UNDERSTANDING AND MITIGATING THE EMERGENCE OF BARTONELLOSIS IN AMAZONIA, IN A SCENARIO OF ONGOING GLOBALISATION AND INCREASING SOCIO-ENVIRONMENTAL CHANGES

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BACKGROUND

The pristine region known as South-western Amazonia represents a microcosm for the resources and challenges of the whole Amazon region. Moreover, it is also a live-laboratory to generate hypothesis on the relationships between socio-environmental changes and the emergence of human diseases, to test mitigating strategies, and to advance the paradigm of disease-regulating ecosystem services suggested by the Millennium Ecosystem Assessment. This historically isolated tri-national region is now subject to an unprecedented globalisation process: the ongoing implementation of roads to link the Soya-bean producing areas in central Brazil to the Pacific ports (fostering commerce and allowing the transportation of goods and people) is expected to increase regional human mobility and land use/cover changes (LUCC).

Changes to the physical environment, together with movement of populations, affect public health due to an exponential growth in human-wildlife interaction and conflict. The pervasive process (road building - human migrations - land use/cover changes through logging and forest fires - biodiversity loss) affects vector breeding and bring people, vectors, and wild reservoirs into overlapping areas, fostering the emergence of vector-borne diseases.

EMERGING ZOONOSES

Bartonella bacilliformis has caused debilitating illness in South America since pre-Incan times, and has been described as "the most lethal human pathogen in the pre-antibiotic era". Bartonellosis was, historically, confined to the Colombian, Ecuadorian, and Peruvian high-altitude Andean valleys, but since the last decade is "slowly emerging from deep background". In Peru, an alarming spread of the disease during the last decade has been seen: the incidence increased ten-fold, mounting from less than 4 cases per 100,000 inhabitants in 1996 to 40 in 2004; and the number of Peruvian Departments infected mounted from 4, in 1995, to 14, in 2004. Laboratorial evidences were found in native Amazonian communities at just 150 metres above sea level. It has been suggested that climate events such as ENSO (El Niño Southern Oscillation) would have influenced the epidemiology of Bartonellosis in the years 1992-1993 and 1997-1998. Moreover, Peruvian Epidemiology Officers pointed to correlations between the spreading of Bartonellosis and (a) the increased "temporary migration" of human populations to/from "ecological niches" of the disease, and (b) land use/cover changes due to agriculture pressure. The Peruvian Department of Cuzco has a two-fold importance for the spreading of Bartonellosis: it bears the highest mortality rate (which reaches 20%), and will represent the geographical link between the already paved roads in the endemic Andean region and the newly paved roads from the disease-free South-western Amazonia's tri-national frontier. In 2004, for the first time, 175 cases (by epidemiological and/or clinical criteria) were reported in the Department of Madre de Dios, bordering Bolivia and Brazil – countries where Bartonellosis is not present and, therefore, the skills to promptly diagnose or treat the disease are not yet available. Although only 18 of these cases had laboratorial confirmation and they were, apparently, imported from other Peruvian departments, the risk of Bartonellosis transmission is reaching the disease-prone Peru-Bolivia-Brazil tri-national borders.

Since the vectors responsible for the transmission of Bartonellosis and American Cutaneous Leishmaniasis (ACL) are the same (Diptera, Psychodidae, Phlebotominae*)*, the Peruvian health authorities consider as potential transmission areas for Bartonellosis all "ecological niches" of sand fly vectors, specially where ACL is endemic. On the one hand, 78 species of sand flies have been reported from the Brazilian side of the tri-national frontier. On the other hand, ACL is endemic in both Bolívia and Brazil. Bolivia considers the Department of Pando, specially the areas along the Brazilian-Peruvian frontiers, as a Hyper-endemic Zone for ACL, with the Detection Coefficient of the six municipalities along the tri-national borders varying between 198 and 1,622 (cases per 100,000 inhabitants) in 2004. Brazil reports annually some 35,000 cases of ACL, of which 35% are from the Northern region. The Brazil's Detection Coefficient varied between 10 and 21 cases per 100,000 inhabitants (from 1985 to 2003), while in the Northern region it was around 94 (above 71 is considered very high risk) cases per 100,000 inhabitants - the highest coefficient among the five regions of the country. In the Brazilian state of Rondonia, ACL is an endemic disease of high importance, second only to malaria, with the annual number of reported cases increasing from 301 (1980) to 1,785 (2003). In the Brazilian state of Acre, the annual number of reported cases increased from 41 (1980) to 1,589 (2003). The municipality of Assis Brasil (the centre of the tri-national frontier, in the State of Acre) is the one with the highest Detection Coefficient in the South-west Amazonian tri-national frontier: 1,046 cases of ACL per 100,000 inhabitants in average, between 2000 and 2005. In the other two Brazilian municipalities on the tri-national border, the average (2000-2004) ACL Detection Coefficients were also well above the very-high-risk level: Brasiléia presented 450-, and Epitaciolândia 364 per 100,000 inhabitants. In the three countries of South-western Amazonia, the steadily increasing health burden from American Cutaneous Leishmaniasis has been attributed to land use/cover changes due to the expansion of the agricultural frontier, road building and temporary migration.

The General Objective of this research proposal is to help understanding and mitigating the emergence of Bartonellosis in the Amazon region. The Specific Objectives are:
(1) to describe the chain of events that lead to the re-emergence of Bartonellosis in Peru, by mapping in space and time (yearly, from 1995 on) the available secondary data on the changes in land use/cover, population dynamics, climate, and on the disease's eco-epidemiology (including vectors' distribution and behaviours);
(2) to produce risk maps for the transmission of the disease in Peru;
(3) to conduce an active search for actual cases of Bartonellosis at the Brazilian side of the tri-national borders (in two sentinel sites namely Assis Brasil and Brasiléia/Epitaciolândia);
(4) to assess the sand fly vectors (*Psychodidae: Phlebotominae*) responsible for the transmission in the tri-national region;
(5) to train Brazilian health professionals to diagnose and treat Bartonellosis (from the two sentinel sites of Assis Brasil and Brasiléia/Epitaciolândia);
(6) to assess the feasibility of developing mitigating strategies for the region, such as scenarios work, agent-based (or individual-based) modelling (ABM), early detection- and early warning systems.