

## Chapter 63

# Environmental Change and the Emergence of Infectious Diseases: A Regional Perspective From South America

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### ABSTRACT

*In South America in the past decades several infectious diseases have emerged or re-emerged either as part of larger pandemics or as local processes involving autochthonous pathogens. These included arthropod-borne viral diseases, such as Dengue Fever, Chikungunya and Zika as well as viral hemorrhagic fevers, such as Hantavirus Pulmonary Syndrome, Junin, Machupo and Guanarito viruses. Parasitic disease was also important such as Malaria, endemic in the northern part of the continent, Leishmaniasis and Chagas Disease. Carrion disease, a bacterial infection originally from the Andes region, also seems to be expanding geographically. Several social and environmental processes have contributed to the emergence of these pathogens, including human migration, deforestation, road and dam building and climate shifts. Due to its high biological diversity of wildlife, arthropods and virus species in still untouched natural ecosystems in the Amazon has the greatest regional potential for the emergence of new human infections.*

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## **INTRODUCTION**

South America is at the Southern part of the America Continent (10°N; 55°S) spanning an area of 17,819,000 million km<sup>2</sup>, which includes 12 countries and an independent territory (French Guyana). The regional climate is predominantly hot and humid, but subtropical climate is found in mountain regions (e.g. The Andes) and temperate and polar climates occur in the southern tip of the continent, in Chile and Argentina (Canziani & Dias, 1998).

There is a high diversity of ecological areas and ecosystems such as the desert areas in northern Chile; the large plains in Venezuela and Colombia and the vast Amazon forest, which is shared by eight countries. The region has the largest freshwater system in the world due to the network formed by the Prata, Orinoco and Amazon River basins (Comisión Económica para América Latina y el Caribe [CEPAL], 2014).

The regional population is about 410 million people with about 83% living in cities. The regional life expectancy reached 73 years in 2010 (Teixeira, Paixão, & Costa, 2013). According to the Pan-American Health Organization [PAHO] (2014), safe water access reaches 89% of people in the Andes. However, this is not consistent across the region. Bolivia has sewage collection and treatment covering only 46% of households. Gross income per capita ranged from US\$12,470 for Chile and Argentina to US\$7,784 in Andean countries. Between 1990 and 2010, regional infant mortality rates dropped by 50%; for Brazil it was 14,6/1000 and for Chile 7,8/1000, in 2012 (PAHO, 2014; Teixeira et al., 2013).

Several endemic infectious diseases occur in South America, some with high annual incidence such as Malaria and Dengue Fever; in 2013, Brazil alone reported a total of 1,470,487 cases of Dengue Fever (PAHO, 2014). Several other endemic infections are autochthonous to the region such as Carrion Disease in the Andes and different forms of hemorrhagic infections caused by Arenavirus, such as Junin, Machupo and Guanarito hemorrhagic fever.

South America is considered vulnerable to climatic conditions, especially when combined with land use and land cover changes (Caqui, Quispe, & Zegarra, 2013; Magrin et al.; 2014). The aim of this chapter is to show the impact of environmental change and human activities on the dynamics of some infectious diseases of major importance to public health in South America.

## **BACKGROUND**

The emergence of infectious diseases was identified as a major global health threat in the last quarter of the 20<sup>th</sup> century. Zoonotic pathogens from wild animals formed the majority of newly emerged human pathogens in the past few decades (Jones et al., 2008). Several factors have been pointed as major contributors to human infectious disease emergence: new strains of the pathogens, increased resistance to antibiotics, reduced resistance of hosts (e.g. infection by HIV), variations in human populations densities, shifts in diversity of populations of vectors and hosts, hunting of wild animals for food, deforestation and loss of biodiversity and climatic anomalies (Jones et al. 2008; Keesing et al, 2010; Pongsiri et al, 2009; Wilcox & Gubler 2005).

In general, it is acknowledged that, for disease emergence to take place, an association of different drivers is necessary. In South America, since the middle of the last century, several diseases have emerged caused by different etiological agents, from Protozoa to viral infections. Some of these were part of larger epidemics/pandemics (e.g. Cholera; Dengue Fever) but other diseases have emerged as autochthonous

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