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Potential impact of climatic variability on the epidemiology of dengue in Risaralda, Colombia, 2010—2011

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Summary Dengue continues to be the most important viral vector-borne disease in the world, particularly in Asia and Latin America, and is significantly affected by climate variability. The influence of climate in an endemic region of Colombia,

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from 2010 to 2011, was assessed. Epidemiological surveillance data (weekly cases) were collected, and incidence rates were calculated. Poisson regression models were used to assess the influence of the macroclimatic variable ONI (Oscillation Niño Index) and the microclimatic variable pluviometry (mm of rain for Risaralda) on the dengue incidence rate, adjusting by year and week. During the study period, 13,650 cases were reported. In 2010, the rates ranged from 8.6 cases/100,000 pop. up to a peak of 75.3 cases/100,000 pop. for a cumulative rate of 456.2 cases/100,000 pop. in that week. The climate variability in 2010 was higher (ONI 1.6, El Niño to −1.5, La Niña) than in 2011 (ONI −1.4, La Niña to −0.2, Neutral). The mean pluviometry was 248.45 mm (min 135.9—max 432.84). During El Niño, cases were significantly higher (mean 433.81) than during the climate neutral period (142.48) and during the La Niña (52.80) phases (ANOVA $F = 66.59$; $p < 0.001$). Regression models showed that the ONI (coefficient 0.329; 95%CI 0.209—0.450) and pluviometry (coefficient 0.003; 95%CI 0.002—0.004) were highly significant independent variables associated with dengue incidence rate, after adjusting by year and week ($p < 0.001$, pseudo $r^2 = 0.6913$). El Niño significantly affected the incidence of dengue in Risaralda. This association with climate change and variability should be considered in the elements influencing disease epidemiology. In addition, predictive models should be developed further with more available data from disease surveillance.

Introduction

Dengue continues to be the most important viral vector-borne infectious disease in the world [1]. In many countries of South East Asia and Latin America, it represents a public health threat that has been considerably affected by climate change and variability [2,3]. During the last decade, multiple studies in these regions have documented the influence of climate variables on dengue epidemiology [4—6]. However, in the case of Colombia, there are a limited number of reports assessing such influences, particularly in some endemic regions [4,7—10].

Dengue could be associated with multiple factors, including changes in environmental and social elements, that may influence its epidemiology. This epidemiology may also be changing in the near future due to the recent emergence of a new serotype (DEN5) [11,12]. In Colombia, climate change and variability have been studied in many vector-borne diseases, such as malaria [13,14], dengue [4,7,8] and leishmaniasis [15—17], in Antioquia [13,18], the Caribbean coast region [4,7] and the northeastern region [15,16], but not in the coffee-triangle region. There is a lack of studies on infectious disease epidemiology from this region of Colombia [19—21].

If the climate is influencing the epidemiology of infectious diseases in this region of the country, particularly vector-borne infections, environmental control efforts are necessary. They require an integrated and systematic approach from both the national and local health authorities as well at the community level to reduce and mitigate the impact on disease epidemiology. These approaches are obviously linked to educational programs and other interventional measures [22].

Recent studies in other regions of the country, e.g., Medellín, Antioquia, have found that the transmission of dengue is influenced by climate variability, especially precipitation or rainfall, which increases its incidence [18]. Even in low incidence areas, e.g., Cereté, Cordoba, studies have found that climate significant influences dengue morbidity [4].

If strong associations between dengue and climate variables were consistently found, it would be possible to produce models to help understand dengue transmission dynamics. This information would be useful for developing appropriate and timely strategies for dengue control.

For these reasons, in this first study, we assessed the potential associations between climatic variation and dengue cases in the context of local surveillance in a department of Colombia, Risaralda. This department is located in the coffee-triangle region, where no previous published studies of dengue have been reported. In addition, in this region, no other studies have assessed the