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Mapping Zika in the 125 municipalities of Antioquia department of Colombia using Geographic Information System (GIS) during 2015-2016 outbreak

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Dear Editor,

Zika epidemics have significantly impacted in the Americas region [1]. Countries such as Brazil and Colombia had regions with high incidence [2, 3]. Nevertheless, there is still a lack of epidemiological studies showing the spatial pattern of distribution, with their implications for public health and infectious diseases practitioners [2-4]. Also, travelers to those endemic areas should be aware about the risk of infective biting exposure when visiting for different purposes these areas [3]. In order to help in the advice to travelers and public health, epidemiological information is of utmost importance, including the availability of detailed maps in order to assess the risk when visiting specific destinations [2, 5, 6]. For these reasons, we have developed and published epidemiological maps for Zika in Colombia using geographical information systems (GIS) for different regions, in this case at one of the largest departments, Antioquia, constituted by 125 municipalities [2-6].

Use of GIS for development of epidemiological maps in Zika and other emerging arboviral diseases has not been used enough in Colombia and Latin America [2, 3, 6].

Surveillance cases data (2015-2016) (official reported by the National Institute of Health of Colombia) were used to estimate cumulative incidence rates using reference population data, on Zika RT-PCR and clinically suspected cases (both estimated as cases/100,000 pop.) to develop the first maps of Zika in the department of Antioquia (constituted by 125 municipalities). GIS used was Kosmo® 3.1. Four thematic maps were developed according municipalities. Determination of ZIKV infection includes either laboratory and syndromic surveillance (clinical definition of fever, rash, conjunctivitis and arthralgias in a municipality with previously ZIKV circulation, at least one case confirmed by RT-PCR). The clinical definition has been recommended by World Health Organization, Pan American Health Organization as well the US Centers for Disease Control and Prevention.

Total number of cases also included those in which clinical diagnostic criteria, *i.e.*, the case definition was met, but which were reported in a municipality without RT-PCR confirmation. After one case is confirmed by RT-PCR in a municipality, patients not classified as risk groups (pregnant women, children <1 y-old, people >60 y-old and patients with comorbidity), can be diagnosed by clinical definition.

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Since September 1, 2015 up to April 23, 2016, 1,965 cases were reported in Antioquia, Colombia (Figure 1), corresponding to: 139 RT-PCR confirmed and 1,826 clinically suspected (1,479 from municipalities with RT-PCR confirmed cases and 347 from other municipalities, without previous confirmed cases) (Figure 1), for a cumulative rate for the department of 30.43 cases/100,000 pop. Highest incidence rate was estimated in Chigorodó (208.58), followed by Carepa (188.75), Apartadó (186.16), Zaragoza (173.47) and Mutata (161.31) (Figure 1). Seventy-nine (out of 125) municipalities reported cases. Medellin (the capital city) reported 323 cases (16.4%) for a rate of 12.99 cases/100,000 pop. Eleven municipalities (high incidence at maps), reported >100 cases/100,000 pop. (Figure 1). The disease is concentrated in northwest municipalities (the whole central Urabá) of the department (neighbor municipalities) (Figure 1).

Data derived from these maps can be used to guide decisions for prevention and control of emerging health problems. Undoubtedly, Zika represents a significant issue in the region and the country, particularly in pregnant women and newborns [2, 3, 7]. And these maps should be used for counseling of travelers and pregnant patients who should be aware about the risk of infective mosquito biting. But also about the possibility of asymptomatic disease and the risk of disease transmission through sexual intercourse that should lead to the use of contraceptive barrier methods even weeks after visiting these areas, such as Antioquia [2, 3, 7]. A previous study assessed the basic reproduction

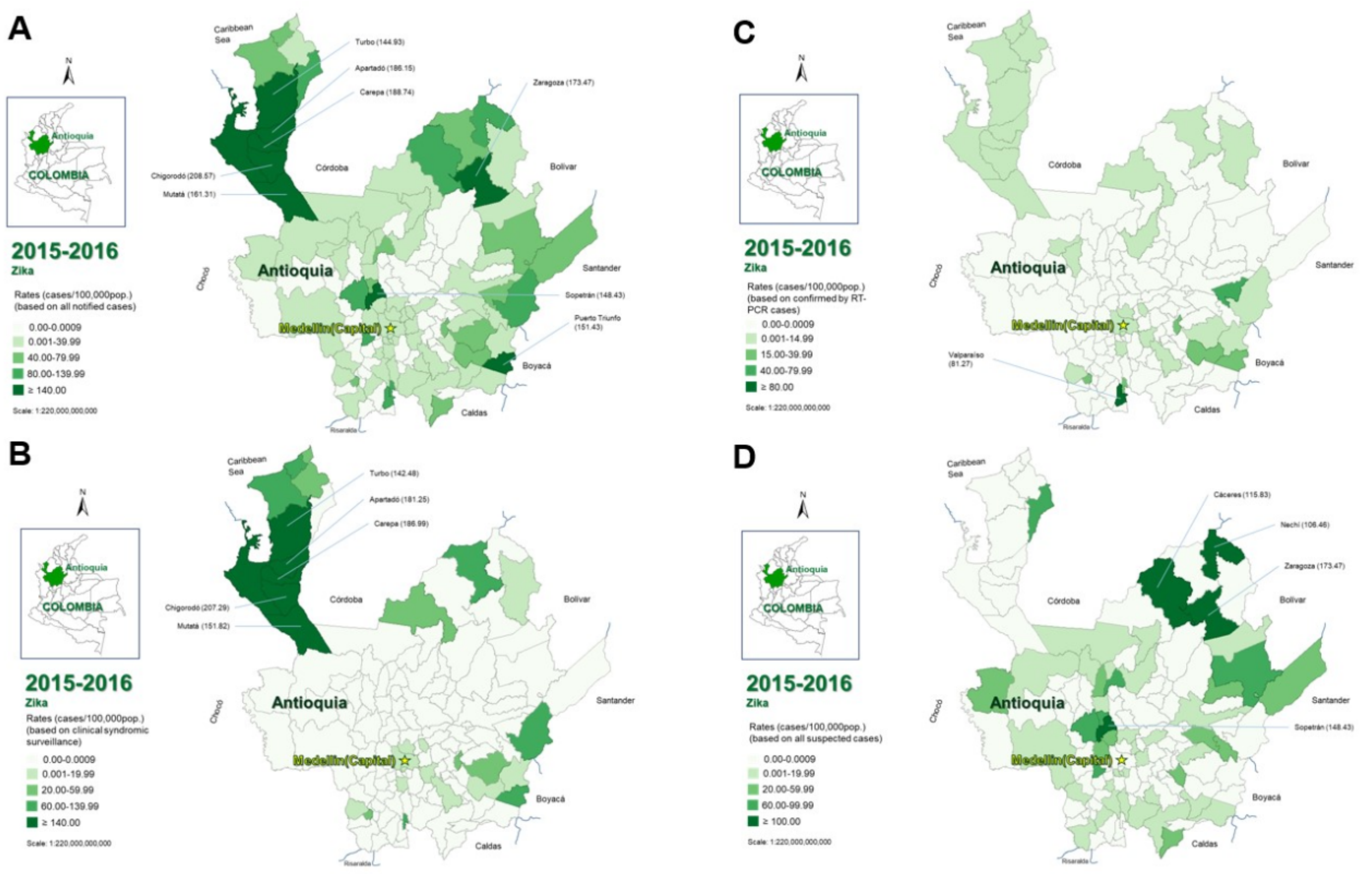

Figure 1 - Geographic distribution of Zika incidence rates (cases/100,000pop) in Antioquia department, Colombia, 2015-2016. A. Based on all notified cases. B. Based on clinical syndromic surveillance (clinical definition of fever, rash, conjunctivitis and arthralgias in a municipality with previously ZIKV circulation, at least one case confirmed by RT-PCR). C. Based on RT-PCR-confirmed cases. D. Suspected cases (clinical definition of fever, rash, conjunctivitis and arthralgias in a municipality without previously confirmed ZIKV circulation).

number (R_0) in Antioquia for this epidemic period, which was found as 1.12, but did not develop incidence maps [8]. For Colombia, a previous report indicated a R_0 ranging from 3.0 to 6.6, that study found that the Urabá had a R_0 between 1.1 to 5.0, consistent to the high incidence we found of >140 cases/100,000 pop [8] (Figure 1).

Colombia officially reported during 2015-2016, a total of 106,659 cases; 2.4% were from Antioquia department. Given the ecoepidemiological conditions of the department and particularly of the northwestern municipalities, these are becoming now endemic for Zika. Other factors, including environment and climate, as have been studied in another *Aedes*-borne disease, such as Dengue, are important in future studies [3, 9]. Public health policies and strategies, considering these conditions, for an integral control of Zika in people living, but also in travelers, in these areas, should be developed and urgently implemented [3, 5, 7, 8].

Use of GIS-based epidemiological maps allows to integrate preventive and control strategies, as well as public health policies, for joint control of this vector-borne disease in this area of the country [2, 6]. As Zika is transmitted primarily by *A. aegypti*, the Dengue and Chikungunya virus vector, maps of both infections as well for coinfections will be also needed [10, 11]. Finally, the availability of relevant information, to assess the risk of travelers with specific destinations, in highly transmission areas, is highly important for prevention advice. Even more, because they play also an important role in the virus spread, as occurred in Colombia and the Antioquia department during 2015-2016 [2, 3, 6, 10].

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