

# EMERGING AND RE-EMERGING INFECTIONS: A CHALLENGE TO HUMAN PROGRESS AND SURVIVAL

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## Introduction

The world is the home for a variety of micro-organisms and multiple hosts. Many interactions are taking place among them resulting in both favourable and unfavourable outcomes. Generally those adverse outcomes are caused by pathogenic micro-organisms. There are more than 1400 recognized pathogens in the world with over 12% of them being novel pathogens. With the increase of these novel pathogens or known pathogens, health professional and authorities identified the need for particular attention and intervention. Thus the term 'emerging and reemerging diseases' was introduced to highlight and warn the world about the impending threat

from epidemics caused by these new pathogens. World Health Organization (WHO) has defined an emerging disease as "one that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence or geographic range". For example Middle East Respiratory Syndrome Corona virus (MERS-CoV) which is sweeping the Arabic peninsula currently is a new pathogen. During the last decade, human plague has re-emerged (India – 1994/2002, Indonesia – 1997, Algeria – 2003), after a silent period of about 30-50 years.

## Who is cleverer, man or microbe?

WHO along with other stakeholders in health in the USA and worldwide, devised rapid response systems to monitor and contain disease outbreaks and to develop new weapons against microbes. This system assesses risks and existing systems

and prioritizes public health problems to develop strategic plans which are executed with ongoing monitoring to evaluate the impact and outcome. These mechanisms were tested by severe acute respiratory syndrome in 2003 and a series of practical and conceptual inadequacies in preparedness were revealed.

## Why should we be worried? What is the impact on us?

Emerging infections are a challenge to human progress and survival and are a leading cause of death and disability worldwide. An infectious disease in one country is a threat to the rest of the world through air travel. They magnify the global burden of infections and cause a major negative impact on economy and well being of the society. Inappropriate and intentional use of biological agents poses a threat to national security in addition to health implications.

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## Emerging and...

Recent media news from countries affected by the Ebola outbreak reporting parliament order of detention of Ebola coordinator, sacking of the national security head, probe into mishandling of funds, closing down of schools, quarantining of hospitals, business bankruptcy due to contact history with Ebola patients, occupational health related lawsuits against working places etc. are a few examples of the chaos caused by emerging infections.

### What are the triggering factors causing infectious agents to emerge or re-emerge?

There are many factors that lead to the emergence of infectious diseases. These are related to the human host, human behaviour, pathogen, environment, industry and technology.

#### Human related factors

- 'Aging planet'-increasing elderly population (Median age has risen to 29.2 with 11.7% being over 60 year of age)
- Human susceptibility to infection has increased due to reasons such as infections (Eg: Human Immuno-Deficiency Virus -HIV), chronic illnesses and medications

As a result people live longer but have weaker immune systems.

#### Human demographics and behaviour related factors

- Inflation of population size
  - Insufficient infrastructures
  - Inadequate sanitation & access to clean water
- Urbanization/migration
  - More people are concentrated in cities
  - Increased population density
- Breakdown of public health measures can contribute too.
  - Decrease in chlorine quantity in water supplies (Eg: rapid spread of cholera in South America 1991-1992)
  - Inadequate vaccination (Diphtheria epidemic in former USSR in the 1990s)
- Travel with expanded distance & speed
  - Ecological diversity
  - Rapid transport of infected fresh products & livestock

Eg.

- Increased tuberculosis and influenza transmission
- contracting cholera during pilgrimage
- Acquiring dengue during travel
- "Airport" malaria
- Poverty and social inequality
  - Difference in quality & expectancy of life
  - Uneven global access to wealth, water, sanitation and public health services
- War and famine
- Occupational exposure (Eg: Ebola)
- Lack of political will and support
- Intent to harm using biological agent (Eg: posting powder form anthrax spores in letter through US postal mail in 2001)

#### Pathogen related factors

There are certain microbial adaptations and changes that support disease emergence.

- Jumping species - from animals to humans (More than 60% of the emerging diseases are zoonoses. Of these, more than 70% of pathogens have originated from wild animals.)
- Pathogens continue to evolve with enhanced virulence (Eg: toxin-producing *Staphylococcus aureus* causing Toxic Shock Syndrome)
- Development of antibiotic resistance (eg: multidrug-resistant *Mycobacterium tuberculosis*)

#### Environment related factors

Ecological and environmental changes and agricultural development have assisted infectious agents in many ways.

- Global warming effect on vectors increasing the abundance and distribution.
- Higher ocean temperature
- Elevated rainfall creating new breeding habitats for mosquitoes and other vectors
- Deforestation and land clearance lead to
  - Habitat encroachment (Eg: rainforest, wetlands)
  - People placed in contact with unfamiliar but already present natural reservoir or host (animal, arthropod)
  - Large dams cause ecological changes that encourage (or discourage) vector breeding

#### Technology and industry related factors

- Uneven global access to information such as HIV innovations in treatment, preparedness plans for pan-

demics and natural disasters, new or existing medical knowledge and new technologies such as Geographic Information System which is useful for planning of control programmes, results in the increased suffering of underprivileged nations while not so needy developed nations enjoy the facilities.

- Globalization of food supplies
- Modern mass production
  - Increases the chances of accidental contamination
  - Amplifies consequences of the contamination
- Excessive antimicrobial usage on livestock farming. (In USA, out of the total antibiotic usage, more than 70% is used on animals for non-therapeutic purposes)
- New or improved diagnostic technology and research advances
  - Reveal of new basis of infectious disease (Eg: role of *Wolbachia* bacteria in the pathogenesis of lymphatic filariasis)
  - Identification of previously unknown microbes for known diseases (eg. *H. pylori* - peptic ulcer)
  - Detection of new pathogens (Eg: Severe acute respiratory syndrome SARS-CoV, West Nile virus)
- Blood & organ transplantation transmitted infections (Eg: HIV, Hepatitis B)

#### Global situation updates

Emerging and re-emerging infections have been classified in different ways by each institution or country. For example, the National Institute of Allergy & Infectious Disease (NIAID) categorizes based on the pathogens, namely pathogens newly recognized in the past two decades (group I), re-emerging pathogens (group II) and agents with bioterrorism potential (group III-category A, B, C). WHO has a separate scope of work aiming to combat the international spread of outbreaks, provide technical assistance to affected countries or communities rapidly and maintain preparedness. Thus WHO alerts the rest of the world in relation to any emergence of infectious disease outbreak. Such diseases reported by 'Global Alert and Response Network' of WHO in 2014 were Ebola (West Africa), Marburg (Uganda), MERS-CoV (Arabic peninsula), Polio (Central Africa, and Madagascar), human infection with avian influenza (China/Hong Kong), Legionnaires' Disease (Portugal) and West Nile virus (Brazil).

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## Emerging and...

In 2015 (up to 20th March) Ebola (West Africa), MERS-CoV (Arabic peninsula), human infection with avian influenza (China/Hong Kong) have continued to exist, while Measles (The Americas and WHO European region), Meningococcal disease (Nigeria) and Typhoid Fever (Uganda) have cropped up.

### Ebola

There are five Ebola virus species, four of which cause disease in humans. It is a virus from the filovirus family. The natural reservoir host of Ebola virus is not known yet but is believed to be bat based on the evidence and the nature of similar viruses. The infection has caused a total of 24701 cases and 10194 deaths by 15<sup>th</sup> March 2015. Sierra Leon, Liberia and Guinea are the countries affected with intense transmission with frequency of occurrence in descending order.

### Human infection with avian influenza (H<sub>7</sub>N<sub>9</sub>)

Avian influenza A (H<sub>7</sub>N<sub>9</sub>) was detected for the first time in March 2013 in China. Until that time it had not been recovered either from animals or humans. According to WHO, there have been 571 confirmed human cases of avian influenza A(H<sub>7</sub>N<sub>9</sub>) mainly (552 cases) from China with 212 deaths by 23<sup>rd</sup> February 2015. The animal reservoir, main exposures and routes of transmission to human and virus prevalence among animals and humans are not known. Canada and Malaysia have had few travel associated infections but so far international spread has not occurred. Therefore WHO does not recommend any travel restrictions or screenings to prevent human infection with avian influenza.

### Middle East Respiratory Syndrome Corona virus (MERS-CoV)

This is a new viral respiratory illness which was first reported in Saudi Arabia in Sept 2012. Later retrospective assessments revealed that the 1<sup>st</sup> case had been found in Jordan in April 2012. As of 5<sup>th</sup> February 2015, there have been 971 laboratory confirmed cases with 356 deaths. Most (63.5%) of the affected patients are males and

the median age is 48 years ranging from 9 months to 99 years.

Countries in or near the Arabian peninsula with cases include,

- Saudi Arabia
- United Arab Emirates (UAE)
- Qatar
- Oman
- Jordan
- Kuwait
- Yemen
- Lebanon
- Iran

Countries with travel-associated cases include United Kingdom (UK), France, Tunisia, Italy, Malaysia, Philippines, Greece, Egypt, United States of America (USA), Netherlands, Algeria, Austria and Turkey. Every year an estimated population of 1.4 million travels to Saudi Arabia for Hajj and no cases had been detected among pilgrims returning. So far no cases have been reported from Sri Lanka, nevertheless surveillance is ongoing.

People are at higher risk if they have a history of,

- Recent travel to the Arabian peninsula
- Contact with suspected/confirmed case in the community/healthcare environment
- Exposure to camels (preceding 14 days)
- Pre-existing co-morbidities (Eg: diabetes, cancer and chronic lung, heart, and kidney diseases)
- Being healthcare workers

To reduce the risk of infection, health advices such as avoidance of contact with camels, drinking raw camel milk or raw camel urine and eating undercooked meat, particularly camel meat should be followed.

### Sri Lankan situation updates

The Epidemiology Unit carries out disease surveillance mainly on the diseases listed in the notifiable register. Dengue is the most important vector borne disease at present with an increasing trend from 32063 in 2013 to 47246 in 2014. When comparing the data of the first two months of the preceding years (7131 in 2012, 6720 in 2013, 5621 in 2014) with 2015 data

(9950), the incidence has clearly risen irrespective of the intense control activities. Further, the Epidemiology Unit has also reported increasing trends in Measles and Leptospirosis during 2013. Emergence of Visceral Leishmaniasis in Sri Lanka during the last decade has been notified by the researchers. Brugian Filariasis which was once thought eliminated seems to have appeared again with cases being detected in both endemic and non-endemic areas.

### Preventive strategies

There are a variety of approaches to counteract the threats imposed by emerging infectious diseases.

#### 1. Surveillance and response

- Strengthen disease surveillance nationwide
- Improve methods for gathering and evaluating surveillance data
- Ensure the use of surveillance data to improve public health practice and medical treatment
- Strengthen global capacity to monitor and respond to emerging infectious diseases

#### 2. Applied research

- Develop tools for identifying and understanding emerging infections
- Identify risk factors
- Conduct research to develop and evaluate control strategies

#### 3. Infrastructure and training

- Enhance epidemiologic and laboratory capacity
- Improve communication with local health departments, health-care professionals, and others
- Enhance capacity to respond to outbreaks
- Provide training opportunities to relevant personnel

#### 4. Prevention and control

- Implement, support, and evaluate control programmes.
- Promotion of safe behaviours that reduce disease transmission
- Support and promote disease control and prevention internationally

### Conclusion

Emerging infections is a challenge imposed by the micro-organism on the health and safety of mankind.

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## Emerging and...

There are many host, pathogen and environment related triggering factors that cause infectious agents to emerge and create outbreaks. Development of effective control strategies, vigilance and preparedness will be essential to face future global outbreaks and epidemics caused by emerging and re-emerging diseases.

### Summary

An emerging disease is one that has appeared in a population for the first time or that may have existed previously but is rapidly increasing in incidence or geographic range (WHO definition). It is a challenge to human progress and survival contributing as a leading cause of death and disability worldwide. It also magnifies the global burden of infections and causes major negative impact on economy and well being of the society. An infectious disease in one country is a threat to the rest of the world especially due to the possibility of international spread through air travel. There are many human, pathogen, environment, societal/human behaviour related and technology or industry related fac-

tors that lead to the emergence of infectious diseases. Rapid population growth, increasing poverty, increasing urban migration, more frequent movement across international boundaries by tourists, workers, immigrants, and refugees, alterations in the habitats of animals and arthropods that transmit disease, increasing numbers of persons with impaired host defenses and changes in the way that food is processed and distributed are some such contributing factors.

Majority (>60%) of emerging diseases are zoonoses. Of these, more than 70% of pathogens have originated from wild animals. The Global Alert and Response Network of World Health Organization has reported Ebola (West Africa), Marburg (Uganda), MERS-CoV (Arabic Peninsula), Polio (Central Africa, and Madagascar), Human infection with avian influenza (China, Hong Kong mainly), Legionnaires' Disease (Portugal), West Nile virus (Brazil) outbreaks during 2014. Dengue is the most important communicable disease in Sri Lanka at present. The Epidemiology Unit of Sri Lanka has reported an increased in-

cidence than in the previous year in Dengue during 2014 and Leptospirosis and Measles cases during 2013. Regular systematic surveillance and rapid response, infrastructure development and training, applied research, preventive and control measures are the control strategies that are useful to counteract the threats imposed by emerging infectious diseases.

### References

- Frank M. Snowden Emerging and reemerging diseases: a historical perspective *Immunological Reviews Special Issue: Immunology of Emerging Infections*, 2008, 225 (1): 9-26
- Morens D.M. & Fauci A.S. Emerging Infectious Diseases: Threats to Human Health and Global Stability. *PLoS Pathog* 2013, 9(7): e1003467. doi:10.1371/journal.ppat.1003467
- Samarasekara S.D. Lymphatic filariasis in Sri Lanka; what have we done? Where are we now? Symposium on moving towards filariasis free Sri Lanka organized by the Expert Committee on Communicable Diseases of Sri Lanka Medical Association March 2015
- Siriwardana H.V.Y.D., Chandrawansa P.H., Sirimanna G. & Karunaweera N.D. Leishmaniasis in Sri Lanka: a decade old story *Sri Lankan Journal of Infectious Disease* 2012, 2(2):2-12
- World Health Organization Global alert and response 2015; <http://www.who.int/>
- Annual Health Bulletin 2012; Ministry of Health, Sri Lanka
- Epidemiology unit Disease surveillance 2015; Ministry of Health, Sri Lanka

## SUMMARY OF THE INTERNATIONAL WOMEN'S DAY CELEBRATIONS 2015

By Dr. Nadeeka Chandraratne,  
Secretary, SLMA Expert Committee on  
Women's Health

In the wake of International Women's Day 2015, the Expert Committee on Women's Health (WCH) of the Sri Lanka Medical Association, together with Women and Media Collective (WMC) and the Family Planning Association (FPA) Sri Lanka, organized a short film screening and a discussion on issues of gender and sexual health at the Auditorium, Lady Ridgeway Hospital, on 3 March 2015. The WMC is a group of Sri Lankan ladies who have been actively engaged in bringing about a fair society that does not discriminate women based on gender.



Discussion with (left to right) Prof. Shalini Sri Ranganathan, Dr. Mahesh Rajasuriya, Dr. Sepali Kottegoda (WMC), Mr. Thisun Chandrasiri (short film winner) and Ms. J.P.K. Jayaweera (short film winner)

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