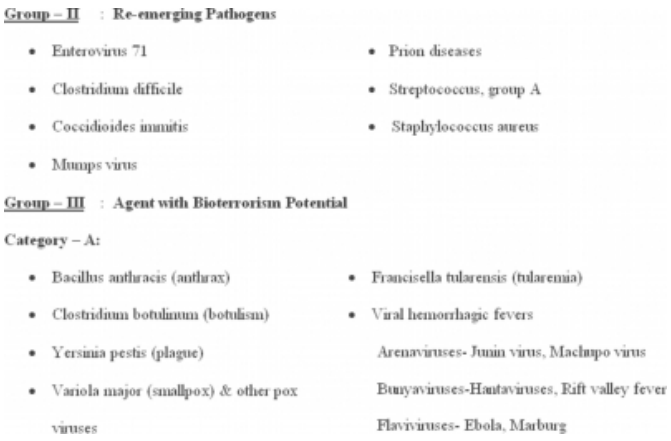
Figure 1



Group – I : Pathogens newly recognized in the past two decades

- Acanthamebiasis
- Australian bat lyssa virus
- Babesia,atypical
- Bartonella henselae
- Ehrlichiosis
- Encephalitozoon cuniculi
- Encephalitozoon hellem
- Enterocytozoon bieneusi
- Corona virus / Severe acute respiratory syndrome (SARS)
- Helicobacter pylori
- Hepatitis - C
- Hepatitis – E
- Human herpes virus 8
- Human herpes virus 6
- Hendra or equine morbilli virus
- Lyme borreliosis
- Microsporidia
- Parvovirus B 19

Figure 2



Group – II : Re-emerging Pathogens

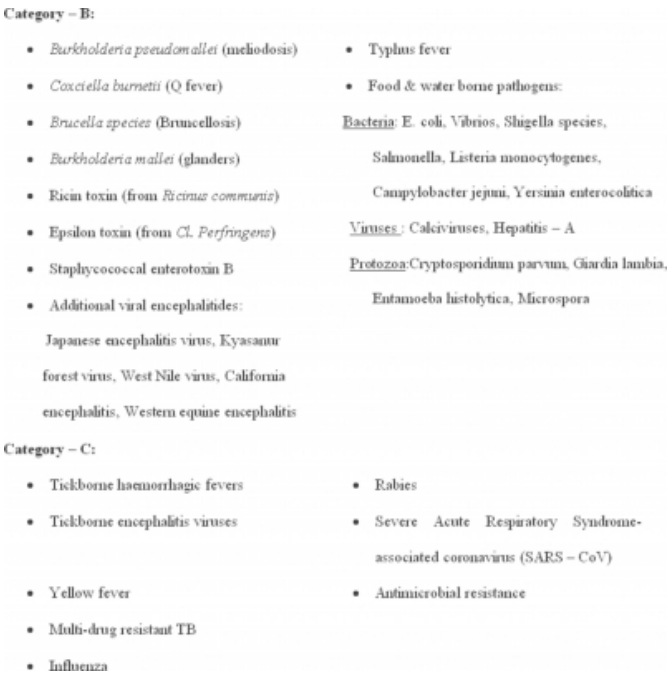
- Enterovirus 71
- Clostridium difficile
- Coccidioides immitis
- Mumps virus
- Prion diseases
- Streptococcus, group A
- Staphylococcus aureus

Group – III : Agent with Bioterrorism Potential

Category – A:

- Bacillus anthracis (anthrax)
- Clostridium botulinum (botulism)
- Yersinia pestis (plague)
- Variola major (smallpox) & other pox viruses
- Francisella tularensis (tularemia)
- Viral hemorrhagic fevers
  Arenaviruses- Junin virus, Machupo virus
  Bunyaviruses-Hantaviruses, Rift valley fever
  Flaviviruses- Ebola, Marburg

Figure 3



Category – B:

- *Burkholderia pseudomallei* (melioidosis)
- *Coxciella burnetii* (Q fever)
- *Brucella species* (Brucellosis)
- *Burkholderia mallei* (glanders)
- Ricin toxin (from *Ricinus communis*)
- Epsilon toxin (from *Cl. Perfringens*)
- Staphylococcal enterotoxin B
- Additional viral encephalitides:
  Japanese encephalitis virus, Kyasanur forest virus, West Nile virus, California encephalitis, Western equine encephalitis
- Typhus fever
- Food & water borne pathogens:

Bacteria: E. coli, Vibrios, Shigella species, Salmonella, Listeria monocytogenes, Campylobacter jejuni, Yersinia enterocolitica

Viruses : Caliciviruses, Hepatitis – A

Protozoa:Cryptosporidium parvum, Giardia lambia, Entamoeba histolytica, Microspora

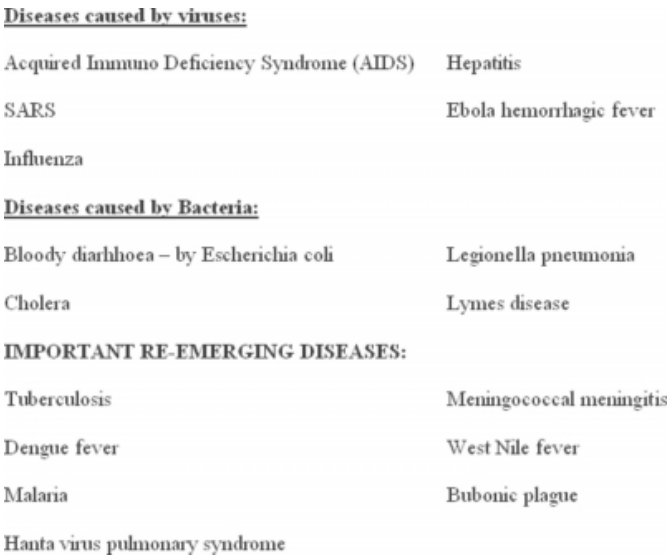
Category – C:

- Tickborne haemorrhagic fevers
- Tickborne encephalitis viruses
- Yellow fever
- Multi-drug resistant TB
- Influenza
- Rabies
- Severe Acute Respiratory Syndrome-associated coronavirus (SARS – CoV)
- Antimicrobial resistance

IMPORTANT EMERGING DISEASES

At least 30 previously unknown diseases have emerged since 1973.[5] Some important ones are:

Figure 4



Diseases caused by viruses:

Acquired Immuno Deficiency Syndrome (AIDS)	Hepatitis
SARS	Ebola hemorrhagic fever
Influenza	

Diseases caused by Bacteria:

Bloody diarhhoea – by Escherichia coli	Legionella pneumonia
Cholera	Lymes disease

IMPORTANT RE-EMERGING DISEASES:

Tuberculosis	Meningococcal meningitis
Dengue fever	West Nile fever
Malaria	Bubonic plague
Hanta virus pulmonary syndrome	

FACTORS RESPONSIBLE FOR EMERGENCE & RE-EMERGENCE OF DISEASES,

Human demographic: Ever increasing world population and migration of masses in search of job to urban areas, leading to overcrowding, inadequate sanitation and hygiene, which provide an ideal breeding ground for infectious agents.

Human behavior: Changing family structure, risky sexual activity, drug abuse, outdoor recreation, changing eating patterns, have all increased the spread of infectious agents. Imprudent use of microbial drugs, decreased compliance with vaccination policy, use of deadly pathogens such as small pox and anthrax, as agents of bioterrorism, have all led to re-emergence of diseases which were thought to be controlled previously e.g. HIV/AIDS, tuberculosis, malaria.

International travel & commerce: Increased international travel, especially without taking appropriate vaccine and other protective measures, lead to increased infection in travelers, brining infection back home. Increased commerce through increased import of food materials from developing to developed countries lead to increase in food-borne diseases in developed countries. Moreover, increased trade in exotic animals for pets and food sources has contributed to rise in opportunity for pathogens to jump from animal reservoir to humans e.g. monkey pox.

Changes in genetic make-up: Natural genetic variations, re-combinations and adaptations allow ‘new' strains of known pathogens to appear. e.g. influenza.

Land use: Inappropriate land use and irrigation projects, upset local ecology and creates new habitats. Encroachment

of human civilization on the environment disturbs delicate balance which humans share with the microbes. Diseases like lyme disease has emerged as a result of disturbance of this balance.

Health infrastructure: Inappropriate and inadequate health infrastructure, especially in developing countries has been unable to cope with increasing demands.

RESPONSE TO THREAT

In response to this threat of emerging and re-emerging infectious diseases, various international & national organizations have come together to combat this threat. Various agencies like World Health Organization (WHO), Centre for Disease Control (CDC), National Institute of Health (NIH),

Department of Defense & FDA, all have come together to work in collaboration to develop strategic plans to combat the microbial emergence and re-emergence.

The key components of the response are:

SURVEILLANCE

GLOBAL / REGIONAL LEVEL LABORATORY SURVEILLANCE

GLOBAL / REGIONAL LEVEL EPIDEMIOLOGICAL SURVEILLANCE

GLOBAL & NATIONAL SURVEILLANCE SYSTEMS / NETWORKS

EXAMPLES OF NETWORKS

In addition to above networks, following networks are also there for surveillance of various emerging and re-emerging diseases:

Outbreak Verification: Outbreak verification system was established by WHO in 1997. After receiving report of the disease outbreak WHO investigates them to confirm its public health importance and exact nature. An outbreak verification team is formed for the purpose.

PREVENTION AND CONTROL

CAPACITY BUILDING / INFRASTRUCTURE DEVELOPMENT

Research:[2,6] Various organizations like CDC, National Institute of Allergy & Infectious Diseases (NIAID), National Institute of Diabetes (NIDDK), Digestive and Kidney diseases, has made research contributions in field of HIV/AIDS, Tuberculosis, Malaria, Hepatitis C etc. Advances in genomics, proteomics have helped in better understanding of pathogenesis, host community and drug resistance and are helping in identifying new drug targets and develop new vaccines and diagnostics.[2] Progress in synthetic chemistry, robotics, computer, modeling and developments in molecular and genetic epidemiology are all helping to understand the pathogens, host factors, transmission patterns.[7]

FUTURE OUTLOOK

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