

Longitudinal trends in the epidemiology and transmission of *P. falciparum* and *P. vivax* in East Sepik, Papua New Guinea after improved malaria control efforts

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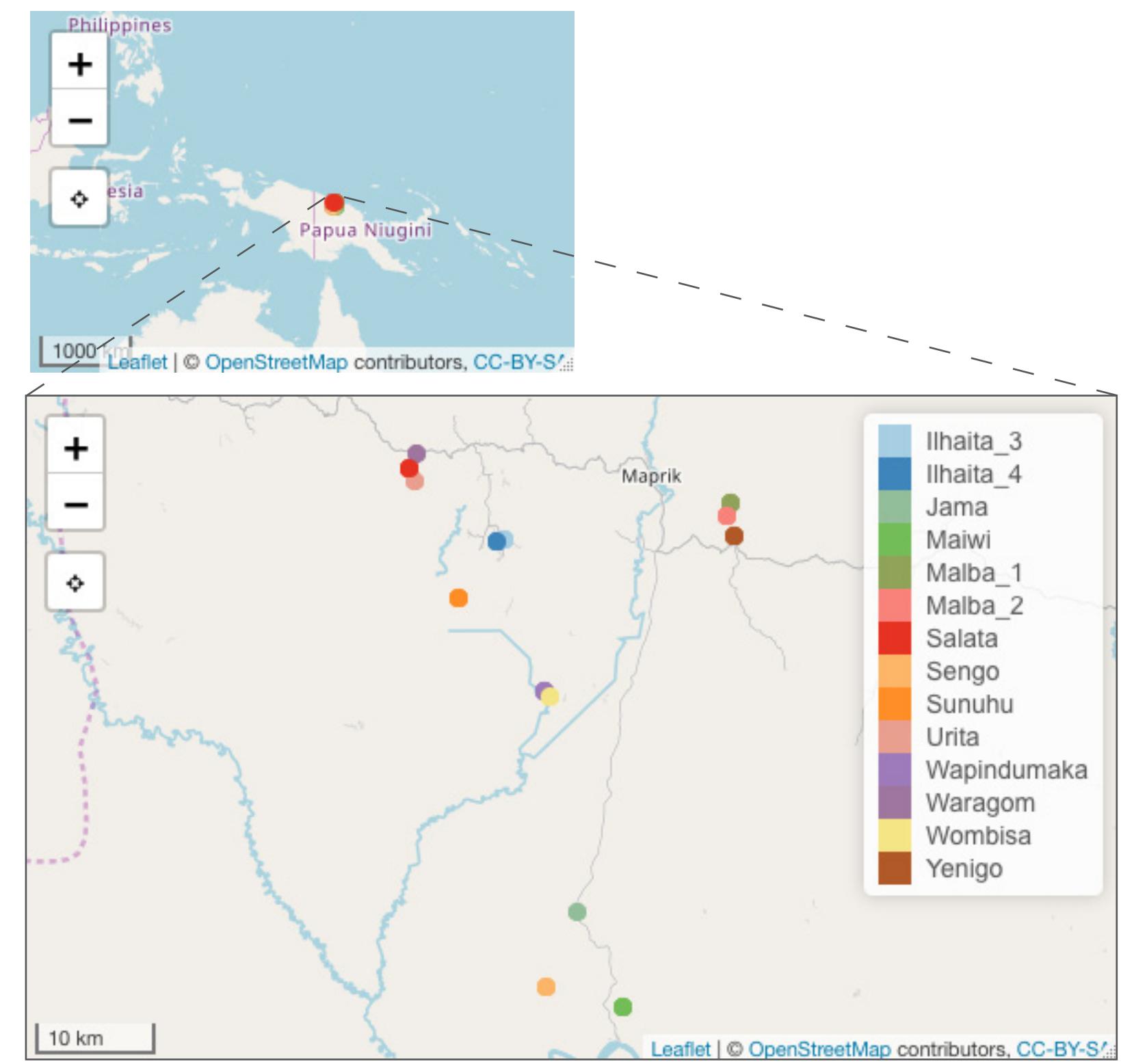
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Background

- Over the past 12 years, national malaria control efforts in Papua New Guinea (PNG) have received renewed support
- The scale-up of control involved nationwide distribution of free long-lasting insecticidal nets (LLINs) in 2005 and implementation of artemisinin-combination therapy in 2012
- It is critical to understand the effects of improved control on malaria prevalence in PNG to ensure continued and targeted interventions are in place to achieve the goal of regional malaria elimination in 2030

Methods

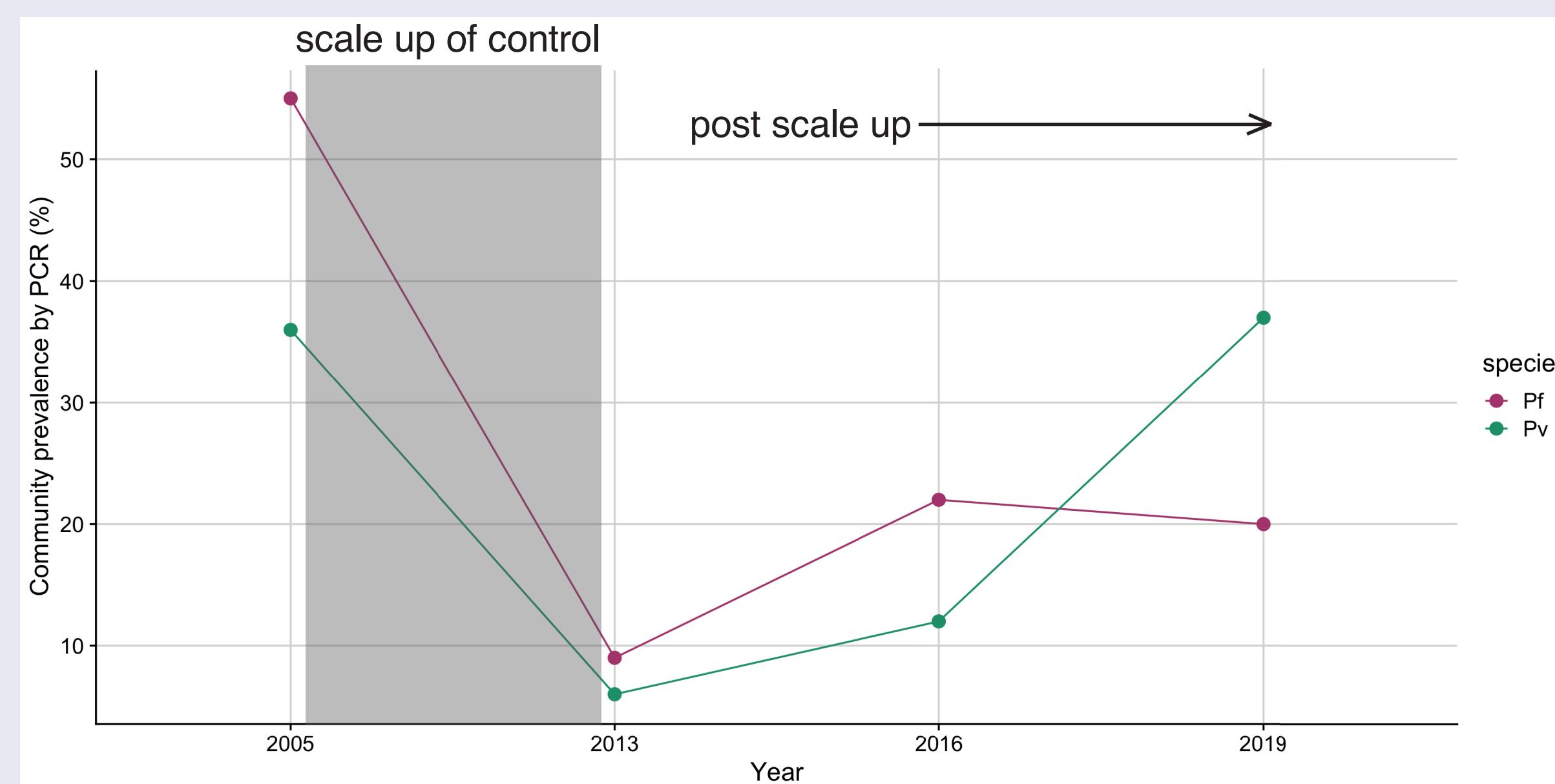
- Cross-sectional surveys were conducted in 2005, 2013, 2016 and 2019 across 14 villages in East Sepik province, PNG
- Surveys combined sensitive molecular diagnosis of infections (light microscopy and qPCR) as well as genotyping with demographic, clinical and spatial data
- Individuals of all ages were surveyed in 2005 (N=2,527), 2013 (N=2,486), 2016 (N=1,893) and 2019 (N=2,535)
- Molecular diagnosis of *Plasmodium* spp was determined by 18s rRNA qPCR using both the pan-species and species-specific assays as described in Rosanas-Urgell (2010)
- All preliminary analyses were conducted in R v3.6.2



Preliminary results

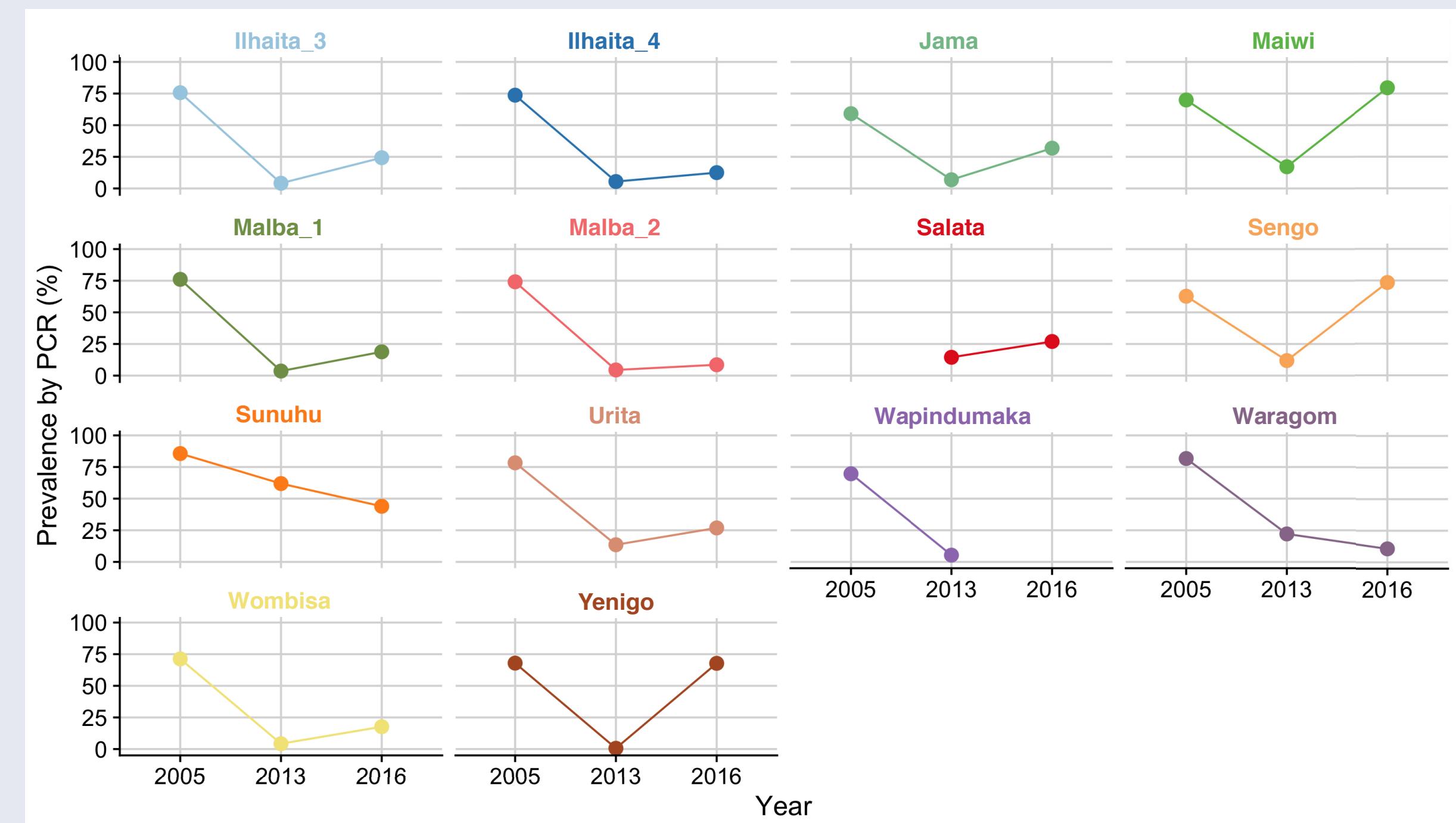
Community prevalence trends show a rebound of *P. vivax*

Between 2013 and 2016, the prevalence of *P. falciparum* increased to 22% in 2016 and remained relatively stable in 2019 (20%). For *P. vivax*, however, prevalence increased to 12% in 2016 and reached >30% in 2019, similar to the community prevalence before the scale-up.



Malaria resurgence in 2016 was spatially heterogeneous

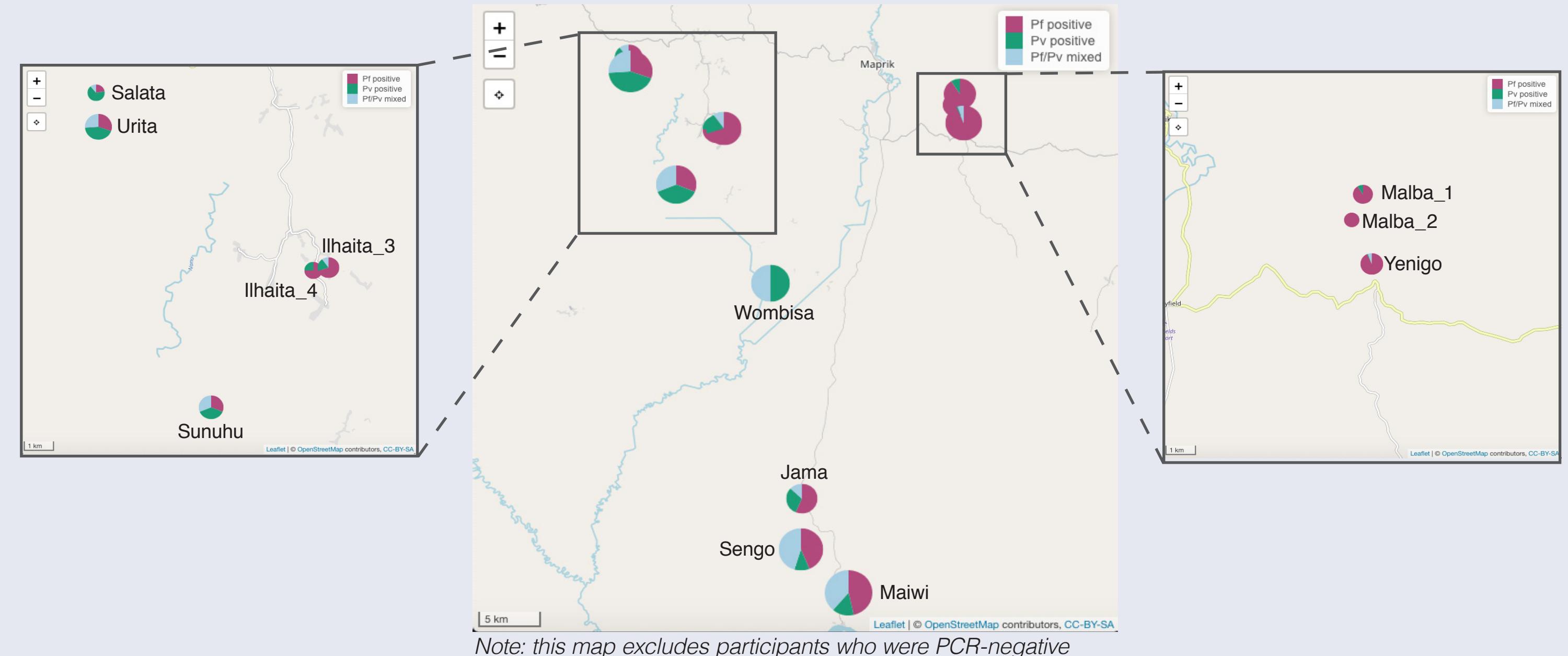
By 2016, the prevalence of *Plasmodium* spp had returned to pre-control levels in Maiwi, Sengo and Yenigo. Prevalence increased from 2013 to 2016 in Ilhaita_3, Ilhaita_4, Jama, Malba_1, Malba_2, Salata, Urita and Wombisa, whereas it continued to decrease in Sunuhu and Waragom after the implementation of control efforts.



Resurgence of *P. falciparum* and *P. vivax* in 2016 varied by village

Overall the highest prevalence of infection in 2016 was observed in Maiwi (80%) followed by Sengo (78%) and Yenigo (70%). The lowest prevalence was observed in Malba (9%) followed by Waragom (11%).

In 2016, when only examining participants with *Plasmodium* spp infections, the species composition of *P. falciparum* and *P. vivax* differed by village. Infections caused by *P. falciparum* predominated in Malba_1, Malba_2, Yenigo, Ilhaita_3, Ilhaita_4 and Jama. By contrast, infections caused by *P. vivax* predominated in Salata, Urita and Sunuhu. Mixed infections (*Pf/Pv*) were detected in 70% (9/13) of the villages surveyed in 2016.



Conclusions and future directions

- The immediate impacts of intensified control resulted in an overall decrease in malaria prevalence in East Sepik (Kattenberg et al 2020), however, more recently a heterogenous resurgence of both *P. falciparum* and *P. vivax* has been observed in PNG communities
- A more in-depth analysis of data from the 2019 survey is still underway, including a further examination of the rebound of *P. vivax* with respect to individual-level risk factors (i.e., age), spatial heterogeneity, complexity of infection, and parasite genetic diversity to better understand the factors underlying malaria resurgence
- The findings from this study will identify key risk factors and guide the targeted implementation of control strategies to ensure progress towards the goal of malaria elimination by 2030

References and acknowledgments

- Kattenberg JH, Lautu-Ninda D, Ome-Kaius M, Karl S, Kiniboro B, Phillip M, Jally S, Kasian B, Sambale N, Siba PM, Barry AE, Felger I, Kazura J, Mueller I, Robinson LJ: Epidemiology and transmission of *P. falciparum* and *P. vivax* in East Sepik Province, Papua New Guinea, pre- and post-implementation of national malaria control efforts. *Malaria Journal* 2020, 19:198.
- Rosanas-Urgell A, Betuela I, Barnadas C, Iga J, Zimmerman PA, del Portillo HA, Siba P, Mueller I, Felger I: Comparison of diagnostic methods for the detection and quantification of the four sympatric *Plasmodium* species in field samples from Papua New Guinea. *Malaria Journal* 2010, 9:361.

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