

Emerging Infections — A Global and Regional Challenge

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SUMMARY

BACKGROUND: Emerging infections have become a global public health program, in part due to the activities of humankind. While this has historically been case, the pace of emergence has been hastened by progress in travel and trade across borders. The Americas have not been spared. **OBJECTIVES:** To summarize the experience of the Americas of the emergence of new infections, and illustrate the correlation of emergence with anthropogenic factors. **METHODS:** Based on literature review, the authors summarize the major types of emergent events that have occurred, and trace their impact on global and regional economies. **RESULTS:** Changes in the epidemiology of existing diseases, including their introduction into new geographic areas have been noted for a number of diseases which affect the Americas. In addition, new agents such as HIV/AIDS have had broad impact and continue to be transmitted. In both of these cases human travel and trade have amplified infection. Finally, changes in the microbes themselves, such as the emergence of resistant Tuberculosis, have also been important. The emergence of new agents, patterns of infection in populations and resistance have set forth a challenge that PAHO has drafted a regional plan to address.

Key words: Communicable Diseases; Public Health; Diseases Outbreaks; Health Planning Organization.

INFECCIONES EMERGENTES: UN DESAFÍO REGIONAL Y MUNDIAL RESUMEN

ANTECEDENTES: Las infecciones emergentes se han convertido, en cierta forma debido al tipo de actividades humanas, en parte de la agenda de la salud pública mundial. Aunque históricamente éstas han permanecido ocultas, su emergencia ha sido precipitada por el progreso de los viajes y el comercio a través del mundo. **OBJETIVOS:** Resumir la experiencia de las Américas en la emergencia de nuevas infecciones e ilustrar la correlación de ésta con factores antropogénicos. **MÉTODOS:** Revisamos, basados en la literatura existente, los principales tipos de problemas emergentes ocurridos, y evaluamos su impacto sobre las economías globales y regionales. **RESULTADOS:** Se han evidenciado cambios en la epidemiología de las enfermedades existentes, que incluyen la introducción de numerosas enfermedades hacia nuevas regiones geográficas. Además, nuevos agentes como el VIH/SIDA han tenido gran impacto y siguen diseminándose. En ambos casos, los viajes y el comercio han amplificado el contagio. Finalmente, también han sido importantes los cambios propios de los microorganismos, como la aparición de tuberculosis resistente. La emergencia de nuevos agentes, patrones de infección y de resistencia propone tal desafío que la OPS ha trazado un plan regional para afrontarla.

Palabras claves: Enfermedades Transmisibles; Salud Pública; Brotes de Enfermedades; Organizaciones de Planificación en Salud.

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Infectious disease is becoming increasingly global in its ecology creating new challenges for the human community. Geographic divisions do not serve to protect vulnerable host populations from the incursion of diseases from other lands and climates. Indeed, climatic protection itself is being compromised as global warming changes the range of temperate zones (1). The paradigm of emergence focuses around the role of human activity itself as a potent force in the selection and propagation of new infections that endanger humans. The factors of emergence described by the Institute of Medicine group and others embrace activities taking place across societies (2).

Emergent events include but are not limited to the following broad types: (1) an outbreak of a truly new, not previously known agent; (2) in incursion of a known agent into a previously unaffected population group or geographic region; (3) an epidemic of an previously

endemic, but controlled agent; and (4) a change in the biological sensitivity of an organism which confounds previously successful control.

Any of these emergent events have the capacity for broad transmission given the pace of travel and trade in the modern global setting. For example, global trade volume has trebled in the past twenty years and the volume of international air travelers is reaching 500 million annually. In the Americas, two new trading accords: NAFTA (the North American Free Trade Agreement) and APEC (The Asian Pacific Economic Cooperation) have been implemented in the past decade to enhance the free flow of goods, money and "business" across borders. Figure 1 shows the past two years of PROMED disease alerts reported over the past two years, and documents the obvious: the Asia Pacific region, including the Americas, is as subject to the emergence of new infections as any other region of the globe.

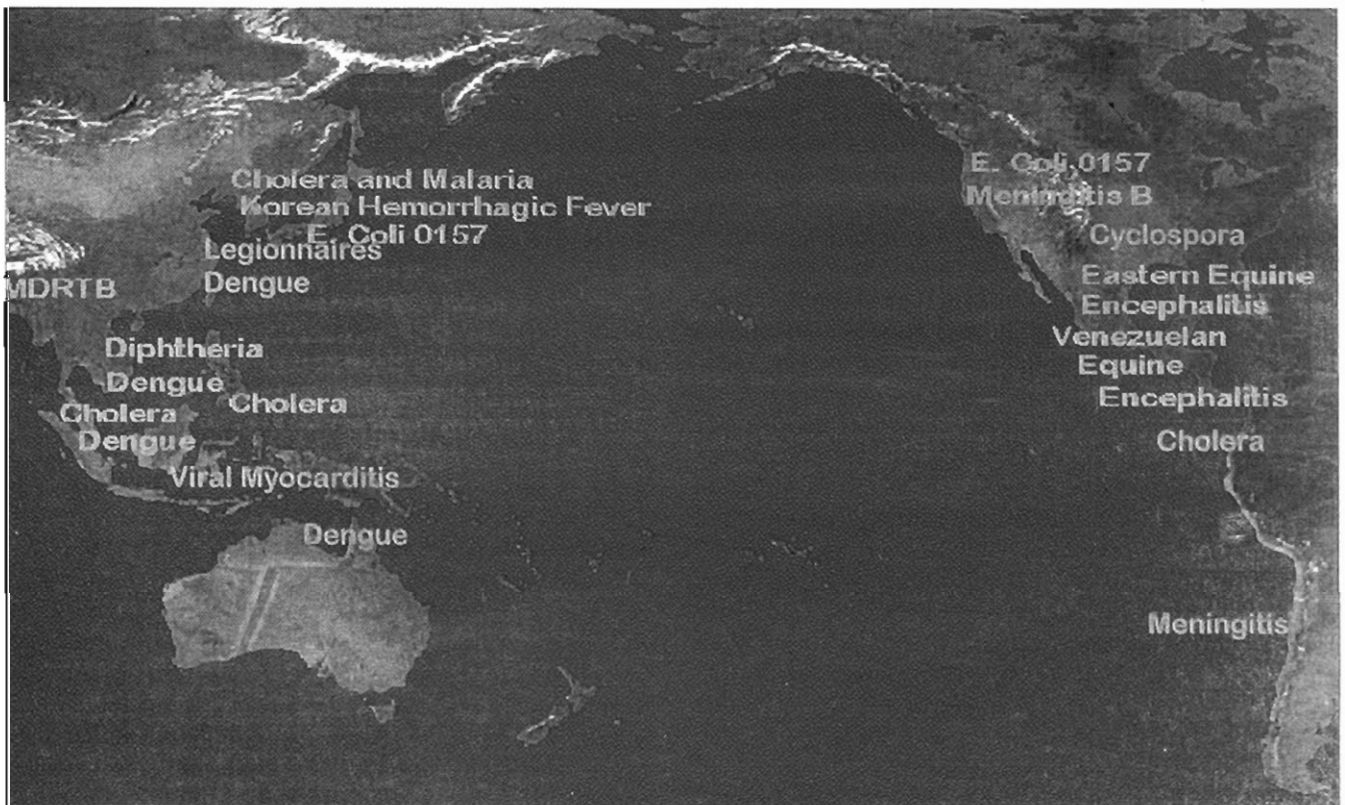


Figure N° 1.- PROMED disease alerts reported over the past two years.

This paper will discuss the challenges of Emerging Infections from the perspective of the Americas. Briefly we outline the historical significance and the challenges to surveillance and outbreak control. Finally we discuss the future and the capacity of regional planning to meet the challenges of disease emergence.

Global pandemics are not new phenomena to the medical sciences. As far back as Exodus 7-12, we have descriptions of the "plagues" of Egypt, which affected both humans and animals. The etiology of these disasters remains unknown but scholars have tried to formulate likely hypotheses as to which vectors or organisms were the cause of these terrible tragedies (³). The most well known historical medical disaster is the Black Plague, which in the 1300's accounted for over 20 million deaths. We now understand the epidemiology and etiology behind this disease: however, in the Middle Ages this was all a mystery. Other historical pandemics are elucidated in the literature, syphilis in Europe, worldwide tuberculosis, and smallpox. Only one of these, smallpox, has been eradicated. More recent pandemics are reminiscent of the "plagues" of yesteryear. In the Americas, the re-introduction of *Vibrio cholerae* into Lima, Peru in 1991 caused thousands of deaths in a relatively short time span (⁴). The proposed mechanisms for this resurgence of this disease are multifactorial. These include increased trade and commerce, with the likely introduction of the bacteria into the food chain by bilge water released from incoming cargo ships. Other factors that contribute to the spread of a disease include increased urbanization, lack of adequate sanitation, and lack or inadequate public health infrastructure.

International disease surveillance has historically been problematic. The increasing pace of emergence of new infections has focused attention on the need effective surveillance to facilitate timely response and containment. Information infrastructure is extremely uneven internationally. Some countries do not have accurate vital statistics on their populations, and cause of death information is confined to projections from those few deaths that are formally diagnosed by the health authorities. Indeed, fewer than 30% of deaths worldwide are medically certified as to cause (⁵). Morbidity reporting is even more problematic in developing country settings. Access to medical care (⁶), access to diagnostics within the medical care setting, the accuracy of diagnosis and the completeness and

timeliness of reporting have all been examined in a diversity of settings. The consensus is clearly that the current networks fall shortly and much disease and death occurs undiagnosed, unreported and uncounted by health authorities in the poorer regions of the world. The type, timing and geographic extant information reported both domestically and internationally must be dramatically improved. On a regional basis, PAHO has outlined this challenge and strategies to meet them, as we will discuss below.

New infections require the close coupling of surveillance and response. This stems from the contemporary potential for broad dissemination discussed above. If we contrast the experience of two recent large E Coli O157:H7 outbreaks in the United States in 1993 (⁷) and in Japan in 1996 the need for timely response is dramatically demonstrated. Through epidemiological studies, the implicated food item in both outbreaks was known early in the epidemics. In the United States, local public health law allowed 400,000 potentially contaminated hamburgers to be taken off the market. In Japan (⁸), partly because of the outdated public health laws in force at the time, much more rigorous criteria for impounding product existed. Thus a much more broadly transmitted epidemic of 14,000 cases occurred, although with a lower case fatality rate, reflecting the very strong clinical treatment capacity in Osaka. Infectious disease laws in Japan have been revised this year by the Diet.

The emergence of a new, previously unknown agent is probably the most challenging scenario. This was the case with the emergence of HIV/AIDS in the 1970's (⁹). At the time of its clinical recognition in the early 1980's the scientific knowledge of this agent did not include its routes of transmission, its basic nature (i.e. viral) nor a reliable screening or diagnostic test. The HIV infection has been profoundly affected the Americas. Although much of the transmission has been sexual, transmission has also been internationally related to the trade in Factor VIII. The United States was the major supplier of lyophilized Factor VIII into Central and Latin American economies at a time when the US blood supply was contaminated. As a result, the first cases in many Central American countries occurred among hemophiliacs who were heavily exposed to this imported contaminated product. Because of the long latency of the virus, broad transmission occurred before the existence of a reliable screening test in the mid-1980's.

The recent experience with the avian influenza cluster in Hong Kong in 1997 created a similar worrisome scenario. The unprecedented transmission of the H5 N1 virus directly from poultry to humans, with an attendant high mortality combined several key elements for a potential global epidemic: an agent (influenza) with historically high contagiousness, and known capacity for rapid transmission internationally, and an agent for which the design of an appropriate vaccine could not be carried out "in time" to interrupt such transmission if it were to occur (¹⁰).

The level of concern about this cluster is reflected not only in the very high media presence of the event, but also in the economic dislocation it provoked. While the cluster was confined to just 18 human cases, and 6 deaths, the public health response included the slaughter of 1.3 million chickens in Hong Kong, the suspension of importation of chickens from the Peoples Republic of China to Hong Kong and a decline of tourism of 35% into Hong Kong. Fortunately, the agent did not prove to be effectively spread from human to human.

The Americas have also seen the rise of new agents, with new strains of Dengue virus appearing in Brazil and the Caribbean, and the newly described hemorrhagic fever viruses such as Machupo virus and Junin virus to name but two examples. None the less, probably the greatest challenges in our hemisphere remain with the prevention and control of epidemics from known agents introduced into new populations, or known agents which acquire new biological resistance to treatment.

The introduction of Cholera into the Americas in 1991 reminded the region that we are not immune from widespread epidemic activity from known agents finding new populations. At the time the agent was reintroduced, Peru was vulnerable because of a number of factors including: (1) an antiquated municipal sanitation and water system which had suffered extensive deferred capital maintenance due to economic austerity with the country; and (2) crowded new settlements in coastal areas due to economic migration and the security situation in the interior of the country. Adjacent economies put in place stringent trade and travel embargoes which did not impede the spread of the illness, but further crippled the Peruvian economy. More than a million cases of cholera occurred in the region between 1991 and 1995, a reminder of the

importance of basic water and sanitary infrastructure in preventing the successful transmission of emergent infections.

Changes in the biological activity of antibiotics are another factor that contributes to the re-emergence of diseases. The first commercial antibiotic, penicillin, was used in 1942, three years later we saw resistant strains of *Staphylococcus aureus* to penicillin. The emergence of antimicrobial resistance has reached epidemic proportions. Three main factors have contributed to the emergence and spread of multiple resistant organisms. These are (1) exchange of genetic information among microorganisms, (2) transfer of well-known genes into new hosts, and (3) the increase in selective pressures in hospitals, communities and commercial industries (¹¹).

An emerging problem with antimicrobial resistance is an increase in the cases of multidrug resistant tuberculosis (MDR-TB). Multidrug resistant tuberculosis is a serious public health threat due to its rapid progression, poor response to treatment regimens and high mortality (¹²). According to the new WHO report on anti-tuberculosis drug resistance, Bolivia, Peru and Argentina ranked 7th, 8th, and 9th, respectively, in the prevalence of drug resistance to any TB medication (¹³). Of the South American countries presented in the WHO report, Peru has the highest incidence of tuberculosis cases (197/100.000) and Argentina the lowest (39/100.000). The combined prevalence of multidrug resistance to TB in Argentina, Bolivia, Brazil and Peru range from 1.3 to 8.0 percent (¹³). More recently there has been reports of MDR-TB in tertiary care facilities in South America with transmission to health care workers (¹⁴).

In response to the ongoing threat of emerging infections in the Americas, the Pan American Health Organization has designed, and is implementing a regional strategy for prevention and control (¹⁵). Existing regional laboratory networks are being strengthened, and enhanced surveillance of infectious diseases through new diagnostics and Internet information transfer is underway. In addition, the Asia Pacific Economic Cooperation has recognized the threat of emergent infections and has launched an initiative to prevent the crippling impact of these events on trade, travel and economic development in the region. However, the most important level of defense remains the level of local public health. Strong investment both

in water and sanitary infrastructure and in the capacity of Public Health to carry out surveillance, and control activities must remain at the top of local priorities.

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