RESIDUAL MALARIA TRANSMISSION IN VIET NAM:

Findings for Policy Makers – Draft Document

Summary

In the Greater Mekong Subregion (GMS), long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) are the primary methods of mosquito control. However, even where universal coverage of nets has been achieved and other recommended interventions, such as community-based primary healthcare, have been scaled up to the maximum level realistically achievable, low level malaria transmission persists. This is known as residual malaria transmission (RMT).

This study determined the magnitude and causes of RMT in two rural communities of Thailand and Viet Nam. This policy brief focuses on the research carried out in Viet Nam. In Viet Nam, Son Thai Commune in Khanh Vinh district of Khanh Hoa Province was chosen as the study site. Within Khanh Hoa province, Khanh Vinh district had the highest malaria incidence rate at district level, and Son Thai commune had one of the highest incidence rates at commune level.

The study has shown that universal LLIN coverage has not been achieved at community level in the study site, with villagers not having enough mosquito nets to use in the village, as well as on the farms and in forests. Even if universal LLIN usage were achieved, however, risk of transmission could still remain. There was no evidence of transmission risk in the village, although, there was a high abundance of mosquito vectors in the farm huts and forest sites where the villagers frequently stayed overnight and where net use was much lower. Furthermore, the mosquitoes in these sites had early evening biting behaviour, biting before people were under nets. Due to the poor structure of farm huts, biting risk was equally high inside and outside the farm huts. A number of policy recommendations have been made, based on these findings.

Key findings:

- Given the good coverage of LLINs, the persistence of malaria transmission has moved from villages to farm plots and forests, with the primary vector.
- Net maintenance and treatment remained substandard.
- There was significant overlap between human activities and vector biting times; this was exacerbated by a gap in personal protection of vulnerable populations who were exposed to bites during the night when malaria mosquitoes were most active.
- There was a high abundance of primary vectors in farm hut and forest sites frequented by the community members.
- Community members perceived malaria as a low risk.

TDR For research on diseases of poverty
UNICEF • UNDP • World Bank • WHO

malaria consortium
disease control, better health

RESEARCH APPROACH

This study was conducted in the Son Thai commune (made up of two neighbouring villages, Giang Bien and Bo Lang), Khanh Hoa Province inhabited by Co Ho and Ra Glai ethnic groups. The province is mostly mountainous and forests cover more than half of its area. Within the commune, there is also a large community practising subsistence and slash and burn agriculture, also known as swidden agriculture. Cassava is the major cash crop here. The disciplines involved in this study were:

1 *Epidemiology*

To determine the species of infection and key risk factors for infection, cross-sectional blood surveys of the study population were conducted. Historical data were also analysed to understand how transmission levels have changed over time. Risk factor analysis was carried out to determine which demographic groups were at a higher risk of getting malaria.

Methods: Passive case detection (PCD), cross-sectional prevalence surveys, and knowledge, attitudes and practices (KAP) surveys.

2 *Sociology*

To find out more about villagers' patterns of movement and their behavioural practices, direct observations were conducted, as well as interviews and focus group discussions with risk groups. Risk groups – the forest-goers and mobile groups – were given GPS tracking devices to monitor their movements and to identify likely transmission spots.

Methods: Direct observation, transect walks, household net use, tracking of forest-goers and mobile groups using GPS-enabled tracking devices, focus group discussions and in-depth interviews with those using the GPS devices.

3 *Entomology*

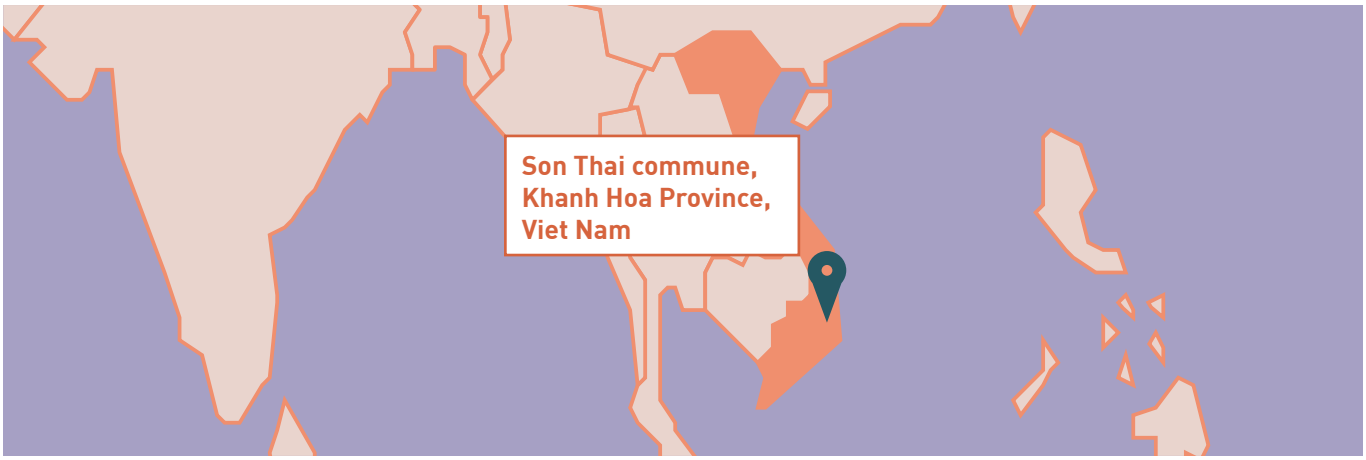
Field and laboratory studies were conducted to find out more about the malaria vectors, including infectivity of mosquito, the mosquito species, biting time, and biting site (village, farm, forest). The researchers also determined whether mosquitoes fed on humans or animals, and whether they fed indoors or outdoors.

Methods: Human landing catch (village, farm hut, forest), baited cow catch (village), vector species identification based on morphology, *Plasmodium* infection determined using quantitative polymerase chain reaction (qPCR), a laboratory technique.

4 *Meteorology*

Data were collected on temperature, relative humidity and light intensity at the same time as the mosquito collections in each village site were undertaken. Rainfall estimates were also collected from national weather monitoring stations.

Methods: Temperature, relative humidity and light intensity were detemined using a weather data logger.



Full details of experiments carried out are available on:

www.vbd-environment.org

KEY RESULTS

1 *Universal LLIN coverage has not been achieved in the study sites*

RMT is the malaria transmission that remains after universal coverage of LLINs has been achieved, and where it has moved from villages to farm plots and forests dominated by primary and secondary vectors. This study showed that universal coverage had not been achieved in the farm hut and forest sites frequented by the community members, and therefore, not all of the malaria cases seen could be attributed to RMT.
This was primarily caused by:

1. Not enough LLINs distributed to cover each family member, **with LLINs not sized for family beds**

2. Very limited to no use of mosquito nets in farm and forest sites, as the family did not have spare mosquito nets and/ or mosquito nets were cumbersome to carry

3. LLINs unavailable in the village markets, and concern over impregnation of nets with insecticides

4. Substandard net maintenance and treatment, with villagers using damaged nets

NET USE ACROSS SITES

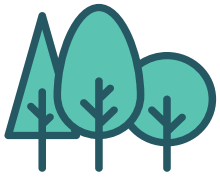
Village: Approximately **95%** of adults used a mosquito net the previous night. However, only half of the households had at least one LLIN per two people, as per WHO recommendations.

Farm: Approximately **half** of people who slept in the field did not take a mosquito net, did not use a net or only used a net sometimes while on the farm.

Forest: Approximately **15%** of forest-goers regularly used a mosquito net.

2 *Other factors were also shown to contribute to malaria transmission*

This study also showed that even if every individual in the study site were to use an LLIN when asleep, malaria transmission could still occur. This was due to a number of reasons, most notably:



No evidence of transmission risk in the village, but **high abundance of mosquito vectors in farm huts and forest where nets were used less or not at all.**

45% of biting by primary vector species (*An. dirus s.l.*) and 100% of biting by secondary vector species (*An. maculatus s.l.*) was observed before 9 pm when people went to sleep.

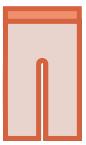
Mosquitoes biting risk was high both outdoors and indoors in the farm huts sites due to poor quality hut construction.

POLICY IMPLICATIONS

1 *Personal vector control tools*

There was a high outdoor transmission risk and high transmission risk outside of sleeping hours, and in farm huts and forest sites. This limited the effectiveness of LLINs. Personal vector control tools are required to supplement LLINs that can protect before and after net use – before bedtime and after waking up, and during night time hours on the farm or in the forest. These need to be light-weight, durable and inexpensive.

POTENTIAL OPTIONS INCLUDE



long-sleeved clothing

insect repellent

light-weight mosquito hammocks

2 *Mosquito net distribution*

Increase ownership and access to treated nets and evaluate net distribution. Follow WHO guidance of one bednet for every two people, and **take into account the need for extra nets at farm huts or dual residences. Conduct bed net attrition and durability through pre- and post- bed net distribution surveys.**

3 *Increase awareness*

Increase awareness of the causes **and risks of malaria and the need to maintain use of nets especially in farm huts.**

FURTHER RESEARCH

- **Identify target groups and site locations** most optimal for intervention to reduce RMT.
- **Conduct an intervention study** using LLINs and innovative new vector control approaches in places where the persistence of malaria transmission has moved from villages to farm plots and forests.
- **Mathematical modelling of transmission** in sites and testing of vector control tools.
- **Quantify RMT across wet and dry** seasons and construct a seasonal diary of the life of a forest worker or seasonal farmer in different transmission (or eco-epidemiological) settings.

About this project

This policy brief summarizes outcomes of the research project on *Residual Malaria Transmission in the Greater Mekong Subregion – Studies to examine its magnitude and identify its causes*. The principal investigator was Dr Jeffrey Hii, Senior Vector Control Specialist at Malaria Consortium Asia. Other technical collaborators included: Institute Malariology, Parasitology and Entomology (NIMPE), Viet Nam; Medisch Comité Nederland-Vietnam (MCNV); and, Provincial Health Department, Khanh Hoa province, Viet Nam.

This work was financially and technically supported by TDR, the Special Programme for Research and Training in Tropical Diseases. Technical support was also provided by the World Health Organization Global Malaria Programme. UK Aid also provided financial support.

TDR For research on diseases of poverty
UNICEF • UNDP • World Bank • WHO

malaria consortium
disease control, better health