



# The Emergence and Re-emergence of Infectious Diseases: A Challenge for Humanity and Health Systems in the 21<sup>st</sup> Century

**Reyes-Esparza Jorge\* and Rodriguez-Fragoso Lourdes**

*Universidad Autónoma del Estado de Morelos, Mexico*

**\*Corresponding author:** Reyes-Esparza Jorge, Faculty of Pharmacy, Universidad Autónoma del Estado de Morelos, Mexico

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## Opinion

When one reads about the challenges facing humanity this century, it becomes clear we must do more with less. A growing population must be provided with welfare while using fewer resources, particularly water, land (working surface) and energy. An aging population, chronic degenerative diseases, addictions, healthcare costs and the integration of health systems all entail challenges in the health department. However, we must not forget the presence of old and new infections that “threaten” to become pandemics. Here I will address the subject of global epidemiology and, in particular, the risk of what can be termed “global” pandemics, as was the case, a century ago, of Spanish influenza. By conservative estimates, this killed 50 million people (some sources estimate double the number of deaths).

The emergence and re-emergence of infectious diseases is strongly linked to the biology and ecology of the infectious agent, its host and vector. Thus, the presence of pathogens is influenced by multiple factors the origin of which can be categorized as a) human; b) animal (wild and domesticated), or c) environmental. We humans are creating the ideal conditions for the quick spread of a virus infection, or one generated by any other microorganism: poverty across a large swathe of the world’s population; voluntary and forced migration, catastrophic scenarios (be they natural or human-made, like civil wars); geopolitics; limited access to health systems and, likewise, deficient health systems. Deliberations regarding Obama Care in the United States are related to this issue: poor healthcare for large sections of the population and demands for “sustainable” healthcare financing. Developing medications has become increasingly expensive and is limited by lack of investment.

Intensive livestock exploitation and altered natural habitats, along with the indiscriminate use of antibiotics for this purpose, is still common in many countries and favors the presence and rapid spread of zoonotic and epizootic diseases that can develop into epidemics. The handling of interbreeding or genetics have resulted in new animal varieties with, for example, more meat and less fat, but susceptible to other diseases to the detriment of the original species. Intensive farming is not only a source of food but also

pollution, and it can become a source for epidemic emergence or re-emergence (e.g., SARS and influenza in recent years).

A variety of human activities, behavior and lifestyles, including geopolitical behavior, have come to threaten biological ecosystems. Chemical, physical and even biological agents impact humans as well as plants and animals, affecting nutrition directly or indirectly (feeding), as well as our physiology, immune response, and endocrine system, among other individual systems. They additionally affect pathogenic transmission and biodiversity. Pollutants also affect pathogens, favoring their proliferation or transmission, while additionally subjecting them to stress and thus favoring the mutation and emergence of resistant or more pathogenic strains.

Since the source of the problem and its manifestations are multifactorial, this necessarily implies that the strategy must be equally multifactorial, involving actions that range from the environmental or ecological point of view to the economic, social, cultural, educational and health-related categories.

“Ecosystem(s)” must be maintained, and this will only be possible if the problem is addressed through a comprehensive approach that envisions the population’s well-being and health, takes into consideration animal and plant health (including wild species), and has respect for ecosystems and biodiversity. This will help avoid the emergence and re-emergence of viruses and other pathogenic organisms.

Such an approach requires solidarious and fraternal international cooperation on a global program that aids low income countries and is focused on the improvement and preservation of human health and welfare in a manner that additionally preserves ecosystems and biodiversity, as well as human dignity. A comprehensive program should also reduce the amount of activities that favor the emergence or re-emergence of infectious and non-infectious diseases.

Poverty must be eradicated, since all human beings should have access to minimal welfare. This includes food, housing, education,

culture, leisure and healthcare management, which demands increased wealth generation as well as a better wealth distribution, lessening wealth accumulation. Automation currently threatens jobs and income rather than foster well-being. Housing needs to become environmentally friendly and the proliferation of large urban centers needs to decrease due to their high economic, social and ecological operation costs. Education levels must rise (and here I am not merely speaking of an increase in schooling levels, but also general culture), nurturing the kind of values needed to face extant challenges, and fostering individual and collective responsibility for the preservation of the environment, welfare and health. Automation is expected to lead to "idleness," in which case pertinent spaces should be made available. This will avoid an increase in addictions and promote both physical activity and a nutritional culture as ways of preserving human health and well-being.

In the health department, we require primary diagnoses that provide coverage, sensitivity, specificity, and opportunities. This entails global reference systems for viral culture, molecular diagnostics, sub-typification, and the identification of new viruses. A surveillance program that identifies emergent and re-emergent diseases, as well as resistance to antivirals and antibiotics, is also needed. Dengue, measles, *Leishmania* and *Rickettsia*, meta pneumo virus, RSV and corona viruses are all particular concerns.

This also means a generation of professionals possessing new knowledge, skills and approaches to healthcare. These skills should include sociological and ecological approaches that take human interaction into account, not as a whole or a single model, but a wide diversity of human societies, as well as the vulnerability

and susceptibility inherent to human, animal and plant relations, along with the toxic agents derived from the first. That is to say, the interaction of the human and natural ecosystems, and their reciprocal influences.

We need to make a common effort toward researching and developing early diagnosis methods, along with medications and treatment for infectious and degenerative diseases as well as rehabilitation. These must foster human health and wellbeing while also benefiting ecosystems and the planet, lowering all-around costs. Here it is worth remembering that nature can be our teacher and provider when it comes to new drugs. Just like the development of computer science required the study of neural networks, the current study of nature is introducing tools such as bacteriophages, probiotics and symbiotics, in addition to antimicrobial peptides (bacteriocins) or effectors of the innate response in protozoa or higher animals. These can be used to combat pathogens and control the emergence and re-emergence of infectious diseases. When it comes to some disease management, we must not forget vector control as well as the use of immune response modifier agents for the management of non-infectious diseases.

In conclusion, scholars, businesspeople, governments, public and private institutions, NGOs, and churches, among others, should all work together toward these common goals. And they, in turn, need to be joined by the individuals affected by the long-term consequences, good and bad, of infectious disease emergence and re-emergence. We must all focus on preserving human well-being while maintaining a sustainable production of food and other consumer goods, one that is in accordance with the ecology and health of our planet.

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