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The Influence of Ecological Factors on New and Emerging Viral Diseases

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Emerging viruses can be defined as those that are newly appeared or recently increased in prevalence. We have seen the emergence of many viruses for the past 25 years, which are either new to medical science or have increased in prevalence to the extent of a major concern for public health. They are RNA viruses which include HIV, hepatitis C virus, Sin Nombre virus, Nipah virus, Hendra virus, West Nile virus and most recently, SARS-CoV and avian influenza virus. Viral diseases, especially those with new faces, have posed the continuing threat on human history and it should be essential to determine the factors underlying viral emergence.

Much faster evolutionary process of RNA viruses and their association with animal reservoir may be the two general features of the emerging viruses. Unlike the DNA viruses which evolve via co-speciation with their hosts through long-term persistent infection, the emergence of RNA viruses has been strongly associated with lateral transfer between different reservoir species to enter new host species. Although both ecology and genetics seem to be important in determining whether a virus is able to successfully cross species boundaries, ecological factors are the most important for the phenomenon. Ecological factors usually reflect changes in either the proximity or density of the host and/or reservoir species. This, in turn, increases the likelihood that humans are exposed to new pathogens and that sustained transmission networks will be established. Vector-borne diseases such as malaria, dengue fever, encephalitis, Lyme disease, and other emerging infectious diseases are the most affected by ecological alterations which is triggered by climate change. Now we may see some early impacts of climate change on infectious diseases through several recent studies. In Australia, scientists showed that early warning of weather conditions conducive to outbreaks of Ross River virus disease is possible with a relatively high degree of accuracy. In this study, it is clear that climatic variation influences the breeding and survival of the mosquito reservoir significantly, which in turn elevate chances of the human exposure to the virus infection. Substantial increase of tick-borne encephalitis (viral TBE) incidence in Sweden also appears to be linked to a succession of warmer winters favoring the development and activity of tick which is the main vector for Lyme borreliosis and TBE in Europe.

Emergence of viral diseases in relation to main ecological disruptions has established a new paradigm in human health. Proliferation of vector or reservoir populations associated with the RNA viruses responds to climatic conditions very sensitively. Altered habitat of the vectors and reservoirs will undoubtedly increase the chance of cross-species transmission of those pathogens. Unfortunately, it is becoming clearer that modern climate change is dominated by human influences rather than natural variability.

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