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Medical Research. Practical Action.

Identifying cases of malaria and asymptomatic infections along the Vietnam-Cambodia border using loop-mediated isothermal amplification (LAMP) and geospatial localisation

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Amari Watergate Bangkok

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A Global and Regional Problem

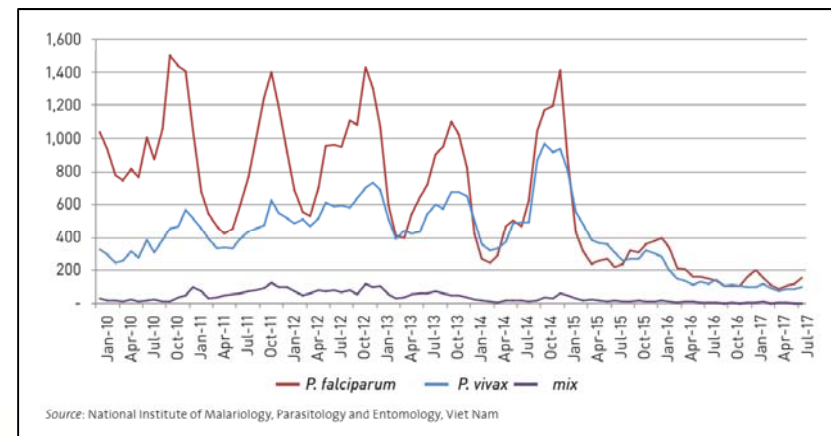
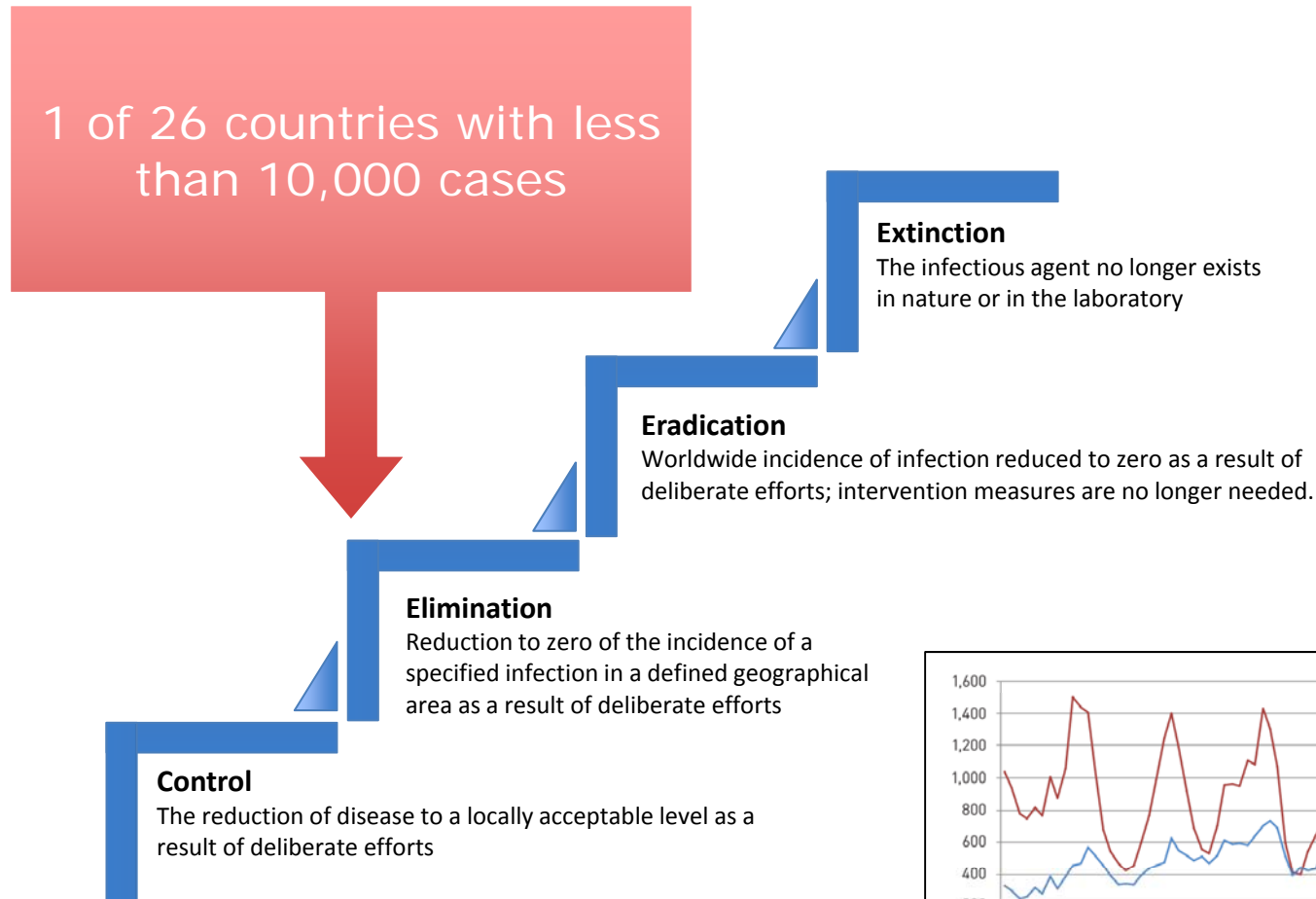


219 mil
cases
worldwide

8% cases
in SEA and
West
Pacific
Regions

Viet Nam:
~ 3,000 Pf
~ 2,000 Pv

Viet Nam is currently on Elimination step

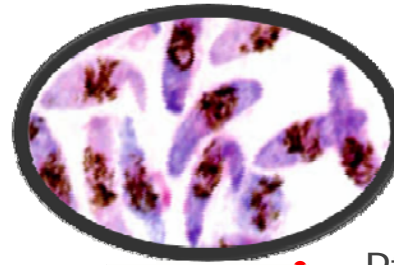


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1998.
W. Dowdle. Bull WHO 1998.

Challenges



- Outdoor feeding
- Resistance to insecticide



- Pf, Pv mainly
- Pm, Po, Pk

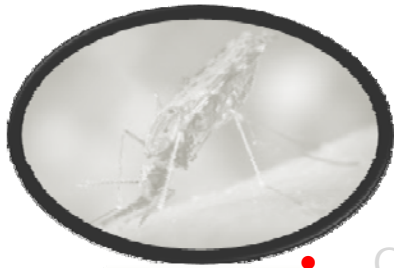


- Resistance to Artemisinin
- Resistance to partner drugs
- Fake medicines



- Forest workers and Plantation workers
- Migration
- Asymptomatic infections
- Drug compliance

Challenges



- Outdoor feeding
- Resistance to insecticide



- Pf, Pv mainly
- Pm, Po, Pk

EFFECTIVE SURVEILLANCE IS ESSENTIAL



- Resistance to Artemisinin
- Resistance to partner drugs
- Fake medicines



- Forest workers and Plantation workers
- Migration
- Asymptomatic infections

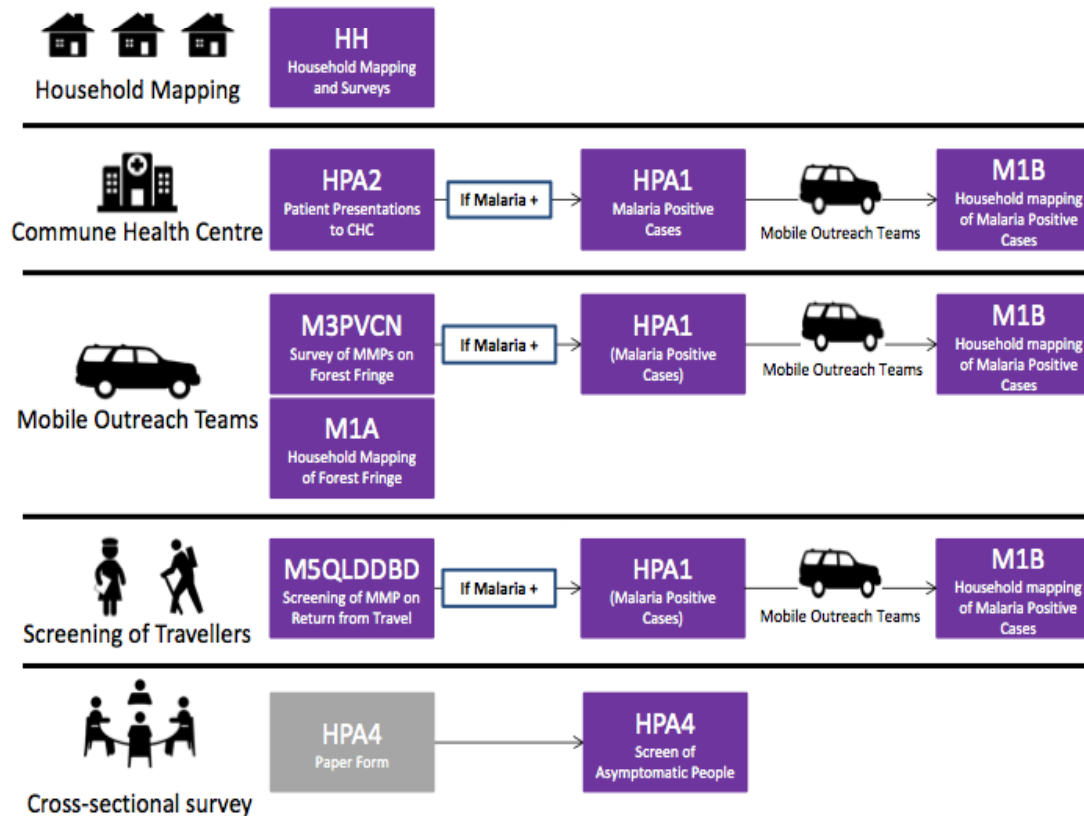
Spatial Decision Support System – Key Components

- Geographical reconnaissance mapping, data collection and enumeration using integrated PDA/GPS devices
 - Household GR
 - Remote-Area GR
- Automated applications designed to help programs conduct priority activities
 - High resolution surveillance
 - Passive / Active case detection and reporting
 - Malaria foci classification and targeted response
 - Intervention management
 - e.g. LLIN distribution and IRS



Regional Artemisinin-resistance Initiative (RAI)

- Global fund project (completed Dec 2017):



Epicollect 5 proved to be an effective tool

Geolocation

X Quit HOUSE...
< Prev Next >

HGD

1. Điểm định vị: hộ gia đình
(Positioning points)

Update location

Latitude	-37.804959
Longitude	144.981327
Accuracy	182

Head of household

X Quit HOUSE...
< Prev Next >

HGD

6. Họ và tên chủ hộ (respondent name)

** This field is required*

Type answer here...

No. in HH

X Quit HOUSE...
< Prev Next >

HGD

7. Số người trong gia đình (no. people)

Min: 1 Max: 20

6

Spraying and nets

X Quit HOUSE...
< Prev Next >

HGD

8. Năm 2016 đến hiện tại tại nhà a/c có được phun, tẩm hóa chất diệt muỗi (Phun=1; Tẩm =2; Phun và tẩm =3; Không =4; Không biết=5)

Min: 1 Max: 5

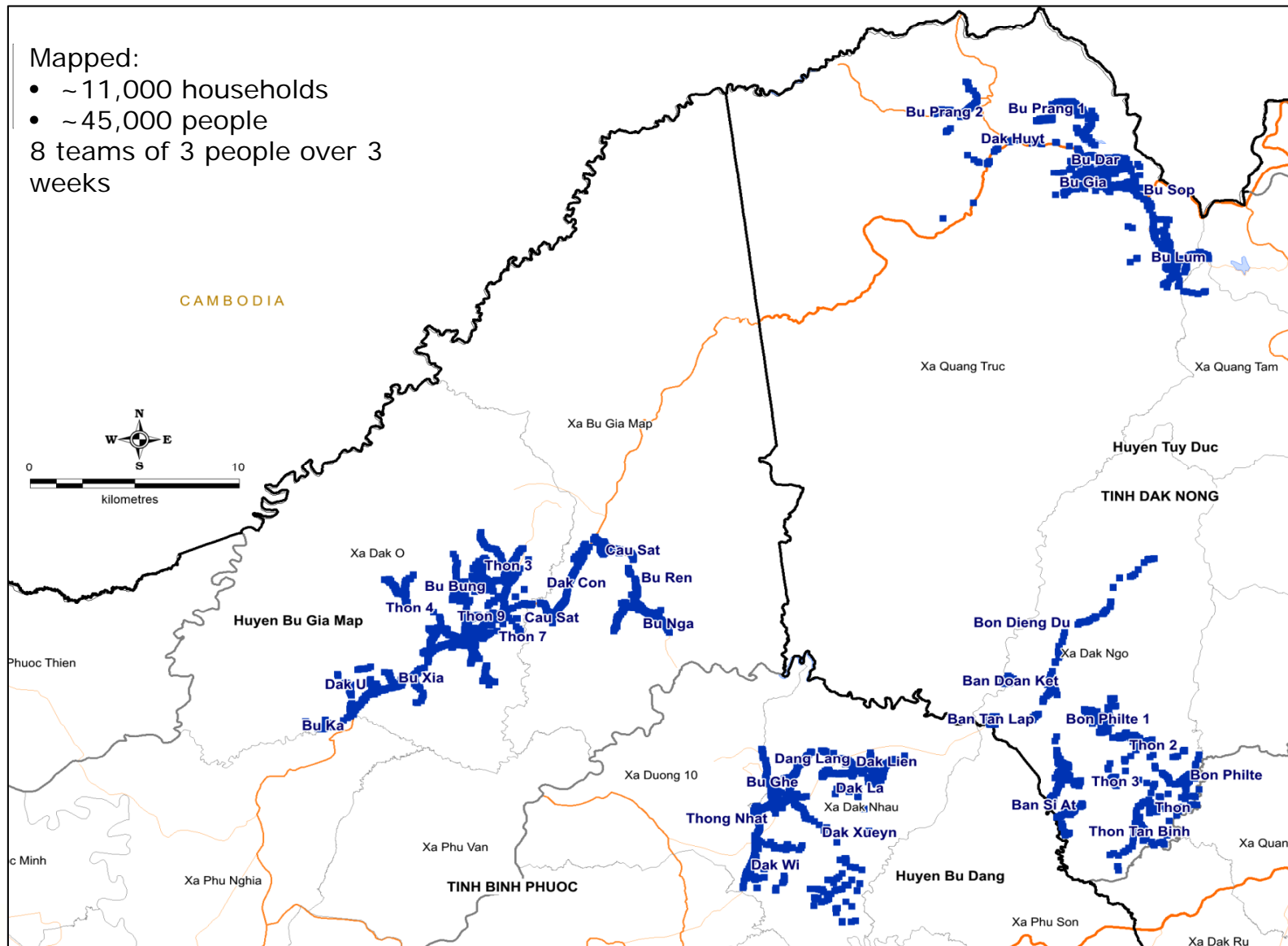
Type answer here...



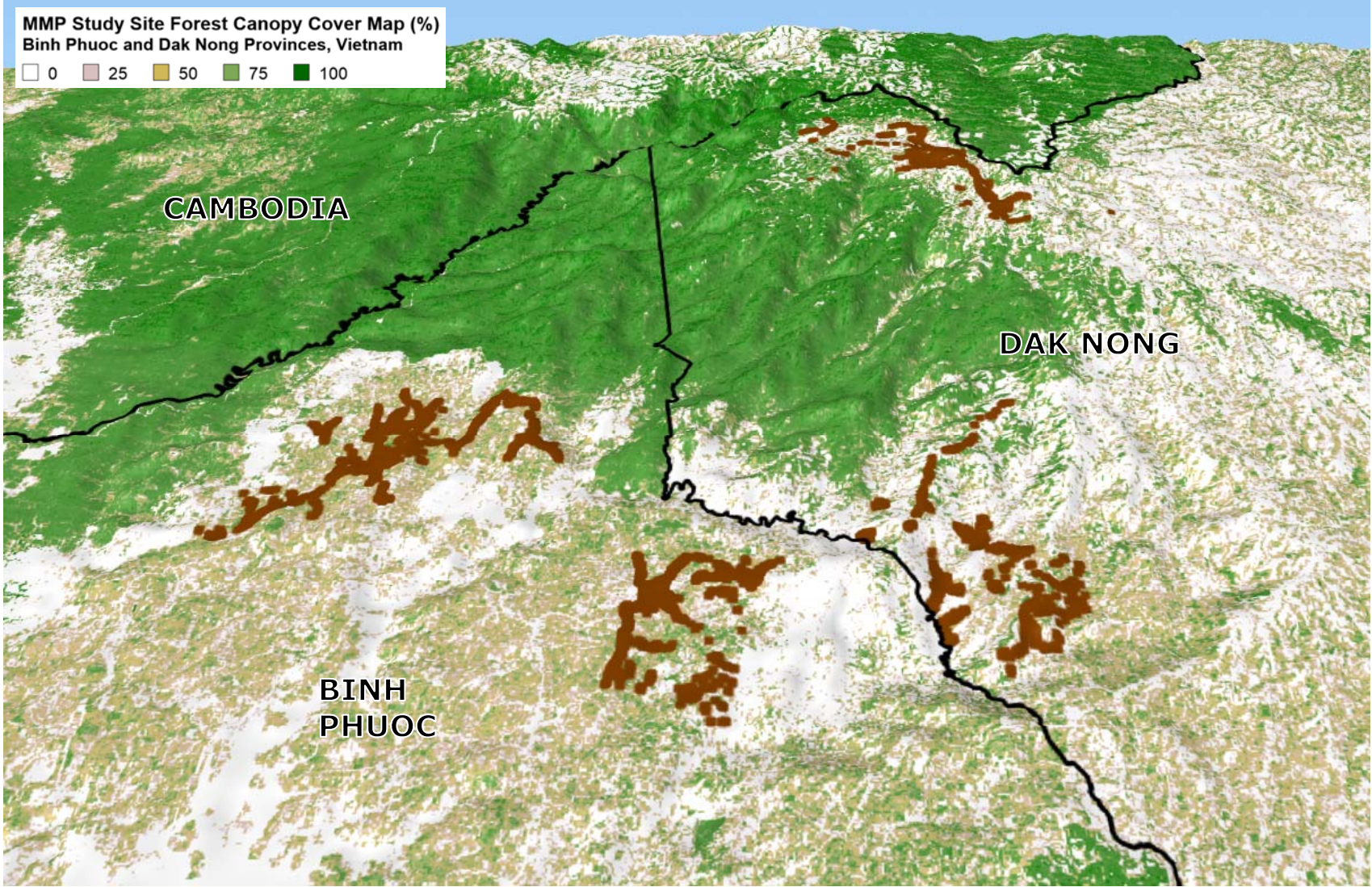
Household mapping

Mapped:

- ~11,000 households
 - ~45,000 people
- 8 teams of 3 people over 3 weeks



Forest cover map reveals the extent of the forested area

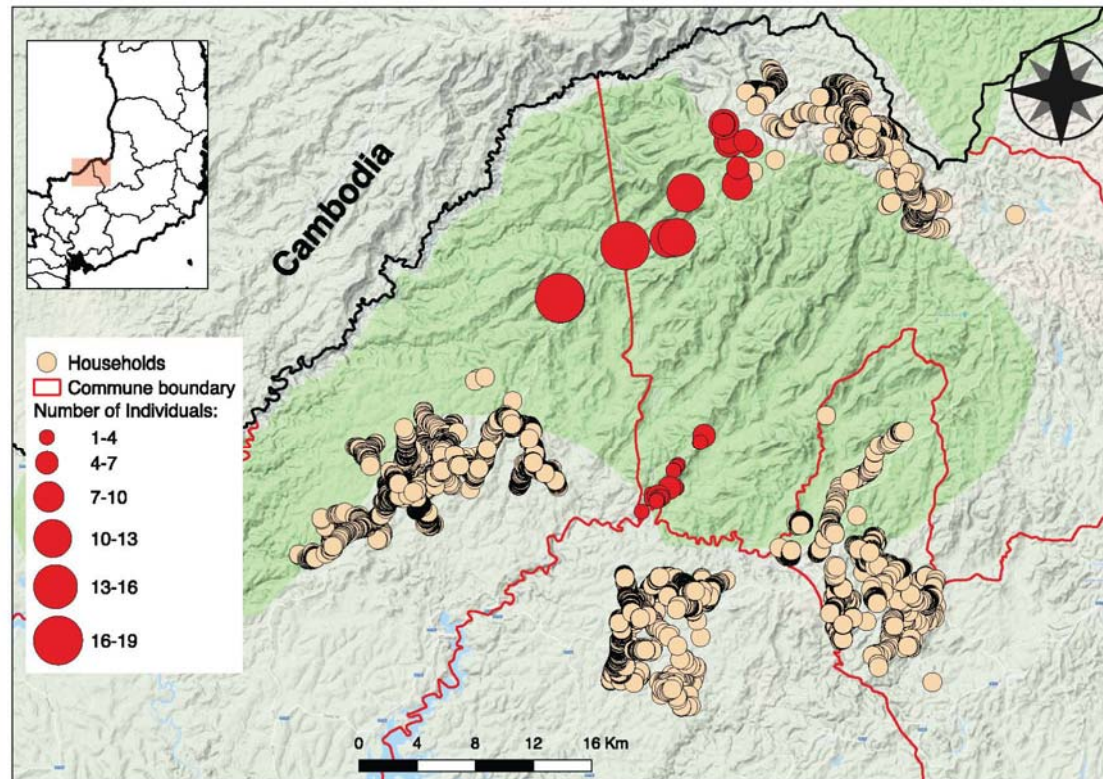


Mapping and tracking Forest Workers

Malaria often occurs among forest workers, mobile and migrant populations

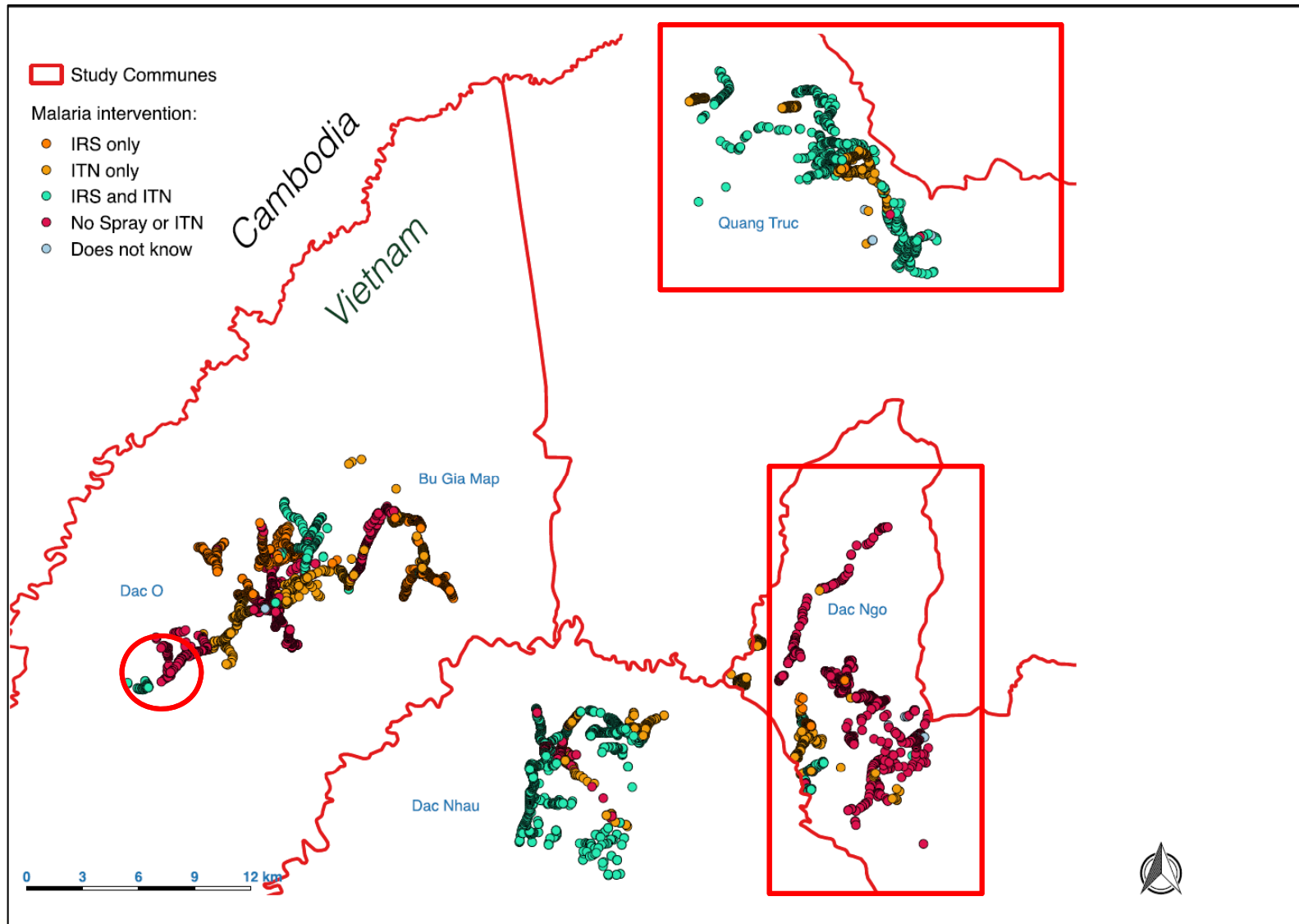
Established Mobile Outreach Teams (MOTs):

- 2 Commune Health Workers
- 1 Village Health Worker

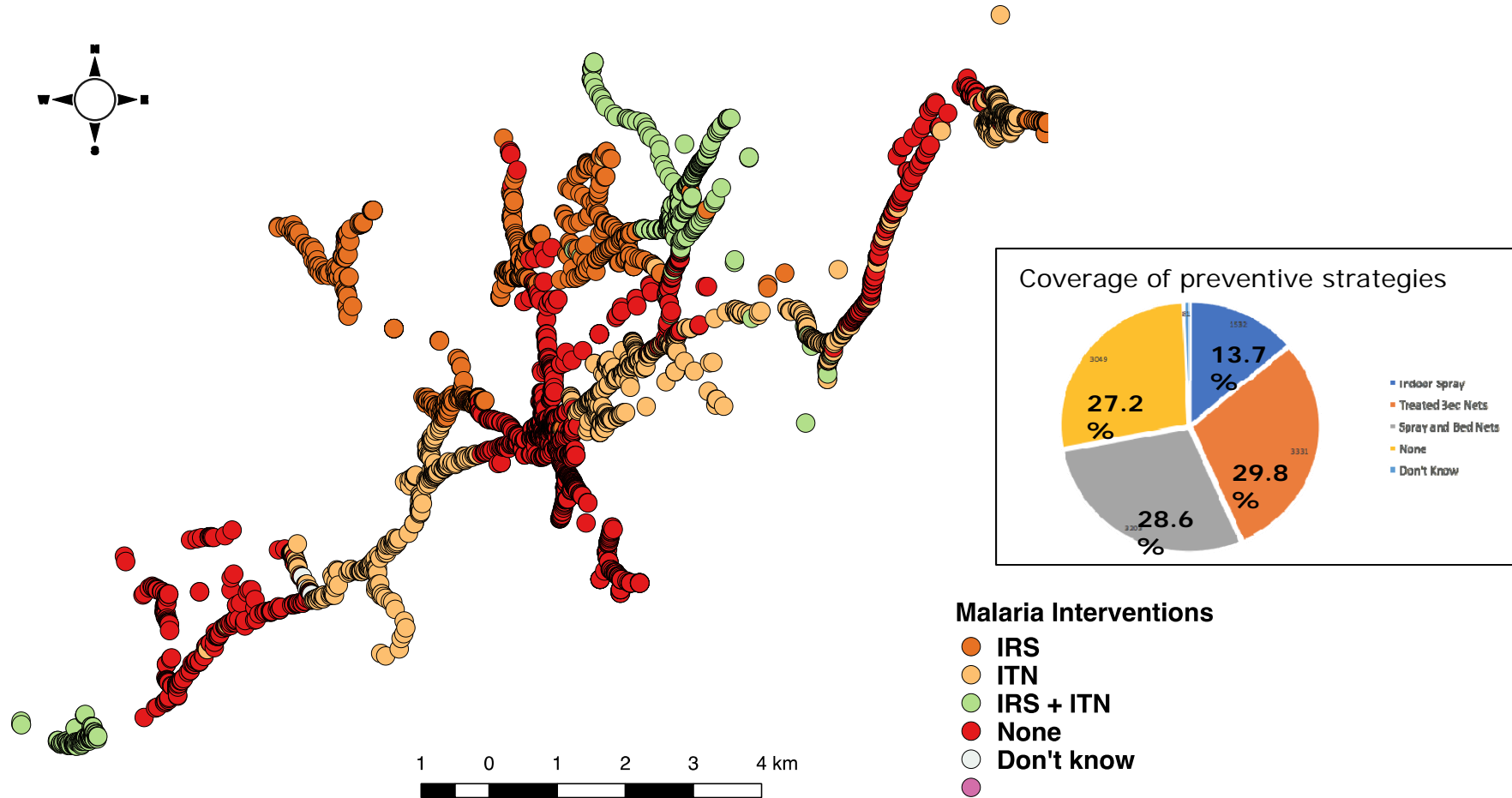


Located 2,699 MMPs (5.18% of the local population)
Tested 1,977 with RDT (0.56% positive)

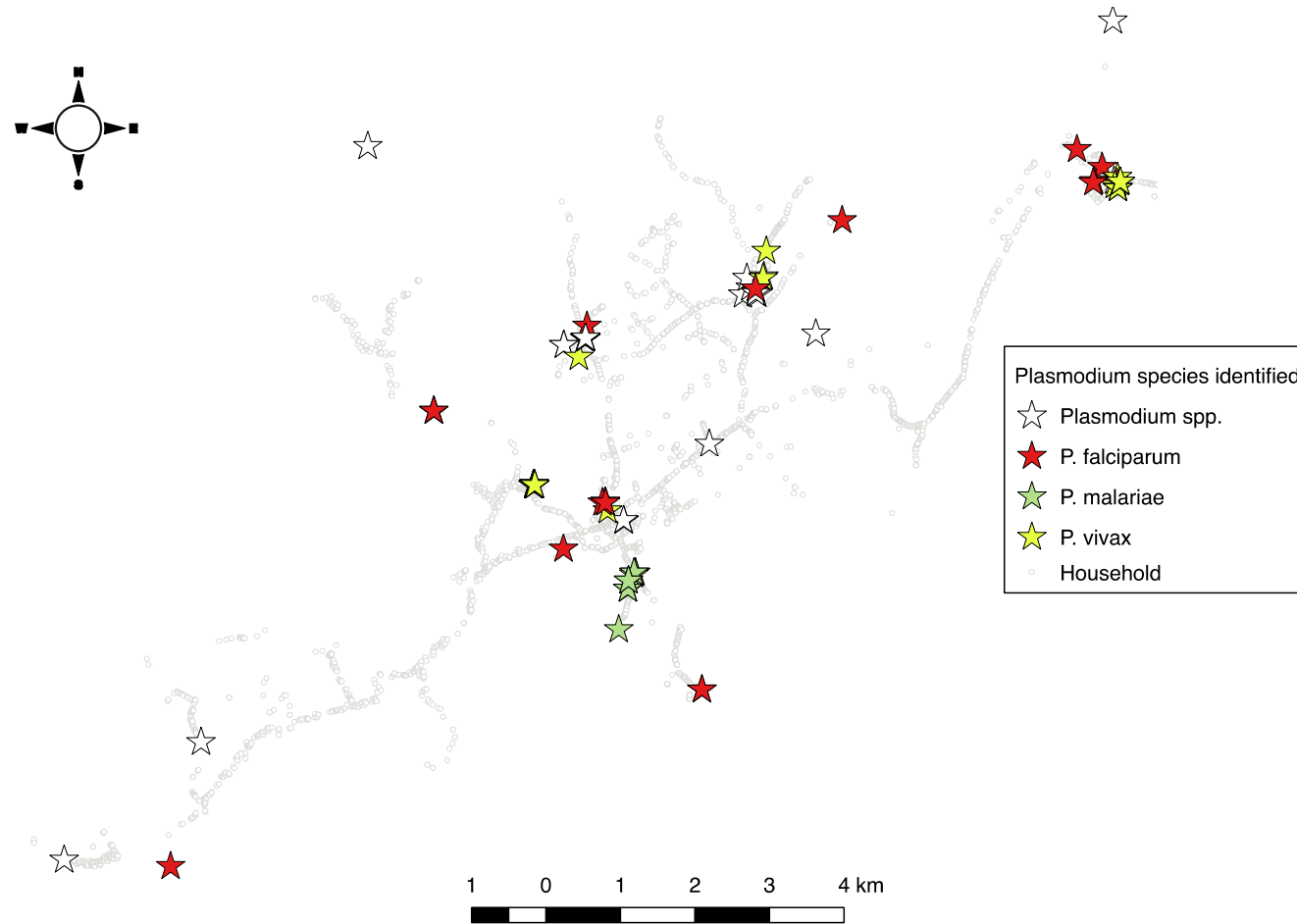
Map of Malaria Interventions



A more detailed look at the interventions

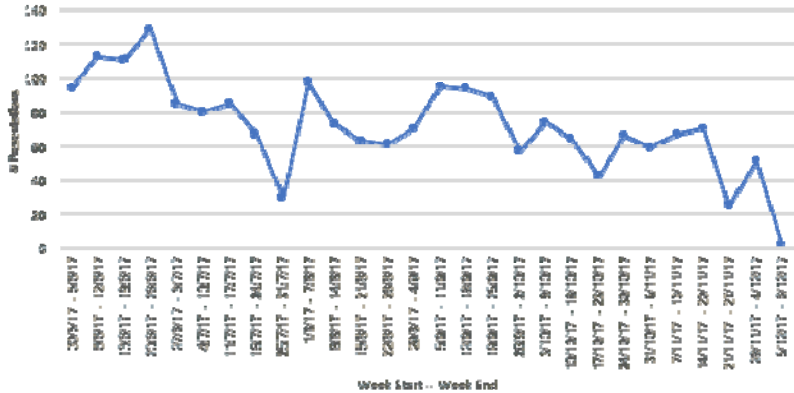


Clinical cases over the whole study period in Dak O



Real-time monitoring of Malaria clinical cases

No. of clinic fever cases per week

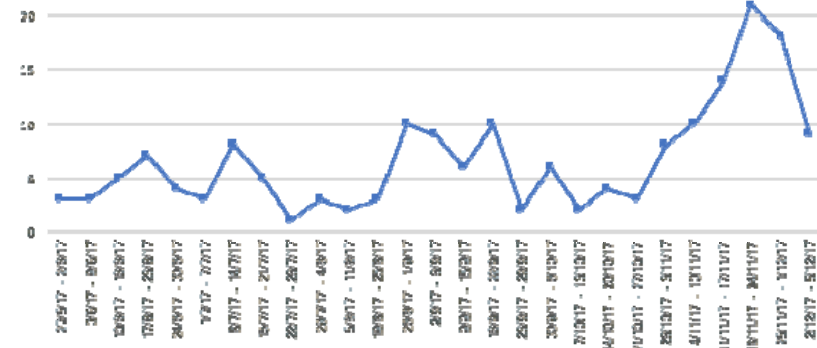


Real-time monitoring of Malaria clinical cases

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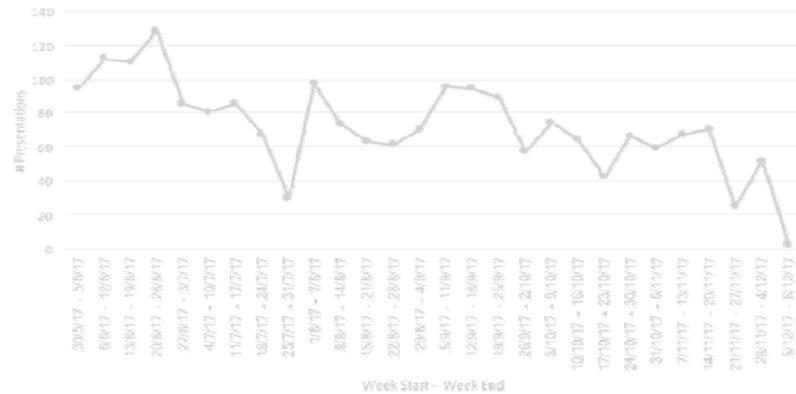


No. of malaria cases per week

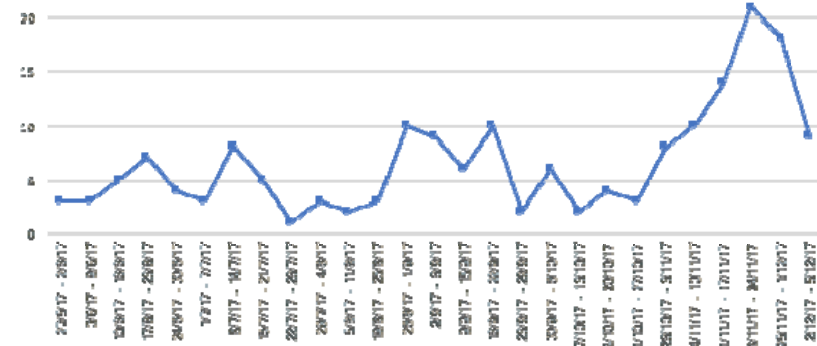


Real-time monitoring of Malaria clinical cases

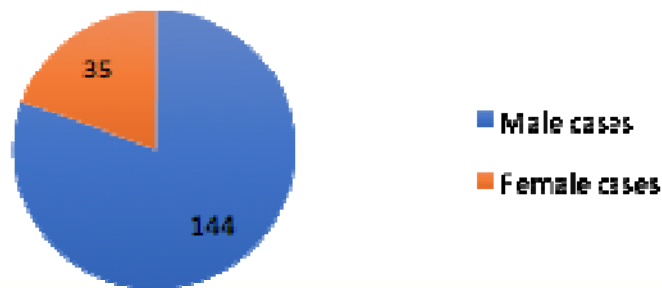
No. of clinic fever cases per week



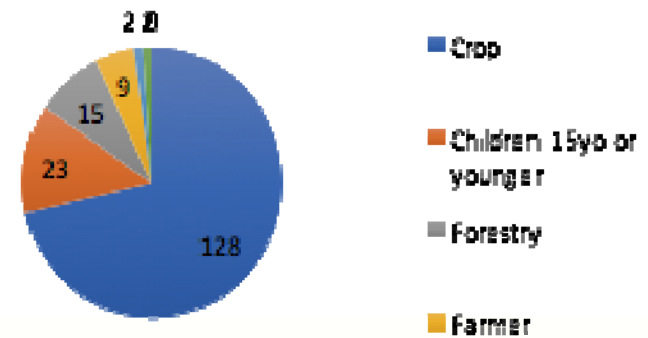
No. of malaria cases per week



A) Sex of malaria cases identified

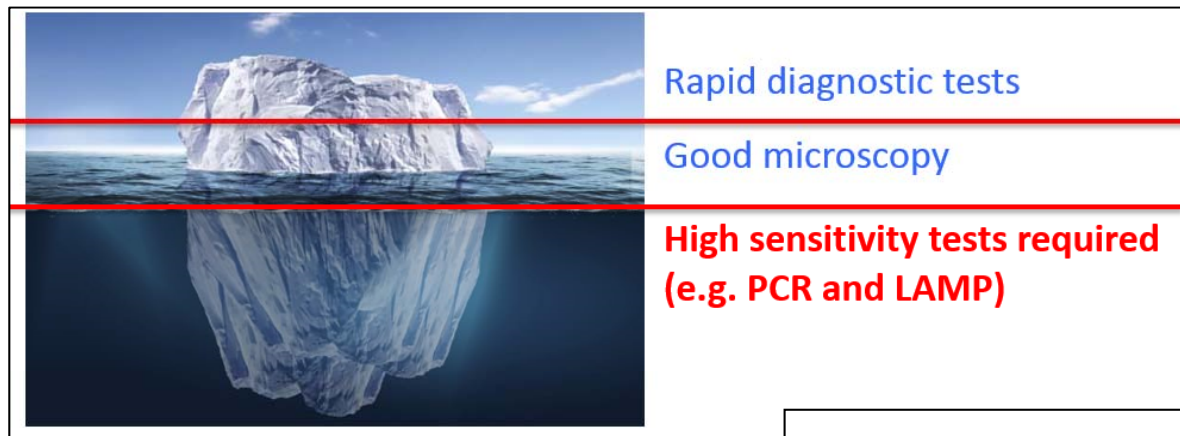


B) Occupation of malaria cases



Shift of malaria health goal for Vietnam

- Then: diagnose sick individuals and treat
- Now: diagnose and treat everyone >>> eliminate malaria
- Asymptomatic but carry parasites at low levels
- Important reservoir for transmission



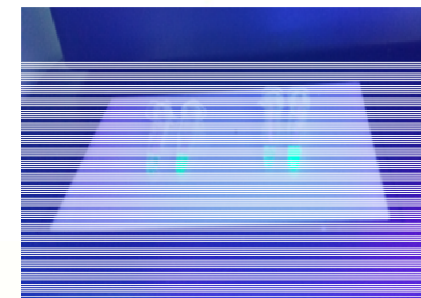
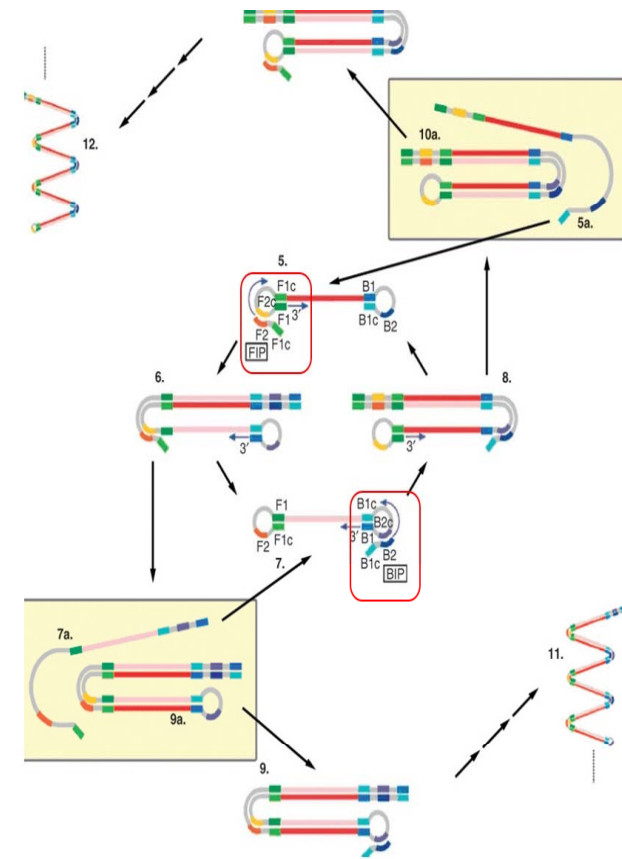
Establishing population-based surveillance with highly sensitive diagnostics tests at the core of elimination activities



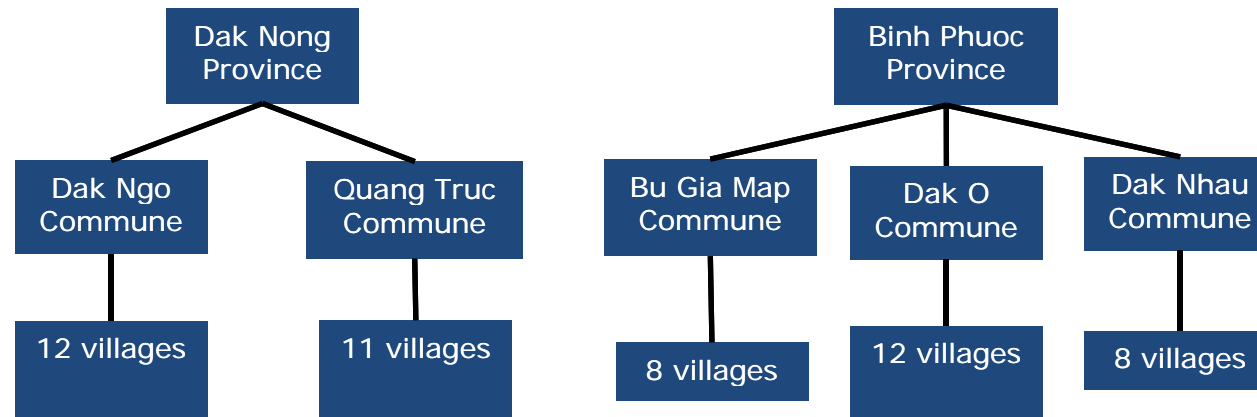
Introduction to loop-mediated isothermal amplification (LAMP)

- Nucleic acid amplification test
- Constant temperature: 60-65° C
- Duration: 15-60 minutes
- 4-6 primers- high specificity

Advantages compared to PCR	Challenges
Quick	
Cheap	Kits expensive
Easier	Primer design
Less equipment	Heat block, water bath, instrument
More sensitive	Contamination
Robust , tolerates crude extractions	Shelf-life stability



Study details



Total samples tested with LAMP: 5424

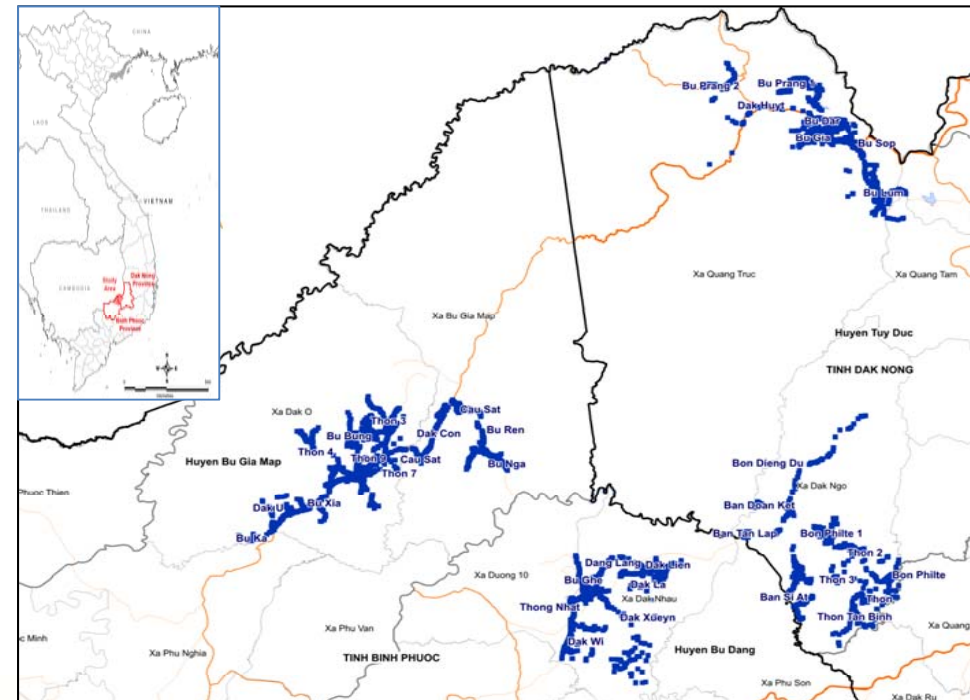
Age:

- Mean- 27 years
- Mode- 11 years
- Range- 0-96 years

Gender: 54% Female, 46% Male

Other activities:

- RDT (if symptomatic)
- Microscopy
- DBS (for PCR and serology)

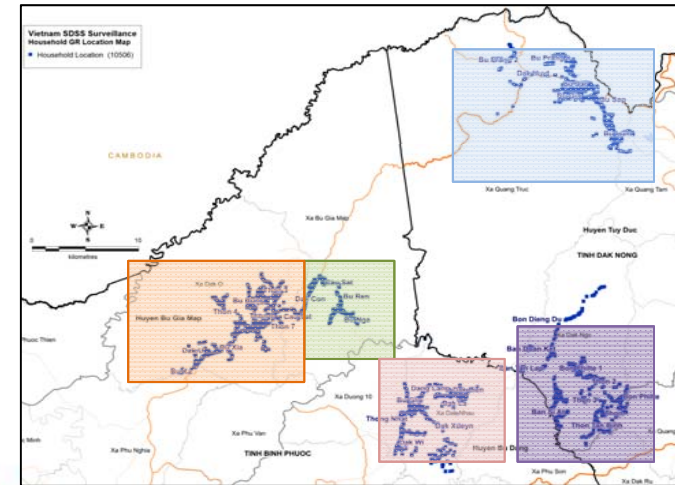


LAMP training and Testing in Vietnam

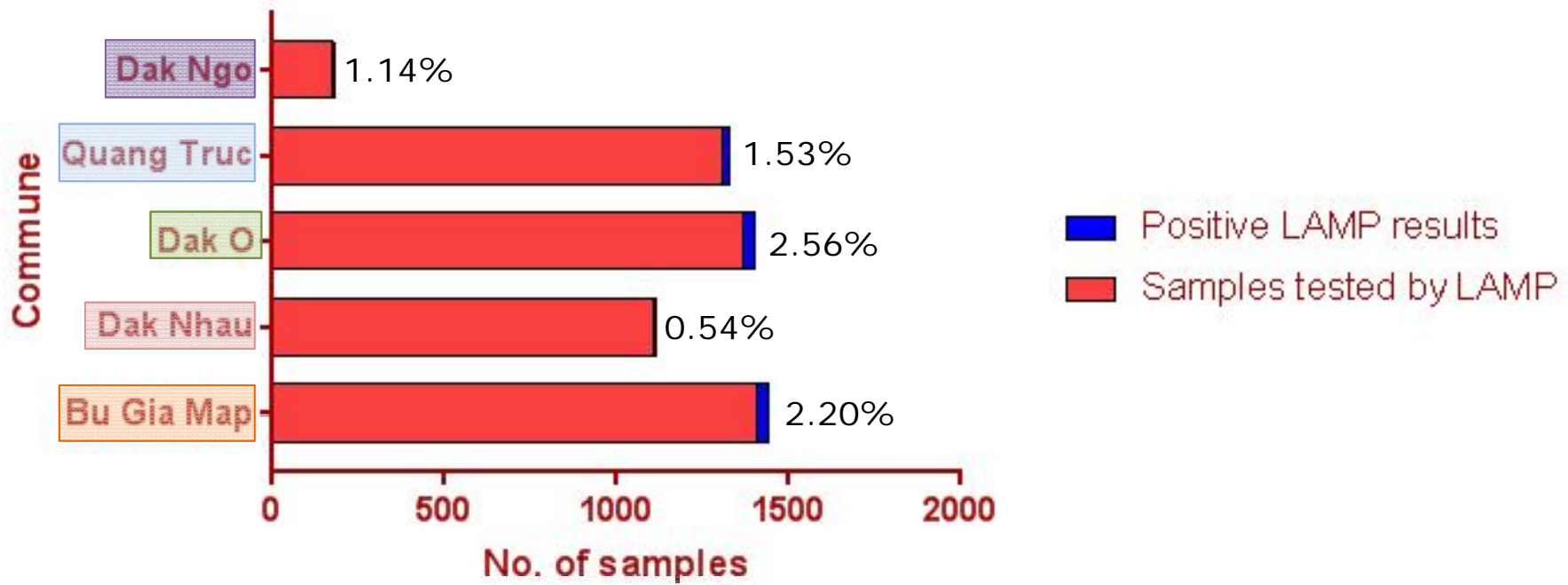
- Training of NIMPE and local health care staff - cross sectional screening in villages to identify asymptomatic reservoir
- Set up of LAMP labs in rural health care centres
- Case reporting via online tool Epicollect



Asymptomatic reservoir



Proportion of LAMP positives by commune

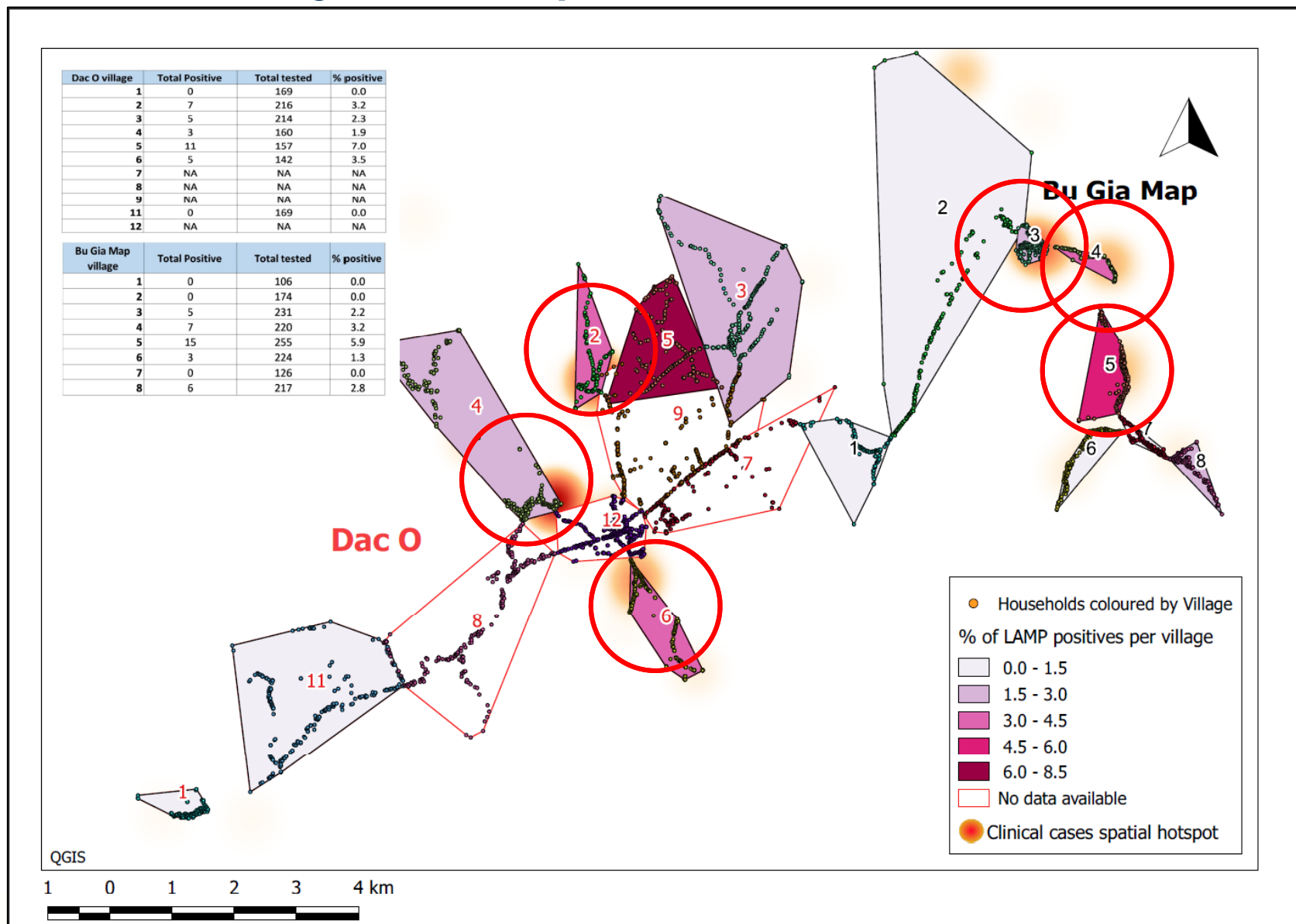


Demographics of positive cases

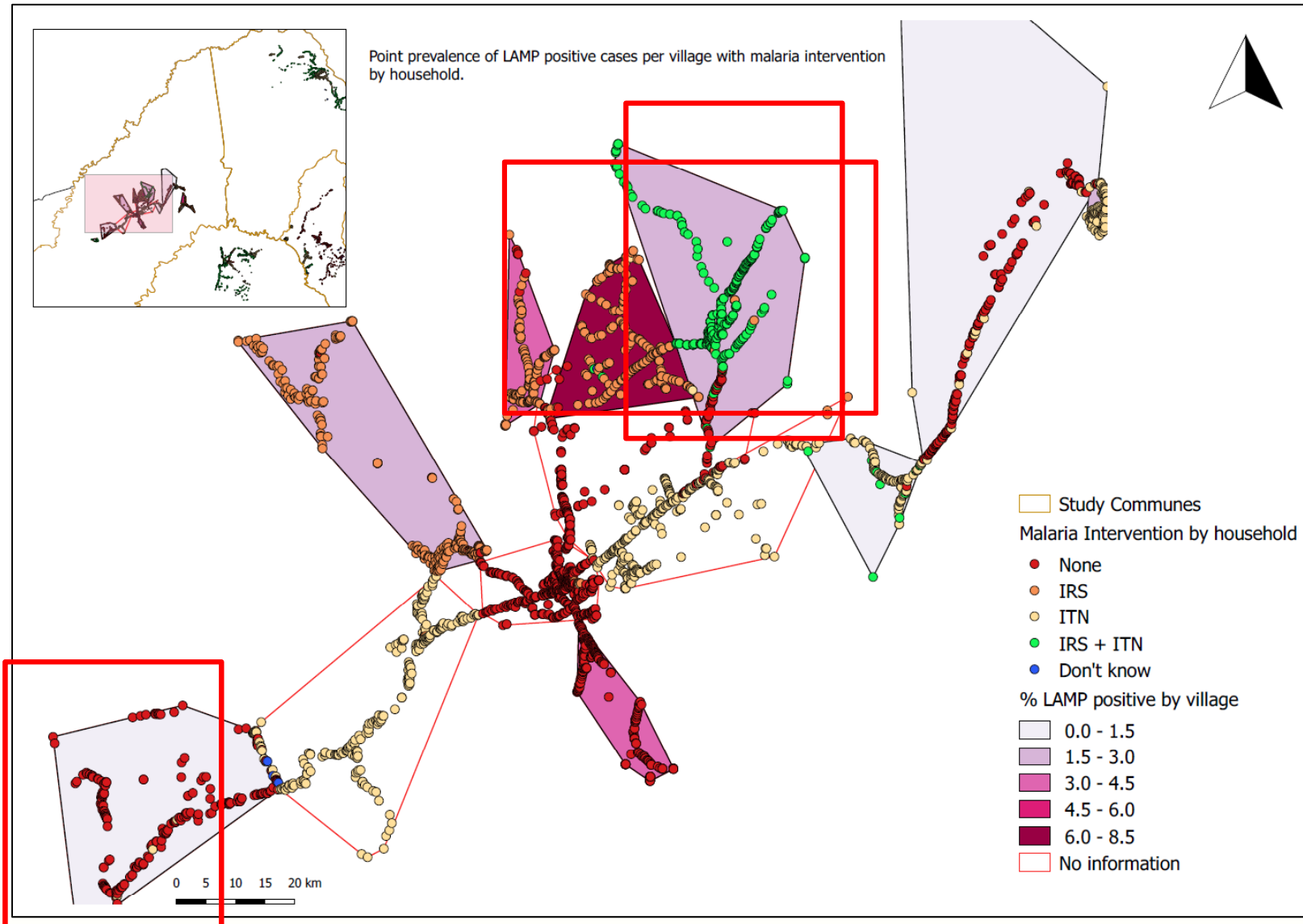
	Clinical malaria cases	Identified LAMP positives
Gender	<p>Female 20% Male 80%</p> <p>Total=226</p>	<p>Female 21% Male 78%</p> <p>Total=70</p>
Age	<p>Number of positive cases</p> <p>Age (Years)</p> <p>Median: 26, IQR: 18-40.25</p>	<p>Number of positive cases</p> <p>Age (Years)</p> <p>Median: 21.5, IQR: 13.75-34.5</p>

NB: some LAMP positive cases excluded due to insufficient data

Overlay of LAMP positive and clinical cases



Overlay of LAMP cases and interventions



Summary and current work

- Although cases of malaria seem to have stagnated, Vietnam is in a **privileged position** to eliminate malaria.
- GIS and more likely SDSS will be **crucial** to achieving this goal
- The ability to monitor malaria **real-time** and deploy interventions using **local resources** is essential for sustainability
- LAMP is an attractive technology that can be implemented at the Commune level.
- The search for malaria cases and asymptomatic individuals needs to continue, but identifying **activity zones** - the actual areas where malaria transmission is occurring - needs to a priority

Acknowledgments

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Investing in our future

The Global Fund

To Fight AIDS, Tuberculosis and Malaria

Health Poverty Action (HPA)

Gary Dahl
Mauricio Vazquez



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