

Mapping *Plasmodium vivax* dispersal in the main malaria hotspot of Brazil: an epidemiological and molecular surveillance study

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Plasmodium vivax malaria remains endemic in the Brazilian Amazon despite control efforts. Four municipalities in Juruá Valley have high-transmission areas (>50 cases per 1,000 inhabitants). We combine epidemiological and molecular surveillance to map *P. vivax* transmission in the main malaria hotspot of Brazil. We analyze epidemiological data from 54,000 cases of laboratory-confirmed *P. vivax* malaria notified between 2018 and 2021 along with amplicon sequencing data from 207 local *P. vivax* isolates. We characterized putative parasite sources and sinks and assessed pairwise parasite relatedness by estimating genome-wide identity by descent (IBD). We introduce the C_{50} metric (number of edges connecting samples with an IBD threshold of 50%) as a measure of parasite connectivity. 9,759 (18.0%) of the *P. vivax* infections notified in Juruá Valley during the study period were imported and two thirds of the imports originated from localities within the municipality of residence, with predominantly rural-to-urban parasite flow. The local *P. vivax* population comprised a large proportion of genetically related parasites (93.2% sharing $\geq 25\%$ IBD). The relatedness network (IBD 50%) comprised a large cluster with 160 isolates (77.3% of the total) from the town of Mâncio Lima and surrounding rural localities, sampled between 2018 and 2021, consistent with the circulation of closely related parasite lineages across time and space. A recent overnight stay outside the locality of residence was associated with an 87.8% increase (CI, 25.6 to 180.8%) in *P. vivax* connectivity, while adjusting for potential confounders. Because *P. vivax* lineages from patients reporting a recent overnight trip are likely to be imported, we hypothesize that imported infections are more connected compared to locally acquired infections. We provide a detailed landscape of *P. vivax* dispersal in a key malaria hotspot of Brazil, informing tailored interventions to advance elimination efforts in the region.

Funding: Fundação de Amparo à Pesquisa do Estado de São Paulo, Brazil (FAPESP; 2022/11963-3 and 2023/15369-1) and Conselho Nacional de Desenvolvimento Científico e Tecnológico of Brazil (CNPq; 303039/2024-8).

Keywords: malaria surveillance; *Plasmodium vivax*; molecular genotyping; Brazilian Amazon