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BASELINE MALARIA RISK IN UMALULU, EAST SUMBA

A CROSS-SECTIONAL HOUSEHOLD AND ENVIRONMENTAL SURVEY – SCIENTIFIC REPORT
UMALULU VILLAGE, UMALULU DISTRICT, EAST SUMBA REGENCY
MARCH - JULY 2025

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BASELINE MALARIA RISK IN UMALULU, EAST SUMBA: A CROSS-SECTIONAL HOUSEHOLD AND ENVIRONMENTAL SURVEY - (MARCH–JULY 2025)

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.

Introduction

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**.

This survey 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.

Methode

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 sanitation improvements.

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

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: +6287777333384 - Wa Only)*

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.

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.

Supporting Documents & Data Access

- 🔗 **Full Report** — Umalulu Malaria Baseline *(PDF, English)* — complete narrative with methods, results, and community action roadmap.
- 🔗 **Financial report – Umalulu Study** *(PDF - English)* – audited budget and expenditure statement.
- 🔗 **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.
- 🔗 **How to Use Our Health Posters** – facilitator guide for nine Fair Future education posters.
- 🔗 **Annual Activity Report 2024** *(PDF, English or French)* – latest overview of Fair Future's programmes, impact metrics and finances, published this month.

Policy Implications | Contributions, Funding & Ethics

Policy & Practice Implications

- **Vector contro**l. Prioritise LLIN repair/replacement and plan seasonal IRS rounds ahead of the Aug–Nov transmission peak.
- **WASH & housing**. Expand household latrines, drainage, and insect-screened ventilation; relocate livestock pens ≥20 m from sleeping areas.
- **Diagnosis & access**. Ensure uninterrupted RDT stocks and cadre refresher training; reduce travel barriers via motorbike outreach and targeted transport support.
- **Health literacy**. Shift IEC/BCC toward breeding-site recognition, source reduction, and net maintenance; tailor materials for low literacy.

Author Contributions

Study design: Fair Future & partners;
Field operations and data collection: trained village cadres and Puskesmas staff;
Analysis and drafting: Fair Future technical team - Kawan Baik Indonesia *(KBI)*
Critical review: partner institutions.

Funding

Australian Rotarians Against Malaria *(ARAM)*, Rotary International, Fair Future Foundation, Kawan Baik Indonesia*(KBI)*

Ethics

Local coordination with district authorities; verbal informed consent from all adult participants *(guardian consent for minors)*. No names or direct identifiers retained.

Data & Materials Availability

An anonymised raw dataset, survey instrument and financial report are available on request under a data-use agreement. The offline app and training materials are listed in the appendices.

Conflicts of Interest

The authors declare no competing interests.

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