Assessing the burden of arboviral diseases using a multiplexed serological survey in French Guiana

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Objective

To assess the level of circulation of DENV, CHIKV, ZIKV, MAYV in French Guiana.

Introduction

Arboviral infections have become a significant public health problem with the emergence and re-emergence of arboviral diseases worldwide in recent decades [1-6]. Given the increasing number of cases, geographic spread, but also health, social and economic impact of arboviral outbreaks, estimating their true burden represents a crucial issue but remains a difficult task [7-10].

In French Guiana, the epidemiology of arboviral diseases has been marked by the occurrence several major dengue fever (DENV) outbreaks over the past few decades, recent emergences of Chikungunya (CHKV) and Zika virus (ZIKV) and the circulation of Mayaro virus (MAYV) [11-14].

Methods

To assess antibody seroprevalence against DENV, CHIKV, ZIKV, MAYV a random 2-stage household cross-sectional survey was conducted among the general population. We enrolled 2,697 individuals aged 1-87 years from June 1 to 12 October 2017. We performed detection of DENV, CHIKV, ZIKV, MAYV IgG antibodies on collected blood samples using a microsphere immunoassay (MIA). Socio-economic data, environmental variables and exposure to mosquitoes, perceptions of the illness and risk of contracting arboviral infections were collected using a standardized questionnaire administrated to all individuals included in the survey. Cross-reactivity between same families of viruses was taking into account using seroneutralisation and modeling approaches.

Results

Overall seroprevalence rates for antibodes against DENV were 69.5% [66.4%-72.5%] and differed significantly according to age and geographical area. Seroprevalence rates of CHIKV, ZIKV and MAYV antibodies were respectively 19.3% [16.5%-22.5%], 23.1% [19.5%-27.2%] and 9.6% [8.1%-11.3%] and did not differed significantly according to gender or age.

The distribution of seroprevalence rates for CHIKV, ZIKV antibodies differed from extrapolations obtained from routine surveillance systems and brings valuable information to assess the epidemic risk of future outbreaks. MAYV has been circulating in the southern part of FG, at levels that appear to be substantially higher than those estimated from epidemiological and virological surveillance.

Conclusions

Serological surveys provide the most direct measurement for defining the immunity landscape for infectious diseases, but the methodology remains difficult to implement particularly in the context of high cross-reactivity between flaviviruses or alphaviruses [15]. The development of reliable, rapid and affordable diagnosis tools and the use of innovative modeling approaches represent a significant issue concerning the ability of seroprevalence surveys to differentiate infections when multiple viruses co-circulate.

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