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Research Article

The Effect of Changing Ecological Niche on Pathogenicity of Unrecognized or Emerging Infectious Diseases (EIDS) Events

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Abstract

This article is written to generate awareness in public that the rapid intensification of socioeconomic change, ecological fragmentation and frequent intensification of agricultural advances can put pressure on the scientific evidences that can diverse wildlife and human interfaces. While these interfaces can be a critical point for cross species transmission and May leads to the emergence of pathogenic strains into new population of host. The spreading and persistence of newly emerged or re-emerged pathogens can be perpetuated by a combination of factors includes expanding global human population and urbanization. Other factors may include trade and travel, reservoir population proliferation and antimicrobial drugs. These all factors such as population density, migration and sanitation leading access to wards clean water promotes transmission of pathogens and can alter vector dynamics.

Keywords: Ecological Fragmentation; Antimicrobial Drugs; Population Proliferation

Introduction

An Emerging Infectious Disease (EIDs) can be defined as an infectious disease whose occurrence is increasing followed by its first introduction in a newer host population, that being long term changes in its epidemiology on long term basis. Emerging Infectious Diseases events also caused by a pathogen which might be expanding into an area in which event went un reported or it may have critically changed its pathological presentation. Despite the importance of virulence changes, we still lack the knowledge of understanding what determines changes following a host shift. Virulence is somewhat thought to be a direct consequence of pathogen application, with greater levels of replication causing larger amounts of damage to the host.

Host shifts occur when a pathogen invades and establishes into a new host species, and this is supposed to be the major source of Emerging Infectious Disease.

When RNA virus (Drosophila C Virus) in 19 different species of Drosophilidae were deep sequenced the viral genome were experimentally evolved to replicate lineages of an RNA virus. A study conducted by (Long don B, DayJP, Alves JM, Smith SCL, Houslay Tagliaferri L, Jiggins FM). They compared viruses that had evolved in different species, they found that parallel genetic changes are more likely to occur if two host species are closely related. This means that when a virus adapts to one host it might also become better adapted to closely related host species.

Climatic Changes

Since our environment is wavering in an unprecedented scale, change means where there is statistically a significant variation from the mean state for a prolonged period of time. The most notable manifestation is initiated in sea surface temperatures in the Pacific, known as El Nino Southern Oscillation, which in turn led to a period of prolonged drought in many regions of USA and emergence of Hantavirus pulmonary syndrome. Whereas, a sudden reversal in sea temperatures in summer 1995 caused heavy down pours, resulting in resurgence of mosquito borne diseases such as Dengue and equine encephalitis.

Vector borne diseases are judged as highly sensitive for climate. Altered vector distributions can also be brought by climate

changes. Increased temperatures and seasonal fluctuations in either rainfall or temperature favor the spread of vector-borne diseases to higher elevations and to more temperate latitudes.

Overview

EIDs (Emerging Infectious Diseases) are receiving greater attention for last two decades. This is resulted from the observation by increasing resistance level to microorganisms to common antibiotics. The realization of the concept of globalization including global exposure of disease agents confined to small or remote areas. Emerging Infectious Diseases and their basis causes, present a threat to the stability of nations and indeed the world. The global village provides global economic and social opportunities but also opportunities for disease emergence and transmission. Behavioral and life style choices are also a major influence on the emergence and spread of many EIDs and thus require attention.

The odds of encountering a previously unknown disease have been raising overtime. Says Peter Daszak; President of New York based Eco Health Alliance, an International scientific group studying interconnections among Wild life, ecosystems and human health. About five entirely new infectious human diseases emerge each year, with perhaps three of five typically coming from insects and other animals.

The Emergence of new diseases has shocked the medical experts 50 years ago. When many considered the age of infectious diseases are essentially over. With antibiotics shutting down bacterial infections and vaccines conquering previously devastating viral illness such as Smallpox. But that view of believing pathogenic disease causing organisms had been eradicated. In 1980, when HIV/AIDS epidemic took USA and other industrial nations by surprise. AIDS alone killed 39 million people worldwide since 1981.

Meanwhile, public health experts are keeping an eye on a large number of other worrisome emerging infections, including the Middle East Respiratory Syndrome (MERS).

E. coli bacteria and Influenza virus mutate so fast that they are considered always emerging, since new strains can appear over night with heightened abilities to infect and spread.

But while emerging diseases are plentiful, experts generally agree that most are also controllable, if public health efforts such as sanitation and Local disease Surveillance are effective.

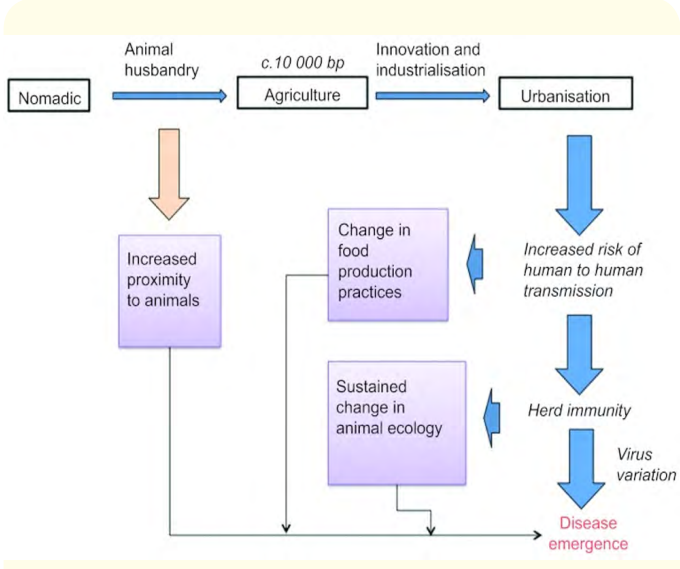

Figure 1: Diagrammatic Representation of Disease Emergence.

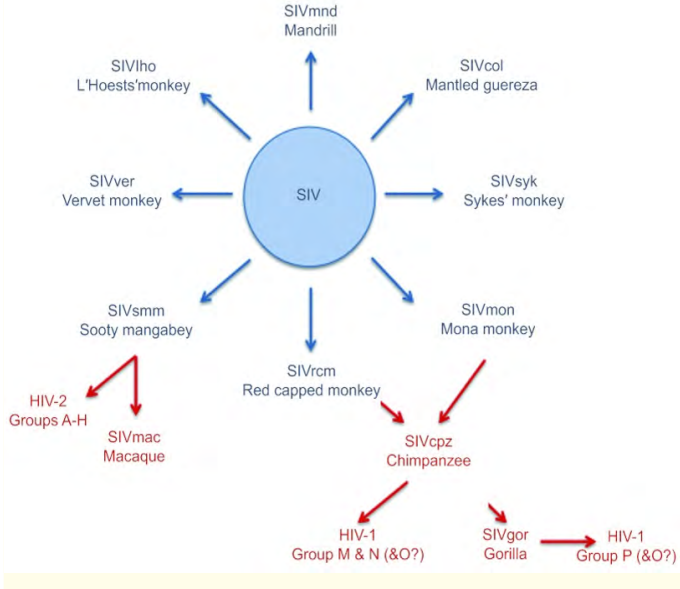

Figure 2: Diagrammatic Representation of Spread of HIV Infections in Monkeys.

This UN chart shows the spread of infectious diseases

Disease	Vector	Population at risk (million)[1]	Number of people currently infected or new cases per year	Present distribution	Likelihood of altered distribution
Malaria	Mosquito	2,400[2]	300-500 million	Tropics and Subtropics	Highly likely
Schistosomiasis	Water snail	600	200 million	Tropics and Subtropics	Very likely
Lymphatic Filariasis	Mosquito	1 094[3]	117 million	Tropics and Subtropics	Likely
African Trypanosomiasis (Sleeping sickness)	Tsetse fly	55[4]	250 000 to 300 000 cases per year	Tropical Africa	Likely
Dracunculiasis (Guinea worm)	Crustacean (Copepod)	100[5]	100 000 per year	South Asia, Arabian Peninsula, Central-West Africa	Unknown
Leishmaniasis	Phlebotomine sand fly	350	12 million infected, 500 000 new cases per year[6]	Asia, Southern Europe Africa, Americas	Likely
Onchocerciasis (River blindness)	Black fly	123	17.5 million	Africa, Latin America	Very likely
American Trypanosomiasis (Chagas disease)	Triatomine bug	100[7]	18 million	Central and South America	Likely
Dengue	Mosquito	1,800	10-30 million per year	All Tropical countries	Very likely
Yellow Fever	Mosquito	450	more than 5 000 cases per year	Tropical South America Africa	Likely

1. Top three entries are population-prorated projections, based on 1989 estimates.
2. WHO, 1994.
3. Michael and Bundy, 1995.
4. WHO, 1994.
5. Ranque, personal communication.
6. Annual incidence of visceral leishmaniasis; annual incidence of cutaneous leishmaniasis is 1-1.5 million cases/yr (PAHO, 1994).
7. WHO, 1995.

Highly likely · Very likely · Likely · Unknown

GRID Arendal · UNEP

GRAPHIC DESIGN : PHILIPPE REKACEWICZ

Source: Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

Figure 3

Methods

Surveillance globally for EIDs aims in detecting changes in the incidence rate of endemic diseases and in time recognition and characterization of syndromes caused by previously unknown pathogens of epidemic potential. Technological progress has been facilitating efforts of disease monitoring and its had made possible for constructing mathematical models for the study of diseases dynamics and epidemic prediction.

Event Based Surveillance Systems

These systems mainly collect and analyze unstructured information from diverse sources, includes news reports, social media and internet based searches. In countries with weak or nonexistent National Public Health Surveillance Systems, Event based Methods can provide real time information on local disease activity.

The WHO, ECDC (European Center for Disease Control and Prevention and US Center for Disease Control and Prevention (CDC) all use both traditional surveillance methods. The main objective of public health surveillance systems is to provide early warnings regarding emerging threats to human health. Socio economic factors and especially weaknesses of the national public health infrastructure systems can affect the local and possibly the international spread of a disease. Therefore, the information on the local social and ecological inequalities, as well as the political and cultural dimensions of a community is essential for investigating risk for disease emergence and transmission. Social network interactions can affect disease spread but also transmit information regarding disease prevention.

Result and Discussion

In a Recent Research published in Applied and Environmental Microbiology Journal demonstrates, that the Pathogenicity in Bacteria is widely affected by the Host Environment, which plays the Pivotal role. The climatic factors influence the Emergence and also Reemergence of many types of Infectious Diseases in turn. In a recent survey and update provided by Climatologists, says an upward trend in global temperatures with an unpresented rise of 2.0C by 2100. Therefore, it might affect diseases transmission and will also bring shift to vector's geographical range. Also, Human migration might lead to damaging effects to Health Infrastructures. Thus, strong measures must be taken in order to sustain with rising mercury levels. De forestation must be checked followed by sanitation activities with pure water safety must be top priority in these circumstances.

Advances in pathogen discovery and diagnostics

The rapidly developing and declining cost of Molecular Techniques has provided the means for Enhanced Pathogen Discovery, with the advancement of high throughput sequencing methods; it is made possible to rapidly acquire detailed sequence data necessary for pathogenic identification and analysis of large databases to identify a new agent. Genomic Wide Sequencing, Multiplex PCR AND Microarray Technology are all being used for Syndromic Surveillance, Microbial Discovery and the study of population host factors that determine disease susceptibility [1-22].

Limitations and Conclusion

The Internet Based Surveillance System although are constantly using much more resources and sophisticated software for Data Acquisition and Analysis, but still Geographical Surveillance gap still remains. Due to communication infra structure, lack of trained personnel and decreased awareness leads to disease unreported and thus hampering Emerging Infectious Diseases Surveillance efforts. The role of Biologists, Social Scientists, Physicians and Climatologists is now crucial for understanding the Linkages between Climate and Ecological changes, helping to optimize strategies for Disease Emergence and Prevention.

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