Umalulu Malaria and Habitat Study
East Sumba, Indonesia. 2025

A baseline malaria risk study and cross-sectional household and environmental survey carried out in Umalulu, East Sumba, Indonesia in March to July 2025.

Introduction

This study was funded by a grant from Australian Rotarians Against Malaria (ARAM), the Rotary Club of Mandurah Districts in Western Australia and Fair Future Foundation, an NGO based in Waingapu, East Sumba.

The study was designed and all data collection, logistics and analysis managed by the Fair Future Foundation, under the direction of Dr Alex Wettstein, and a dedicated team. It is part of the Rotary Sumba Project, Water Distribution and Malaria Prevention Program, managed by PDG John Kevan.

Australian Rotarians Against Malaria	Rotary Mandurah Districts	FAIR FUTURE FOUNDATION

Umalulu is an acknowledged detection point for malaria within East Sumba, with recent data indicating a significant increase in cases during 2023–2024 and seasonal peaks from August to November.

The study was designed to replace assumptions with a door-to-door baseline led locally by trained enumerators, providing detailed evidence on transmission factors and service usage to guide control efforts in Umalulu and neighbouring high-transmission clusters.

Abstract

Objective. Establish a household-level baseline of malaria risk, behaviours, and environmental determinants in Umalulu Village (East Sumba) to inform targeted control.

Design. Cross-sectional survey using two structured modules (environmental/household and knowledge/experience) administered by trained village cadres and Puskesmas staff. Data were captured with an offline mobile application and later synchronised.

Setting & Sample. 269 households (target 335) across 12 hamlets; 460 individual interviews. Primary outcomes. Vector-control coverage (LLIN/IRS), exposure environments, care-seeking/testing pathways, access/financing, and knowledge/practices.

Key findings. Only 1.1% of households reported any IRS; 68% of sleeping spaces were fully protected by nets, 27% partially, and 4% unprotected; most nets (>92%) were >1 year old.

Open defecation remained common (56.9%). 93.7% reported public insurance, yet more than 50% lived more than 5 km from care, and most required at least 15 minutes of travel. RDTs were the predominant diagnostic modality (89.1%).

Awareness that Anopheles transmit malaria was high (≈77%), but environmental risk knowledge was weak (≈68% could not name breeding sites).

Conclusion. The risk profile reflects inconsistent vector control, sanitation deficits, and distance-related access frictions—amid strong community reliance on cadres and near-universal insurance.

Priorities include net maintenance/replacement, IRS capacity, WASH and breeding-site control, and continuity of community-based RDT testing.

Map of Sumba indicating the location of Umalulu Region
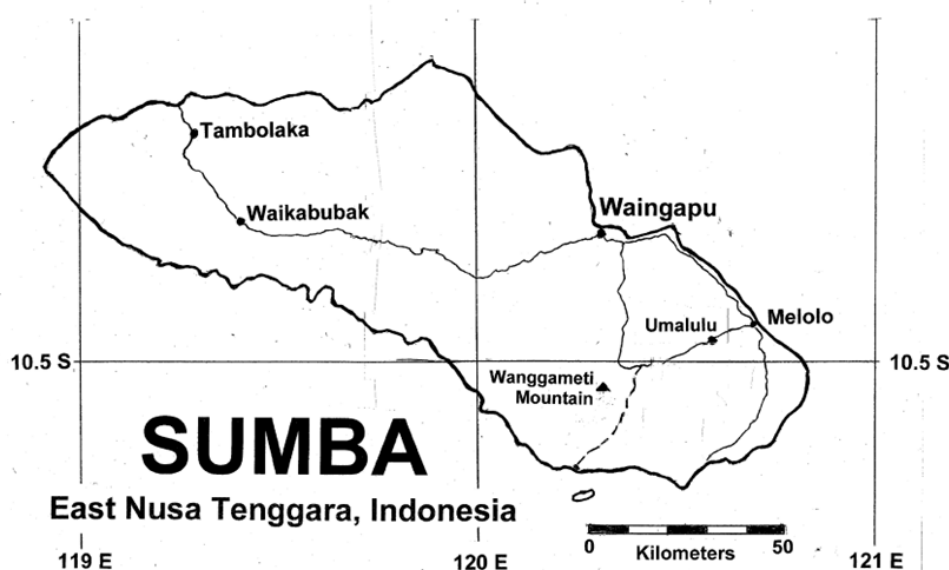
Method

Design & period. Cross-sectional household and environmental risk survey *(March–July 2025)*.

Sampling & coverage. 269 out of 335 planned households were completed across 12 hamlets; shortfalls were due to non-residential structures, out-of-area points, unoccupied or renovation statuses, and two dwellings lost to fire.

Respondents. 460 individuals completed the knowledge/experience module.

Enumerators and training. Village malaria cadres and Puskesmas staff participated in a structured refresher covering epidemiology, vector ecology, survey techniques, and app use.

Data capture. Offline mobile application *("Kawan Against Malaria")* with geo-tagged photographs and later synchronisation.

Definitions. Net ownership refers to households with at least one LLIN; coverage pertains to sleeping-space protection; denominators vary by sub-sample *(household versus person-level)*.

Outcomes & analysis. Descriptive statistics summarised vector-control coverage, environmental exposures *(ventilation, stagnant water, sanitation, livestock proximity, electricity)*, knowledge and practices, and care-seeking/testing/financing.

Results
Demography & livelihoods
Most respondents identified farming as their primary livelihood, aligning with outdoor evening exposure. Educational levels were generally low, with the largest group (104 out of 460) having not completed primary school.

Vector control & exposure
Nets. Among 269 households (693 sleeping spaces), 68% of sleeping spaces were fully net-covered, 27% partially, 4% unprotected; >92% of nets were >1 year old.
IRS. Only 1.1% reported any indoor residual spraying; three-quarters had never been sprayed.
Housing. 45.4% of homes had unscreened vents; 30.1% relied on unscreened roof-wall gaps.
Sanitation & water. Open defecation was reported by 56.9% of households; only 58 households had sealed septic tanks, while 42 discharged without septic containment. Standing water was present at ≈19% of homes.
Electricity & signal. 135 households lacked electricity, and >75% reported no/unstable mobile signal.

Knowledge, behaviors, and exposure patterns
Transmission knowledge. ~77% identified Anopheles bites as the mode of transmission; ~20% did not know or cited incorrect causes.
Environmental awareness. ~68% could not name common breeding sites.
Night-time exposure. Residents commonly engage in evening activities (e.g., water collection around dusk), aligning with Anopheles host-seeking times.
Clothing & indoor practices. Clothes hanging habits (terraces and indoor beams) create resting sites and odour cues for vectors.

Care-seeking, testing, and financing
Where people go. 97% sought care at Puskesmas/Pustu.
Testing. RDTs dominated (89.1% of respondents reported RDT use historically); cadres (Kader) performed most testing at home (68%), with 17.6% mixed home/Puskesmas.
Distance/time. 250/460 lived >5 km from care; 239/460 needed 15–30 minutes travel (169/460 >30 minutes).
Costs & insurance. 93.7% reported KIS/BPJS coverage; 67.8% reported free treatment costs. Motorbikes were the dominant transport mode (~94%).

Self-reported malaria history & seasonality (interpreted with caution)
On self-report, 74.6% of respondents denied any past malaria, and 23.7% recalled an episode within five years; however, limited symptom literacy, asymptomatic parasitaemia, recall bias, and absence of parasitological confirmation mean these figures are not true prevalence estimates.
In endemic settings, many febrile episodes go untested and past malaria may be misclassified as "flu," so the apparent "never malaria" proportion is likely overestimated, and the 5-year illness proportion likely underestimated.
Reported seasonality—August–November—remains credible and aligns with local experience, but should be validated against prospective RDT/microscopy and, ideally, serological markers.

Discussion
The initial door-to-door assessment in Umalulu highlights a typical peri-rural risk profile: uneven household protection levels (such as ageing nets and minimal IRS), permissive built environments (unscreened ventilation and nearby livestock), and gaps in Water, Sanitation, and Hygiene (WASH) that support larval habitats.

These are compounded by distance- and time-related barriers to accessing care, despite almost universal insurance enrollment.

The results support the importance of cadre-led rapid diagnostic tests (RDT) and community education, while emphasising the need to professionalise IRS implementation and speed up improvements in sanitation.

The contrast between high awareness of malaria transmission (~77%) and low recognition of environmental risks (~68% unable to identify breeding sites) explains ongoing exposure and indicates that future IEC/BCC efforts should focus on identifying breeding sites, household source reduction, and net maintenance.

Limitations
Incidence and prior infection are self-reported and therefore subject to recall bias and underdiagnosis; microscopy confirmation was not universal; and some targeted households could not be surveyed due to structural or access issues—potentially biasing estimates. Percentages use different denominators depending on the sub-sample (households versus individuals), as specified in the report.

Conclusions
- Maintain and replace nets: prioritise LLIN replacement/repair and nightly use in partially covered households.
- Build IRS capacity: train spray teams and provision pumps/insecticide; plan seasonal rounds ahead of Aug–Nov.
- Tackle breeding sites & WASH: household-level source reduction and latrine/septic expansion to interrupt both malaria and enteric transmission.
- Keep diagnostics close: ensure uninterrupted RDT stocks and cadre refresher training; sustain home-based testing.
- Mitigate access frictions by leveraging motorbike outreach, micro-grids/solar lighting to reduce nighttime exposure, and provide targeted transport support for remote hamlets.

Acknowledgements
Australian Rotarians Against Malaria (ARAM), Rotary Club Mandurah Districts, Fair Future Foundation, Kawan Baik Indonesia, East Sumba District Health Office, Melolo Puskesmas, Umalulu Village Authorities, PERDHAKI, and the Umalulu enumerator team.

Ethics & consent
The survey was conducted with local authority coordination; verbal informed consent was obtained from all adult respondents or guardians for minors; no names or direct identifiers were retained in the analysis dataset. (For more info: contact DR Alex Wettstein +6287777333384 - WhatsApp Only)
The authors declare no competing interests.

Data availability
An anonymised raw dataset and the financial report are available on request from Fair Future; access is provided under a simple data-use/confidentiality agreement. Questionnaire and training materials are also available via the foundation's repository.

Financial Report

			AUD	AUD
No	**Categories**	**Activity**	**Income**	**Expenses**

<table>
<tr><td colspan="5" align="center">Umalulu Malaria and Habitat Study</td></tr>
<tr><td colspan="5" align="center">East Sumba, Indonesia. July 2025</td></tr>
<tr><td colspan="5" align="center">FINANCIAL REPORT</td></tr>
<tr><td></td><td></td><td></td><td align="center">AUD</td><td align="center">AUD</td></tr>
<tr><td>No</td><td align="center">Categories</td><td align="center">Activity</td><td align="center">Income</td><td align="center">Expenses</td></tr>
<tr><td>1.1</td><td>Donation ARAM</td><td align="center">Funding</td><td align="right">6,615</td><td></td></tr>
<tr><td>1,2</td><td>Rotary Club of Mandurah Districts</td><td align="center">Funding</td><td align="right">4,050</td><td></td></tr>
<tr><td>1.3</td><td>Fair Future Foundation</td><td align="center">Funding</td><td align="right">2,907</td><td></td></tr>
<tr><td>2</td><td>Human Resources</td><td align="center">Lunches, Travel</td><td></td><td align="right">1,020</td></tr>
<tr><td>3</td><td>Field Operations</td><td align="center">Logistics</td><td></td><td align="right">3,951</td></tr>
<tr><td>4</td><td>Tools and Materials</td><td align="center">App development, questionnaire</td><td></td><td align="right">5,331</td></tr>
<tr><td>5</td><td>Data Management</td><td align="center">Analysis Report preparation</td><td></td><td align="right">2,423</td></tr>
<tr><td>6</td><td>Education and Training</td><td align="center">Team inductions, posters</td><td></td><td align="right">636</td></tr>
<tr><td>7</td><td>Administration</td><td align="center">Forex, printing</td><td></td><td align="right">231</td></tr>
<tr><td>8</td><td>TOTAL</td><td></td><td align="right">$13,573</td><td align="right">$13,572</td></tr>
</table>

Supporting Documents & Data Access

Link:- **:** The Umalalu Malaria study - July 2025 - Fair Future Foundation

Full Report — Umalulu Malaria Baseline (PDF, English) — complete narrative with methods, results, and community action roadmap.

Raw survey dataset* (Excel) – anonymised household-level data from the 2025 Umalulu malaria study.

Malaria Survey Training Guide – module for agents and surveyors on running malaria-risk surveys.

Malaria Knowledge Questionnaire – (PDF - English) – full survey instrument for reuse or adaptation.

Recognising Malaria Symptoms – A Life-Saving Guide (PDF - Poster) – visual aid showing early warning signs and urging prompt treatment.

Preventing Malaria – Simple Steps to Stay Safe (Poster) – poster promoting nets, repellents, water management and protective clothing.

GLOSSARY OF TECHNICAL TERMS

ACT (Artemisinin-based Combination Therapy) – First-line malaria treatment pairing artemisinin with a partner drug to clear parasites and slow resistance.

Anopheles – Mosquito genus that transmits human malaria; females bite mainly from dusk to dawn and lay eggs in shallow water.

Anthropophilic – Preferring to bite humans.

API (Annual Parasite Incidence) – Confirmed malaria cases per 1,000 population in a year; a transmission-intensity metric.

Asymptomatic parasitaemia – Malaria infection without symptoms, detectable only by tests.

Cadre / Kader – Trained community health volunteer supporting prevention, testing, and follow-up at the village level.

Cross-sectional survey – Snapshot study measuring outcomes and exposures at a single time period.

Denominator (study) – The specific population a percentage is calculated from (e.g., households vs individuals vs sleeping spaces).

Endemic – Constantly present in a given area; contrasts with short-lived outbreaks.

IEC / BCC – Information-Education- Communication / Behaviour-Change Communication; tools to turn knowledge into protective action.

IRS (Indoor Residual Spraying) – Applying long- lasting insecticide to interior walls to kill mosquitoes resting indoors.

JKN / BPJS-Kesehatan – Indonesia's national health-insurance scheme that finances most primary care.

KAP (Knowledge, Attitudes, Practices) – Survey module capturing what people know, believe, and do about malaria.

KIS (Kartu Indonesia Sehat) – Health card granting subsidised access to JKN for the poorest households.

Larval habitat – Water bodies (puddles, hoof prints, pits, ponds) where mosquito larvae develop.

Larval source management/source reduction – Eliminating or treating breeding sites (drain, fill, cover, or larvicide).

LLIN (Long-Lasting Insecticidal Net) – Bed net factory-treated to remain insecticidal for several years.

Microscopy (confirmatory) – Laboratory examination of stained blood smears to identify Plasmodium species.

Net coverage (sleeping-space) – Proportion of beds/mats/hammocks protected by a net.

Net ownership (household) – Households possessing ≥1 mosquito net (may differ from sleeping-space coverage).

Offline-first (data capture) – App workflow that works without a network and synchronises when a signal is available.

PAUD – Early-childhood education centres are often used for health outreach.

PHBS – "Clean and Healthy Living Behaviour" health-promotion framework used in Indonesia. Posyandu – Monthly integrated village health post for growth monitoring, vaccination, and education. Pustu – Auxiliary health post affiliated with a Puskesmas, serving remote hamlets.

Puskesmas – Government primary-care clinic providing outpatient services and surveillance. RDT (Rapid Diagnostic Test) – Finger-prick antigen test giving a malaria result in ~15 minutes.

Recall bias (self-report) – Inaccuracy from imperfect memory about past illness or care- seeking.

Reservoir (human) – Infected people (symptomatic or not) who can infect mosquitoes. Seasonality (Aug–Nov window) – Local period when transmission rises during the dry-to-wet transition.

Sleeping space – Any place regularly used for sleeping (bed, mat, hammock) assessed for net coverage.

Vector – Living organism (here, Anopheles mosquito) that transmits a pathogen.

WASH – Water, Sanitation and Hygiene interventions reducing disease and mosquito breeding.

Zoophilic – Preferring to bite animals; relevant when livestock are kept near houses.

END REPORT