

Emergence of Infectious Diseases in the 21st Century

BY JAIME R. TORRES

The tropics include those regions of the earth around the Equator, where the sun reaches a point directly overhead at least once during the solar year. The area is limited in latitude by the Tropic of Cancer in the northern hemisphere at approximately 23° 26' 16" (or 23.4378°) N and the Tropic of Capricorn in the southern hemisphere at 23° 26' 16" (or 23.4378°) S. The tropics are also referred to as the Torrid or Tropical Zone.

About 40 percent of the world's human population currently lives within the tropical zone, and by 2060 it is estimated that at least 60% of the human population will be in the tropics, due to high birth rates and migration.

The concept of tropical diseases and tropical medicine arose in the 19th century, when European colonial doctors encountered infectious diseases unknown to them. According to the World Health Organization, tropical diseases are illnesses that occur uniquely in tropical and subtropical regions (which is rare) or, more commonly, are either more widespread in the tropics or more difficult to prevent or control. The warmth and humidity of the tropics, as well as the often unsanitary conditions under which so many people live in these areas contribute to the development and dissemination of many infectious diseases and parasitic infestations.

*»... the concept of »domestic« as distinct from »international health« is outdated. Such a dichotomous concept is no longer germane to infectious diseases in an era in which commerce, travel, ecologic change and population shifts, are intertwined on a truly global scale.«**

While communities are geographically separated, they have become progressively closer and more interdependent because of efficient transport, communication and trade systems that allow pathogens to travel and infect people much more easily than ever before. This has resulted in the inexorable globalisation of infectious diseases. The latter is possible in part because of massive human movement across borders.

* U.S. CDC, Addressing Emerging Infectious Disease Threats: A Prevention Strategy for the United States, p. 12



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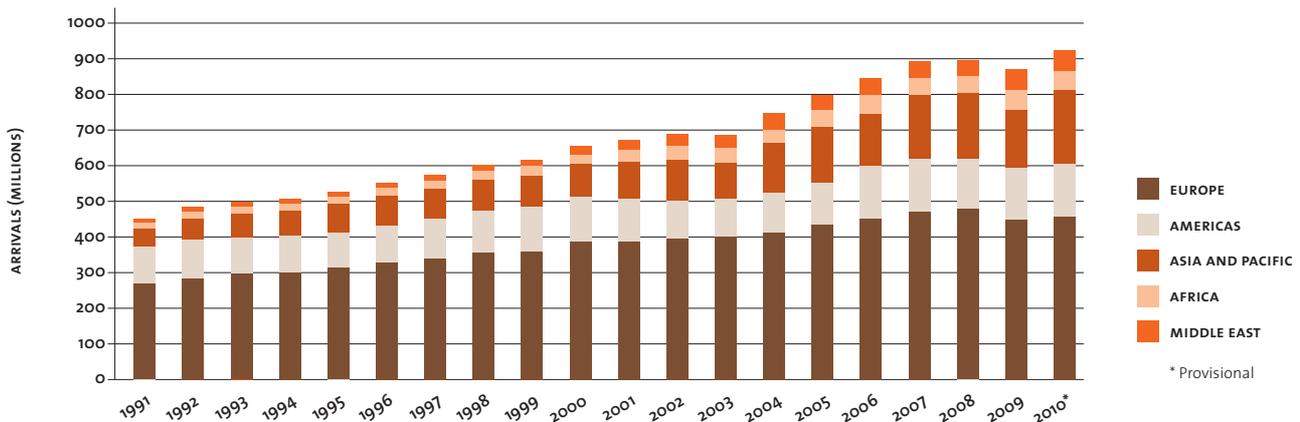
In a fashion resembling ancient caravans and oceangoing vessels, which used to carry illnesses between cities and countries, modern transportation systems do the same thing, only at a vastly greater speed. According to the World Tourism Organization (WTO), by the year 2010 there were 935 million international tourist arrivals, a 6.6% increase compared to 2009 and a 1.8% increase over the previous peak in 2008. It is estimated that by 2020, the number of people crossing international borders will increase even more, exceeding 1.5 billion per year.

Abstract

NEUE INFEKTIONSKRANKHEITEN IM 21. JAHRHUNDERT

In den Tropen lebt ein großer, stetig wachsender Anteil der Weltbevölkerung. Die Tropenkrankheiten, die ursprünglich als exotisch galten und ein geografisch beschränktes Verbreitungsgebiet aufwiesen, haben sich zu einem erheblichen Gesundheitsproblem im globalen Maßstab entwickelt. Durch enorme grenzüberschreitende Menschenströme, effiziente Verkehrssysteme, die Massenkommunikation und den integrierten Handel können sich Krankheitserreger heute viel einfacher ausbreiten denn je. Dadurch können Tropenkrankheiten vermehrt auftreten, erneut auftreten oder in Gebiete eingeschleppt werden, in denen sie traditionellerweise nicht existierten. Somit müssen Gesundheitsmitarbeiter in nichtendemischen Ländern in der Lage sein, Hinweise auf diese Krankheiten zu erkennen, sie richtig zu diagnostizieren und zu behandeln. Eine wirkungsvolle Bekämpfung dieser Krankheiten würde überdies stärkere gemeinsame internationale Anstrengungen erfordern.

FIGURE 1
INTERNATIONAL TOURIST ARRIVALS BY REGION OF DESITNATION 1991–2010*



Source: World Tourism Organization. UNWTO World Tourism Barometer [accessed 12 April 2011]. Available online at: www.unwto.org/facts/eng/barometer.htm

There is a growing awareness among health-care professionals that, as people travel more frequently to remote places and global trade expands, more people will return home carrying unusual infectious diseases that, until recently, have only seriously beleaguered the developing world. Global travel is relevant not only because of the increased propagation of contagions, but also because transit itself often contributes to the spread of disease.

Of note, the transmission routes of infectious tropical diseases do not flow exclusively from poorer populations to richer ones. Indeed, as history has often revealed, when people of developed countries come into contact with isolated or developing populations, it is the health of people from developing societies that tends to be impacted most severely.

As of 2011, mankind is confronted with about 350 generic infectious diseases, distributed in a seemingly random fashion across 220 countries. Over 1,600 human pathogens have been reported, each with a specific set of phenotypic, genomic, biotype and susceptibility characteristics. On average, three new diseases are described every two years – and remarkably, a »new« infecting organism is published every week.

At present, there are many new emerging tropical infectious diseases. Good recent examples are SARS, West Nile encephalitis, Chagas' Disease and dengue fever. Most of the newly recognised infectious tropical diseases are originally zoonoses from wild creatures, especially mammals, which at a given moment, may jump from animals to humans. As human population increases, wildlife is progressively crowded into ever-smaller areas, and the chances for crossing over multiply. Some pathogens may be picked up by hunting or accidental contact; others, such as Nipah virus, go from wildlife to livestock, then to people. Since humans have evolved no resistance to zoonoses, these diseases can be extraordinarily lethal.

The emergence of tropical and »exotic« diseases as a public health problem certainly affects the whole world. This became apparent yet again in August 2007, in Castiglione di Cervia and Castiglione di Ravenna, two small villages of the province of Ravenna, Region

Emilia-Romagna, Italy, where a sudden large outbreak of chikungunya fever, which is normally found in the Indian Ocean region, occurred. When more than two hundred residents developed high fevers, joint pain and exhaustion; summer vacations were cancelled and African immigrants were blamed. However, public health officials eventually traced the epidemic back to an Italian citizen who had recently been visited by a relative returning from Kerala in India; the high density of tiger mosquitoes (*Aedes albopictus*) – invaders from Albania – contributed to the rapid spread of the disease. More recently, autochthonous dengue infection has been documented in Nice, South-East France, where *Aedes albopictus* is also established, and in Southern and Central Florida in USA, where *A. aegypti* was never eradicated.

Whereas Chagas' disease, paradoxically, exhibits a decreasing health and economic impact in endemic countries, due to successful multi-national control programs aimed principally at the interruption of vectorial and transfusional transmission, the illness now appears to be emerging outside these areas. Some European countries, especially Spain and Italy, as well as Australia, increasingly recognise cases of Chagas' disease as a consequence of recent trends in immigration from Latin America, and the disease may become a significant cause of chronic cardiomyopathy in the near future. In countries where vectorial transmission does not occur, blood or organ grafts from infected donor and congenital infection would be the main modes of transmission of *Trypanosoma cruzi*. Besides changes in national policies with respect to the screening of blood donations already in effect, further specific preventive strategies would need to be developed and implemented at a national level in order to control non-vectorial transmission in these new distribution areas.

The concept of imported tropical diseases (ITD) is emerging. As described before, many tropical pathogens are not restricted to the tropics, and may be diagnosed instead in countries of the developed world in common travellers, immigrants and travellers visiting friends and/or relatives (VFR).

Tropical diseases manifesting in endemic areas and



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ITD will share certain features, but differences may also be expected. The spectrum and frequency of such diseases diagnosed in endemic and non-endemic areas may differ. Disease burden may also be lower when the infections occur outside endemic areas. Although the number of patients traveling with pre-existing medical conditions is increasing, a large proportion of travellers are healthy and in the same way an important proportion of immigrants who seek better work opportunities and who are able to travel to do so, would generally be expected to be in good health. The occurrence of a tropical disease in a healthy person should not have the same devastating effects as those observed in endemic areas, where infections and re-infections with multiple pathogens are not infrequent and worsen the burden of disease.

Populations in endemic regions can harbour several infectious agents simultaneously and the same has been observed with ITD. As would be expected due to the greater risk and length of exposure, polyparasitism is significantly more frequent among immigrants, followed by travellers VFR. The most frequent cause of polyparasitism is in coinfection with one of the geohelminths (ascariasis, trichuriasis, and hookworm), reflecting the large burden of disease caused by these parasites worldwide.

The cornerstone method for studying the interaction of the human and pathogen at a population level is epidemiology. Modern epidemiology covers a broad range from molecular to global level. The application of new epidemiological techniques to study tropical infectious diseases can be a useful tool for harvesting the data of new outbreaks. Along with modern epidemiology, the new advanced molecular biology and biochemoinformatics techniques are extremely useful supplementary tools for facing up with new emerging tropical diseases [5]. Geographical pathology knowledge may also be used for further prediction and implementation of treatment and prevention protocols for new emerging tropical infections.

To recognise and cope with these newly emerging diseases, the medical community of developed countries first needs to be aware of the pathogens involved.

Fortunately, physicians, medical students and other health professionals from Europe and North America have developed a growing interest in tropical diseases as they increasingly need to be able to diagnose and treat them. Nonetheless, this new interest also reflects a larger trend: developed countries are paying greater attention to world health for humanitarian, economic and political reasons.

It is conceivable that the problem of the tropical diseases »spilling over« into more developed countries will be linked to even greater combined international efforts to control these infections. ■

Efficient transport, communication and trade systems allow pathogens to travel and infect people much more easily than ever before

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