

Short Communication

Binational burden of American cutaneous leishmaniasis in Oiapoque, Amapá State, Brazil, bordering French Guiana

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Abstract

Introduction: American cutaneous leishmaniasis (ACL) is regarded as a public health problem in the Oiapoque basin, between Brazil and French Guiana. **Methods:** Data on ACL occurrence/epidemiological profile and etiology were sourced from Brazilian health services and a reference laboratory. Rainfall correlation was also analyzed. **Results:** Majority of the ACL cases were observed in adult men working as gold miners. ACL incidence peaks appeared to be linked to periods 2 months after the dry season. Migratory flow was found to be a non-negligible complicating factor in epidemiological surveillance. **Conclusions:** Binational strategies are required to minimize exposure for high-risk populations.

Keywords: Leishmaniasis. Binational. Public health.

The Oiapoque basin is in the Guianan Ecoregion Complex, where the Oiapoque River borders Brazil and French Guiana (FG). On the Brazilian side, the region is bordered by the state of Amapá, where the municipality of Oiapoque is the primary socioeconomic connection to the FG villages (**Figure 1**). In that region, American cutaneous leishmaniasis (ACL) is endemic¹ and is caused by at least three *Leishmania* species: *L. (Viannia) guyanensis* (81%), *L. (V.) braziliensis* (17%), and *L. (V.) lainsoni* (2%)². In this study, we aimed to present several epidemiological aspects of ACL in Oiapoque and its traits as a binational burden.

Primary data were sourced directly from epidemiological records located in the public health services offices (Brazilian side). Patients also sought ACL diagnosis at the Ralph

Lainson's Leishmaniasis Lab (Instituto Evandro Chagas [IEC], Ananindeua, Pará State, Brazil), where parasite isolation/characterization was performed according to previously established methodology^{3,4} (ethical approval CAAE: 57710416.2.0000.0019). Monthly average rainfall data were obtained from the Oiapoque Meteorological Station-A242 and ACL monthly/annual prevalence was obtained by searching the database of the Agency for Surveillance Coordination in Health of the Amapá State Health Secretary. The relationship between ACL occurrence and rainfall was evaluated with Pearson's correlation coefficient using the Past Software Package (Øyvind Hammer, Oslo, Norway), Version 3.22. The significance level was set at 5%.

During 2008-2017, a total of 1,299 new ACL cases were documented by the health services in Oiapoque (an average of 118 cases/year), with 560 cases being demonstrated to be autochthonous for the municipality (average of 50 cases/year). An increasing number of ACL cases (n = 187) were observed in 2014; however, the greatest number of autochthonous cases was observed in 2012 (n = 86).

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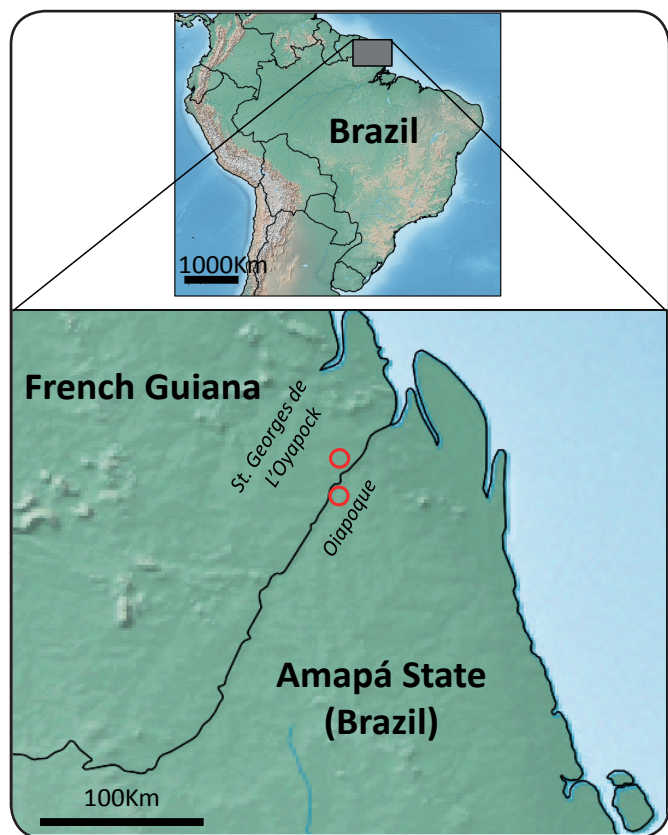


FIGURE 1: Map showing the border area of the Oiapoque basin, between the Brazilian State of Amapá and French Guiana, and the main closely-related villages/municipalities.

The frequency of ACL cases was greatest in December, January, February, March, and April, with these months accounting for 75% of the annual cases. Rainfall showed a moderate correlation with ACL occurrence ($r = 0.646$; $p = 0.0262$) (**Figure 2**). Climate is usually attributed as a non-negligible explanatory factor for monthly ACL fluctuations, but

strong correlations are not expected since there is a natural gap between transmission and diagnosis (incubation period ranging from 2 to 3 months)³. In FG, a decrease in rainfall is linked to an increase in ACL cases 2 months later⁵. Here, it was not possible to determine a relevant correlation, but graphical observations demonstrated a delay of 2 months between a dry period and ACL peaks. There is a reasonable explanation for this trend: In October, for instance, decreased rainfall can provide suitable conditions for forest activities and ecotourism, consequently raising the risk for human infection. The infected patients, therefore, seek a diagnosis after the appearance of lesions, 2 to 3 months later, coinciding with increased ACL statistics in January.

Due to the particular border characteristics of Oiapoque, ACL epidemiology is a mosaic of “binational” infections, reflecting in half of ACL notified cases being autochthonous from Brazil and the other half probably imported from French Guiana. The majority of the “imported” ACL cases are presumed to be from FG gold mines. Despite this finding, the proportion of autochthonous cases seems to be increasing slightly, as shown in the linear tendency in **Figure 3**. The rise can be attributed to a real increase in cases due to demographic growth or simply to the natural optimization of diagnostic/notification strategies in Oiapoque.

Thirty-five localities were declared as probable infection sites, most of them ($n = 25$) in the upper Oiapoque region. The localities with a concentration of ACL cases were the gold mines of Kuata (9.04%), D21 (8.04%), Anarry (6.28%), and Sikini (5.52%), all of which are located in FG territory. On the Brazilian side, ACL occurred in many localities, contributing to a dilution of frequencies, thus making it difficult to identify hotspots. Nevertheless, the gold mine of Cricou (2.51%), and the village of Vila Brasil (2.26%) stood out.

Gold miners comprised 49.14% of positive cases, followed by agriculturists (small farmers, 8.54%) and students (7.26%). Men (78.94%) aged 21 to 50 years comprised the majority

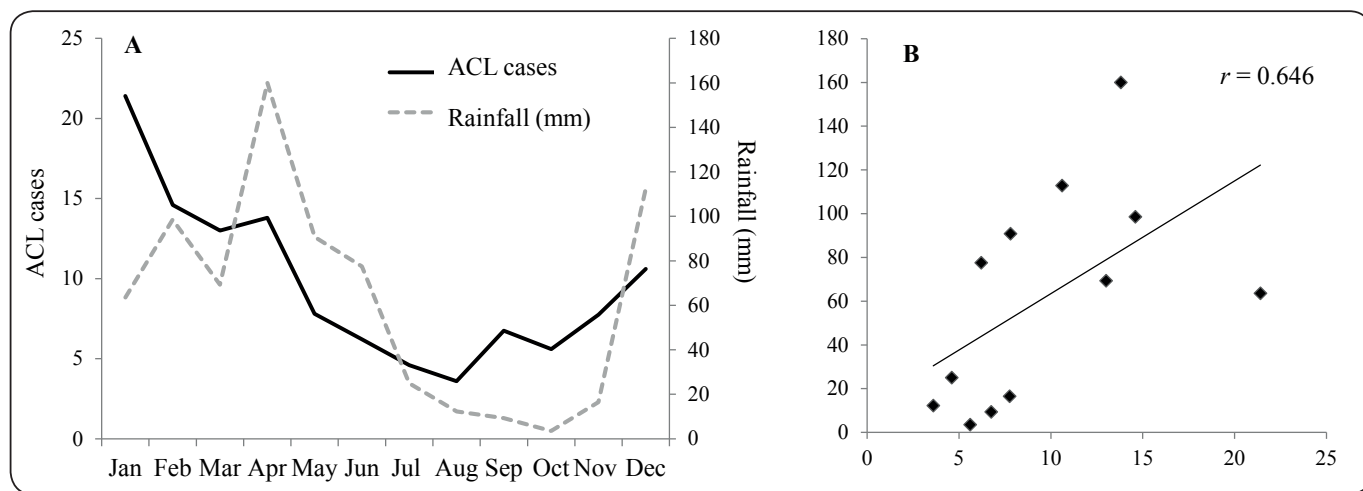


FIGURE 2: (A) Average monthly frequency of American cutaneous leishmaniasis cases and rainfall (B) with linear regression between ACL/rainfall fluctuations (2008-2017).

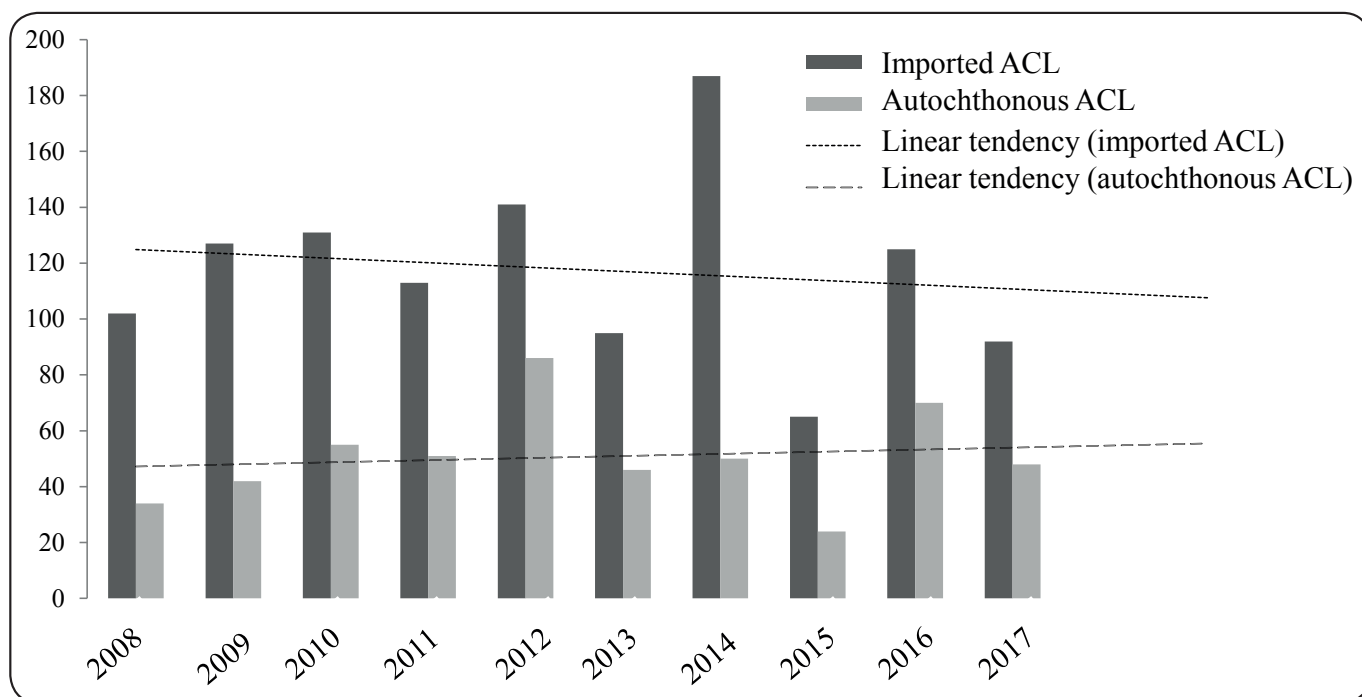


FIGURE 3: Annual fluctuation of autochthonous and imported American cutaneous leishmaniasis cases and linear tendency during a 10-year period (2008-2017).

of confirmed cases. In Saint Elie (FG), approximately 90% of patients were illegal workers originating from the poorest northern Brazilian states⁶. Official data on the population of Oiapoque indicates 25,514 inhabitants in 2017. Unpredictable fluctuations in the illegal migrant population may be biasing the estimation of ACL incidence, but no consideration was given to this issue.

Occasional mucosal infections were reported in Oiapoque, mainly during the last 2 years, but *Leishmania* isolation/characterization was not attempted. A supposed emergence of ACL due to *L. (V.) braziliensis*^{2,7,8} could explain this clinical-epidemiological profile. Alternatively, mucosal leishmaniasis due to *L. (V.) guyanensis* has been debated, and at least six cases have already been documented in FG⁹. Conversely, all *Leishmania* strains of ACL patients from Oiapoque attended in the IEC were isolated from cutaneous forms due to *L. (V.) guyanensis* (FT Silveira, personal observation) and the Oiapoque mucotropic parasite's identity remains speculative. Ecoepidemiology of *L. (V.) braziliensis* in the Oiapoque basin is poorly understood to date. Despite several records of human cases since the 1980s in FG^{2,7,8} and so far officially reported for Amapá State³, no phlebotomines or mammals were observed to be infected by that parasite in these two bordering territories/states. Putative vectors, *Psychodopygus wellcomei*, *Ps. complexus*, and *Nyssomyia intermedia/Ny. neivai*, have not been documented in the bordering region¹⁰. Even though *Nyssomyia whitmani* was reported, this fly is rarely present and there is strong evidence that this species is more likely to be associated with *L. (V.) guyanensis* transmission in the Amazon/Guianan ACL scenario¹¹.

Adult men exposed in the forest gold mines of the upper Oiapoque proved to be the majority of ACL patients treated

by Brazilian health services, as has been suggested earlier. ACL incidence peaks seem to be linked to periods 2 months after the dry season. Information provided in the present communication may be useful for the establishment of preventive measures under binational responsibility. Surveillance strategies are needed, primarily to minimize exposure for high-risk populations, particularly in strategic areas, such as international borders.

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Conflict of Interest: The authors declare that there is no conflict of interest.

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