

## Research gaps and challenges for malaria control in Brazil

Malaria is one of the main infectious diseases for which decades of intensive control efforts have met only partial success in Brazil (Barreto ML et al. *Lancet* 2011; 377:1877-89). Massive human migration to the Amazon Basin from 1970 to the mid-1980s, encouraged by agrarian settlements and mining projects, led to an explosion in malaria incidence, with 600,000 laboratory-confirmed infections in 1995. Nearly 350,000 malaria cases are still reported each year in Brazil, 99.9% of which in the Amazon Basin. Malaria transmission typically clusters in mining and logging camps and farming settlements, which not only cause massive environmental changes (such as deforestation) that alter vector biology and favor malaria transmission, but also attract non-immune migrants to areas full of natural vector breeding sites.

Despite the emerging consensus that “*public health needs to be evidence-based if it is to be done correctly*” (Eriksson C. *Scand J Public Health* 2000; 28:298-308), translating scientific evidence into malaria control interventions is still a major challenge in Brazil. Malaria control currently focuses on early diagnosis and treatment of clinical cases to reduce transmission and morbidity; a large network of malaria diagnosis outposts provides free microscopy-based diagnosis and treatment of laboratory-confirmed infections. However, vector control measures, particularly cyclical spraying of houses with insecticides, were gradually phased out over the past decade, and little locally generated research has addressed alternative tools or interventions that could improve current control strategies. Insecticide-treated bednets (ITBNs) are an example: although large-scale ITBN trials in Africa and Asia have demonstrated the efficacy of this intervention, the varied biting behavior of malaria vectors is a source of effect modification that severely affects the external validity of these trials and requires their local validation. Since antimalarial drug resistance patterns are also regional, therapies that have proven highly effective in some endemic settings may fail in others and must also be locally evaluated.

An additional example of a major gap in Brazil's malaria research agenda is the need for improved strategies to identify and treat asymptomatic reservoirs of infection. Nearly all malaria infections in Brazil are identified through either active or passive case detection (ACD and PCD, respectively), which relies on the presence of fever to diagnose the infection. A major limitation of ACD and PCD is that asymptomatic infections (usually associated with very low levels of parasitemia, often missed by conventional microscopy-based laboratory diagnosis) go undetected and untreated. In addition, because the clinical spectrum of symptomatic malaria in semi-immune Amazonians ranges from very mild illness to full-blown disease, ACD- and PCD-based strategies deal with a heterogeneous disease in which fever and cyclical paroxysms, the hallmark of textbook malaria, are not necessarily prominent features.

The paucity of scientific evidence to support current malaria-control interventions in Brazil is particularly surprising for a middle-income country with relatively well-developed research capability. This situation calls for an enhanced partnership between researchers and decision-makers in order to deal effectively with the country's challenges in this area.

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