Note: Charts below are illustrative placeholders and should be replaced with official series before publication.

CHAPTER 12

Vectored Diseases: Malaria (Ethiopia focus plus global lens)

Aynalem Adugna, October 2025

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CONTENT

12.8 Vector Control II: Indoor Residual Spraying (IRS)
(Targeting, insecticide classes/rotation, operational quality, coverage metrics)

12.9 Larval Source Management & Environmental Measures
(Habitat mapping, source reduction, larviciding, irrigation schemes, urban drainage)

12.10 Insecticide & Drug Resistance Monitoring
(WHO susceptibility tests, intensity & synergist assays; molecular markers; ACT efficacy studies)

12.11 Vaccines & Chemoprevention
(RTS,S/AS01 and R21/Matrix-M; IPTp for pregnancy; IPTi; SMC—global evidence and Ethiopia applicability)

2.12 Climate, Environment & Seasonality
(Rainfall/temperature drivers, ENSO links, drought/flood shocks, climate change projections)

12.13 Special Populations & Equity
(Pregnant women, infants/children, IDPs/refugees, pastoralist & mobile/migrant workers, border communities)

12.14 Supply Chain & Commodities
(RDTs, ACTs, antirelapse drugs, nets, insecticides; cold chain & storage; stock-out prevention; eLMIS)

12.15 Program Management, Partnerships & Financing
(Federal–regional roles, partner coordination, Global Fund/PMI alignment, costing & value-for-money)

12.16 Monitoring, Evaluation & Data Use
(Core indicators; dashboards; triangulation with MIS/entomology; data quality & denominator audits)

12.17 Geospatial Risk Mapping & Micro-Stratification
(Incidence-based stratification, PfPR maps, travel-time/access overlays, targeting IRS/LLINs)

12.18 Outbreak Preparedness & Response
(Thresholds, early warning, stockpiles, surge staffing, RCCE, after-action reviews)

12.19 Operational Research & Innovation
(Spatial repellents, ATSBs, endectocides, eave-tubes, gene-drive debates, digital decision-support)

12.20 Elimination Pathways & Modelling
(Receptivity/vulnerability, importation management, foci response, district-level elimination roadmaps)

12.21 Policy Landscape & Guidelines
(National treatment & vector-control policies; WHO updates; regulatory aspects)

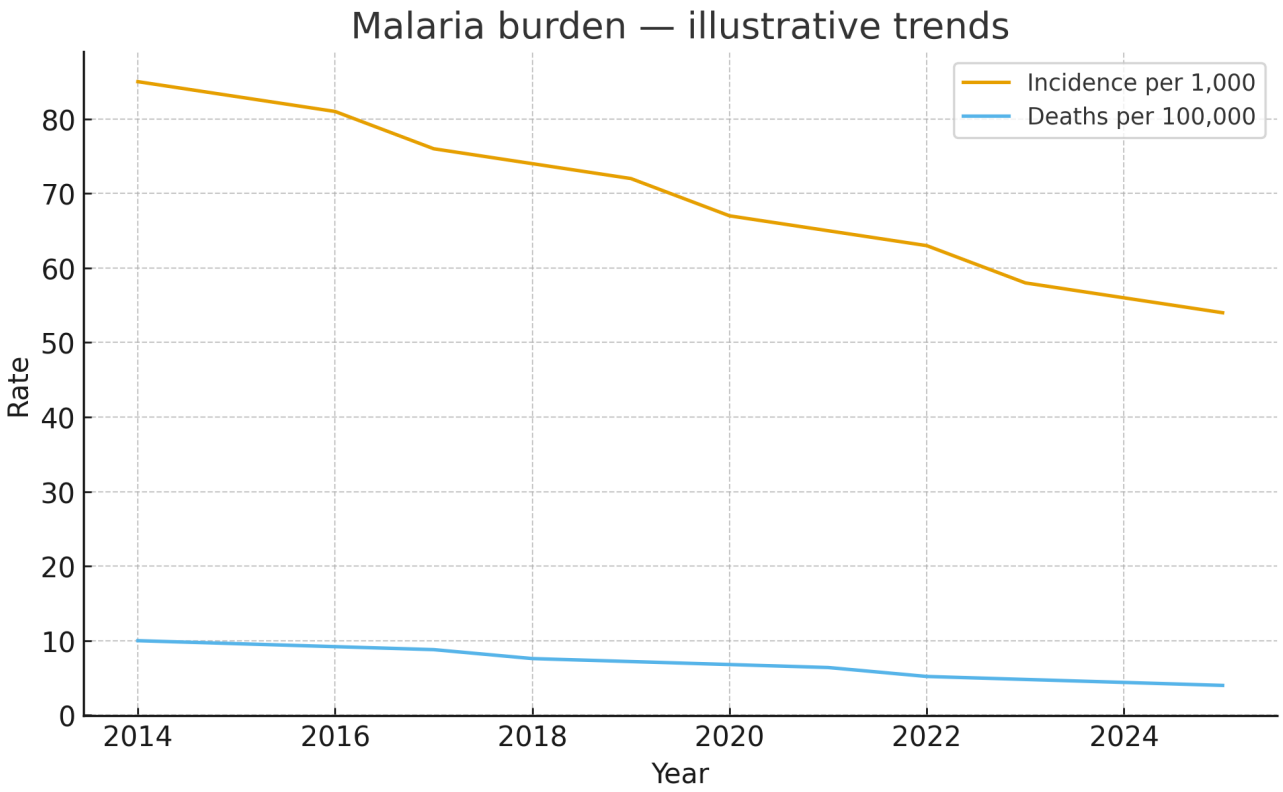
12.22 Ethics & Community Engagement
(Consent in reactive case detection, data governance, community empowerment, risk communication)

12.23 Landing-Page Summary, Glossary & Consolidated References
(For the chapter front page + back matter, mirroring Chapter 11)

12.1) Concepts, Burden & Transmission Ecology — Malaria

This section introduces malaria transmission concepts, summarizes burden with simple trend placeholders, and sketches Ethiopia’s eco-epidemiology. Replace illustrative numbers with official HMIS/MIS/WHO series before publication. Years on charts are integers only.

Figure . Malaria burden trends — incidence & deaths (illustrative)



‘Figure . Seasonality of cases (share of annual total) — illustrative

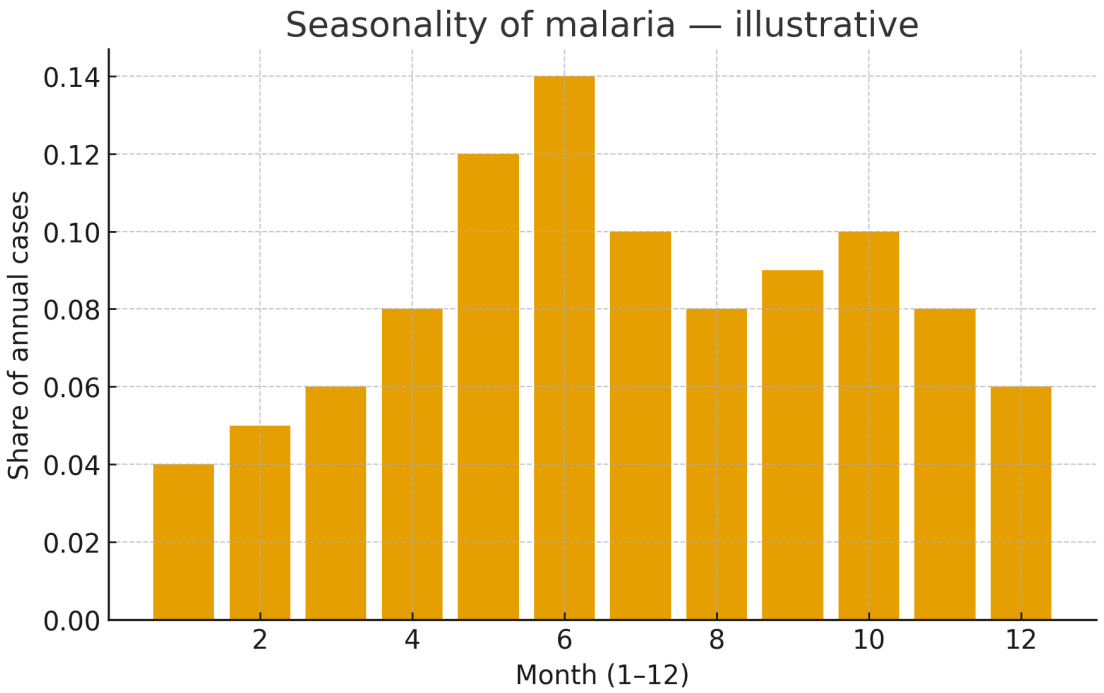


Figure . Species composition — illustrative

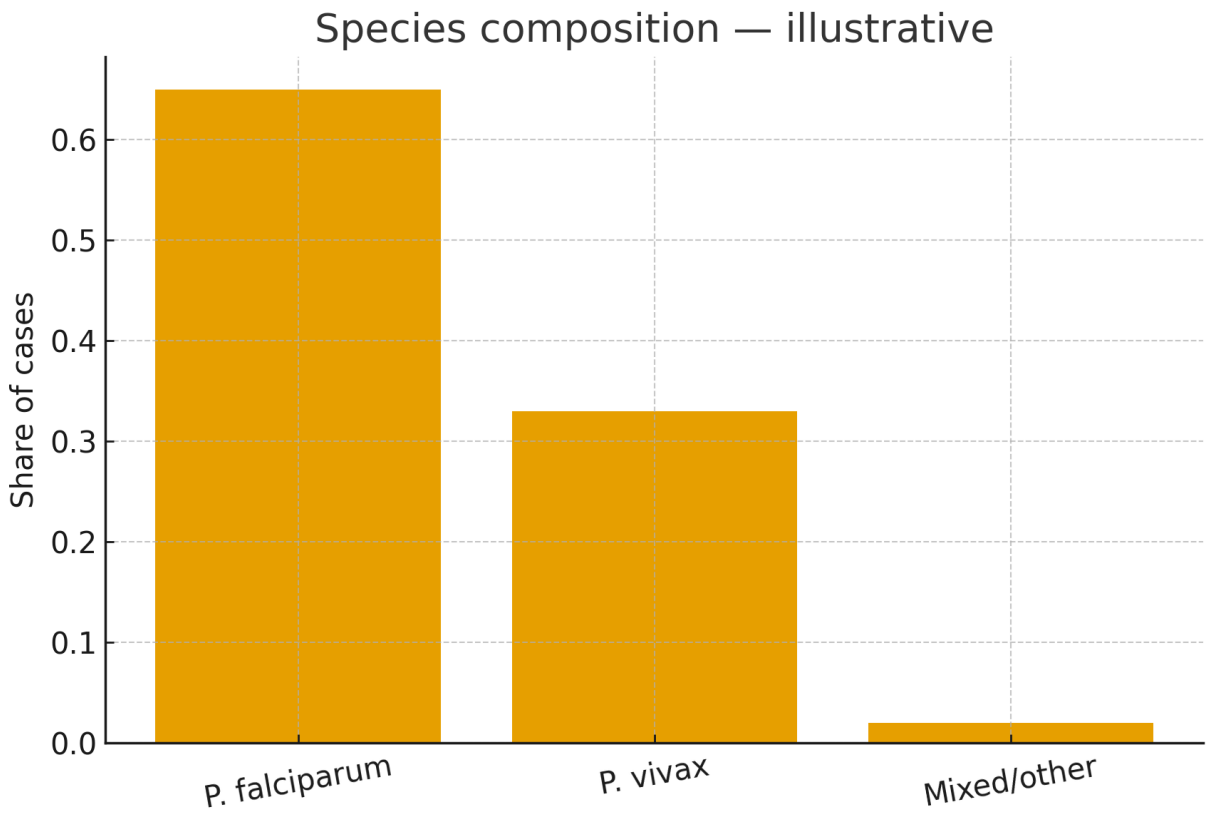


Figure . Vector behavior indices (indoor/outdoor biting & resting) — illustrative

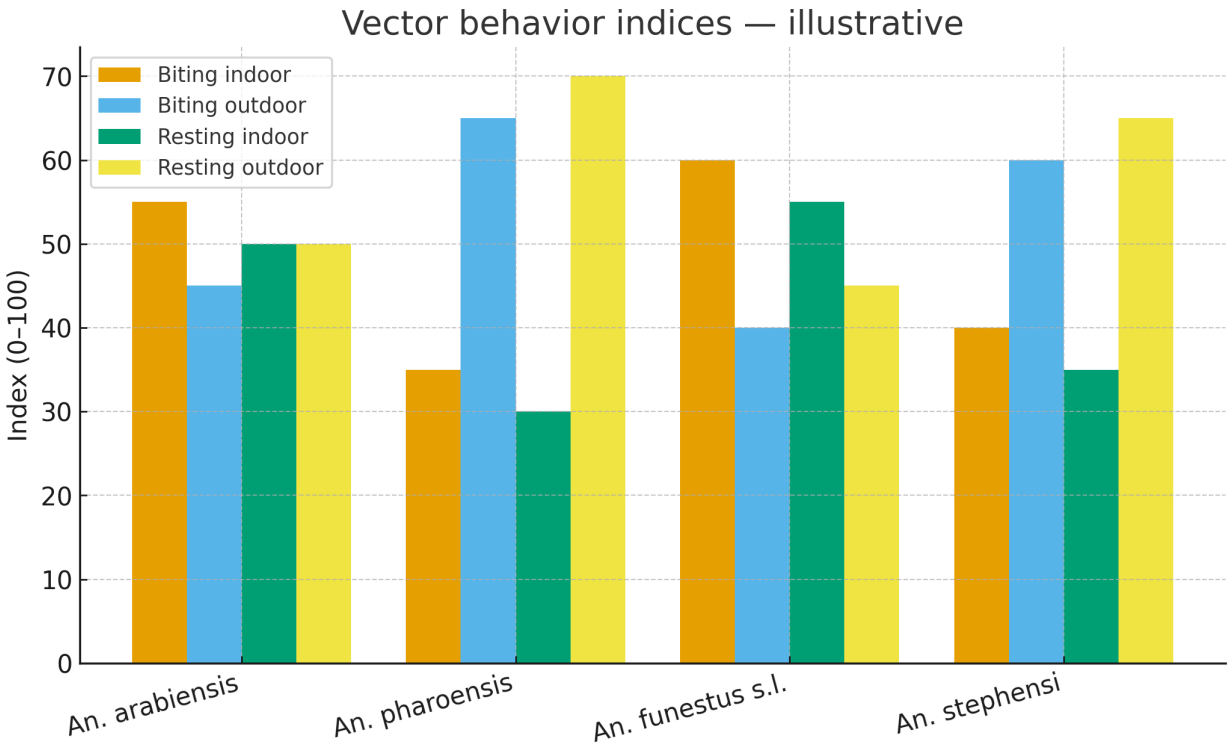


Figure 12.1-5. Rainfall vs transmission intensity (EIR) — illustrative

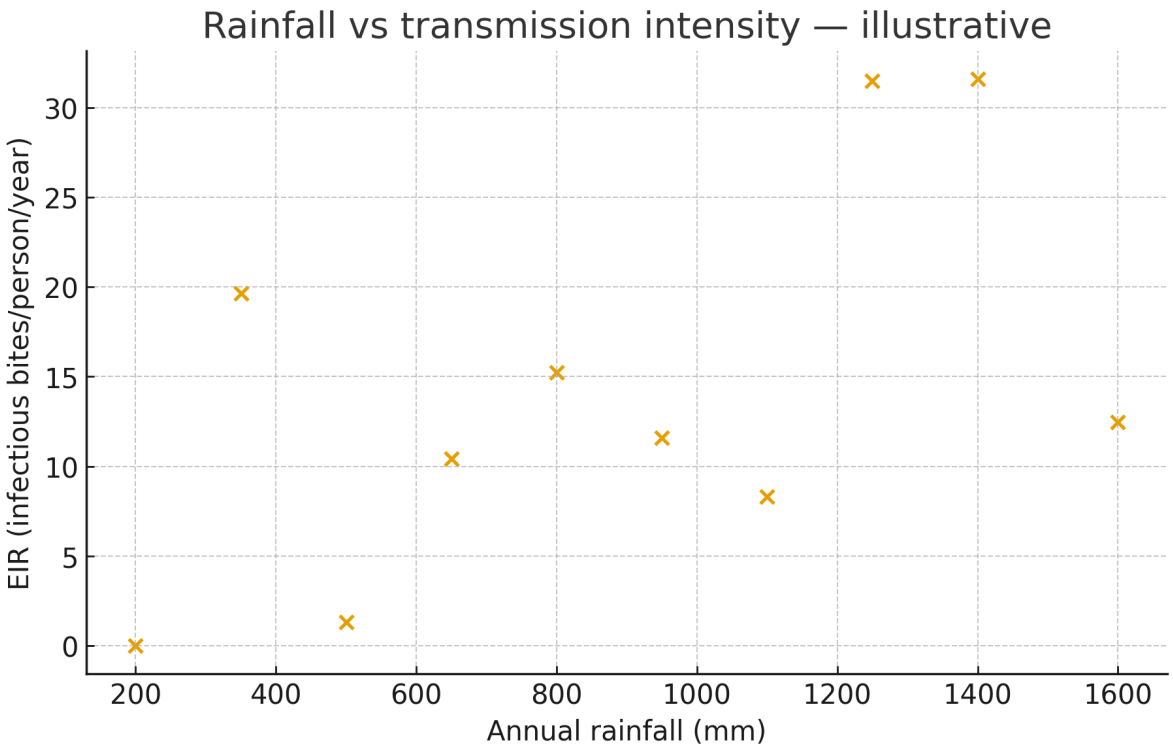


Table 12.1-A. Transmission cycle & key concepts

Concept	Summary
Transmission cycle	Human ↔ Anopheles mosquito ↔ human; sporozoites → liver → blood stages
Extrinsic incubation (EIP)	Sporozoites develop in mosquito; temperature dependent (≈10–14 days)
Intrinsic incubation	Time from infectious bite to symptoms; ~7–30 days by species
Receptivity	Environmental suitability for transmission (vector presence, climate)
Vulnerability	Risk of parasite introduction/importation
Vectorial capacity	Potential for transmission given vector density, survival, biting

Table 12.1-B. Ethiopia eco-epidemiological zones (illustrative)

Zone (illustrative)	Ethiopia transmission notes
Highland fringe (1,500–2,000m)	Unstable/seasonal; epidemics after heavy rains; Pf dominant
Lowland pastoralist belts	Stable/seasonal; breeding in temporary pools/riverbeds; Pf and Pv
Irrigation/peri-urban	Focal breeding; construction & agriculture-linked; An. stephensi risk
Urban settings	Generally low but rising risk with An. stephensi; water storage habitats

Table 12.1-C. Core indicators & definitions

Indicator	Definition
Incidence rate	Confirmed cases per 1,000 population per year
Test positivity rate (TPR)	Positive tests among those tested (%)

Annual blood examination rate (ABER)	Number tested per 100 population per year
Annual parasite incidence (API)	Confirmed cases per 1,000 at risk per year
Entomological inoculation rate (EIR)	Infectious bites per person per unit time

Table 12.1-D. Malaria case definitions (programmatic)

Definition	Criteria/notes
Suspected case	Fever/history of fever where malaria transmission occurs
Confirmed case	Positive RDT or microscopy for Plasmodium spp.
Severe malaria	Clinical/lab criteria (e.g., severe anemia, danger signs)
Malaria death	Death with confirmed malaria where malaria is main cause

Table 12.1-E. Typical seasonality windows by area (illustrative)

Area	Typical transmission windows
Amhara highland fringe	Sep–Dec (primary), Apr–Jun (secondary)
Afar & Somali lowlands	Aug–Nov; flash-flood associated peaks
Oromia (rivers/irrigation)	May–Jul; Oct–Dec
Gambela & Benishangul-Gumuz	May–Nov extended season
Urban/peri-urban	Localized after rains; water storage risks

Narrative summary (plain-language)

Malaria spreads when an infected mosquito bites a person and passes tiny parasites into the blood. Warm temperatures and standing water help mosquitoes breed, so transmission rises after the rains and in areas where mosquitoes survive longer. In Ethiopia, both Plasmodium falciparum and P. vivax are common. The highland fringe has seasonal outbreaks, while lower-lying and irrigated areas can have longer seasons.

Simple measures—like sleeping under insecticide-treated nets, spraying houses in high-risk areas, testing fevers quickly, and treating with effective medicines—can drive down illness and deaths. Good data on when and where cases occur helps target resources to the right places at the right time.

References — Section 12.1

• **Federal Ministry of Health (Ethiopia) — National Malaria Guidelines & MIS —** https://www.moh.gov.et/

• **WHO — World Malaria Report & guidance —** https://www.who.int/teams/global-malaria-programme

• **Malaria Atlas Project — maps & metrics —** https://malariaatlas.org/

• **PMI — Ethiopia malaria activities —** https://www.pmi.gov/where-we-work/ethiopia/

• **CDC — Malaria biology & prevention —** https://www.cdc.gov/malaria/

12.2) Parasite & Vector Biology — Malaria

This section summarizes key biological features of the parasites and vectors relevant to Ethiopia’s program decisions. Charts are illustrative placeholders using integer years. Replace with MIS/HMIS/entomology surveillance data before publication.

Figure 12.2-1. Parasite species composition over time — illustrative

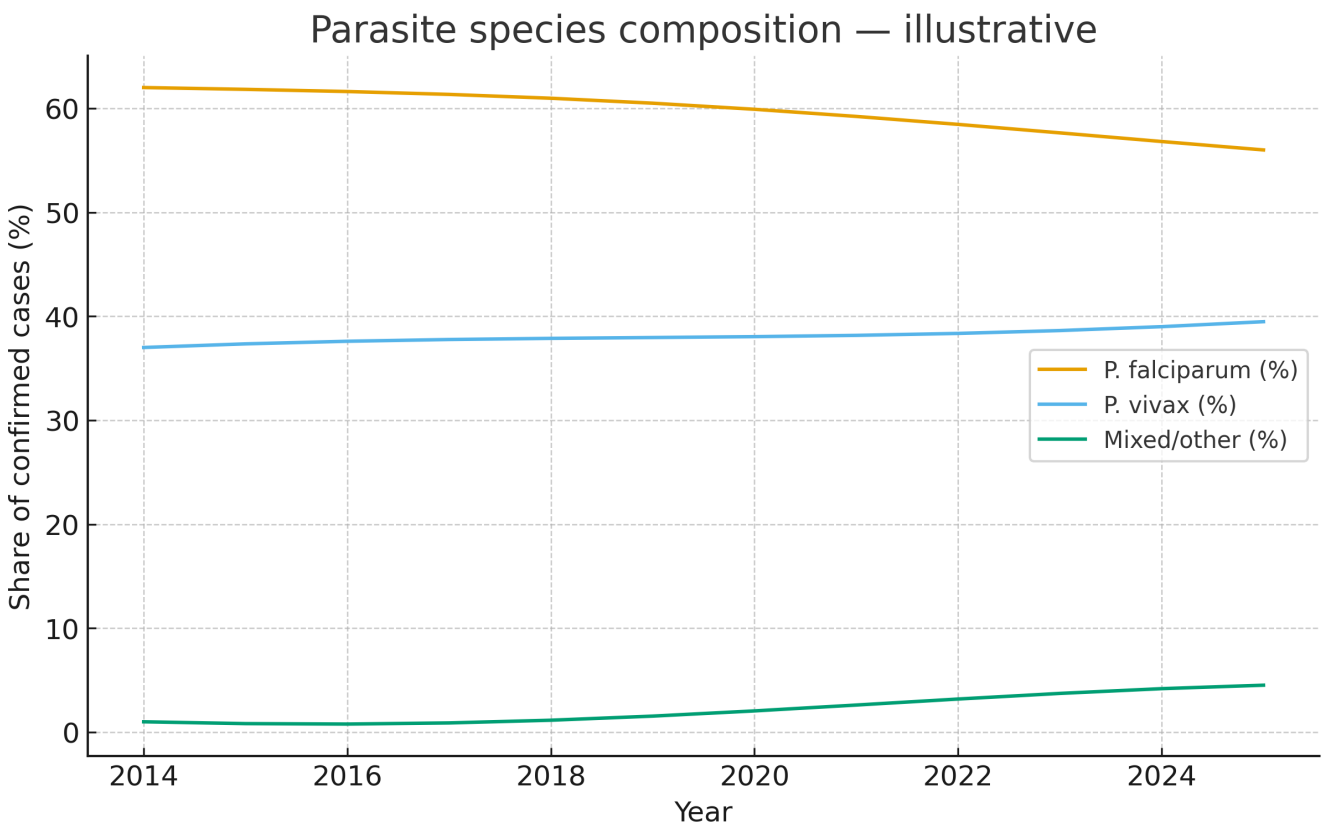


Figure . HRP2/HRP3 deletion prevalence among Pf positives — illustrative

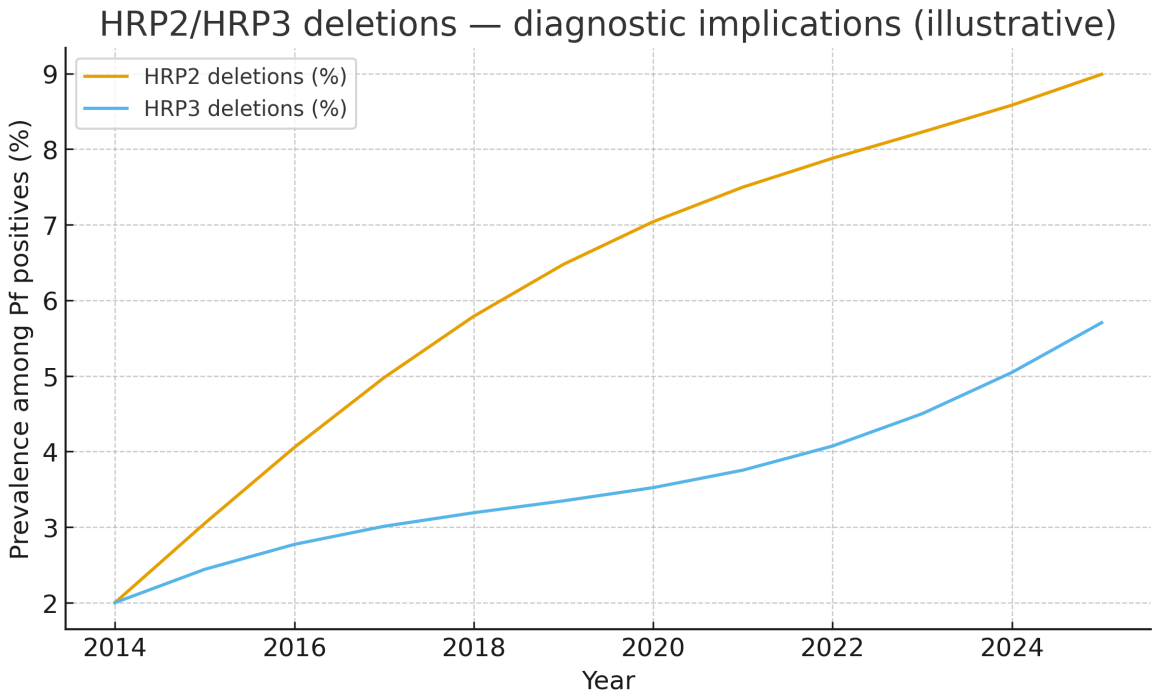


Figure . Vector abundance by habitat — illustrative

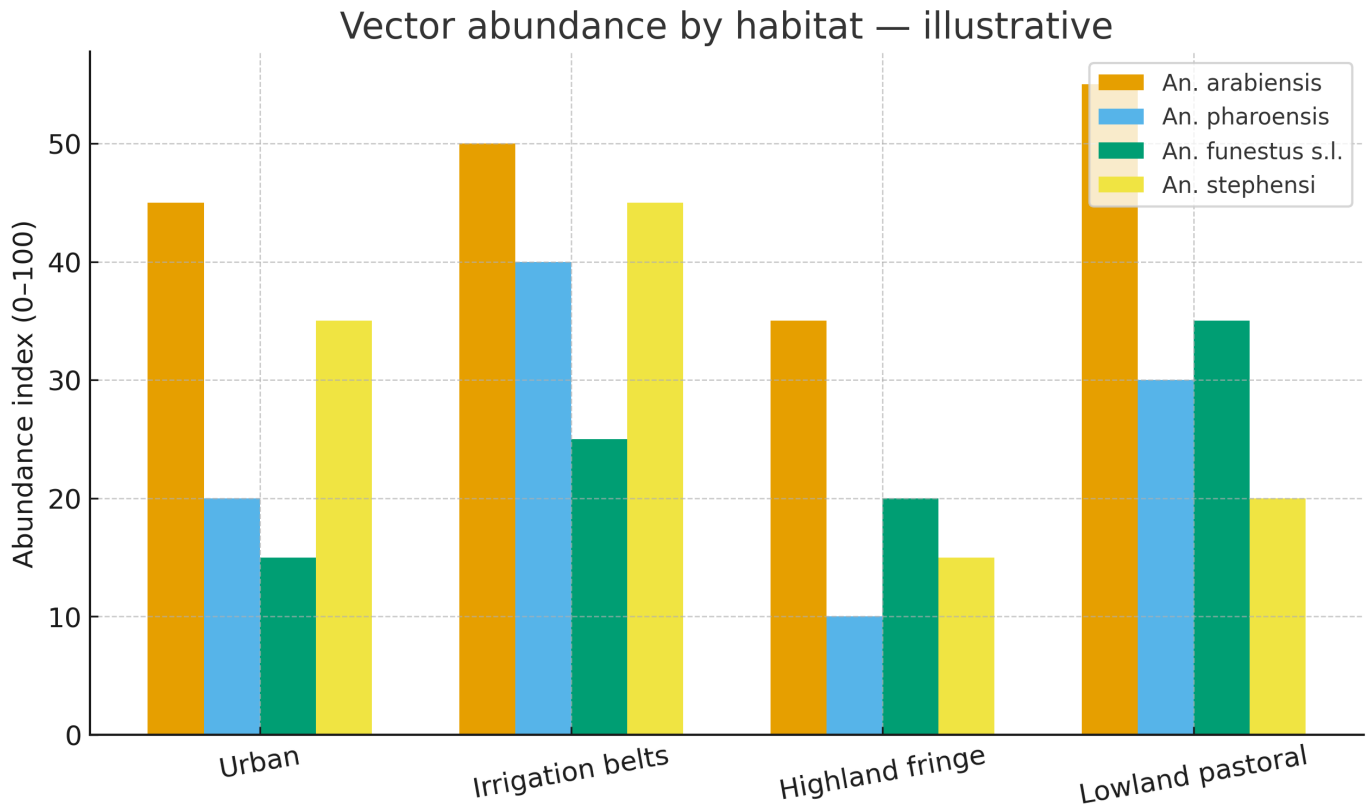


Figure . Insecticide resistance trends (bioassay 24h mortality) — illustrative

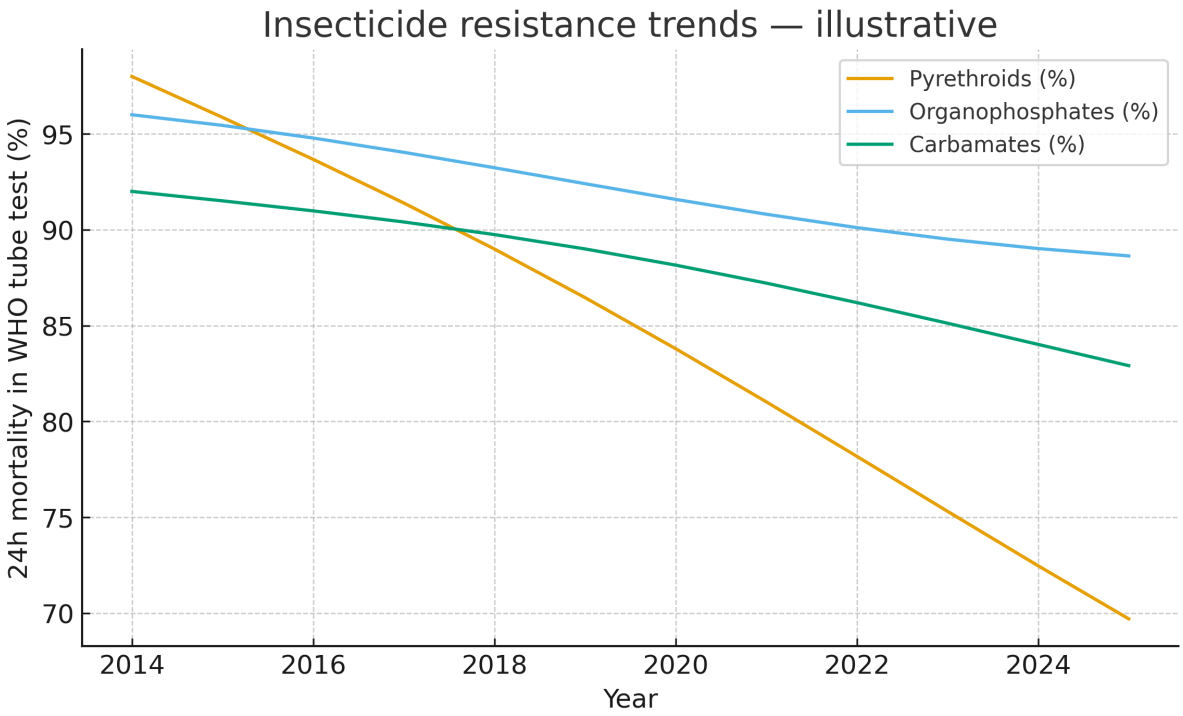


Figure . Nocturnal biting pattern (hourly) — illustrative

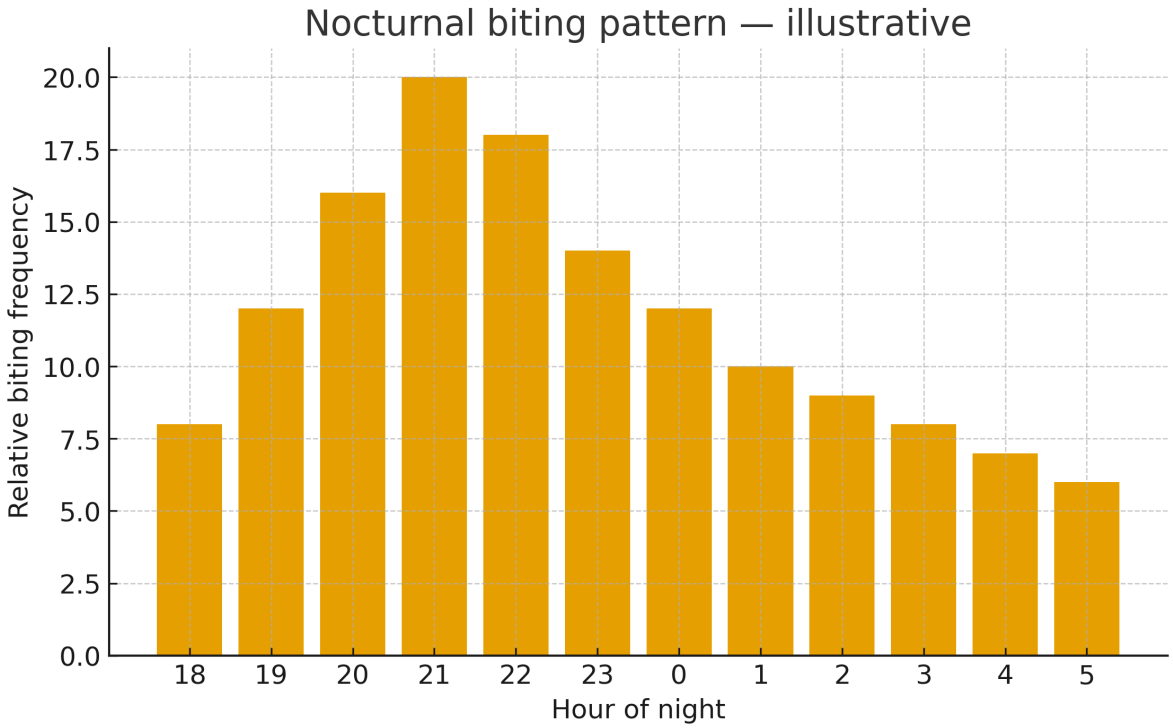


Table 12.2-A. Parasite biology (P. falciparum vs P. vivax)

Species	Key biological features & Ethiopia notes
P. falciparum	Severe disease risk; sequestration; HRP2 antigen target for many RDTs
P. vivax	Hypnozoite liver stage causing relapses; requires radical cure; broader temperature range

Table 12.2-B. Vector species in Ethiopia — bionomics & relevance

Vector	Bionomics & program relevance
An. arabiensis	Major vector; opportunistic feeder; indoor & outdoor biting/resting; agricultural/temporary pools
An. pharoensis	Breeds in lagoons/slow rivers; early-evening biting; secondary vector role
An. funestus s.l.	Prefers permanent vegetated water; strong indoor resting; can sustain perennial transmission
An. stephensi	Urban container breeder; invasive in Horn of Africa; threatens urban/peri-urban transmission

Table 12.2-C. Insecticide classes & mode of action

Class	Mode of action & Ethiopia notes
Pyrethroids	Voltage-gated sodium channel; used in LLINs; resistance widespread
Organophosphates	Acetylcholinesterase inhibitors; used in IRS (e.g., pirimiphos-methyl)
Carbamates	Acetylcholinesterase inhibitors; IRS rotations; resistance variable
Neonicotinoids	Nicotinic acetylcholine receptor agonists; newer IRS options

Pyrroles & others	Uncouplers/novel MOAs; deployment context-specific

Table 12.2-D. Resistance mechanisms & monitoring toolbox

Item	Programmatic implication
Target-site mutations	kdr (L1014F/S) for pyrethroids; Ace-1 for carbamates/OPs
Metabolic resistance	Elevated P450s, GSTs, esterases; synergist assays (PBO) identify
Intensity testing	1×, 5×, 10× doses; determines operational significance
Bioassays & cone tests	WHO tube tests; CDC bottle assays; LLIN cone tests for efficacy
Molecular surveillance	PCR/sequencing for markers; incursion tracking (e.g., An. stephensi)

Table 12.2-E. Diagnostic & treatment implications of biology

Biological issue	Operational response in Ethiopia
HRP2/HRP3 deletions	False-negative HRP2 RDTs; consider pLDH-based or combo RDTs; microscopy QA
P. vivax hypnozoites	Need radical cure (primaquine/tafenoquine) + G6PD testing to prevent hemolysis
Outdoor/early biting	Complement LLINs/IRS with larval source management and personal protection
Urban container breeding (An. stephensi)	Urban vector control (source reduction, water management, targeted IRS/LLINs)

Narrative summary (plain-language)

Two malaria parasites matter most in Ethiopia. *P. falciparum* can cause severe disease and is usually detected by HRP2-based rapid tests, while *P. vivax* can hide in the liver and come back months later. That means patients with *P. vivax* need a

‘radical cure’ medicine, but only after checking for G6PD deficiency to avoid side effects. Mosquitoes that transmit malaria differ by habitat and behavior—some bite indoors, some outdoors, and some thrive in urban water containers. An invasive species, *Anopheles stephensi*, increases risk in towns and around irrigation schemes. Mosquitoes can also become resistant to insecticides, so Ethiopia rotates IRS chemicals and uses next-generation nets where needed. Understanding these biological details helps programs choose the right tests, drugs, and vector control tools for each area.

References — Section 12.2

• **Federal Ministry of Health (Ethiopia) — National Malaria Guidelines —** https://www.moh.gov.et/

• **WHO — Malaria: vector control, resistance monitoring, and test guidelines —** https://www.who.int/teams/global-malaria-programme

• **CDC — Malaria biology & vectors —** https://www.cdc.gov/malaria/

• **Malaria Atlas Project — Pf/Pv distributions —** https://malariaatlas.org/

• **WHO & FAO — Global plan for insecticide resistance management (GPIRM) —** https://www.who.int/publications/i/item/9789241564472

12.3) Ethiopia’s Epidemiology & Stratification — Malaria

This section synthesizes Ethiopia’s malaria epidemiology and illustrates a practical stratification approach. Charts and values are placeholders using integer years; replace with official HMIS/MIS/entomology and geospatial series before publication. Stratification thresholds must align with national policy.

Figure . National malaria incidence trend — illustrative

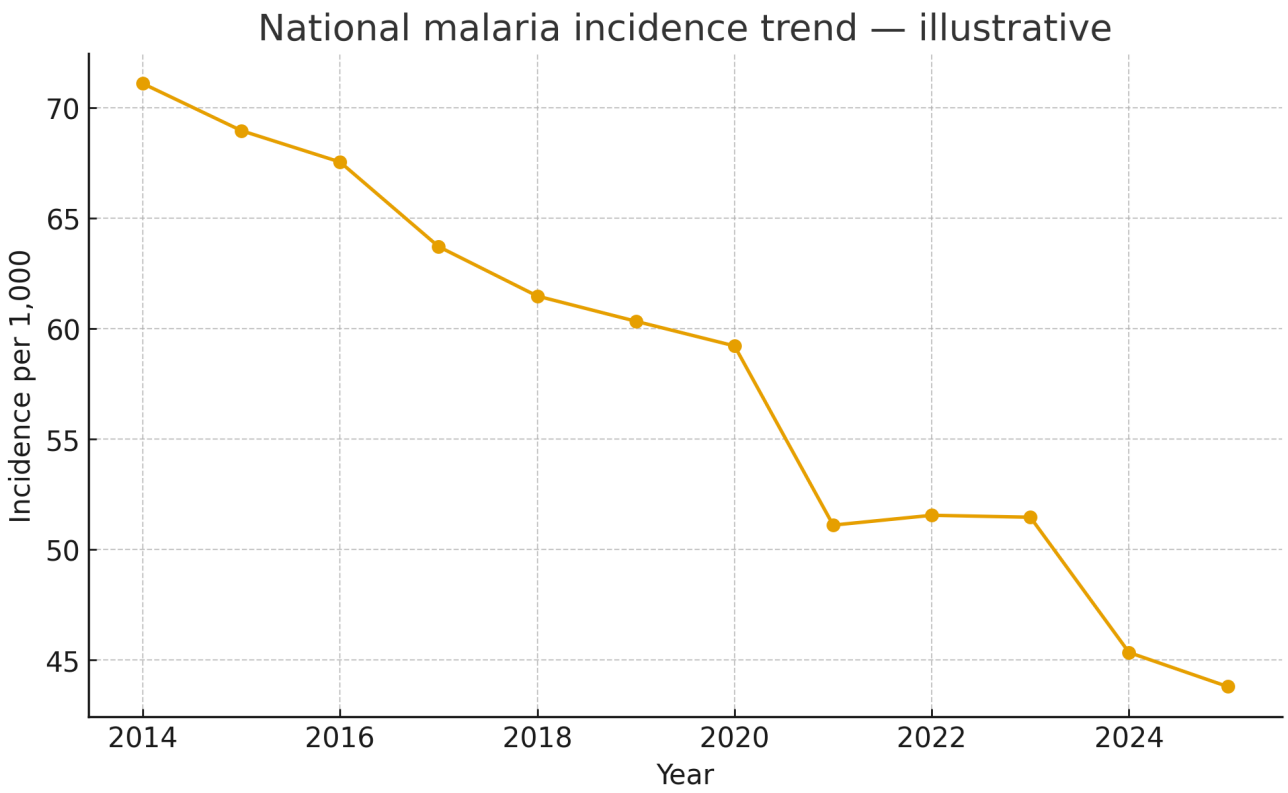


Figure . API by region — latest year (2025, illustrative)

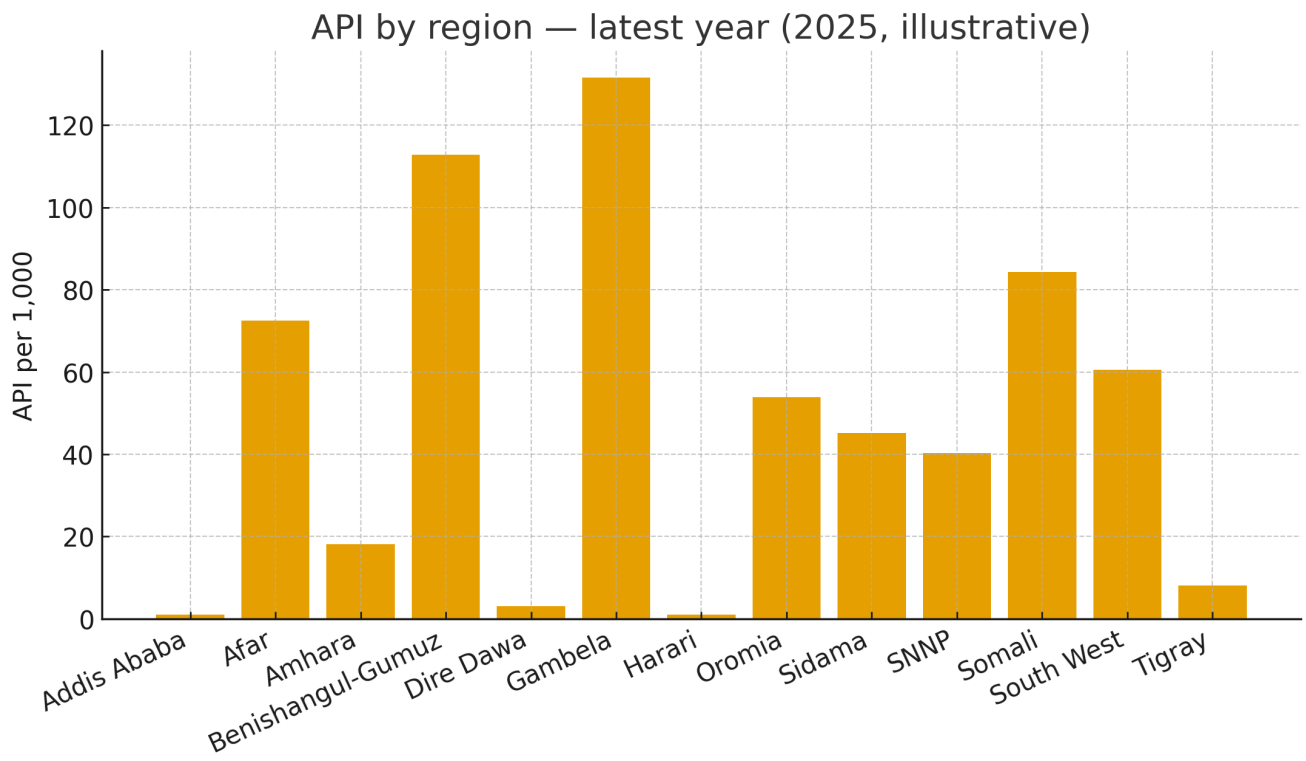


Figure . Testing volume vs positivity (ABER vs TPR) — 2024 (illustrative)

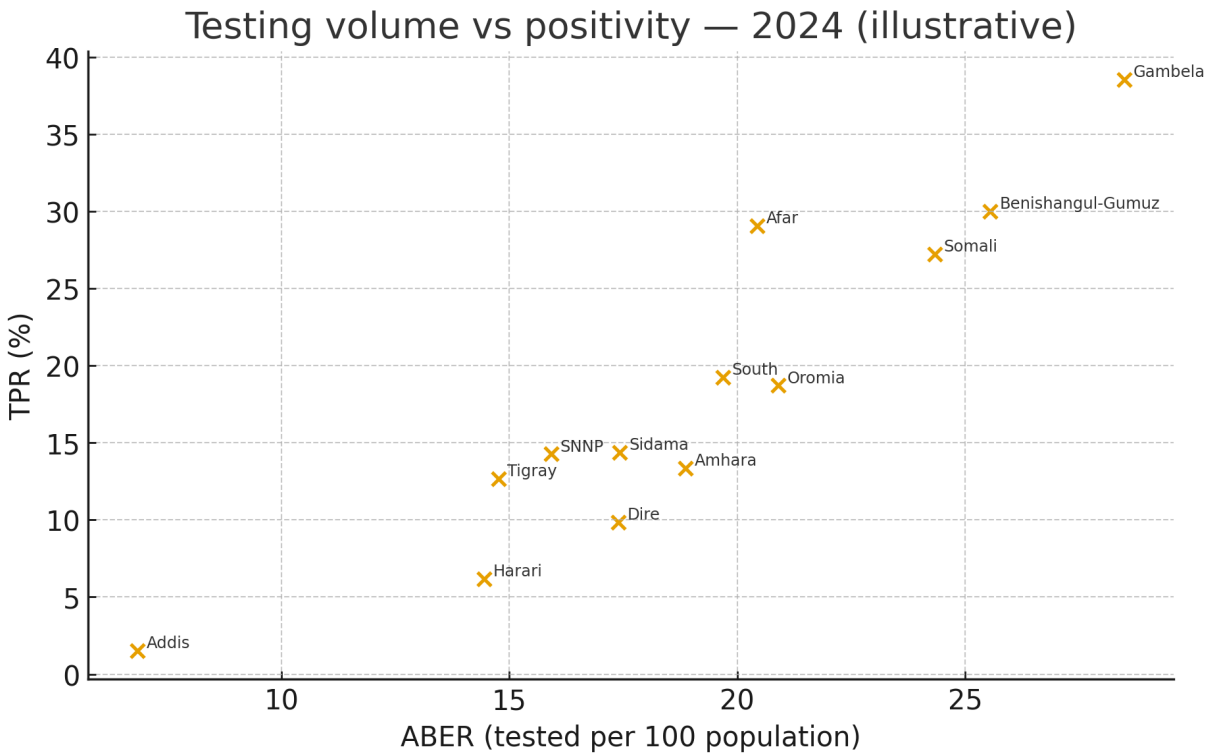


Table 12.3-A. Transmission stratification criteria (example)

Stratum	Operational guidance (illustrative — align with national policy)
Very low	API < 5 per 1,000; TPR < 5%; strong surveillance; targeted foci response
Low	API 5–<25; seasonal response; LLIN maintenance; focal IRS where indicated
Moderate	API 25–<100; routine LLIN + focal/rotational IRS; case investigation in hotspots
High	API ≥100; universal LLIN + targeted IRS; enhanced surveillance; surge response

Table 12.3-B. Regional snapshot: API, seasonality, testing & urban risk (latest)

Region	API_2025_per_1000	SeasonShare_main_%	ABER_2024_per_100	TPR_2024_%	UrbanRiskSignals

Addis Ababa	1.0	45.0	6.8	1.5	12
Afar	72.5	62.0	20.4	29.1	3
Amhara	18.2	58.0	18.9	13.3	6
Benishangul-Gumuz	112.8	60.0	25.6	30.0	2
Dire Dawa	3.1	52.0	17.4	9.8	5
Gambela	131.5	66.0	28.5	38.5	1
Harari	1.0	50.0	14.5	6.2	3
Oromia	53.9	57.0	20.9	18.7	7
Sidama	45.2	56.0	17.4	14.4	4
SNNP	40.3	55.0	15.9	14.3	5
Somali	84.3	63.0	24.3	27.2	4
South West	60.6	58.0	19.7	19.2	3
Tigray	8.1	54.0	14.8	12.7	2

Table 12.3-C. Urban/peri-urban risk factors & responses (An. stephensi context)

Risk factor	Program response in Ethiopia
Water storage containers	Promote covered storage; larval source management
Construction & irrigation	Source mapping; site management; drainage
Informal settlements	Targeted LLIN distribution; community-led source reduction
Mobility & importation	Travel history in case investigation; workplace outreach

Table 12.3-D. Data sources used in micro-stratification

Source	Use in micro-stratification

HMIS/DHIS2 cases & tests	Routine incidence, TPR, ABER by woreda/facility
MIS & special surveys	Prevalence, ITN access/use, IRS coverage
Entomology surveillance	Vector species, resistance, biting/resting behavior
Geospatial layers	Rainfall, temperature, elevation, travel-time, waterbodies
Population denominators	Projected populations; catchment adjustments; IDP/seasonal workers

Table 12.3-E. Targeting menu by stratum (align with policy)

Stratum	Priority interventions (align with national policy)
Very low	Case investigation and foci response; importation screening; maintain LLINs in foci
Low	Maintain LLIN coverage; focal IRS; school/community testing during peaks
Moderate	Universal LLIN distribution; targeted IRS; enhanced surveillance and response
High	Universal LLINs + IRS; expand diagnostics/treatment access; surge stocks and staff

Narrative summary (plain-language)

Malaria risk is not the same everywhere in Ethiopia. Some low-lying or irrigated areas face longer seasons, while the highland fringes have short, sharp outbreaks after rains. Programs use data—confirmed cases, test positivity, and the number of people tested—to group areas by transmission level. Higher-risk places get a full package of tools such as insecticide-treated nets and spraying, while very-low areas focus on quickly finding and stopping small clusters. Urban neighborhoods need extra attention where the invasive mosquito Anopheles stephensi can breed in water tanks and containers. Clear

stratification helps target the right mix of prevention, testing, and treatment to the right locations at the right time.

References — Section 12.3

• **Federal Ministry of Health (Ethiopia) — National Malaria Guidelines; stratification guidance —** https://www.moh.gov.et/

• **WHO — High burden to high impact (HBHI) & stratification resources —** https://www.who.int/teams/global-malaria-programme

• **Malaria Atlas Project — risk mapping & PfPR/API tools —** https://malariaatlas.org/

• **PMI — Ethiopia Malaria Operational Plans (MOP) —** https://www.pmi.gov/where-we-work/ethiopia/

• **CDC — Anopheles stephensi resources —** https://www.cdc.gov/malaria/malaria_worldwide/reduction/stephensi.html

12.4) Surveillance, Case Definitions & Data Systems — Malaria

This section outlines Ethiopia’s malaria surveillance and case definitions, and offers a pragmatic data-to-action approach. Charts use integer years and are illustrative placeholders to be replaced with official HMIS/DHIS2/MIS/IDSR series before publication.

Figure . Routine surveillance: timeliness & completeness — illustrative

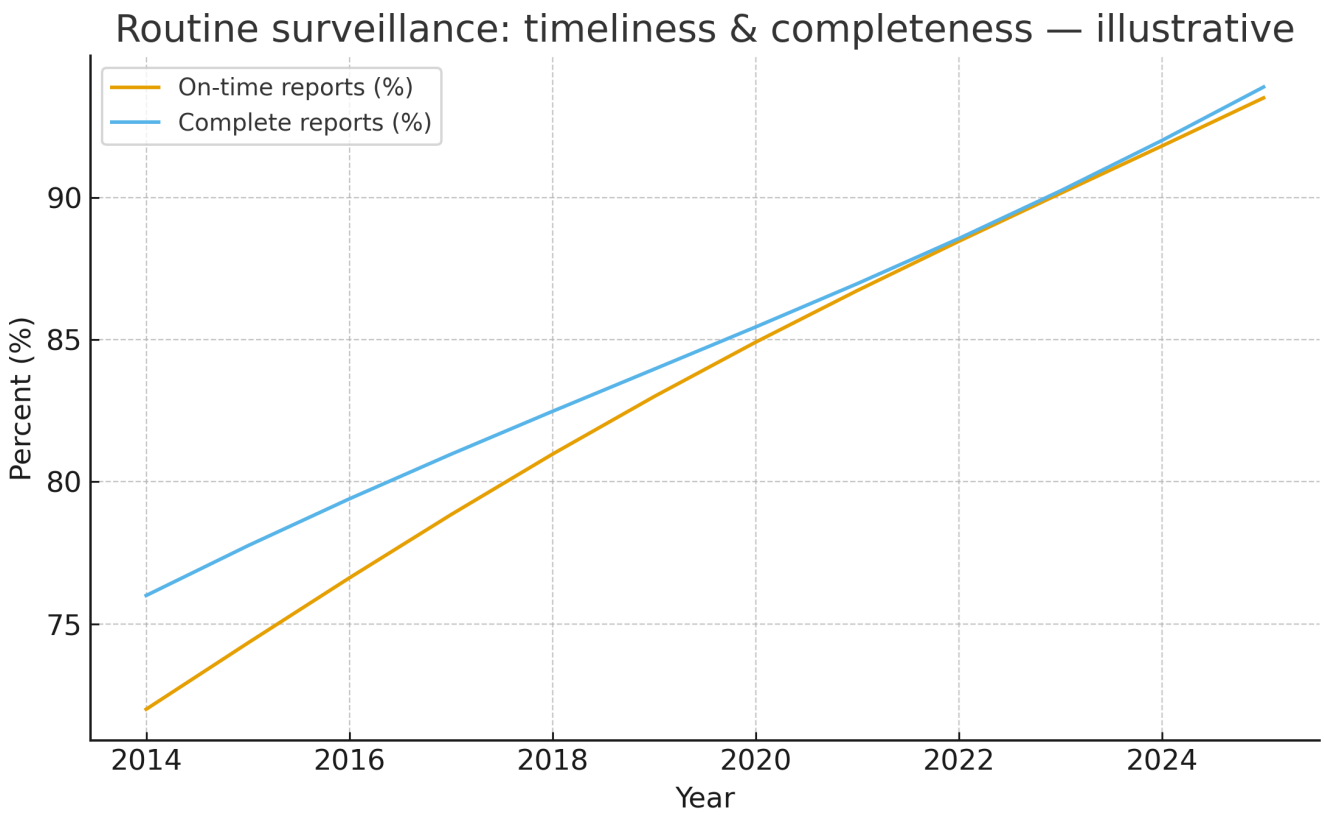


Figure . Case notification & investigation — illustrative

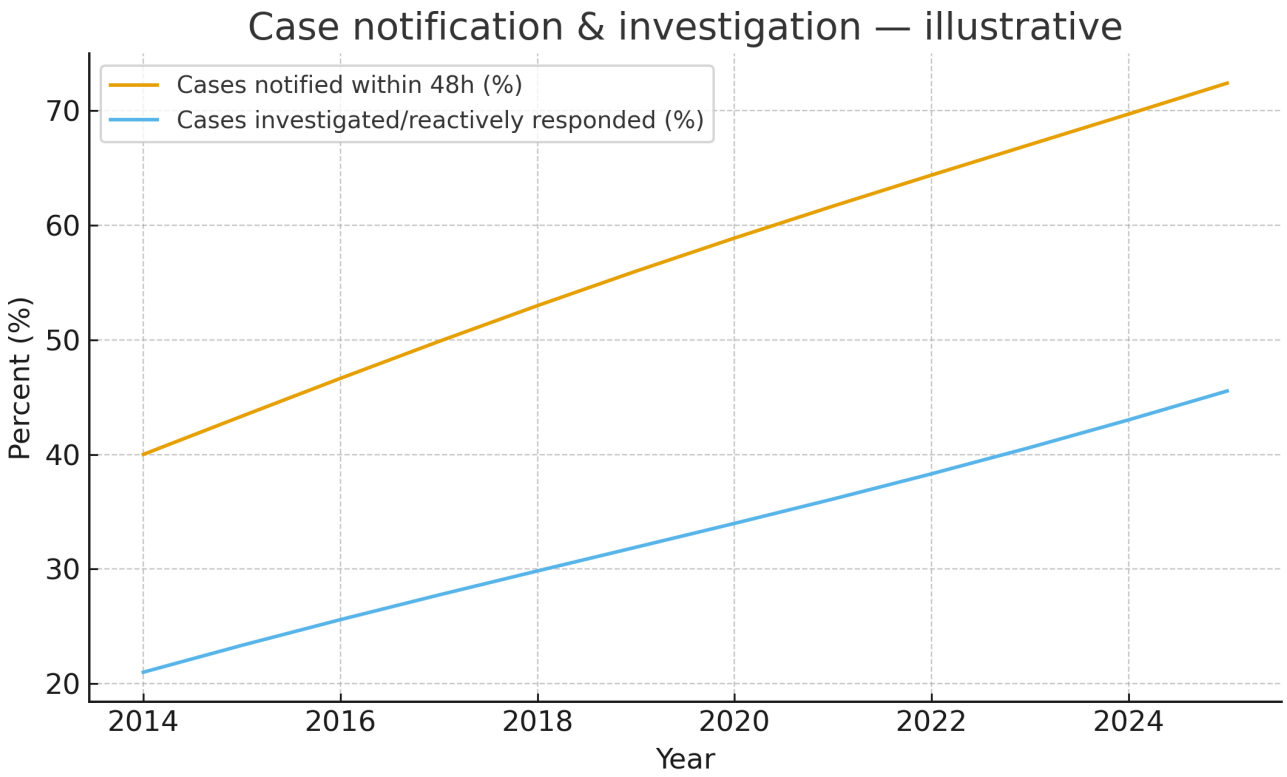


Figure . Routine–survey data concordance (lower is better) — illustrative

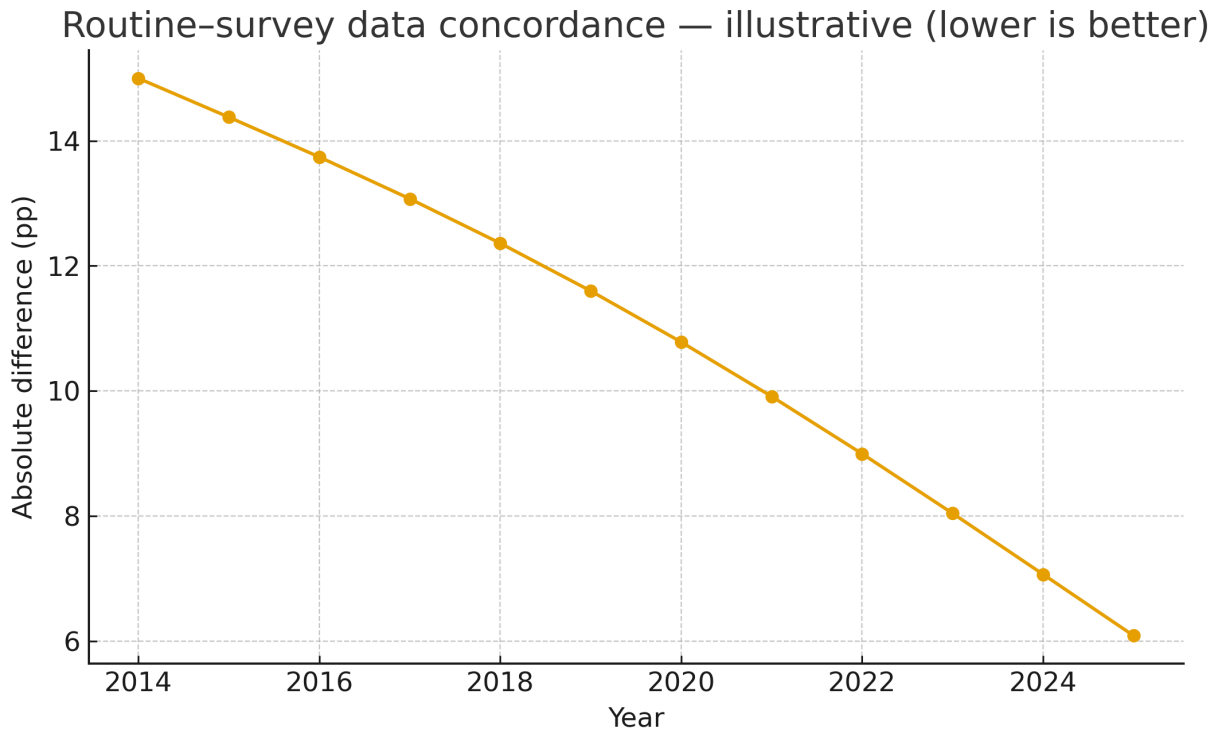


Figure . Quality quadrant: ABER vs TPR by region (latest year) — illustrative thresholds

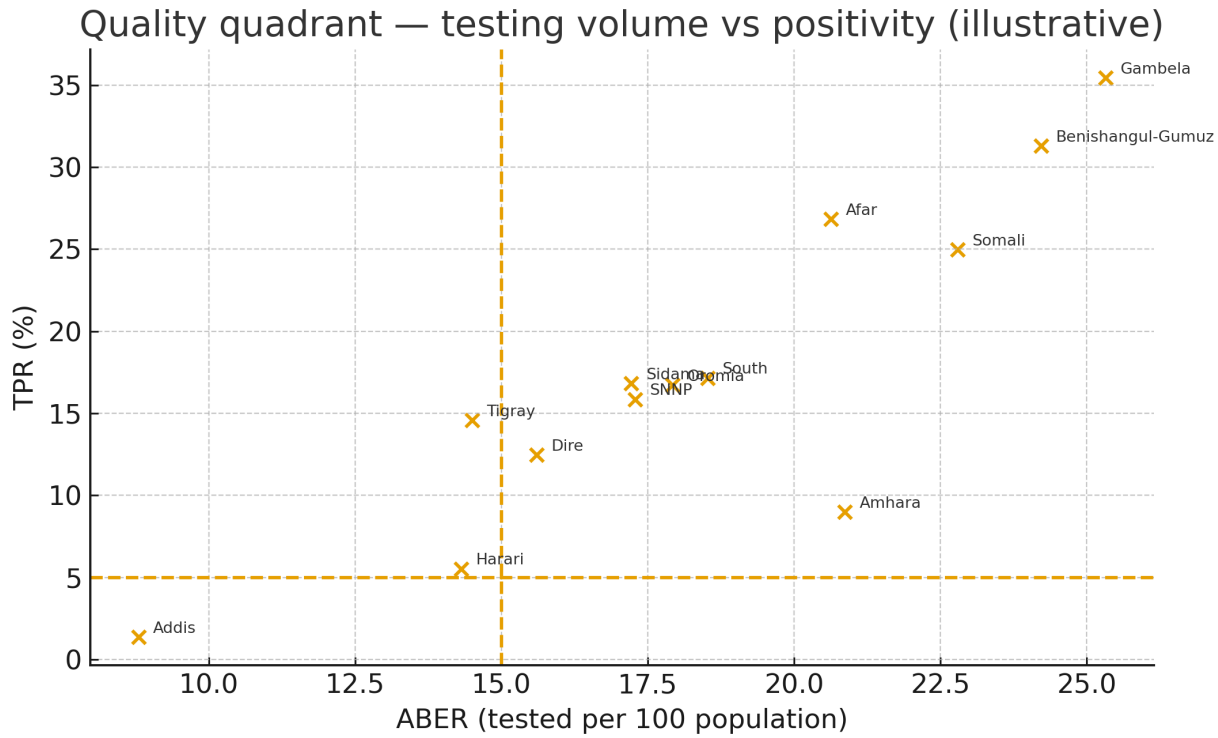


Figure . Digital malaria case capture (facility EMR & eCHIS) — illustrative

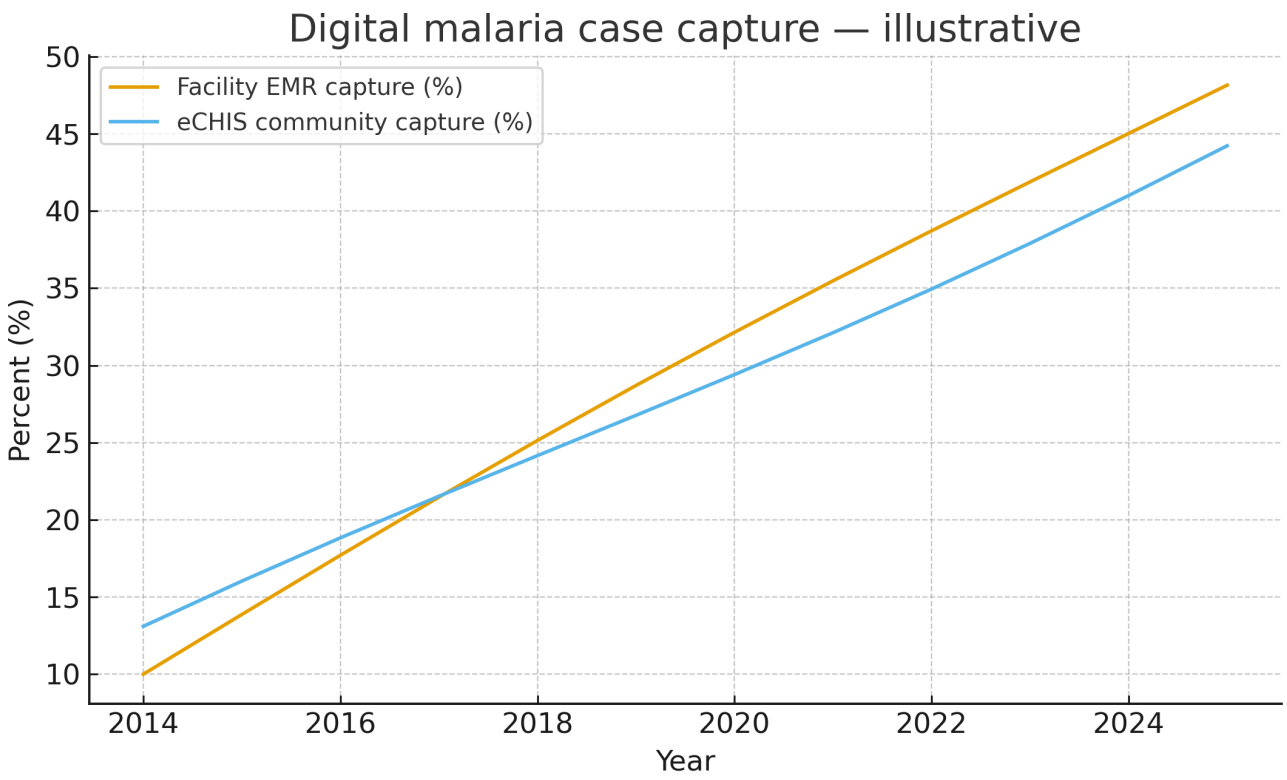


Figure . Alert-to-action timeliness (verification & response) — illustrative

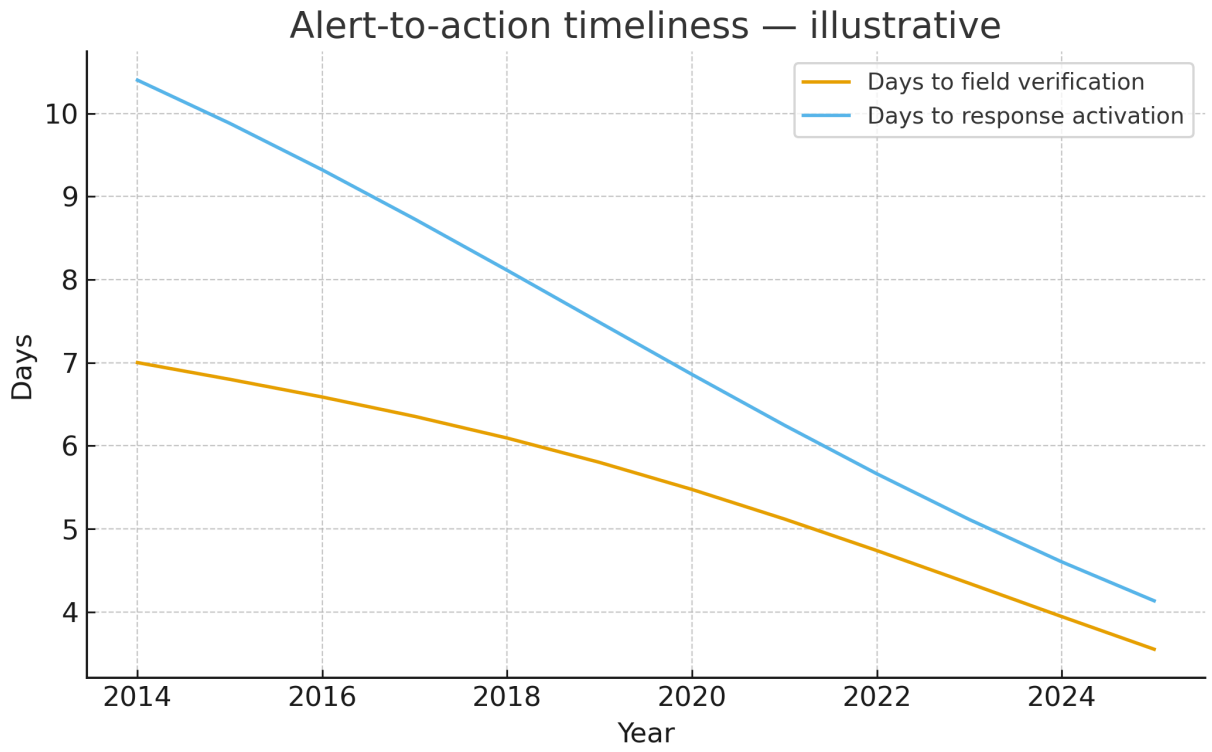


Table 12.4-A. Malaria case definitions (program standard)

Definition	Criteria/notes
Suspected case	Fever/history of fever in malaria area.
Confirmed case	Positive RDT or microscopy for Plasmodium spp.
Severe malaria	Clinical/lab criteria (e.g., severe anemia, danger signs).
Malaria death	Death in a patient with confirmed malaria where malaria is the main cause.

Table 12.4-B. Data systems & flows in Ethiopia

System level	Data flow in Ethiopia
Facility (OPD/IPD, lab)	Registers → DHIS2 monthly; some EMR integrations for line lists.

Community (HEW/eCHIS)	Household tests & treatments → eCHIS sync → DHIS2 aggregates.
IDSR alerts	Immediate reports (SMS/phone) for unusual events; verification within 24–72h.
MIS / special surveys	Periodic prevalence, ITN use, IRS coverage, knowledge & practices.
Entomology network	Species, resistance, bionomics; shared to DHIS2 or parallel database.

Table 12.4-C. Quality checks & concordance practices

Practice	Purpose & method
Denominator audits	Align catchment population with census/projections; remove ghost facilities.
Internal consistency	Check tests vs positives (ABER vs TPR), commodity use vs cases.
Concordance with surveys	Trend-level agreement with MIS/DHS; investigate divergence.
Outlier review	Flag extreme values; verify with facilities; correct if errors.
Feedback & action	Data review meetings; supervision checklists; dashboards.

Table 12.4-D. Core indicators for malaria dashboards

Indicator	Definition
ABER	Persons tested per 100 population per year.
TPR	% of tests that are positive.
API	Confirmed cases per 1,000 population per year.

Timeliness/Completeness	% facilities reporting on time/complete.
Notification/Investigation	% cases notified in 48h; % investigated/reactively responded.

Table 12.4-E. Interoperability & unique IDs

Item	Operational note for Ethiopia
Facility IDs	Standardized facility registry; consistent across DHIS2, LMIS, EMR.
Client IDs	Unique IDs where feasible; privacy-preserving linkage for case follow-up.
Provider IDs	Link training and supervision to case quality and outcomes.
FHIR/APIs	Use HL7 FHIR and open APIs for system interoperability.

Narrative summary (plain-language)

Good surveillance means we find malaria quickly and act fast. Ethiopia uses clinic, hospital and community reports to track testing and confirmed cases. Programs watch two simple numbers closely: how many people were tested (ABER) and what share were positive (TPR). High positivity with low testing may mean we're missing cases; low positivity with good testing suggests control is working. Digital tools like DHIS2, eCHIS and some EMRs can speed reporting and help teams act on alerts. Comparing routine data with survey findings builds confidence that the system reflects reality. The goal is simple: get reliable data to the front line so health workers can protect communities.

References — Section 12.4

• **Federal Ministry of Health (Ethiopia) — HMIS/DHIS2; IDSR; malaria case definitions —** https://www.moh.gov.et/

• **WHO — Malaria surveillance, monitoring & evaluation (SME) —** https://www.who.int/teams/global-malaria-programme/surveillance-monitoring-evaluation

• **The DHS Program/MIS — Ethiopia malaria indicators —** https://dhsprogram.com/

• **CDC — IDSR & surveillance resources —** https://www.cdc.gov/globalhealth/healthprotection/idsr/index.html

• **OpenHIE/DHIS2 — Interoperability & data exchange —** https://dhis2.org/

12.5) Diagnostics — Malaria

This section outlines malaria diagnostic tools and program implications for Ethiopia. Charts and values are placeholders using integer years; replace with official HMIS/MIS/QA and surveillance series before publication. Algorithms must align with national policy.

Figure 12.5-1. Testing volume by modality — illustrative

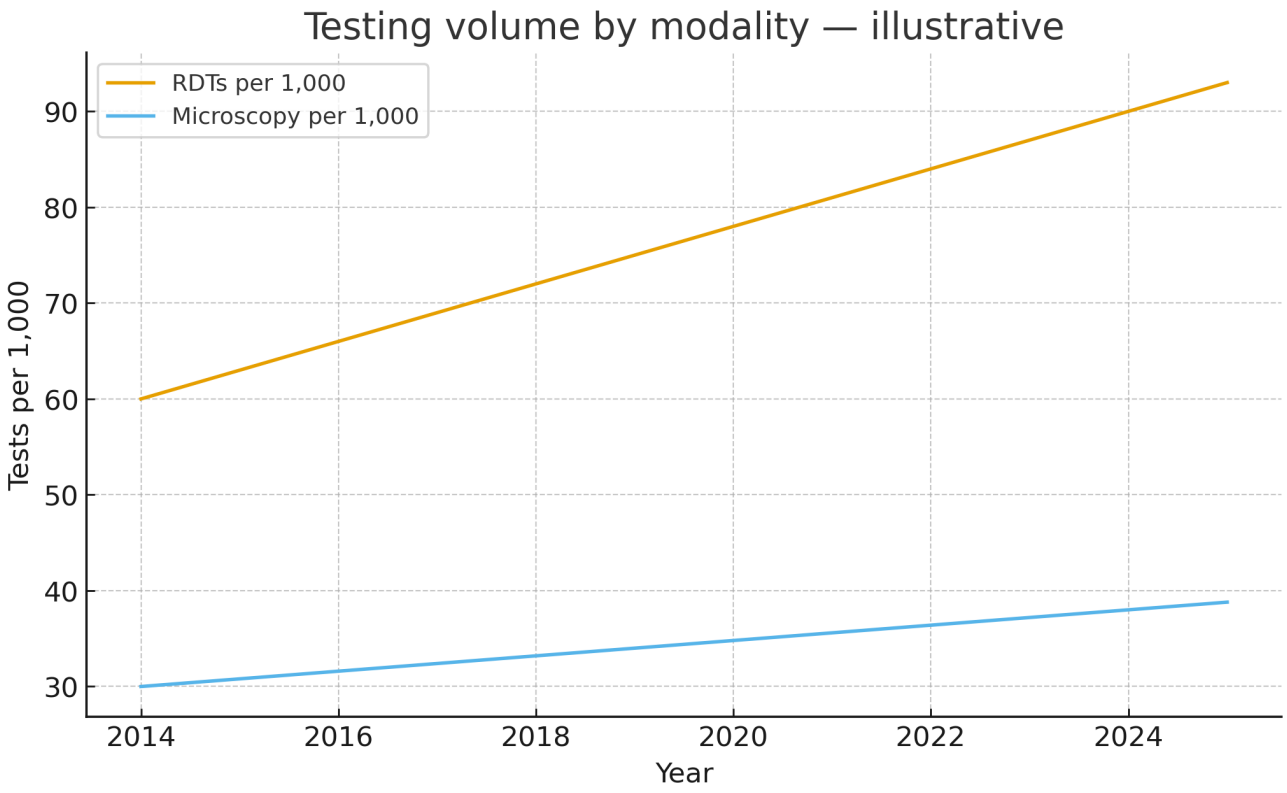


Figure 12.5-2. Test positivity rate (TPR) by modality — illustrative

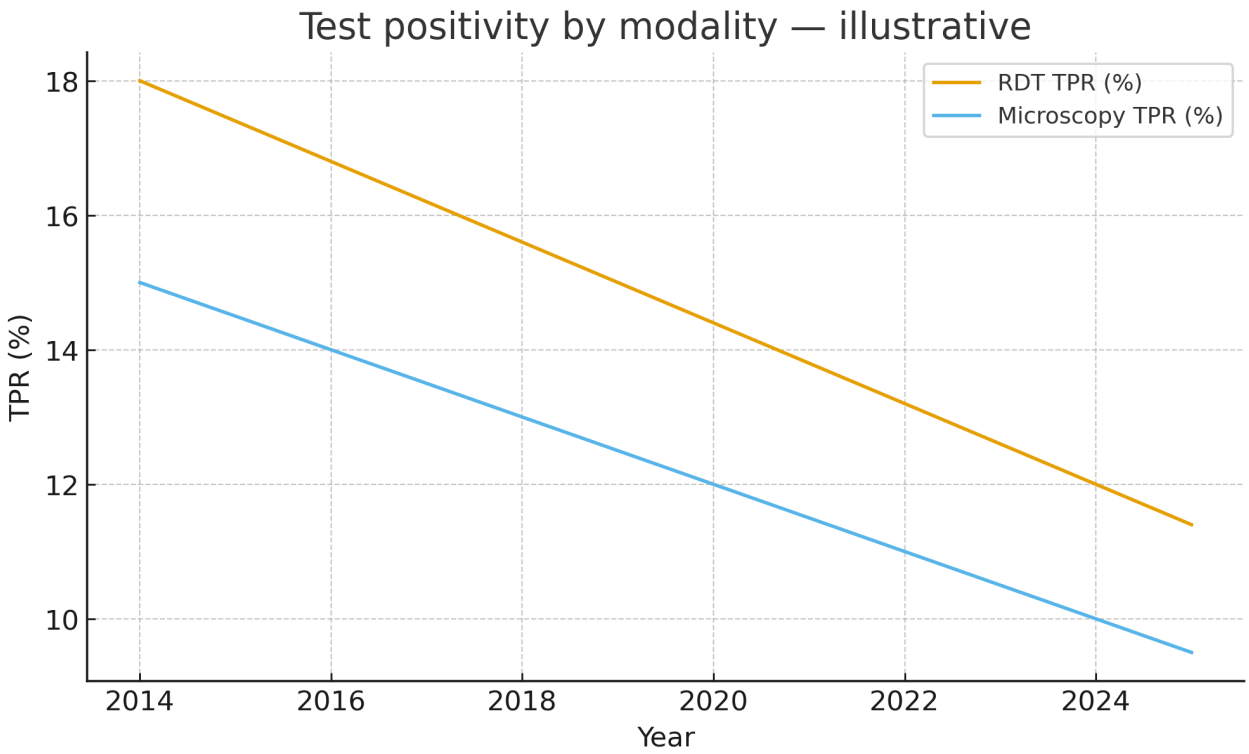


Figure 12.5-3. HRP2/HRP3 deletions among Pf positives — illustrative

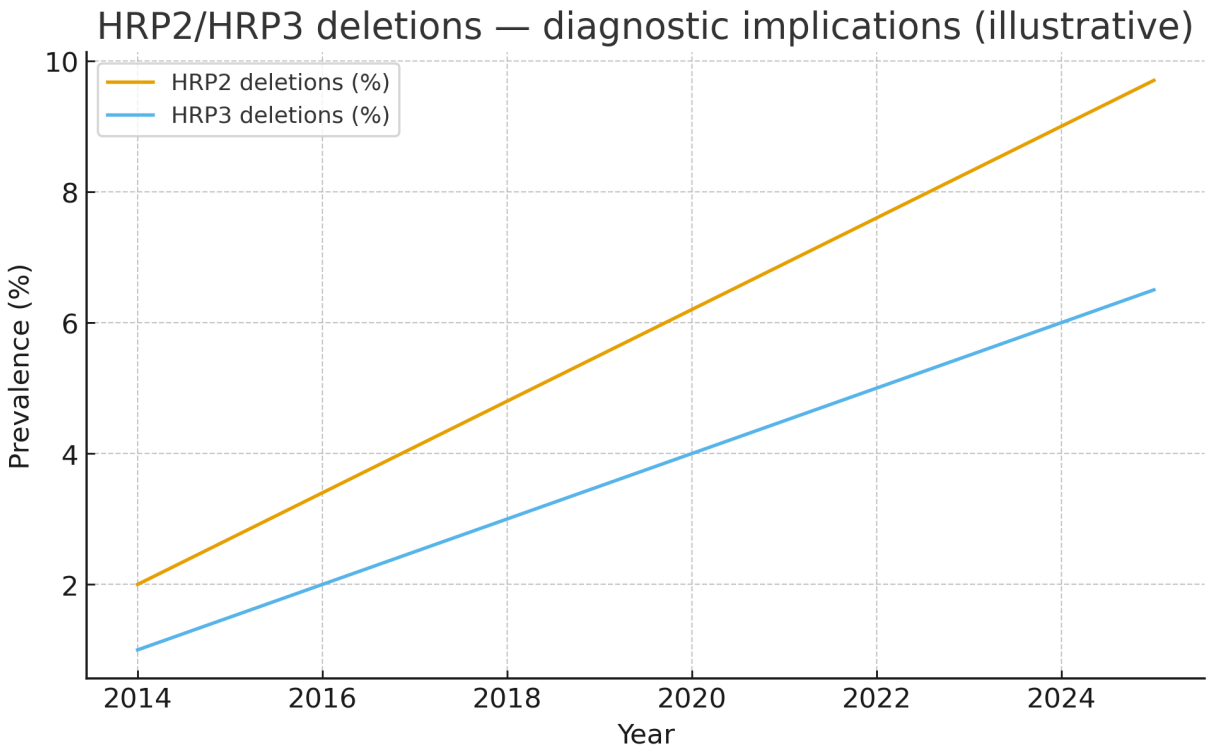


Figure 12.5-4. G6PD testing coverage among eligible cases — illustrative

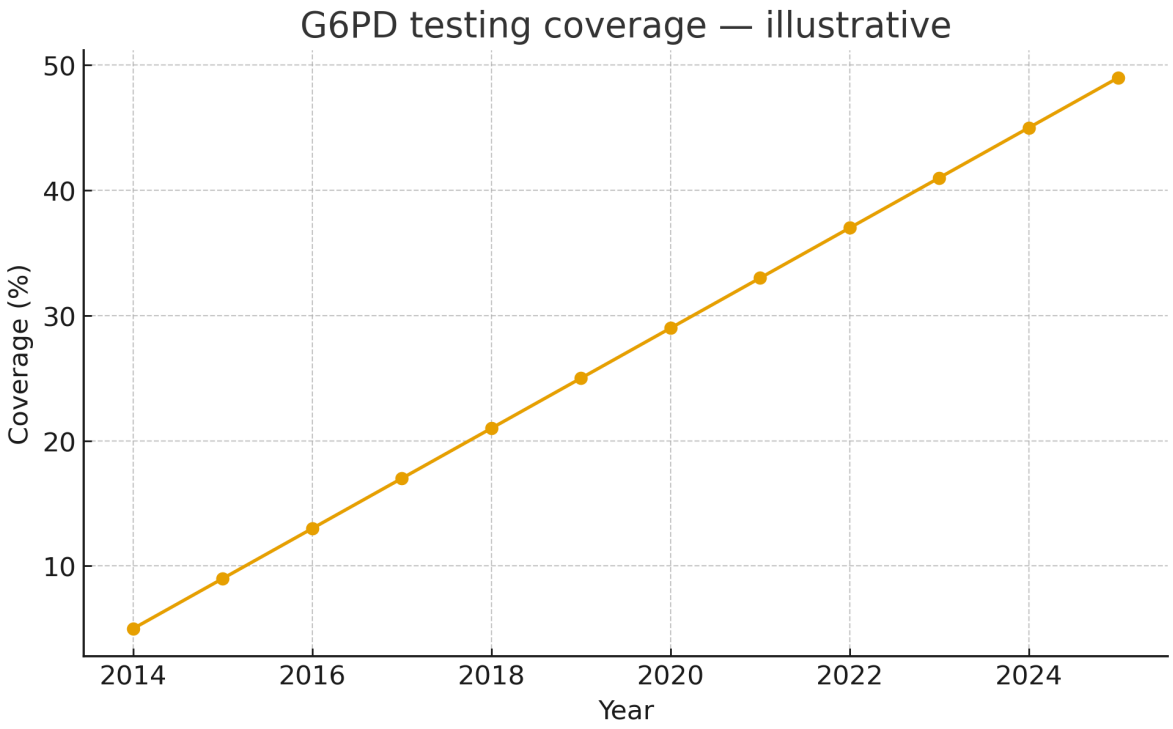


Figure 12.5-5. Microscopy QA/EQA concordance — illustrative

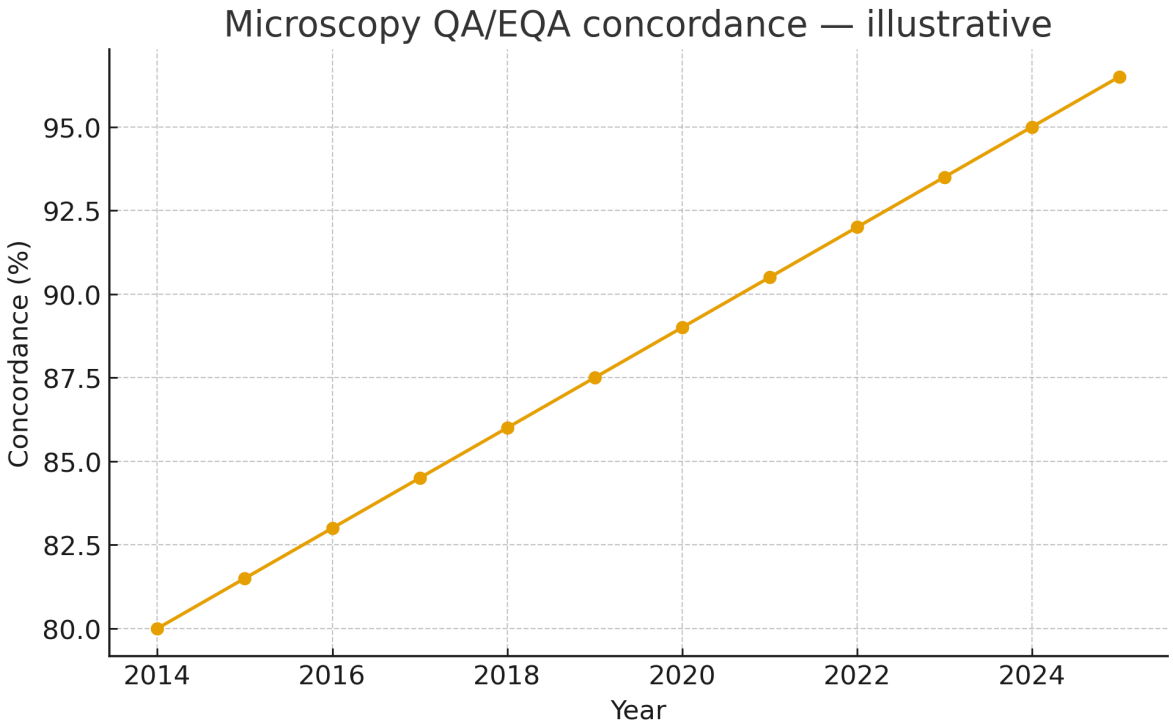


Figure 12.5-6. Stock-out rates and microscopy TAT — illustrative

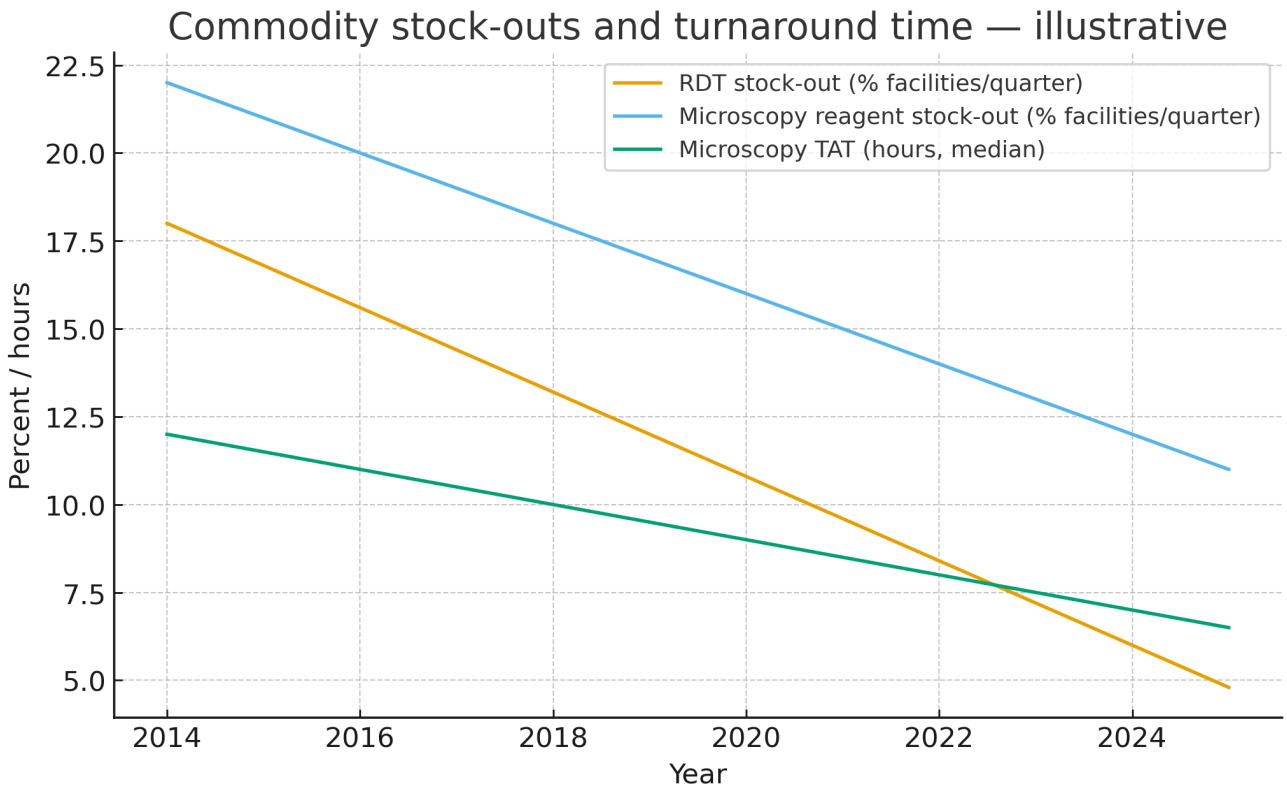


Table 12.5-A. National testing algorithm (illustrative — align with guideline)

Step	Action
Suspected malaria (fever)	Test all with RDT or microscopy; no presumptive treatment except per policy for severe cases without test.
Positive Pf by HRP2 RDT	Treat per guideline; consider HRP2 deletion risk if clinical suspicion high and RDT negative.
Non-Pf or Pv suspected	Use pLDH-based or combo RDTs/microscopy to detect non-falciparum.
Pv case	Assess G6PD and provide radical cure (primaquine/tafenoquine) per protocol.
Severe malaria	Immediate parenteral treatment; confirm microscopy/quality-assured test as feasible.

Table 12.5-B. Quality system components for diagnostics

Component	Description
Training & certification	Competency-based training; periodic re-certification for microscopists.
EQA (rechecking/proficiency)	Blind rechecking; unknown slides; corrective actions.
Internal QC	Daily positive/negative controls for RDT lots; stain quality checks.
Lot verification	Pre-distribution testing of RDT lots; retain samples.
Supervision & mentoring	Regular site visits with feedback and on-the-job coaching.

Table 12.5-C. HRP2/HRP3 deletion response guide

Program context	Diagnostic response
Low/unknown deletion prevalence	Standard HRP2-based RDTs acceptable; routine monitoring.
Rising deletions (sentinel)	Introduce combo (HRP2 + pLDH) RDTs; increase microscopy QA.
High deletions documented	Shift to pLDH-based algorithms; strong microscopy capacity; update guidelines and training.

Table 12.5-D. G6PD testing & radical cure — operational notes

Item	Ethiopia program note
Test type	Quantitative devices preferred; qualitative acceptable with clear thresholds.
Eligibility	Pv/Pm cases and relapsing febrile illness consistent with Pv.
Contraindications	Severe G6PD deficiency; pregnancy for primaquine; infants <6 months.

Follow-up	Adherence counseling; hemolysis warning signs; documentation.
Supply chain	Controls, cuvettes/strips, device calibration and maintenance.

Table 12.5-E. Indicators & definitions for diagnostic dashboards

Indicator	Definition
Testing rate	RDTs/microscopies per 1,000 population per year.
TPR by modality	% positive among tests by RDT and microscopy.
QA/EQA concordance	% slides concordant on rechecking/proficiency testing.
G6PD coverage	% eligible Pv/Pm cases with documented G6PD test.
Stock-out rates	% facilities with any stock-out days per quarter for RDTs/reagents.
Turnaround time	Median hours from sample to result for microscopy.

Narrative summary (plain-language)

To manage malaria well, Ethiopia needs fast and reliable diagnosis. Rapid diagnostic tests (RDTs) help frontline workers confirm malaria quickly, while microscopy is essential for species confirmation, parasite density, and quality checks. Some P. falciparum parasites lack the HRP2/HRP3 proteins that many RDTs detect—this can cause false negatives. Programs should monitor these deletions and introduce combo or pLDH-based RDTs when needed. For P. vivax, a special liver stage can trigger relapses, so patients need ‘radical cure’ after testing for G6PD deficiency to avoid harmful side effects. Reliable supplies, trained staff, and regular quality assurance make test results trustworthy. When diagnosis is timely and accurate, treatment improves and transmission drops.

References — Section 12.5

• **Federal Ministry of Health (Ethiopia) — National Malaria Diagnosis & Treatment Guidelines —** https://www.moh.gov.et/

• **WHO — Malaria diagnostic testing & HRP2/HRP3 deletions guidance —** https://www.who.int/teams/global-malaria-programme

• **CDC — Malaria diagnosis (microscopy, RDT) —** https://www.cdc.gov/malaria/diagnosis_treatment/diagnosis.html

• **FIND — G6PD testing and radical cure resources —** https://www.finddx.org/malaria/

• **WHO — Good practices for QA/EQA in malaria microscopy —** https://www.who.int/publications

12.6) Case Management & Treatment Protocols — Malaria

This section presents Ethiopia-relevant treatment protocols for uncomplicated and severe malaria, with attention to P. vivax radical cure, G6PD testing, and quality of care. Charts are illustrative placeholders using integer years; replace with official HMIS, TES and pharmacovigilance data before publication. Always align recommendations with the national guideline in force.

Figure . Timely appropriate treatment — illustrative

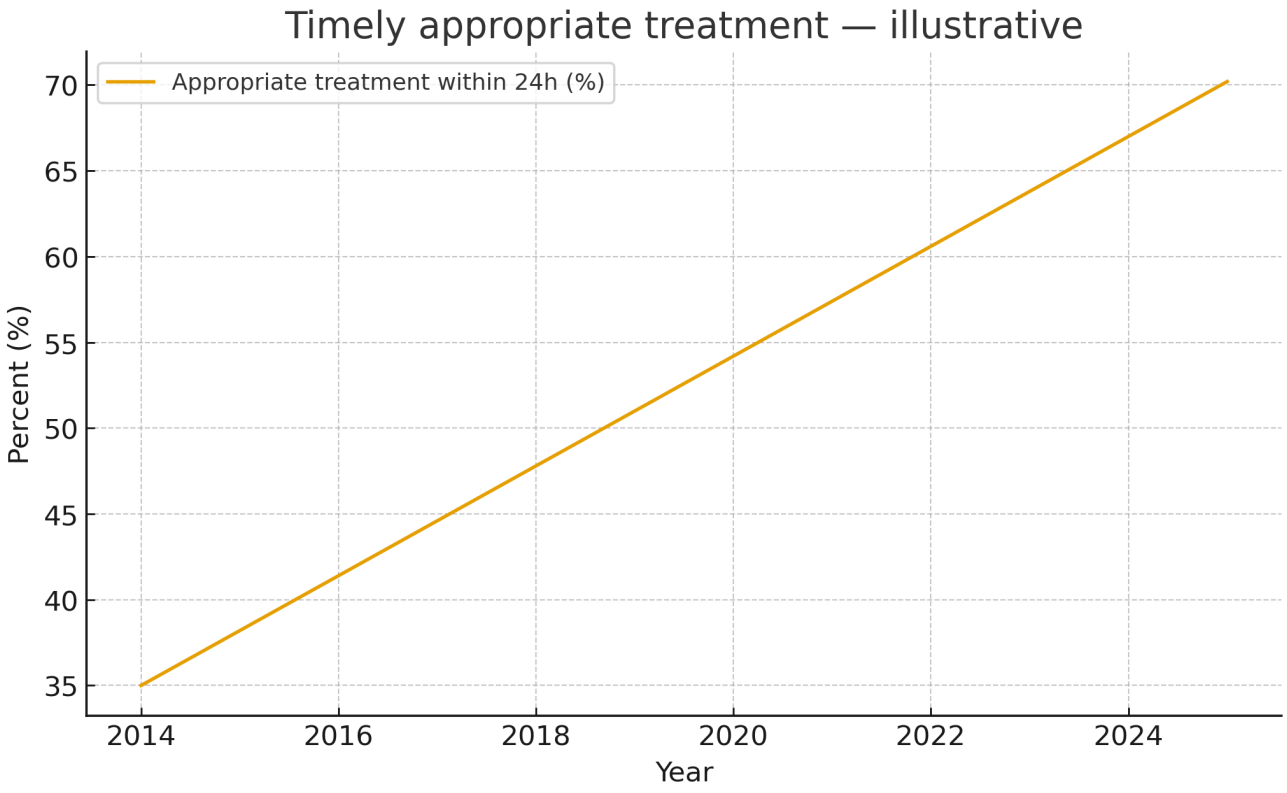


Figure . Correct ACT use & severe malaria case fatality — illustrative

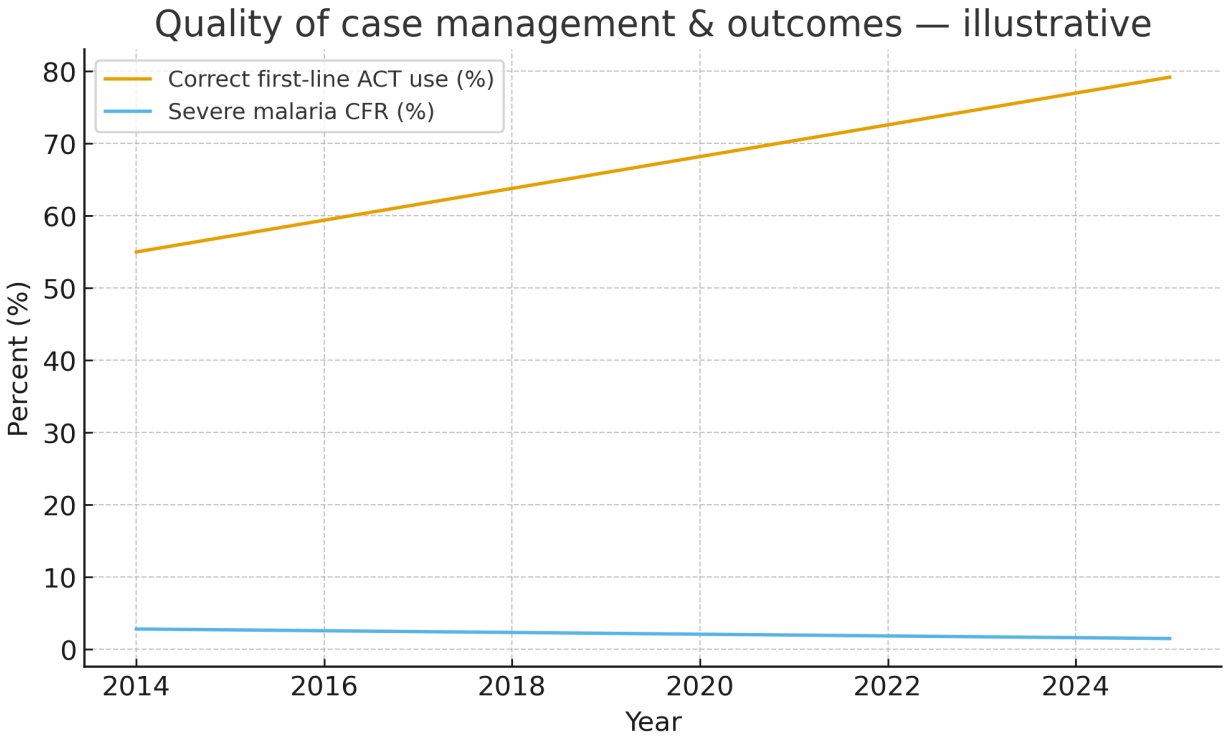


Figure . Vivax radical cure cascade (G6PD testing & completion) — illustrative

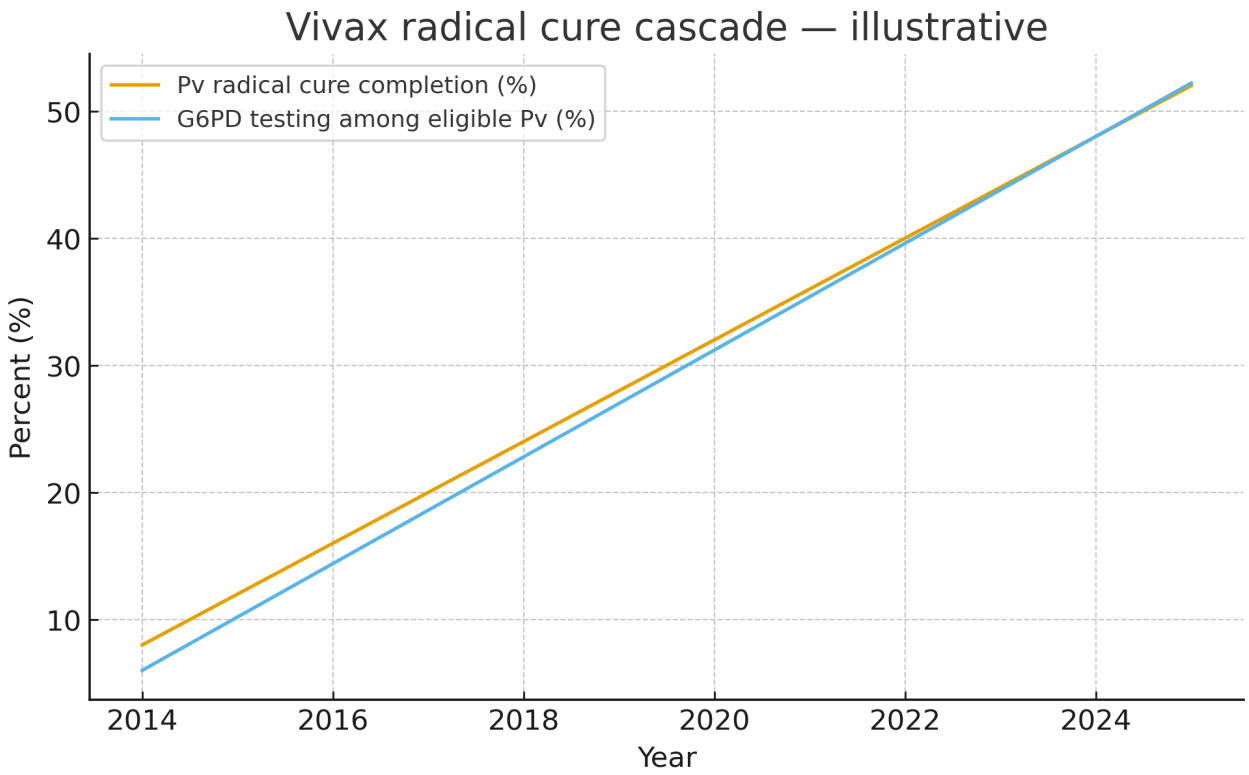


Figure . Commodity availability: ACT & injectable artesunate stock-outs — illustrative

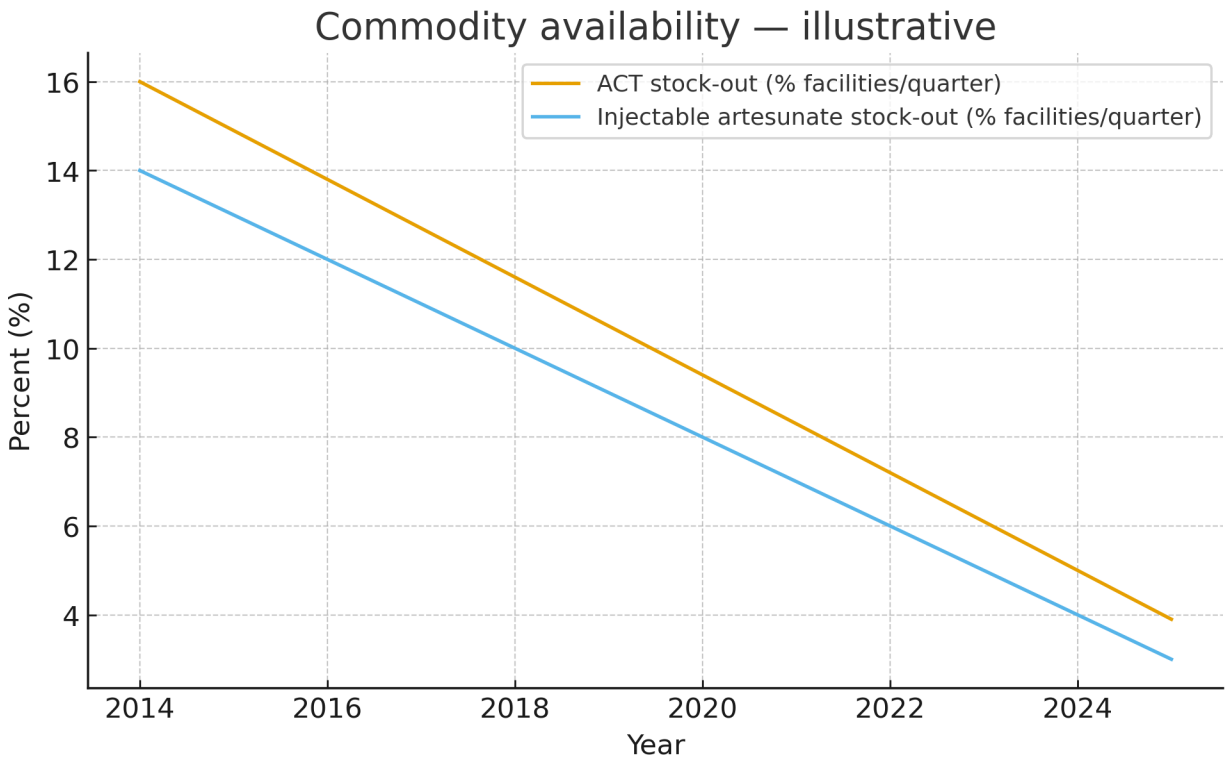


Figure . Referral timeliness & rational antibiotic use — illustrative

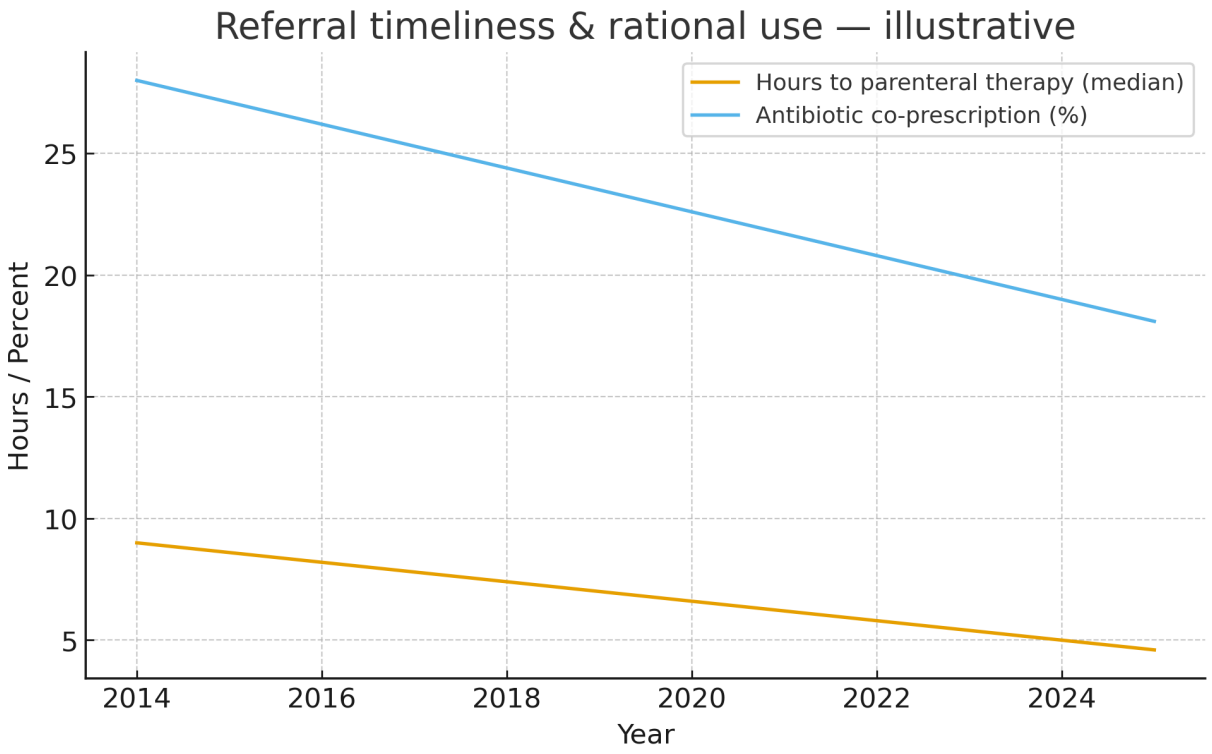


Figure . Therapeutic efficacy study (TES) failure rate (Pf) — illustrative

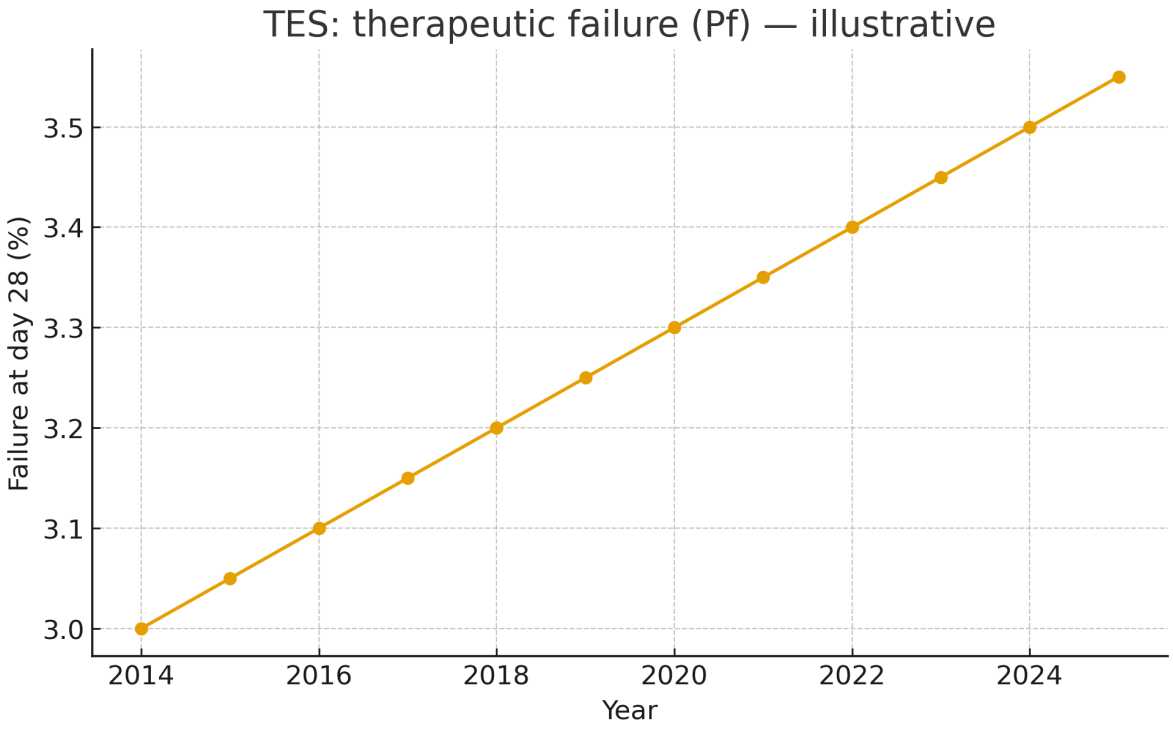


Table 12.6-A. National treatment algorithm (illustrative — align with guideline)

Clinical scenario	Recommended action
Uncomplicated Pf (non-pregnant ≥5kg)	ACT per weight band; consider single low-dose primaquine for transmission where policy allows; counsel adherence.
Uncomplicated Pv	Chloroquine where sensitive OR ACT if policy; plus radical cure (primaquine/tafenoquine) after G6PD testing and eligibility checks.
Pregnancy	1st trimester: quinine + clindamycin (per policy); 2nd/3rd trimester: ACT allowed per national guideline.
Severe malaria (any species)	Immediate parenteral artesunate; manage hypoglycemia/fluids; step-down to full ACT course once oral tolerated; urgent referral if needed.
Referral & follow-up	Danger signs → same-day referral; day-3 review for Pf; verify adherence for Pv radical cure; pharmacovigilance for AEs.

Table 12.6-B. Weight-band dosing summary (confirm with guideline)

Weight band	Dose summary
5–14 kg	ACT pediatric dose × 3 days
15–24 kg	ACT dose × 3 days (higher band)
25–34 kg	ACT dose × 3 days (adult start)
≥35 kg (adult)	Standard ACT × 3 days
Primaquine (Pv radical cure)	Daily × 14 days OR single-dose tafenoquine (age/weight & G6PD restrictions)

Table 12.6-C. Severe malaria care bundle

Component	Notes

Parenteral treatment	IV/IM artesunate (preferred) or artemether if artesunate unavailable
Supportive care	Treat hypoglycemia, fluids, transfusion as indicated, manage seizures
Antibiotics	Only if bacterial co-infection suspected; avoid routine co-prescribing
Referral	Stabilize and transfer rapidly to higher-level facility if needed
Step-down	Complete full oral ACT after parenteral course

Table 12.6-D. Therapeutic efficacy & pharmacovigilance plan

Element	Specification
Sites & periodicity	Sentinel sites representing eco-epidemiological zones; rotate every 2–3 years
Endpoints	PCR-corrected adequate clinical & parasitological response at day 28/42; late failure rates
Molecular markers	k13 and partner drug markers as per WHO guidance
Safety monitoring	Pharmacovigilance for ACTs and primaquine/tafenoquine; hemolysis watch with G6PD issues
Data use	Update national guidelines when thresholds crossed; inform procurement choices

Table 12.6-E. Indicators & definitions

Indicator	Definition
Appropriate treatment within 24h	% febrile patients with confirmed malaria receiving guideline-concordant treatment within 24h of onset

Correct ACT use	% uncomplicated Pf cases receiving correct first-line ACT dose & duration
Severe malaria CFR	% in-hospital deaths among severe malaria admissions
Radical cure completion (Pv)	% Pv cases completing radical cure among those eligible
G6PD testing coverage	% eligible Pv/Pm cases tested for G6PD deficiency
Stock-outs (ACT/injectable artesunate)	% facilities with any stock-out days in quarter
Time to parenteral therapy	Median hours from first contact to first parenteral dose
Therapeutic failure (TES)	% PCR-corrected failures at day 28/42 in TES

Narrative summary (plain-language)

Effective malaria care has three pillars: confirm the diagnosis, give the right drug at the right dose, and act fast when illness is severe. For uncomplicated P. falciparum, ACTs cure most patients when taken correctly. For P. vivax, patients also need a medicine that clears parasites hiding in the liver; this is only safe after a G6PD test. Hospitals must treat severe malaria immediately with injectable artesunate and provide supportive care, then complete treatment with an ACT when the patient can take tablets. Ethiopia can improve outcomes by reducing stock-outs, speeding referrals, and tracking treatment effectiveness through periodic studies. When these pieces work together, fewer people die and fewer infections spread.

References — Section 12.6

• **Federal Ministry of Health (Ethiopia) — National Malaria Diagnosis & Treatment Guidelines —** https://www.moh.gov.et/

• **WHO — Guidelines for the treatment of malaria (latest edition) —** https://www.who.int/teams/global-malaria-programme/policy-and-recommendations/guidelines-for-malaria

• **CDC — Treatment of malaria (U.S. guidance for reference) —** https://www.cdc.gov/malaria/diagnosis_treatment/treatment.html

• **MMV & WHO — Severe malaria toolkit & artesunate use —** https://www.mmv.org/

• **FIND — G6PD testing and radical cure resources —** https://www.finddx.org/malaria/

12.7) Vector Control I: ITNs/LLINs — Malaria

This section summarizes Ethiopia's ITN/LLIN approaches, monitoring metrics, and operational choices. Charts are illustrative placeholders using integer years and should be replaced with official HMIS/MIS/Vector Control datasets before publication.

Figure . ITN access & use — illustrative

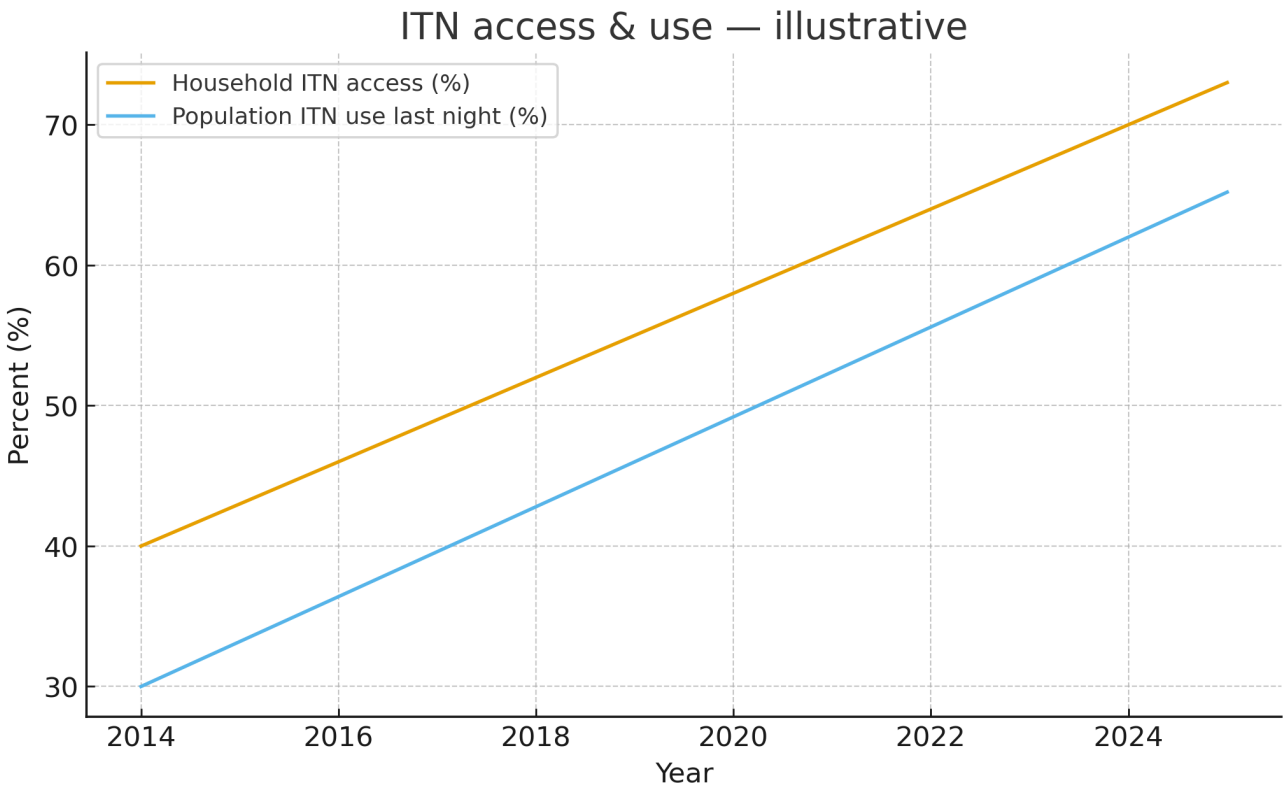


Figure . Use-to-access ratio — illustrative

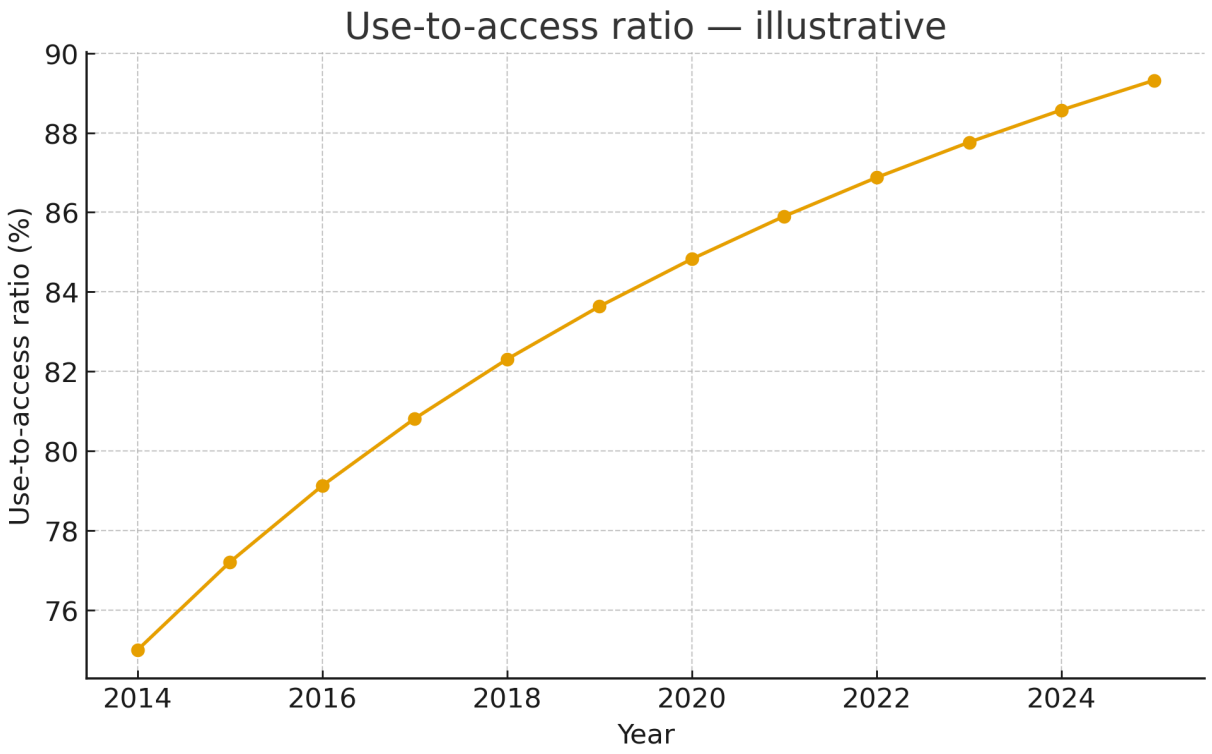


Figure . Next-generation LLINs in distributions — illustrative

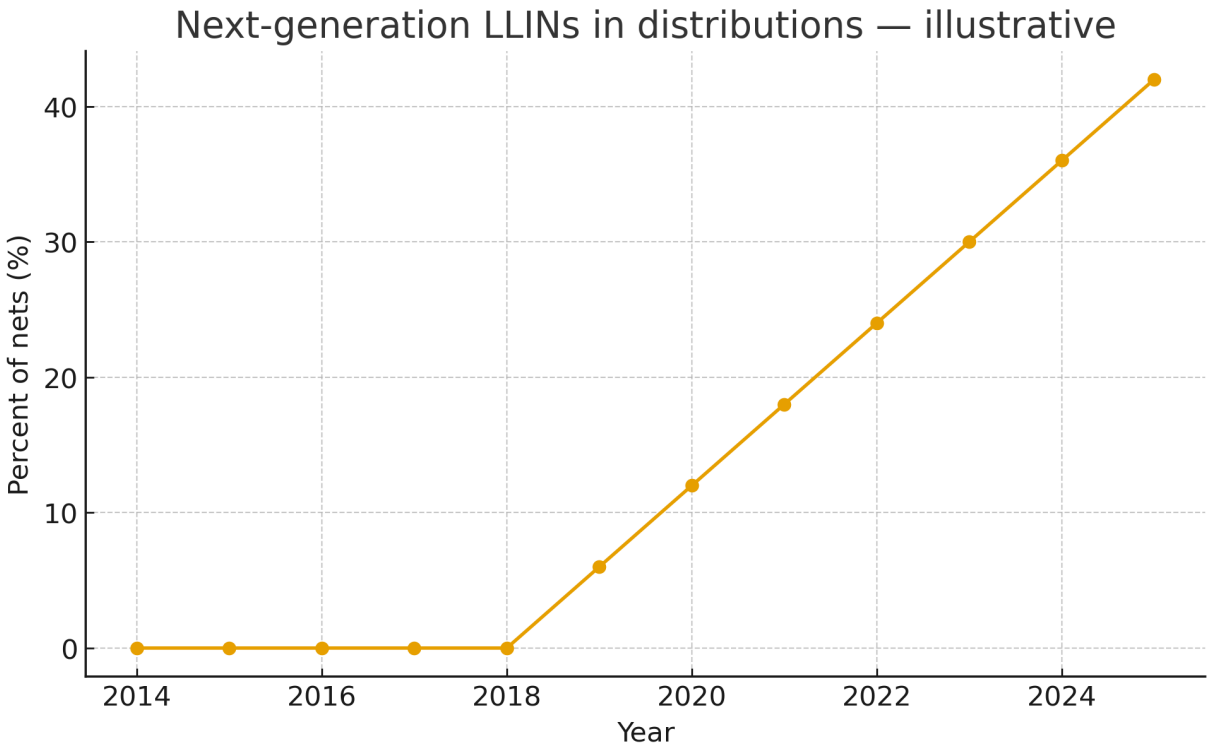


Figure . LLIN functional durability — illustrative median months

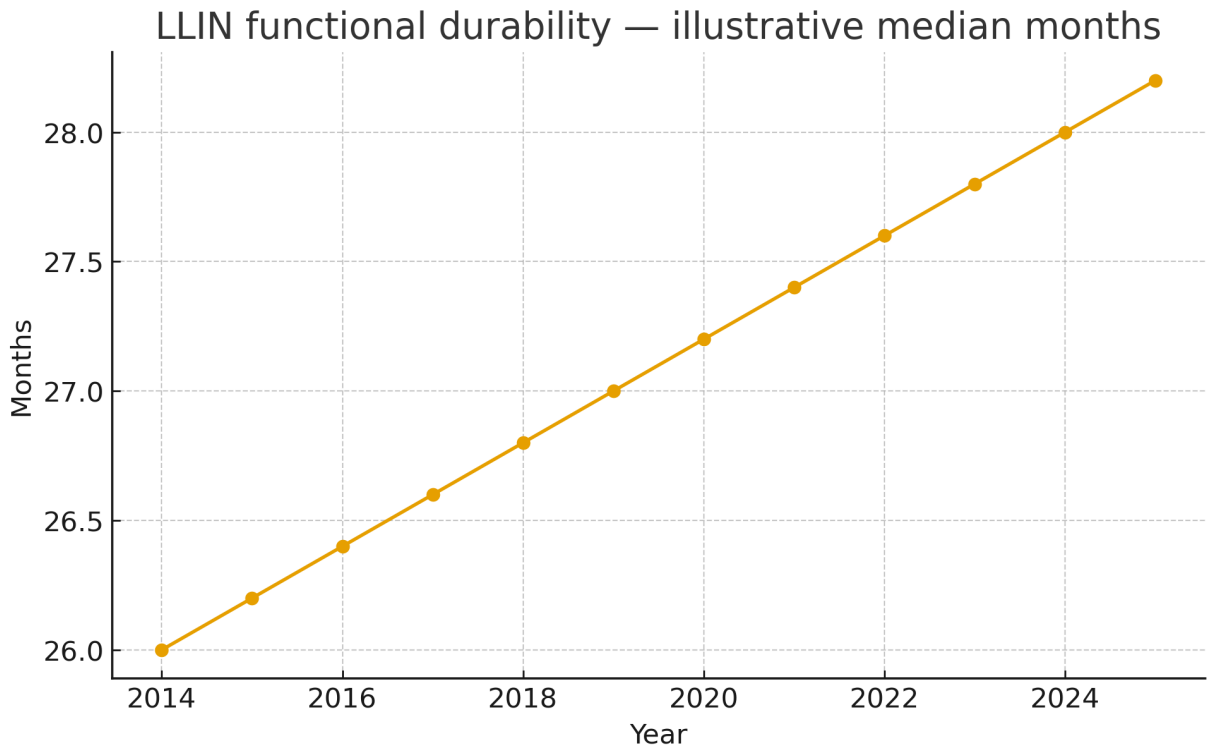


Figure . Delivery channels: mass campaign vs continuous — illustrative

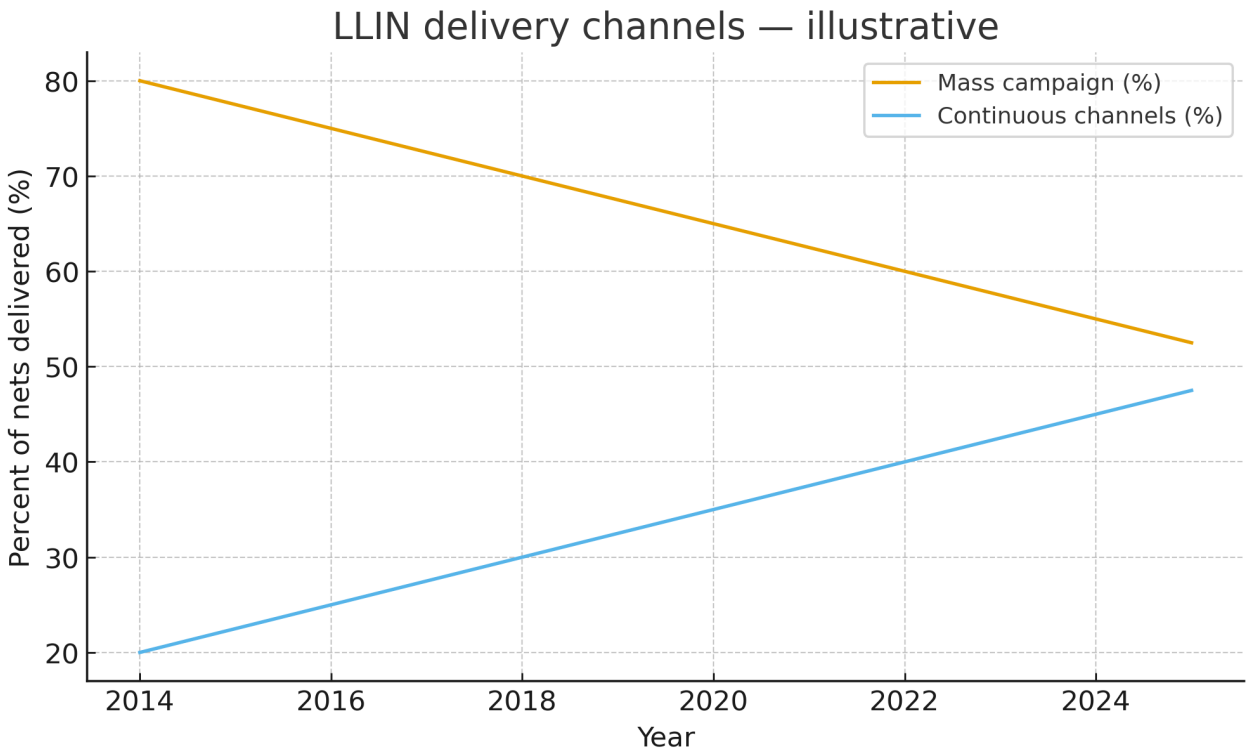


Figure . Insecticide resistance mitigation: PBO/dual-active bioassay mortality — illustrative

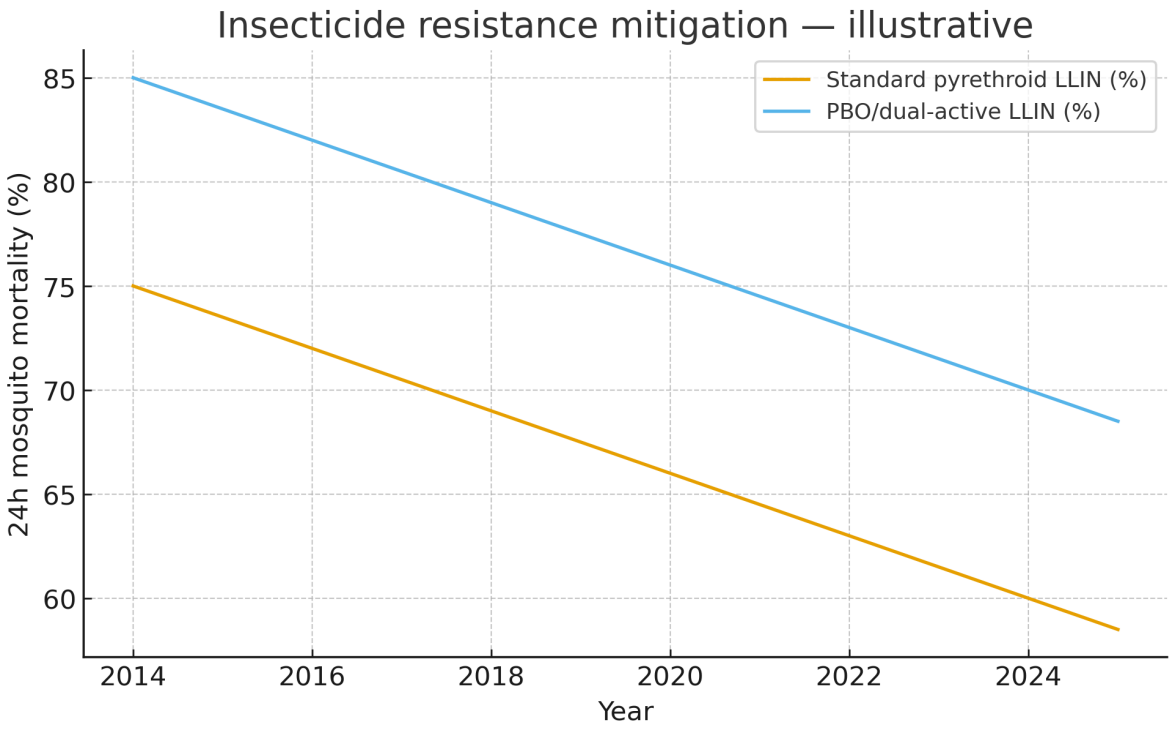


Table 12.7-A. ITN indicators & definitions

Indicator	Definition
Household access	% of people who could sleep under a net if each net covers two people
Population use last night	% of people who slept under an ITN the night before the survey
Use-to-access ratio	Population use ÷ household access × 100
Next-gen net coverage	% of nets distributed that are PBO or dual-active
Functional survivorship	% of cohort nets still present and serviceable at 12/24/36 months

Table 12.7-B. LLIN types & active ingredients

Type	Active ingredient(s) / feature
Standard pyrethroid LLIN	Deltamethrin or alphacypermethrin monotherapy

PBO net	Pyrethroid + piperonyl butoxide (synergist)
Dual-active LLIN (non-PBO)	e.g., pyrethroid + chlorfenapyr or pyriproxyfen

Table 12.7-C. Distribution channels in Ethiopia

Channel	Notes for Ethiopia
Mass campaigns	Periodic universal coverage campaigns (every ~3 years; align with policy)
Antenatal & EPI services	Routine distribution to pregnant women and infants
Schools & community	Targeted top-ups; outbreak response; focal distributions
Emergency/IDP settings	Rapid replacement; buffer stocks in hotspots

Table 12.7-D. Durability monitoring plan

Component	Specification
Cohort surveys	12/24/36-month follow-ups for net survivorship & hole index
Bioefficacy	Cone tests/tunnel tests on net samples
User behavior	Care/repair practices; drying/storage methods
Reporting	Dashboards with survivorship and serviceability by brand/batch/zone

Table 12.7-E. Social & behavior change (SBC) focus

Item	Ethiopia-oriented guidance
Barriers	Heat, perceived low risk, net condition, sleeping outdoors

Messages	‘Every rainy season, every night’; repair & care benefits; outdoor protection tips
Channels	HEWs, schools, radio, social media, faith/community leaders
Metrics	Use-to-access, net hanging rate, proper care behaviors

Narrative summary (plain-language)

Insecticide-treated nets are one of Ethiopia’s most important malaria tools. ‘Access’ means enough nets are available for people in a household, while ‘use’ is whether people actually slept under a net last night. Closing the gap between access and use requires community outreach, replacing worn nets, and solving practical problems like heat and sleeping outdoors. In places with insecticide-resistant mosquitoes, next-generation nets that include a synergist (PBO) or a second active ingredient can kill more mosquitoes. Ethiopia combines big net campaigns with continuous distribution through clinics and schools. Tracking durability helps decide when to replace nets. When the right nets are in the right places—and people use them every night—illness and deaths go down.

References — Section 12.7

• **Federal Ministry of Health (Ethiopia) — Vector Control & ITN guidelines —** https://www.moh.gov.et/

• **WHO — Guidelines for malaria vector control (ITNs/LLINs, PBO/dual-AI) —** https://www.who.int/teams/global-malaria-programme

• **PMI — Ethiopia Malaria Operational Plans (LLIN strategies) —** https://www.pmi.gov/where-we-work/ethiopia/

• **Alliance for Malaria Prevention — Net distribution & SBC resources —** https://allianceformalariaprevention.com/

12.8) Vector Control II: IRS & Larval Source Management — Malaria

This section summarizes Ethiopia-relevant indoor residual spraying (IRS) strategies and larval source management (LSM) options. Charts use integer years and are illustrative placeholders to be replaced with official vector control datasets and entomological monitoring before publication.

Figure . IRS scale: targeted vs sprayed — illustrative

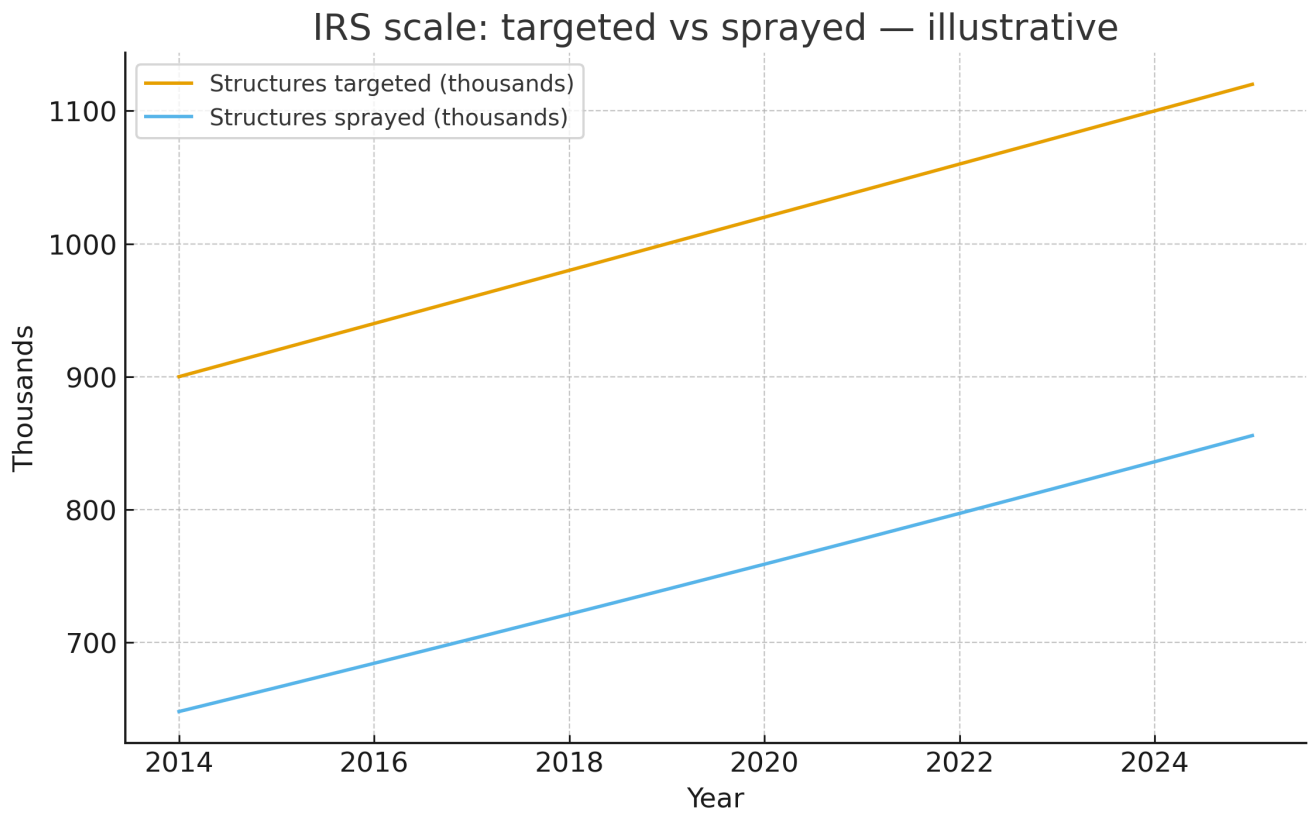


Figure . IRS coverage (sprayed/targeted) — illustrative

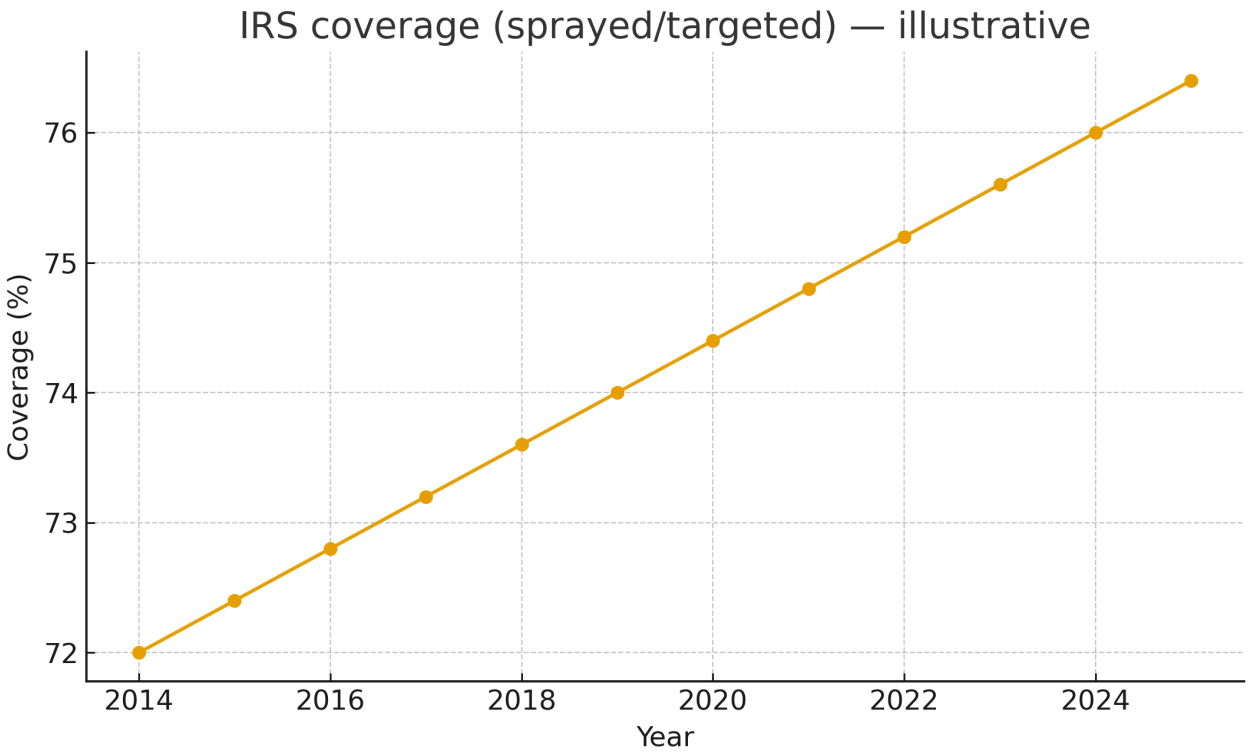


Figure . Residual efficacy months by class — illustrative

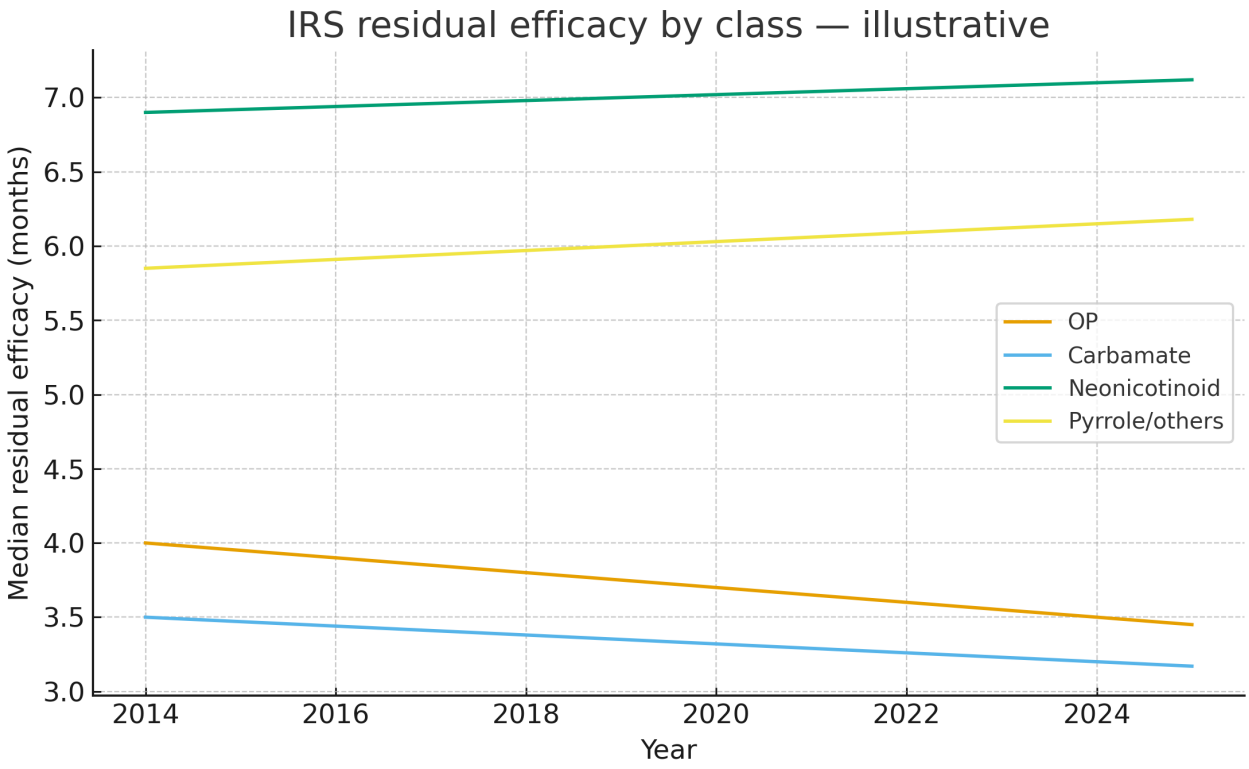


Figure . IRS timeliness — kebeles completed before main season

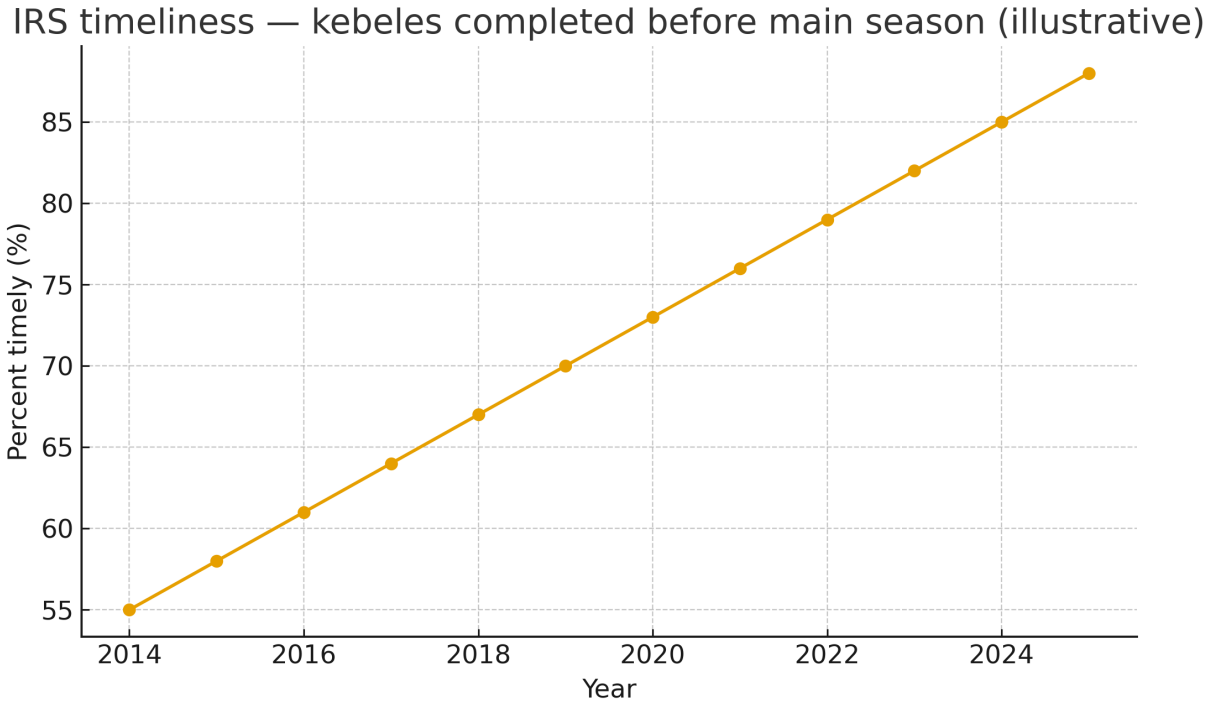


Figure . LSM coverage in eligible sites — illustrative

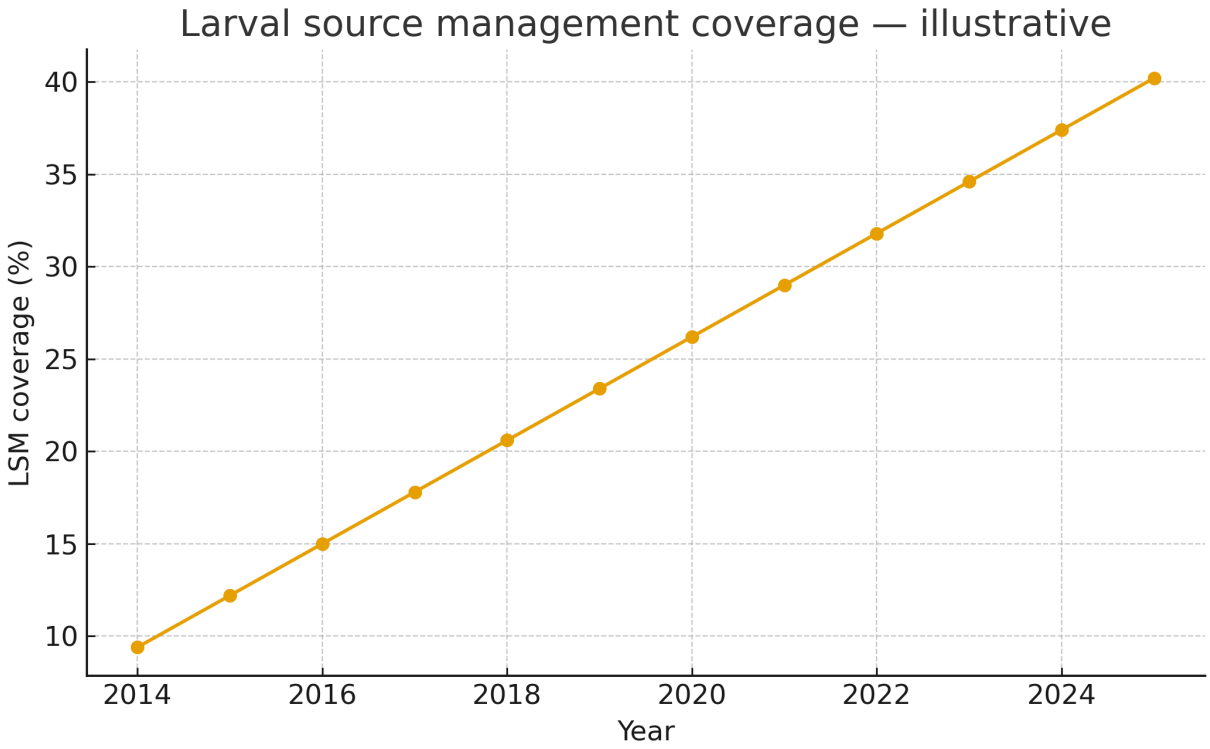


Figure . Cost per person protected: LSM vs IRS — illustrative

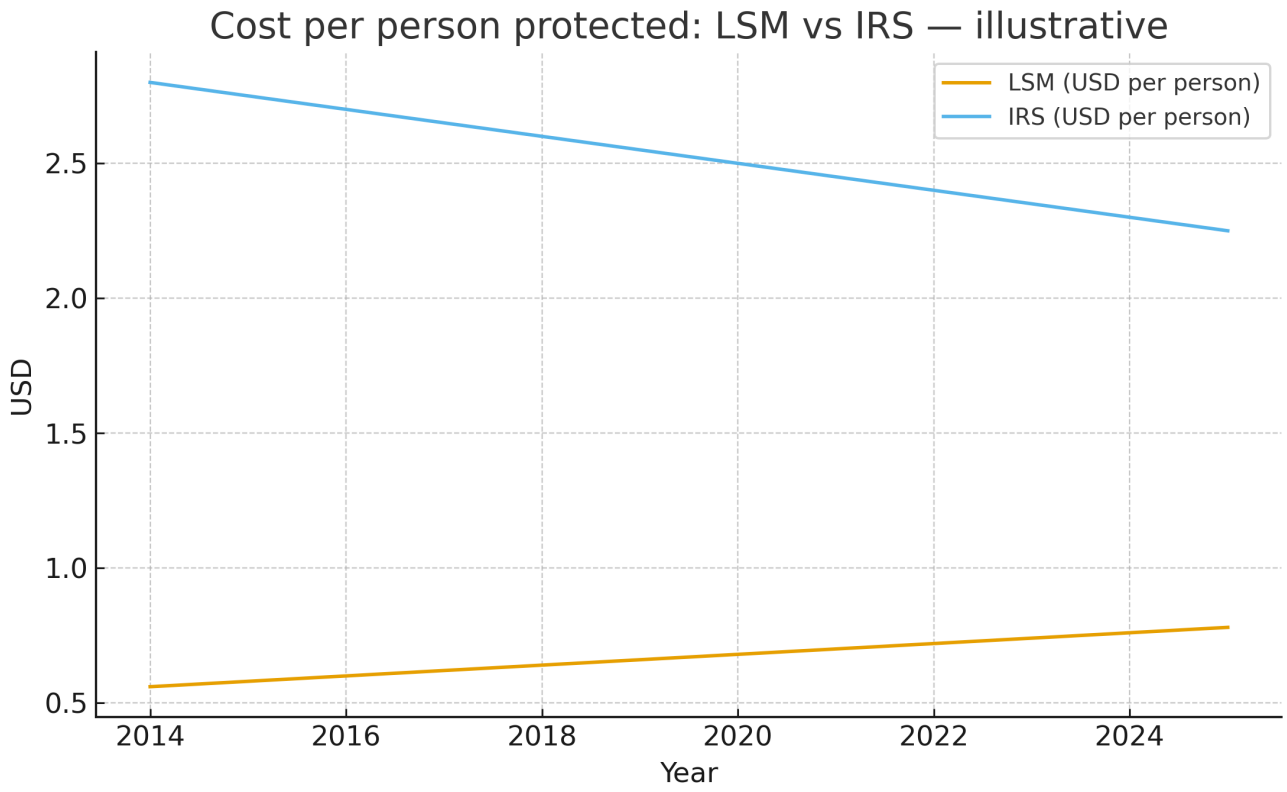


Figure . Environmental management within LSM — illustrative

Table 12.8-A. IRS planning and implementation checklist

Domain	Key actions for Ethiopia
Stratification	Prioritize woredas with moderate/high risk, epidemic-prone zones, and perennial transmission.
Product & rotation	Use resistance data to drive rotation; track lot numbers and expiry.
Microplanning	Geo-list structures; estimate spray-days; logistics & buffer stock plan.
Workforce & safety	Train sprayers; PPE; insecticide handling, storage and disposal SOPs.
QC/QA	Cone tests, wall bioassays, spray quality checks (filter papers)
Community engagement	Advance notice; consent; moving household items; re-entry times.

Environmental safeguards	Wash bays; soak pits; waste transport; incident reporting.

Table 12.8-B. LSM toolbox

Tool	Operational note
Larviciding (biolarvicides)	Bti/Bs products for targeted habitats; schedule based on water persistence.
Source reduction	Drainage, filling, clearing vegetation; combine with local works programs.
Habitat manipulation	Intermittent irrigation, flushing canals; align with agriculture calendars.
Fish or biological control	Where ecologically appropriate; monitor non-target impacts.

Table 12.8-C. Site eligibility for LSM

Criterion	Why it matters
Few, fixed, findable habitats	LSM is efficient where breeding sites are limited and mappable.
Water persistence	Habitats lasting >7 days are higher-yield targets for larviciding.
Access & security	Safe access and community acceptance required.
Cost-benefit	Compare cost per person protected against IRS/LLIN mix locally.

Table 12.8-D. Indicators & definitions

Indicator	Definition
IRS coverage	Sprayed / targeted structures × 100
Timeliness	% of target kebeles completed before main transmission season

Residual efficacy	Median months of effective wall bioassay mortality
LSM coverage	% eligible water bodies treated per schedule in season
CPP (cost per person)	USD per person protected by intervention

Table 12.8-E. Integration with nets and case management

Context	Recommended mix
High resistance + long season	Prioritize IRS with longer-lasting products; pair with next-gen nets.
Urban/peri-urban	Target LSM, source reduction, container management; address An. stephensi.
Epidemic-prone highland fringe	Pre-season IRS + surveillance triggers for surge response.
Irrigation belts	Hybrid approach: IRS in worker housing + LSM in canals and pumps.

Narrative summary (plain-language)

Indoor residual spraying coats walls with an insecticide that kills mosquitoes when they rest indoors. It works best when the right product is chosen for local resistance patterns and when spraying finishes before the rainy season. Rotating insecticides helps slow resistance. Larval source management targets mosquito breeding sites, especially in towns and irrigation areas where water collects in canals, tanks, and puddles. LSM is most effective when breeding places are few, fixed, and easy to find. In many Ethiopian settings, combining IRS in high-risk districts with LSM in urban or irrigation zones, and using insecticide-treated nets everywhere, offers the strongest protection. Careful planning, safety, and monitoring keep these tools effective and cost-efficient.

References — Section 12.8

• **Federal Ministry of Health (Ethiopia) — Vector Control & IRS guidance —** https://www.moh.gov.et/

• **WHO — Guidelines for malaria vector control (IRS & LSM) —** https://www.who.int/teams/global-malaria-programme

• **PMI — IRS 2.0 and Best Practices; Ethiopia MOPs —** https://www.pmi.gov/

• **IVCC — IRS product profiles and resistance management resources —** https://www.ivcc.com/

12.9) Resistance Monitoring & Insecticide Management — Malaria

This section summarizes Ethiopia-relevant insecticide resistance monitoring (IRM) and how results inform product choices for LLINs and IRS. Charts are illustrative placeholders using integer years; replace with official entomology datasets before publication.

Figure . Pyrethroid susceptibility with/without PBO — illustrative

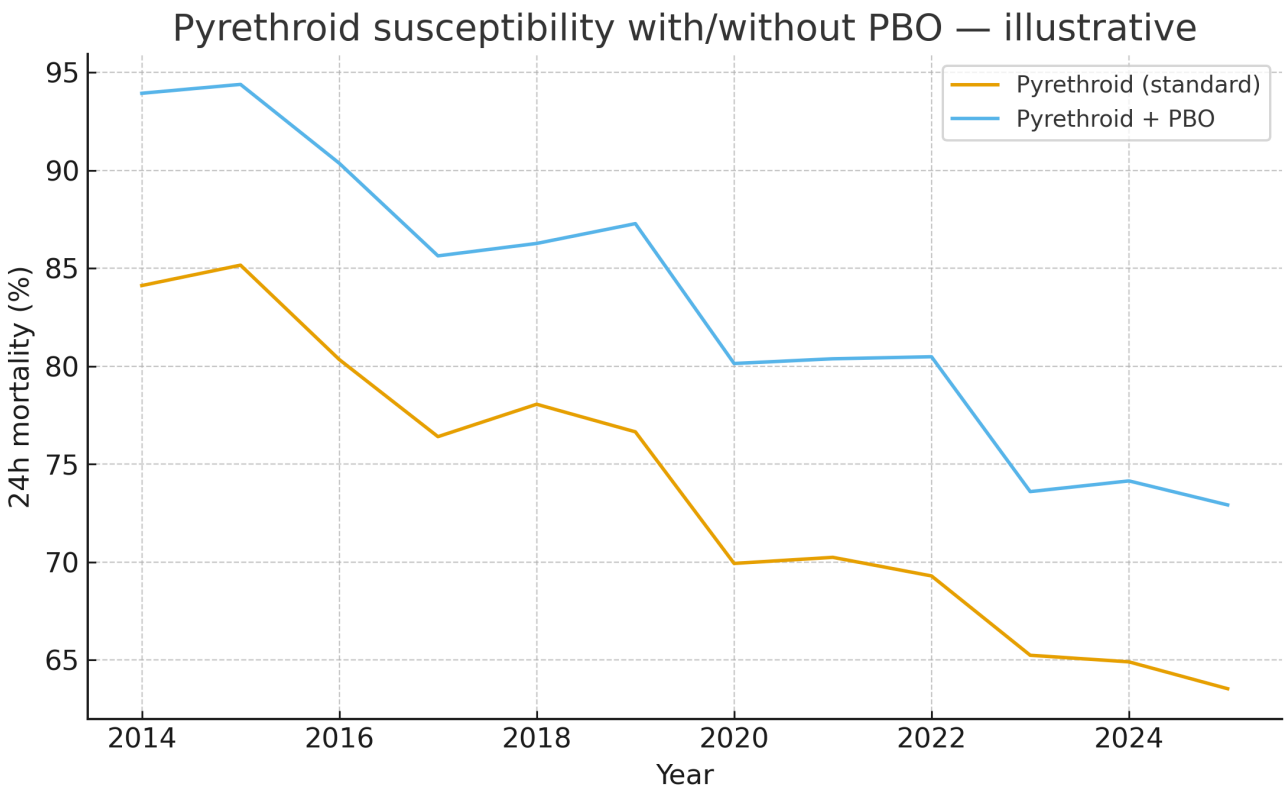


Figure . Vector susceptibility by insecticide class — illustrative

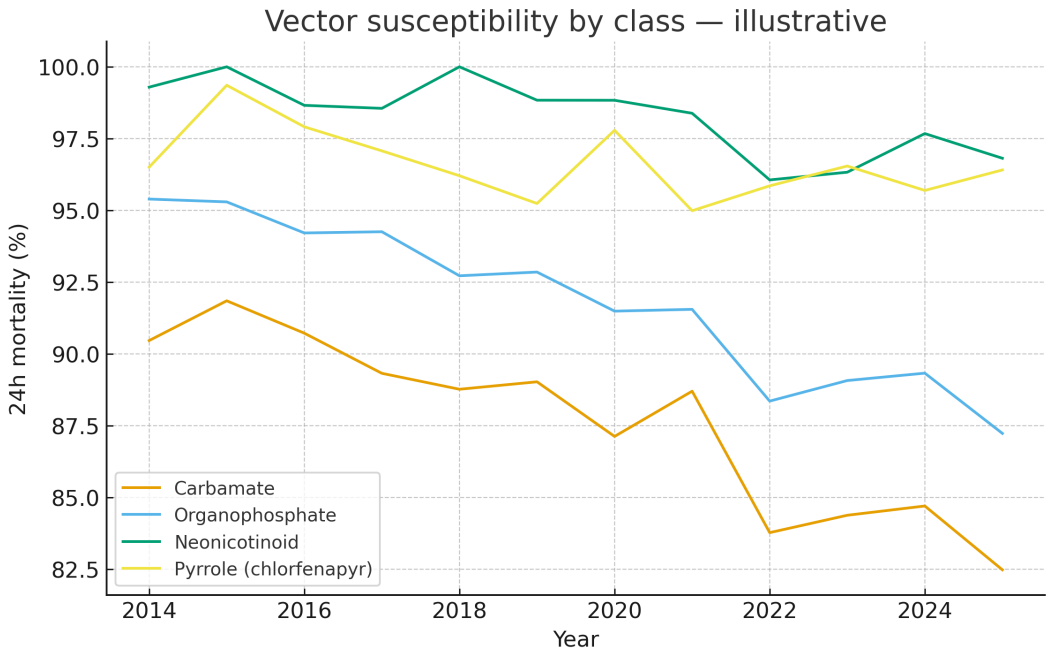


Figure . Entomology network capacity: functional sentinel sites — illustrative

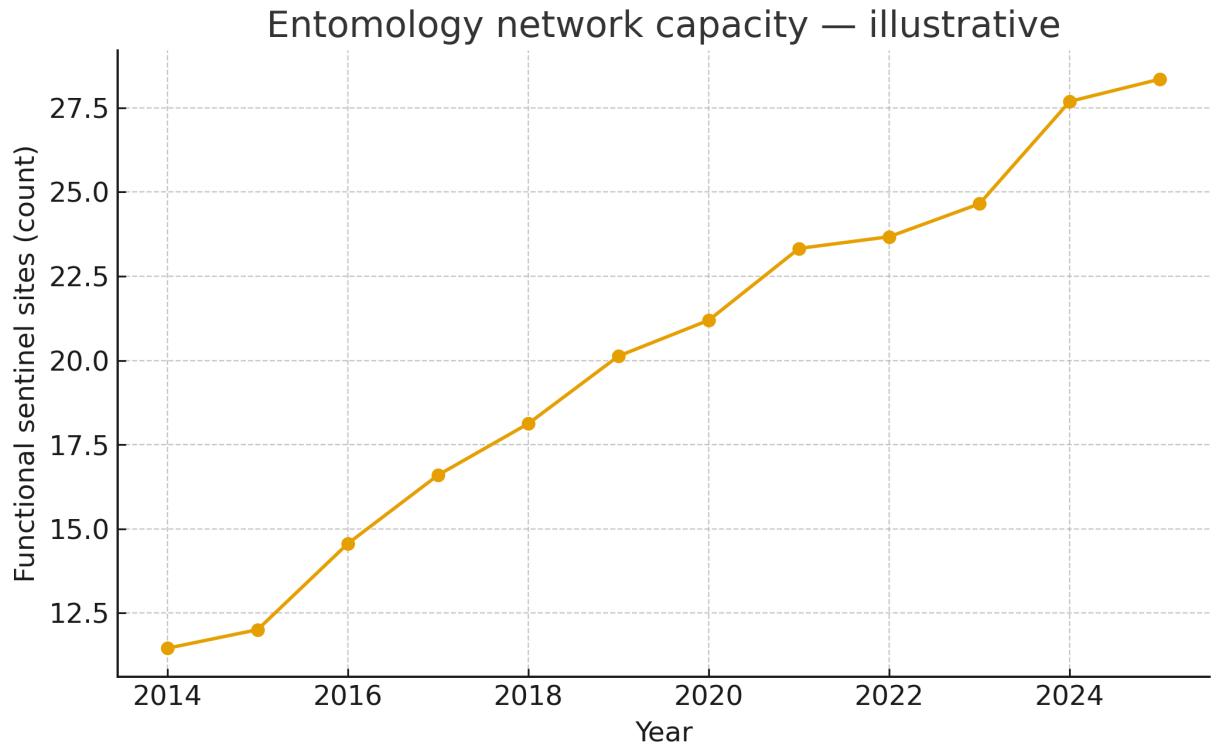


Figure . LLIN bioefficacy samples meeting threshold — illustrative

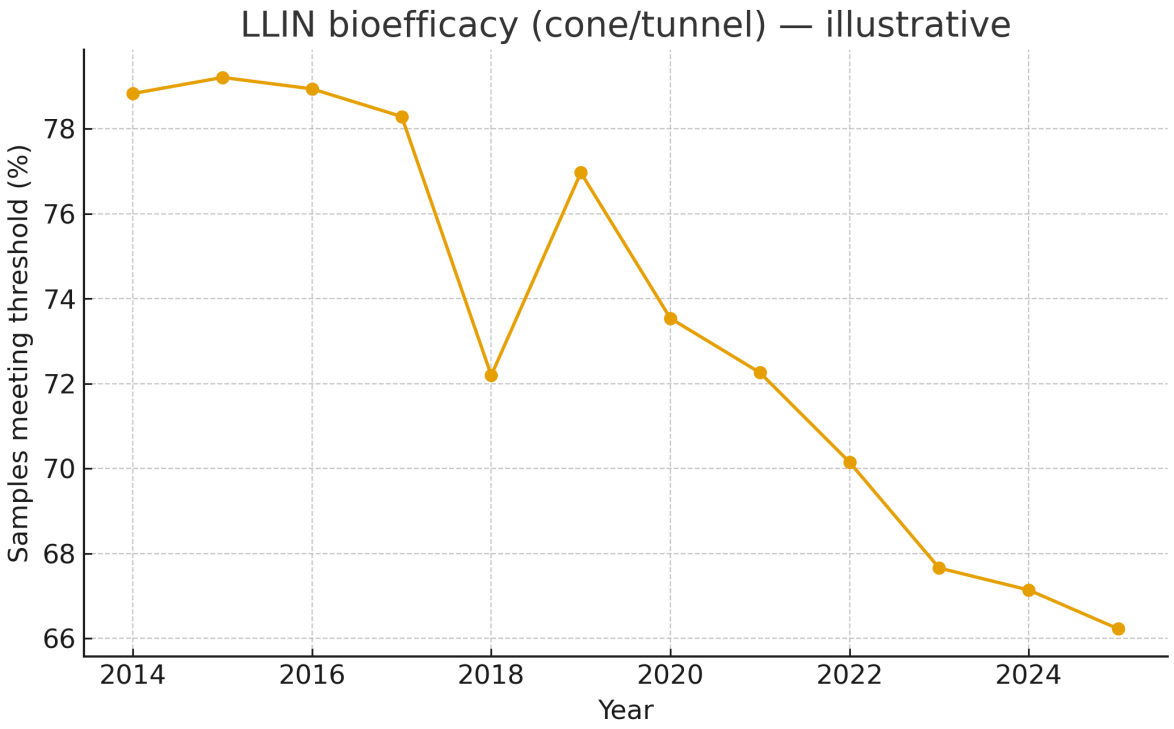


Figure . IRS residual efficacy by product — illustrative

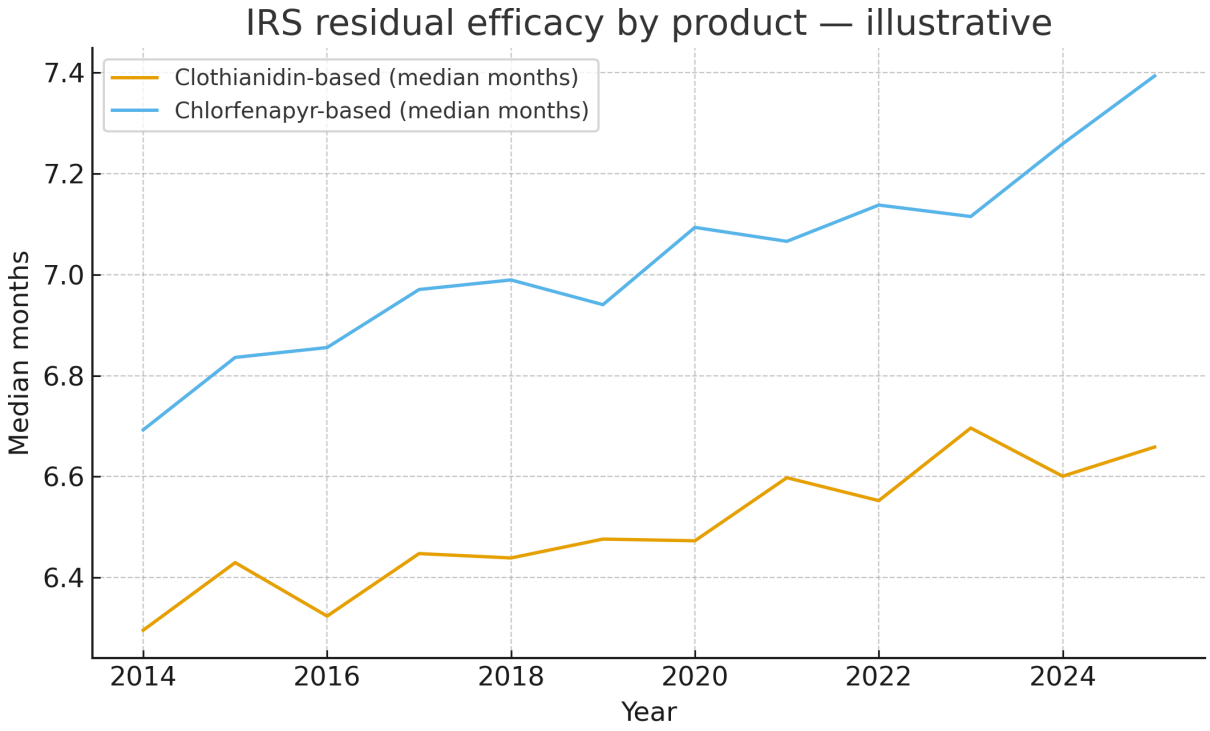


Table 12.9-A. WHO bioassay interpretation thresholds

24h mortality result	Interpretation
Mortality ≥ 98%	Susceptible
Mortality 90–97%	Possible resistance (confirm; consider intensity/synergist tests)
Mortality < 90%	Resistance confirmed (plan product rotation/combination)

Table 12.9-B. Sentinel monitoring plan for Ethiopia

Component	Specification for Ethiopia
Site coverage	≥1 site per eco-epidemiological zone; urban/peri-urban sentinel for An. stephensi
Assay panel	Pyrethroids (±PBO), carbamates, organophosphates, neonicotinoids, pyrrole; intensity tests
Frequency	At least annually; pre- and post-IRS; before LLIN campaign where feasible
Markers	kdr L1014F/S; Ace-1; metabolic markers (CYP6 family where feasible)
Data systems	DHIS2 entomology module; open data standards; GIS references

Table 12.9-C. Product decision matrix (illustrative)

Resistance profile	Program choice
Low pyrethroid mortality; PBO gain ≥10pp	Prioritize PBO/dual-AI nets; standard IRS only if needed
Low pyrethroid & low PBO gain; OP/carb high	Rotate IRS to OP/carbamate; dual-AI nets where feasible
OP/carb declining; neo/pyrrole high	Adopt clothianidin/chlorfenapyr IRS; maintain next-gen nets

Urban stephensi risk	Container management/LSM; next-gen nets; focused IRS where indicated

Table 12.9-D. Stock & resistance management rules

Domain	Management rule
Procurement mix	Avoid single-class dependence; maintain buffer across classes
Lot/batch tracking	Barcode lots; record in LMIS; link to site outcomes
Safe disposal	Expired products to approved facilities; training & incident logs
Rotation rule	Avoid same class >2 consecutive years in same geography (where feasible)

Table 12.9-E. Indicators for an IRM dashboard

Indicator	Definition
Bioassay mortality by class	% mortality at 24h for each active class
PBO gain	Difference in mortality with vs without PBO (percentage points)
Resistance allele frequency	% for kdr/Ace-1/metabolic markers (where available)
Residual efficacy (IRS)	Median months above threshold by product
Product mix conformity	% woredas following rotation plan
Sentinel functionality	# sites reporting per year; % on-time reports

Narrative summary (plain-language)

Mosquitoes can become harder to kill if the same insecticide is used year after year. Ethiopia tracks this by testing mosquitoes in the lab and by checking how long IRS products remain effective on walls. If a ‘helper’ chemical called PBO raises kill rates, then nets that include PBO or a second active ingredient may work better. Results guide which spray products to use and when to rotate to a different class. Urban areas also face the invasive mosquito Anopheles stephensi, which breeds in containers—so programs add larval control and targeted spraying. The goal is simple: use the data to choose the right tool in the right place, and change tactics before resistance becomes a crisis.

References — Section 12.9

• **Federal Ministry of Health (Ethiopia) — Entomology & IRM guidance —** https://www.moh.gov.et/

• **WHO — Test procedures for insecticide resistance monitoring in malaria vectors —** https://www.who.int/teams/global-malaria-programme

• **IVCC — IRS product profiles & resistance management —** https://www.ivcc.com/

• **PMI — VectorLink & IRS best practices; Ethiopia MOPs —** https://www.pmi.gov/

12.10) Surveillance–Response & Epidemic Preparedness — Malaria

This section outlines Ethiopia’s malaria early warning and response (EPR) principles, emphasizing alert thresholds, climate integration, and rapid surge capacity. Charts use integer years and are illustrative placeholders to be replaced with official HMIS/IDSR/EPR datasets before publication.

Figure . Annual API vs alert threshold — illustrative

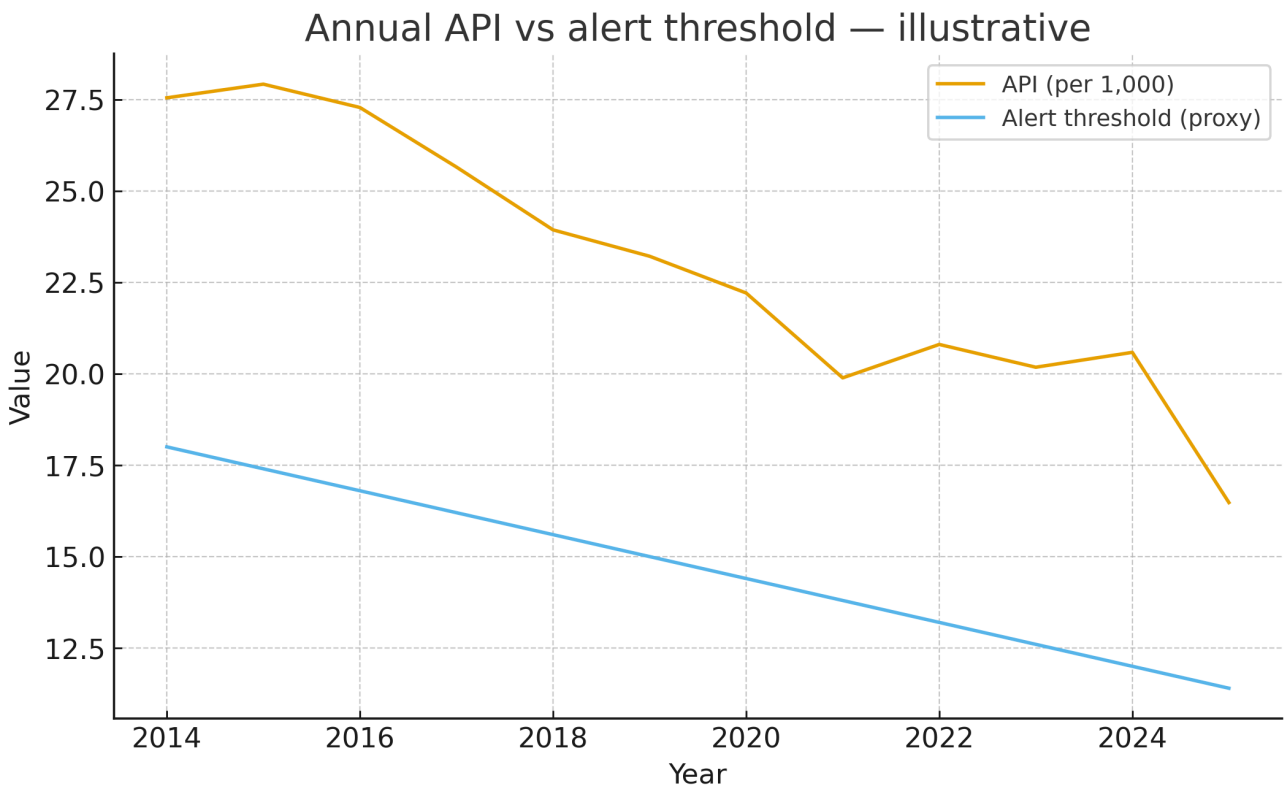


Figure . Early warning alerts per year — illustrative

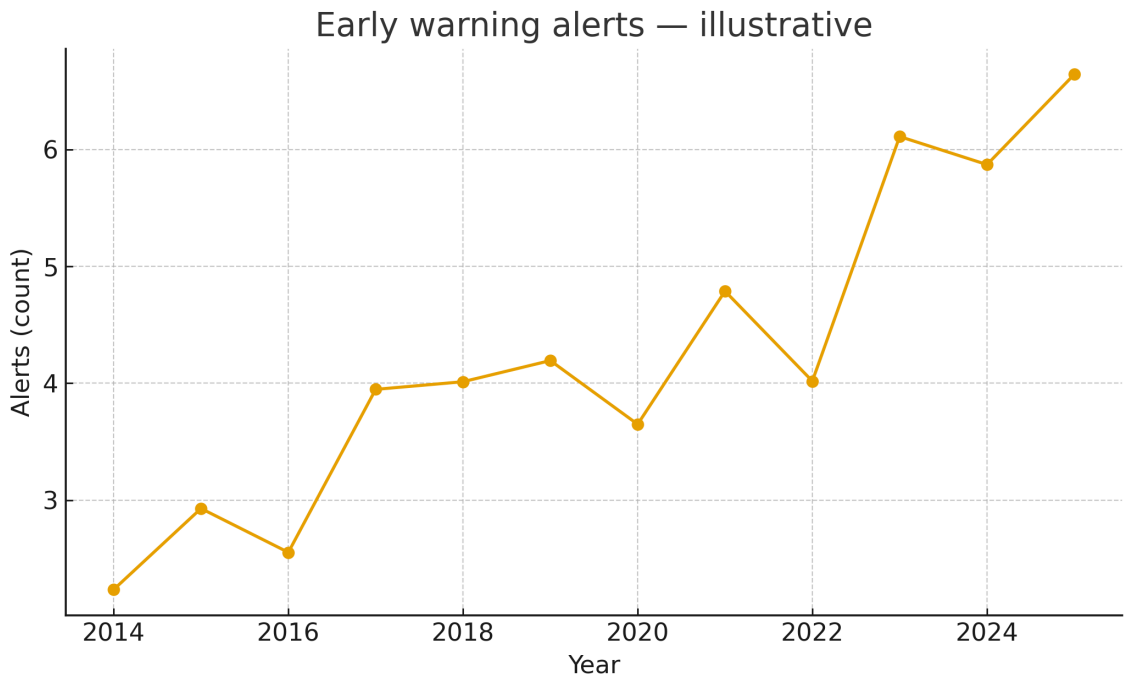


Figure . Climate–case co-variation (standardized) — illustrative

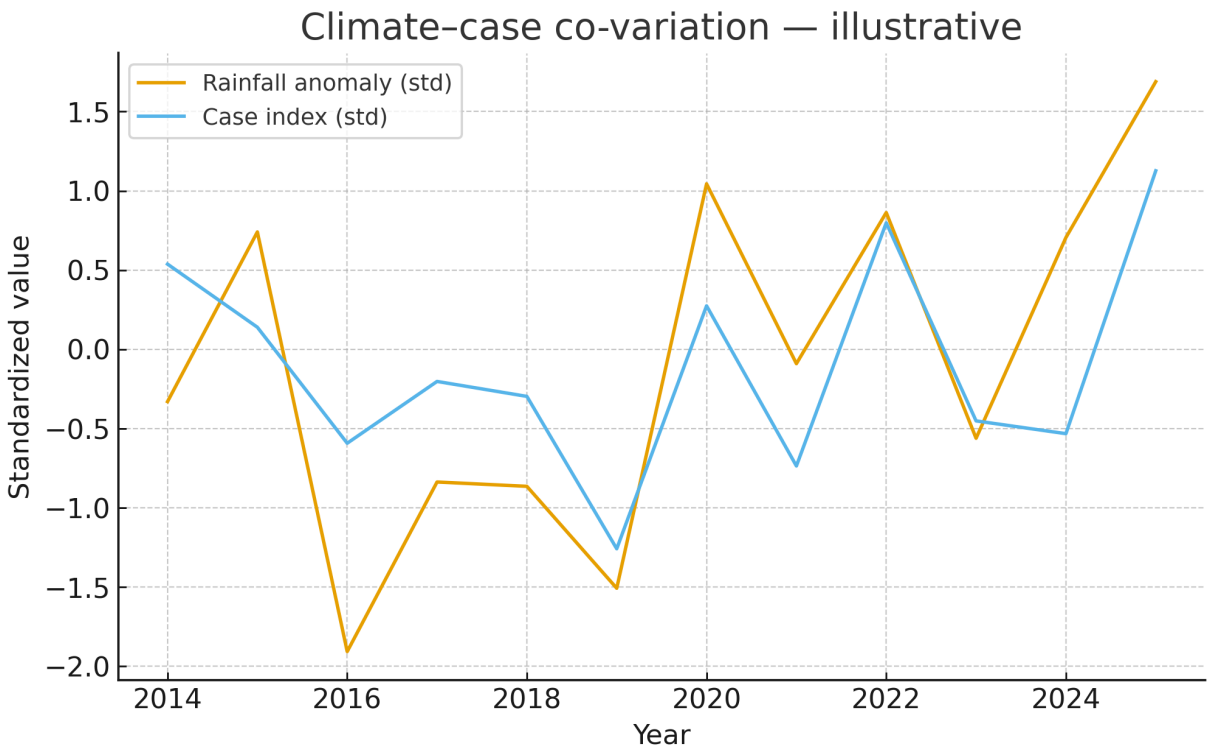


Figure . Alert-to-action timeliness — illustrative

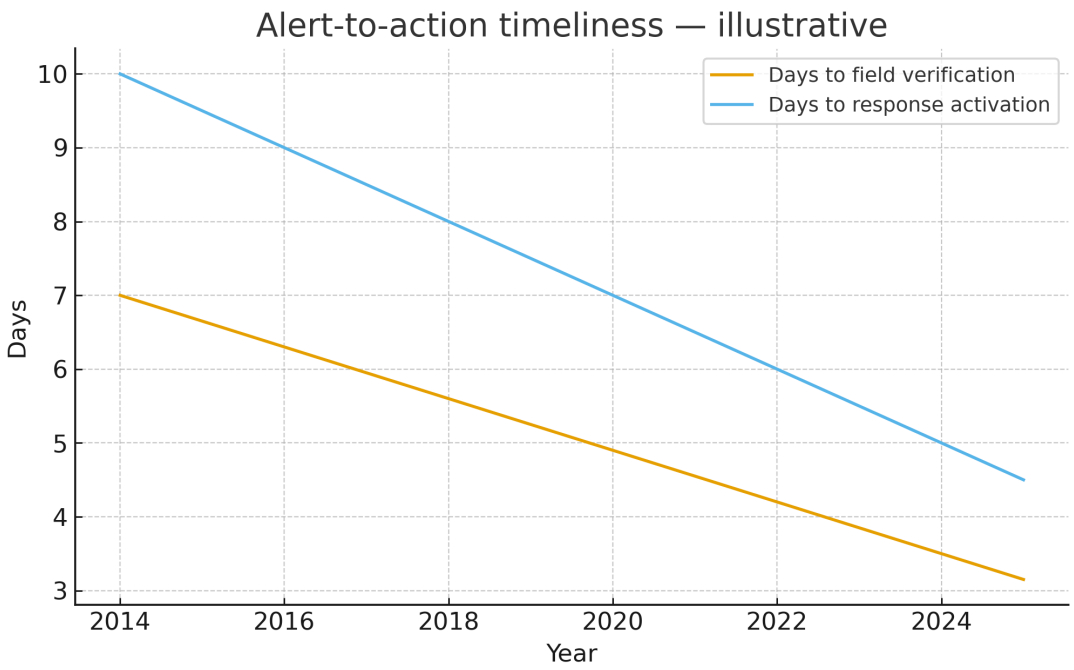


Figure . Outbreak commodity buffer — illustrative

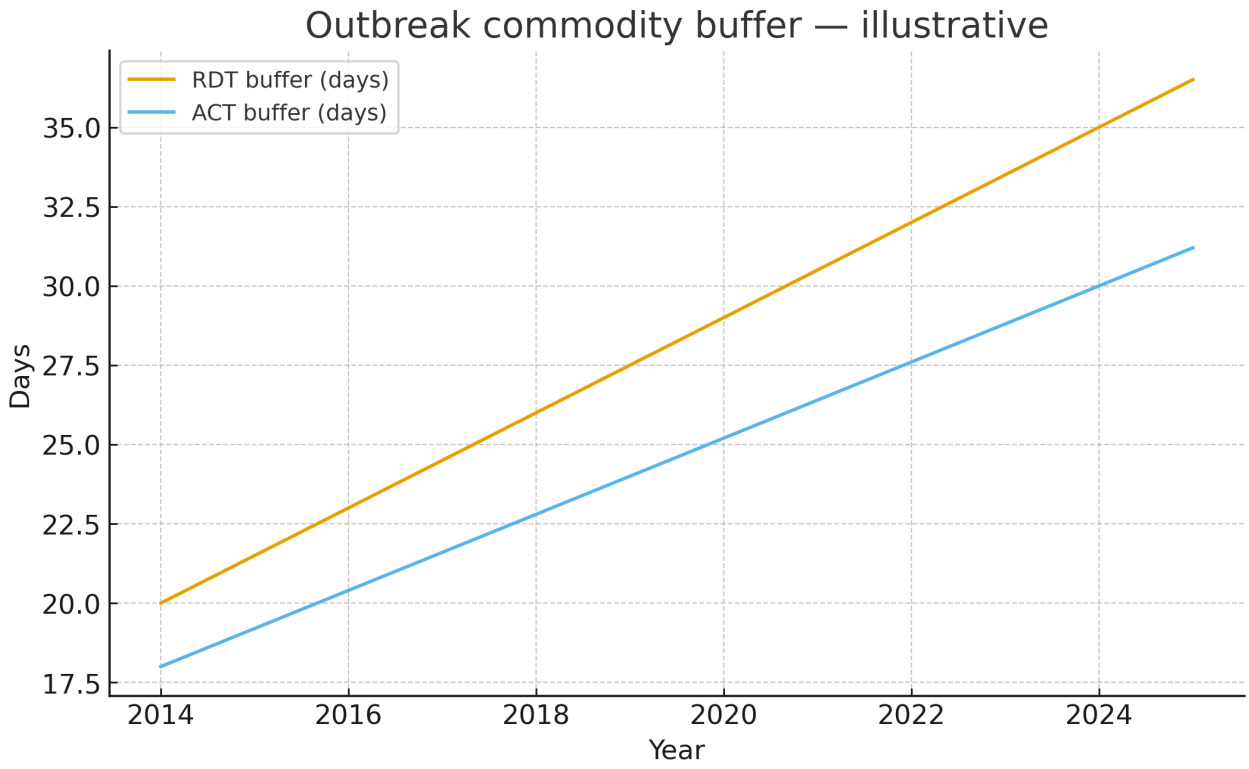


Figure . EPR readiness checklist met — illustrative

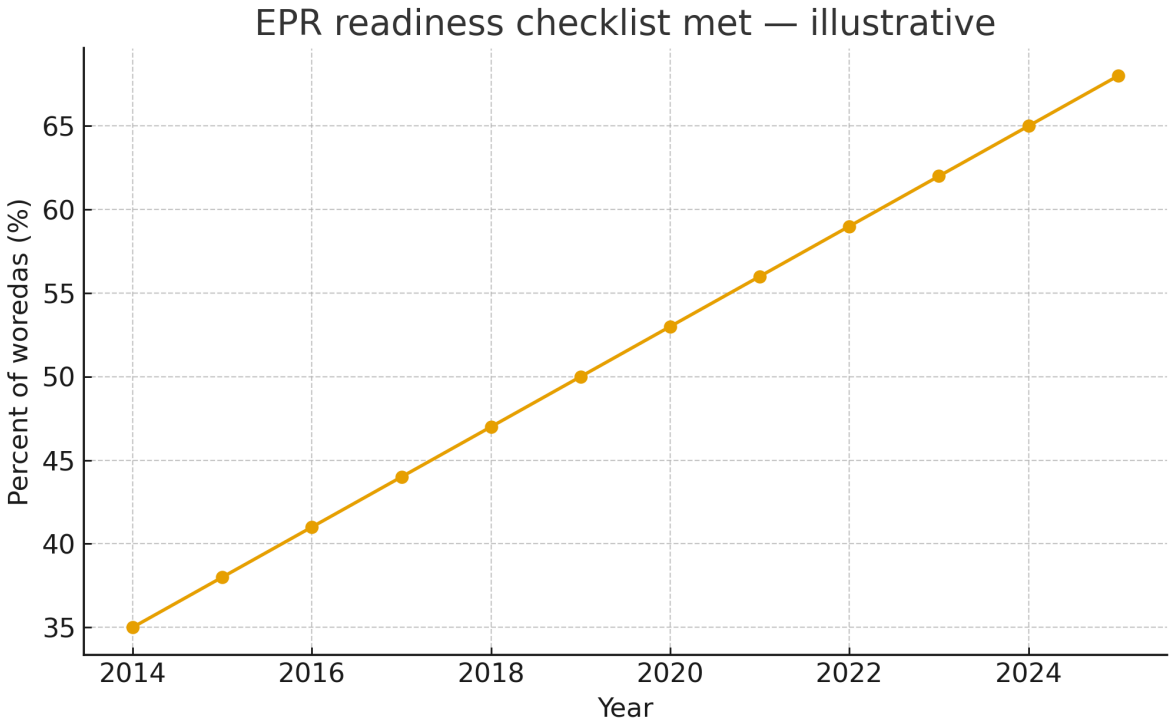


Table 12.10-A. Ethiopia epidemic thresholds (align with policy before publication)

Element	Operational definition
Seasonal baseline	Mean + 2 SD from last 5 non-epidemic years (by woreda).
Alert level	Exceed baseline in any two consecutive weeks OR rapid rise in TPR/API.
Action level	Sustained exceedance + clinical burden and hotspot clustering.
All-clear	Four consecutive weeks below baseline and declining trend.

Table 12.10-B. EPR checklist domains

Domain	Preparedness requirement
Coordination	PHEOC links; woreda taskforce; roles & contacts.

Surveillance	Configured thresholds; automated alerts; weekly review.
Case management	Surge SOPs; referral pathways; severe malaria readiness.
Diagnostics	RDT/microscopy capacity; QA; overflow plans.
Vector control	IRS/LLIN surge playbook; focal LSM; logistics.
Supplies	Buffer stock; last-mile plan; transport standby.
Risk comms	Pre-drafted messages; channels; rumor tracking.
After-action	AAR templates; capture lessons learned.

Table 12.10-C. Alert workflow (detect → verify → classify → respond → review)

Step	Key actions
1. Detect	Dashboard flags threshold breach OR facility raises alert.
2. Verify	Validate data; field assessment within 48–72h.
3. Classify	Confirm outbreak (epi + lab + service burden).
4. Respond	Treatment surge; targeted vector control; SBC.
5. Review	Daily SITREP; adjust actions; AAR.

Table 12.10-D. Indicators & definitions

Indicator	Definition
Alert count	# EWS alerts generated per year.
Verification timeliness	Median days from alert to field verification.

Response timeliness	Median days from verification to first intervention.
Commodity buffer	Median days of RDT/ACT stock on hand in hotspots.
EPR readiness	% woredas meeting the checklist.
Climate integration	% alerts with linked climate analysis.

Table 12.10-E. Climate & mobility data streams commonly integrated

Data stream	Use in EPR
Rainfall/temperature	National Meteorology Agency; CHIRPS/ERA5.
Hydrology/flood risk	River levels; flood bulletins; FEWS NET.
Mobility proxies	Market days; displacement updates; road access.
Health service load	OPD, admissions, lab backlogs; referral time.

Narrative summary (plain-language)

When malaria spikes, time is everything. Ethiopia's system watches routine data, climate patterns, and local reports. If numbers cross a warning line, health teams quickly verify and classify the situation. If an outbreak is confirmed, actions follow fast: more testing, enough medicine and nets, targeted spraying, and community messages. Tracking how many days it takes to move from an alert to a field response helps teams get faster each season. Preparing in advance—clear roles, buffer stocks, transport on standby—keeps small problems from becoming big ones. Good preparedness protects lives and prevents health facilities from being overwhelmed.

References — Section 12.10

• **Federal Ministry of Health (Ethiopia) — IDSR/EPR guidance —** https://www.moh.gov.et/

• **WHO — Malaria surveillance & epidemic response —** https://www.who.int/teams/global-malaria-programme/surveillance-monitoring-evaluation

• **FEWS NET — Seasonal climate and food security outlooks —** https://fews.net/

• **National Meteorology Agency (Ethiopia) — climate bulletins —** https://www.ema.gov.et/

• **PMI — Ethiopia Malaria Operational Plans (EPR) —** https://www.pmi.gov/where-we-work/ethiopia/

12.11) Monitoring, Evaluation & Learning (MEL) — Malaria

This section proposes a practical MEL approach for Ethiopia’s malaria program: a focused indicator set, routine performance review, data quality audits, and an explicit learning agenda. Charts use integer years and are illustrative placeholders; replace with official HMIS/DHIS2/MIS/EPR series before publication.

Figure . Core malaria indicators — illustrative

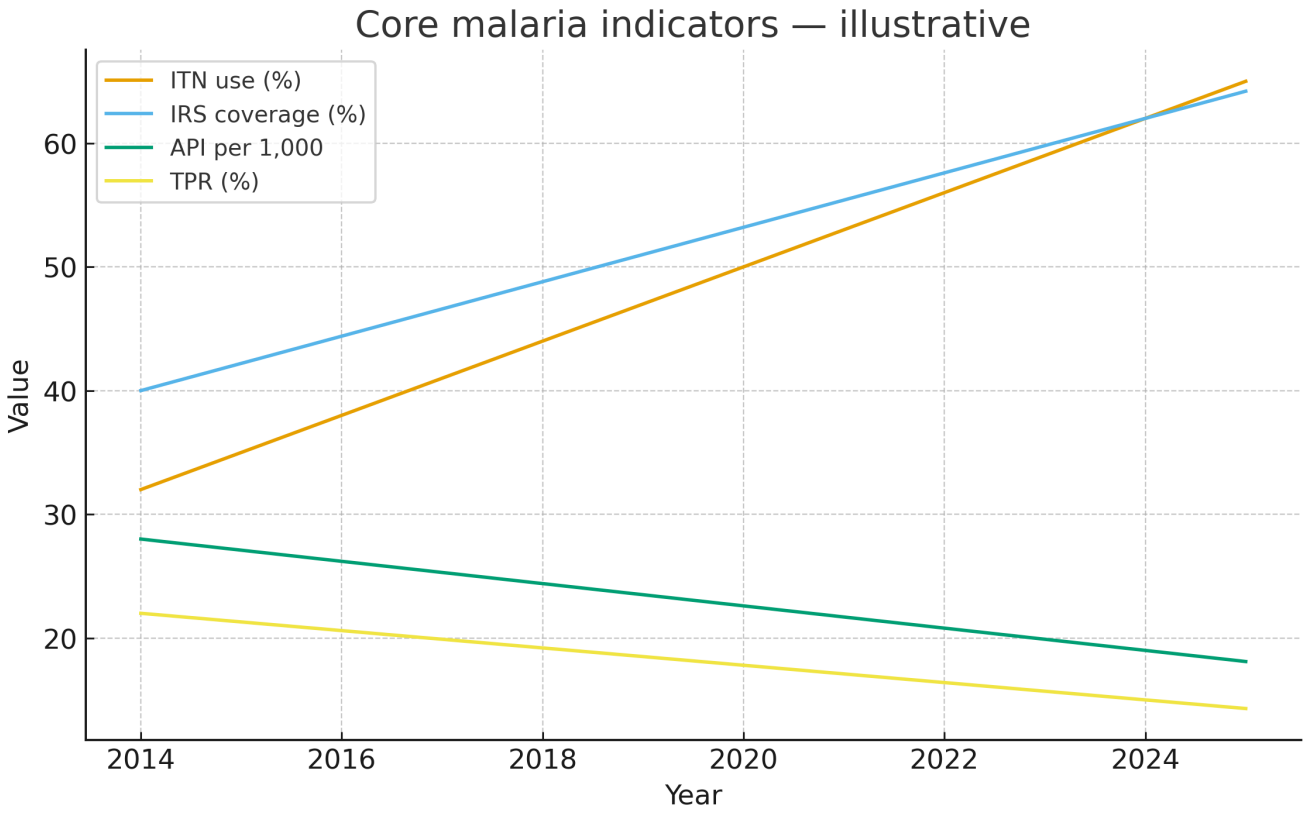


Figure . Reporting performance — timeliness & completeness — illustrative

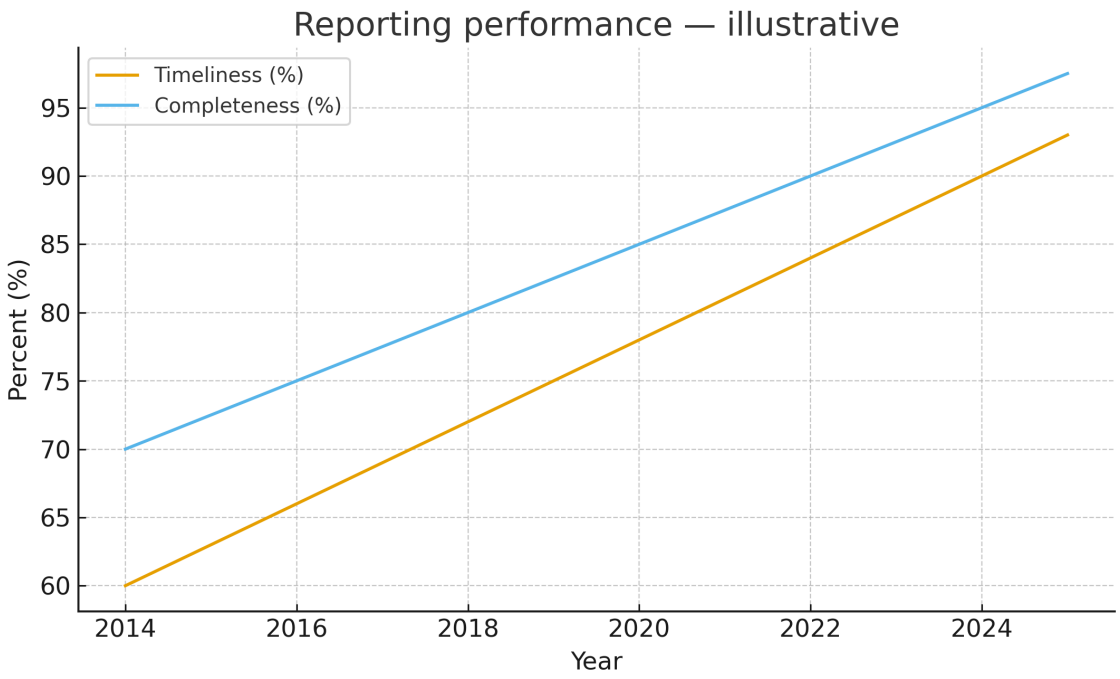


Figure . Data quality & supportive supervision — illustrative

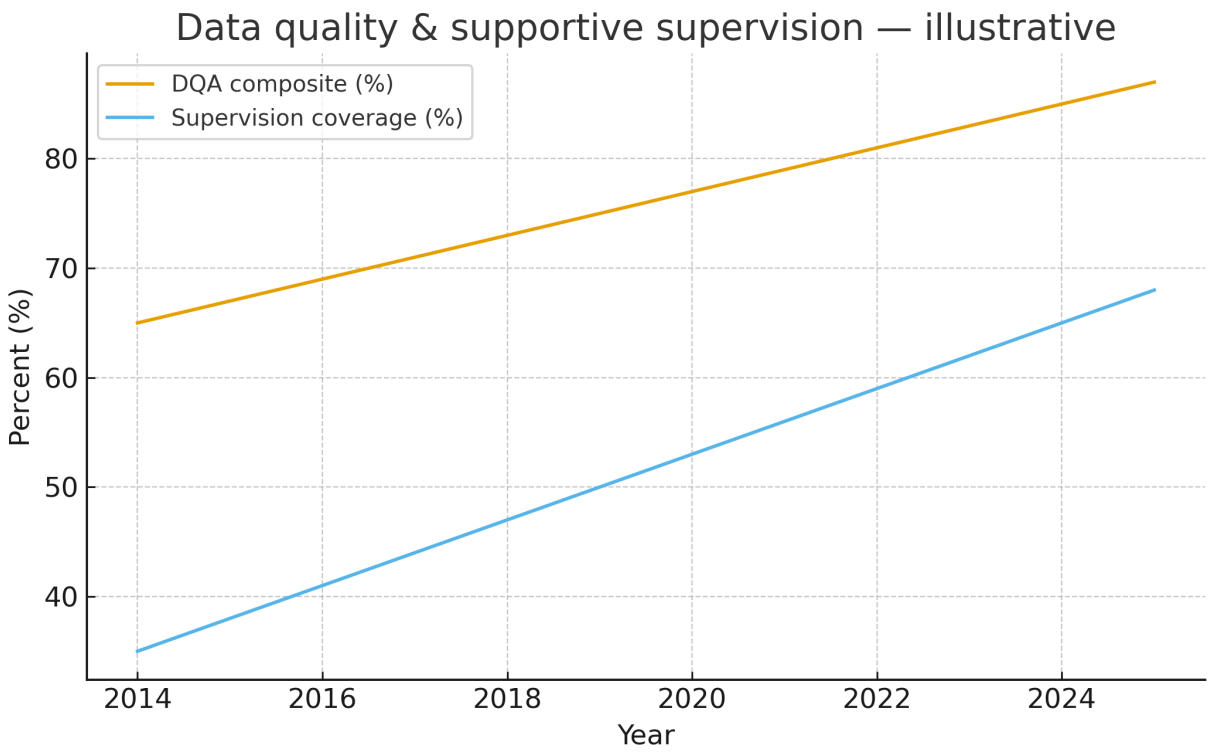


Figure . Learning & adaptive management — illustrative

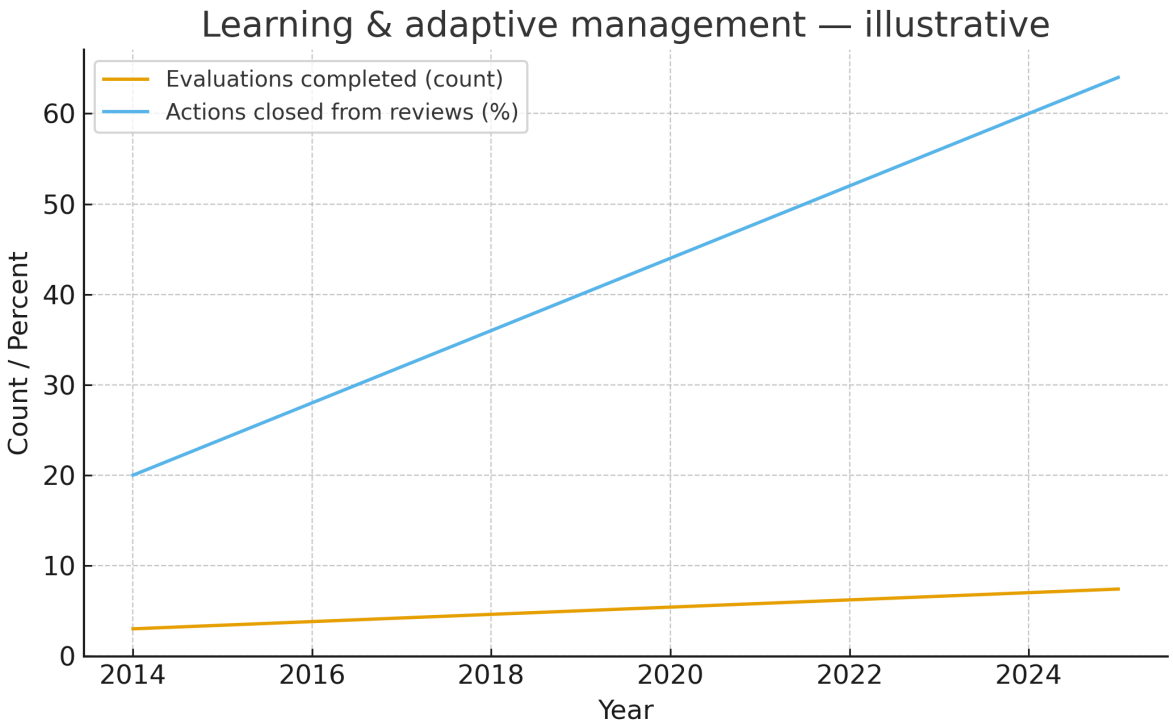


Table 12.11-A. MEL results framework (simplified)

Level	Definition (Ethiopia context)
Inputs	Financing; commodities; HR; data systems; training
Activities	Prevention (LLIN/IRS/LSM), diagnosis, treatment, EPR, SBC
Outputs	Nets distributed, structures sprayed, tests done, cases treated
Outcomes	Higher coverage & quality; reduced TPR; fewer outbreaks
Impact	Lower incidence/mortality; toward elimination in low-transmission zones

Table 12.11-B. Indicator dictionary (program + system)

Indicator	Definition	Data source	Frequency

ITN use	% population who slept under an ITN last night	MIS/HMIS	Annual/seasonal
IRS coverage	% targeted structures sprayed	IRS campaign reports	Annual
API	Confirmed cases per 1,000 population/year	HMIS/surveillance	Monthly/Annual
TPR	% positive among those tested	HMIS/lab	Monthly
Reporting timeliness	% weekly/monthly reports on time	DHIS2	Weekly/Monthly
Reporting completeness	% facilities submitting reports	DHIS2	Monthly
DQA composite	% conformity on verification, consistency, accuracy	DQA audits	Semi-annual
Supervision coverage	% facilities visited per quarter	Supervision logs	Quarterly
Evaluations completed	# evaluations/operational studies	MEL plan tracker	Annual
Actions closed	% of action items closed from reviews/AARs	AAR/action tracker	Quarterly

Table 12.11-C. Data Quality Assessment (DQA) checklist

Dimension	What to check
Verification	Recount at source registers; compare to reports (±5% tolerance)
Consistency	Trends coherent across indicators/neighboring districts
Completeness	No missing values; denominator definitions documented

Timeliness	Reports submitted by deadline; dashboard alerts configured
Integrity	Audit trail; role-based access; change logs
Accuracy	Spot checks; re-abstraction; error rates captured

Table 12.11-D. Evaluation & review plan

Evaluation type	Purpose & cadence
TES (drug efficacy)	Every 2–3 years per zone; informs treatment policy
Vector control effectiveness	Net durability & bioefficacy; IRS residual life studies
Cost & efficiency	Cost per person protected/treated; supply chain costs
Epidemic After-Action Review	Post-outbreak lessons; action plan with deadlines
Operational research	SBCC, community health worker models, digital tools

Table 12.11-E. Learning agenda & uptake

Element	Ethiopia-oriented specification
Priority questions	How to close use-access gap? Which net types where resistance is high? How to speed alert-to-action?
Uptake mechanisms	Quarterly review; policy briefs; dashboards; learning forums
Ownership	MOH NMCP with regions; partners support capacity building
Success metric	% of priority questions answered & actions completed

Table 12.11-F. Dashboard specification

Component	Specification
Granularity	Woreda level with roll-up to region and national
Core widgets	Coverage (ITN/IRS), burden (API/TPR), system (timeliness/completeness)
Disaggregation	Age/sex where feasible; urban/rural; livelihood/eco-zone
Alerting	Auto-alerts for anomalies; stock-out and outbreak flags
Interoperability	Link to LMIS, EPR, entomology modules; open APIs

Narrative summary (plain-language)

Monitoring, evaluation, and learning make malaria programs smarter over time. Monitoring tracks routine numbers like net use, IRS coverage, and how quickly clinics report data. Evaluation checks whether strategies are working and worth the cost. Learning brings teams together to turn findings into action—updating guidelines, fixing supply problems, or changing how messages are delivered. Good MEL is not about collecting more data; it is about using a small set of reliable indicators and reviewing them regularly to guide decisions. When Ethiopia's program measures what matters and acts on it, cases fall faster and resources go further.

References — Section 12.11

• **Federal Ministry of Health (Ethiopia) — M&E/MEL frameworks & DHIS2 guidance —** https://www.moh.gov.et/

• **WHO — Malaria surveillance, monitoring & evaluation toolkit —** https://www.who.int/teams/global-malaria-programme/surveillance-monitoring-evaluation

• **Global Fund — Modular framework & M&E guidance (malaria) —** https://www.theglobalfund.org/

• **PMI — Monitoring & evaluation guidance; Ethiopia MOPs —** https://www.pmi.gov/where-we-work/ethiopia/

12.12) Financing, Governance & Partnerships — Malaria

This section summarizes how Ethiopia’s malaria program is financed and governed, and how partnerships align resources for impact. Charts use integer years and are illustrative placeholders; replace with official budget execution data before publication.

Figure . Malaria financing by source — illustrative

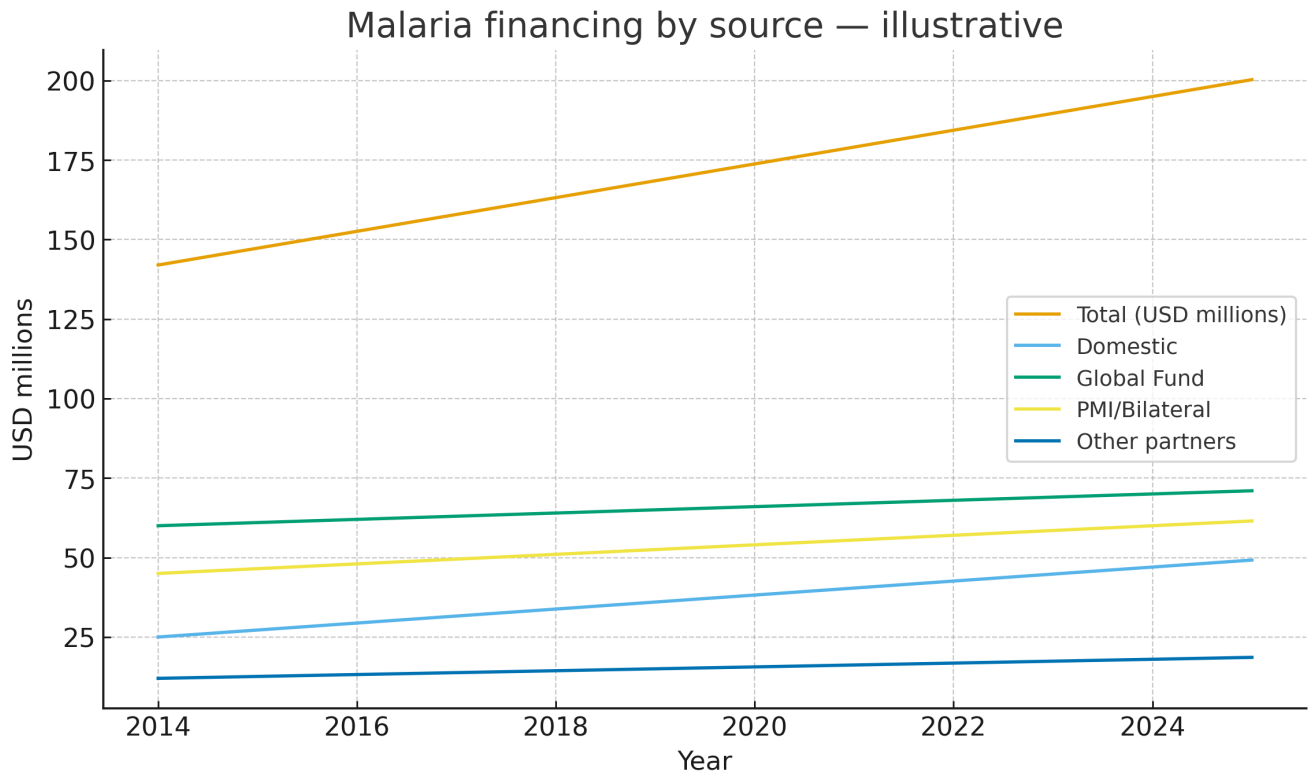


Figure . Budget execution & absorption — illustrative

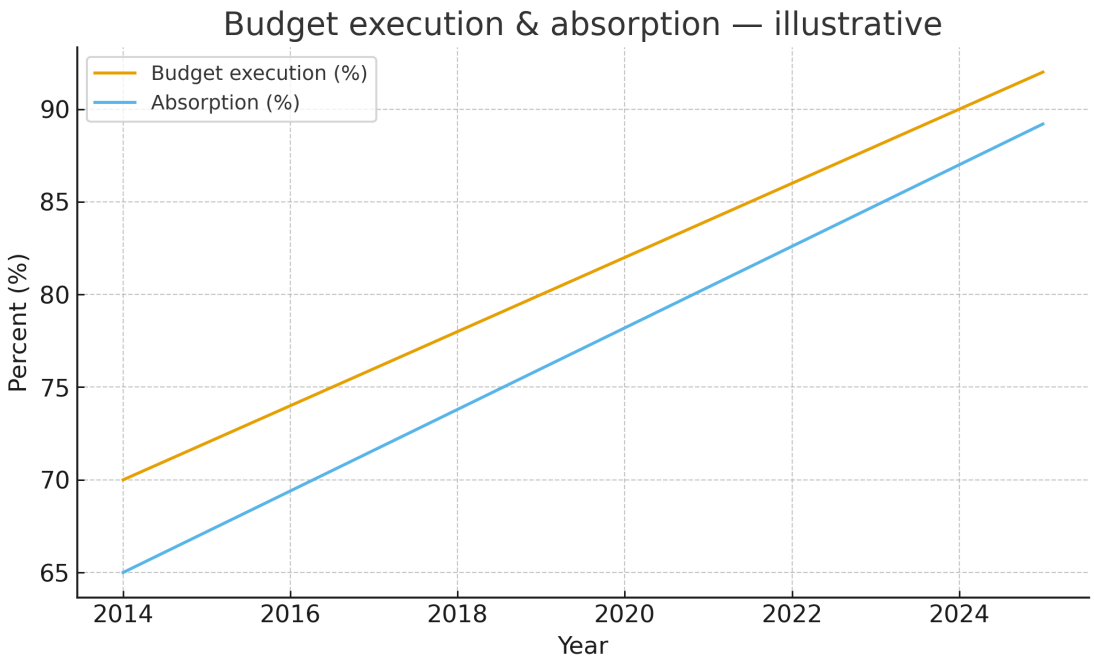


Figure . Spending by program area — illustrative

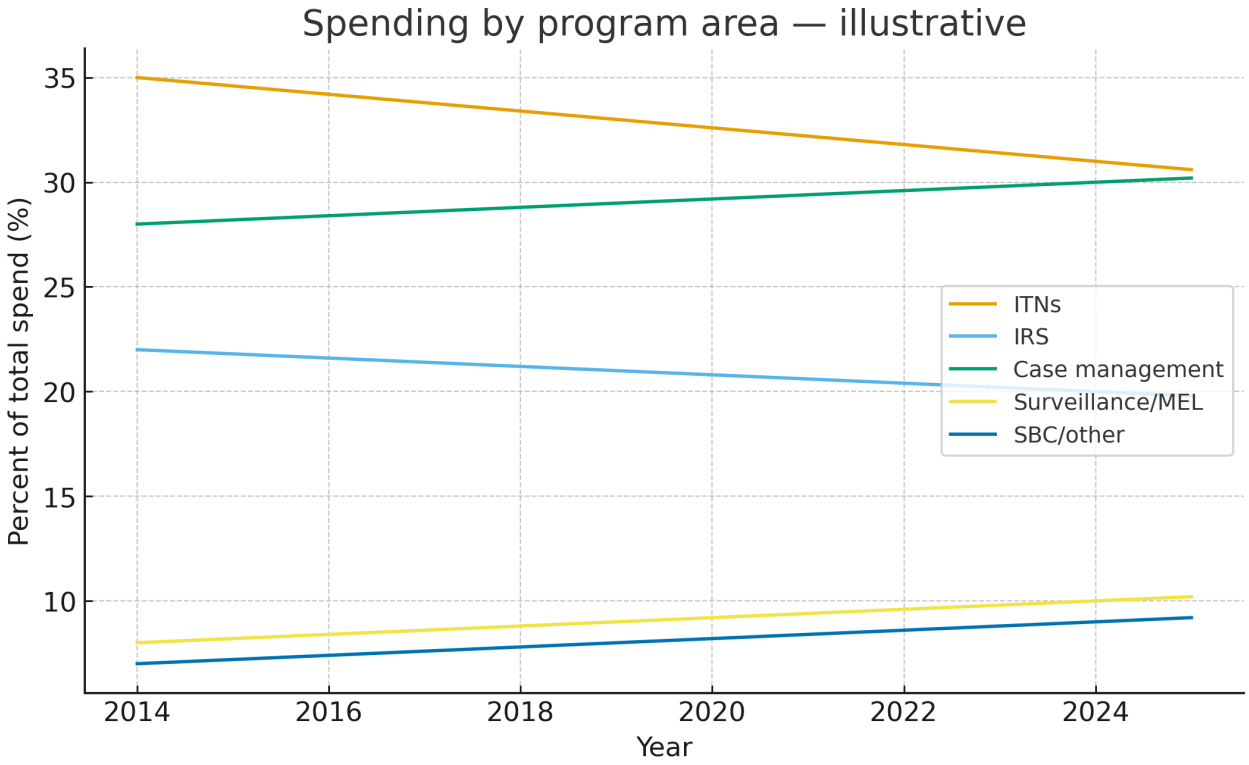


Figure . Pooled procurement uptake — illustrative

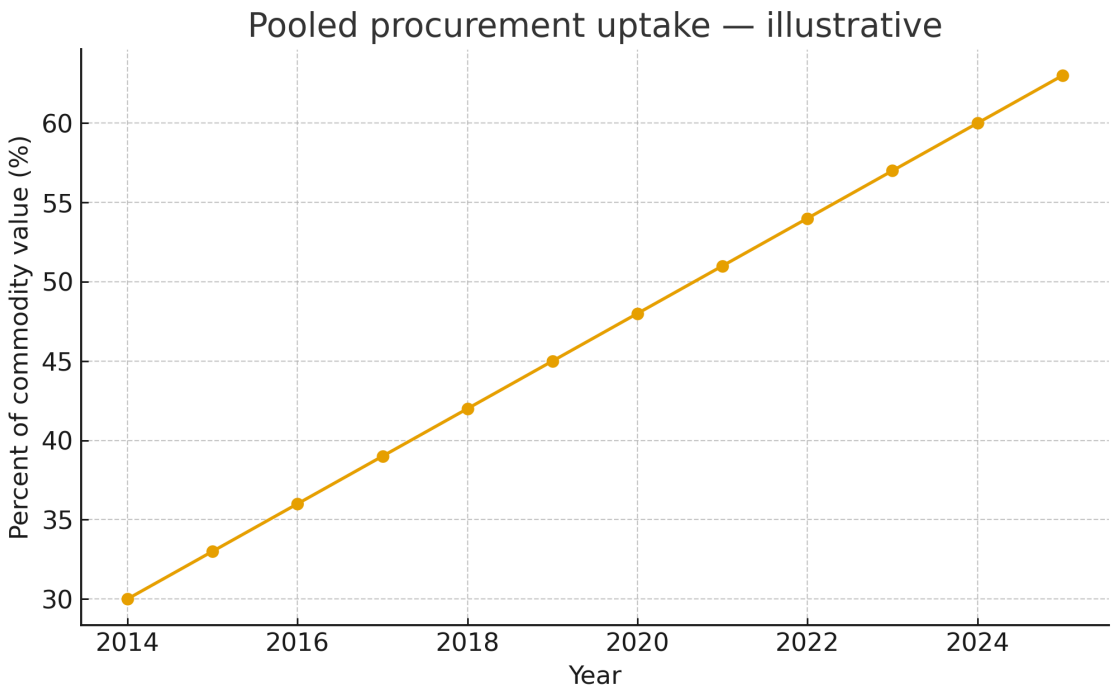


Figure . Partner coordination score — illustrative

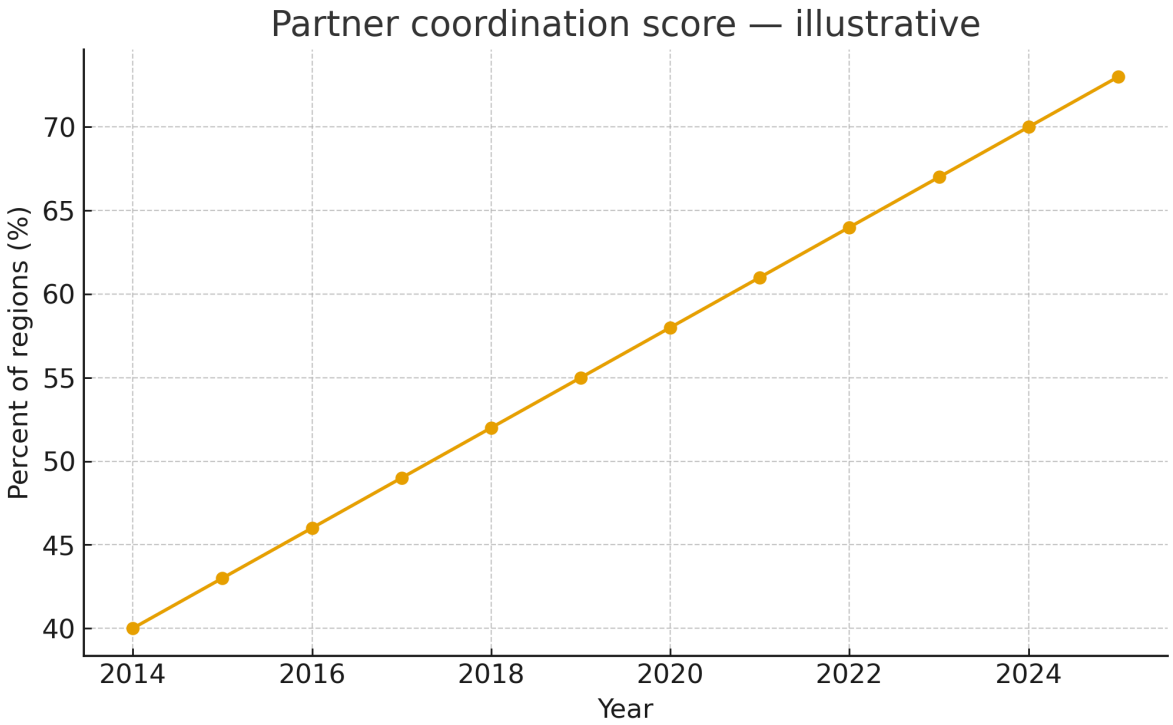


Table 12.12-A. Governance structure (Ethiopia malaria program)

Layer	Core roles
Stewardship	MOH/NMCP leads strategy, standards, and accountability.
Regional health bureaus	Adapt plans and supervise execution; coordinate partners.
Woreda & facilities	Deliver services; report data; manage local stocks.
National platforms	CCM; PHEOC/EPR; TWGs.
Community	Health Extension Program; civil society oversight.

Table 12.12-B. Funding sources & typical use

Source	Typical allocations
Domestic budget	Salaries; co-financing; operations; partial commodities
Global Fund	LLINs, IRS, diagnostics, case management, systems, SBC
PMI/Other bilateral	IRS, LLINs, surveillance, OR, supply chain
UN/NGO/Private	Gap filling; emergency response; innovation pilots

Table 12.12-C. Annual joint review & planning calendar

Quarter	Key governance activities
Q1	Annual review; gap analysis; confirm envelopes
Q2	Micro-planning; finalize procurements; align training
Q3	Implementation surge; supervision; mid-year review

Q4	Re-program if needed; AARs; next-year pipeline & CCM submissions

Table 12.12-D. Procurement & supply chain safeguards

Domain	Safeguard
Product selection	IRM & TES-informed; WHO-PQ only
Procurement route	Pooled/central preferred; transparent tendering
Quality assurance	Lot testing; PSI; random sampling on arrival
Traceability	Barcode lots; LMIS; expiry/FEFO tracking
Risk controls	Dual sign-off; segregation; independent audits

Table 12.12-E. Co-financing & sustainability roadmap

Component	Actions for Ethiopia
Domestic co-finance	Increase commodity/EPR line items
Efficiency gains	Scale pooled procurement; optimize distribution
Private sector	CSR for nets/IRS; workplace programs; logistics partnerships
Innovative financing	Results-based contracts; catalytic matching
Transition planning	Shift recurrent costs (LLIN top-ups, surveillance) to domestic

Table 12.12-F. Partnership map (illustrative)

Group	Illustrative members
Government	MOH/NMCP; RHBs; EPHI; EMA; Meteorology; Finance; Education
Bilateral	PMI/USAID; FCDO; KfW/GIZ; JICA

Multilateral	Global Fund; WHO; UNICEF; World Bank
NGO/CSO	PSI; Jhpiego; MSH; MSF; local NGOs
Academia/Research	EPHI; universities; AHRI; international consortia
Private sector	Net manufacturers; agro-industry; mobile operators; logistics firms

Table 12.12-G. Performance & risk dashboard indicators

Indicator	Definition/metric
Budget execution	% of approved budget disbursed
Absorption	% of disbursed funds spent on-time/for purpose
Procurement lead time	Days from requisition to delivery
Stock-out frequency	% facilities with any stock-out days (key commodities)
Audit findings closed	% corrective actions closed within deadline
Partner alignment	% regions holding quarterly joint reviews with minutes

Narrative summary (plain-language)

Malaria control in Ethiopia depends on strong partnerships and predictable financing. The Ministry of Health leads, while regions adapt plans and partners fund and implement activities. Budgets work best when money flows on time and commodities are bought through pooled procurement to lower prices. Regular joint reviews help everyone stay aligned and fix problems early—like bottlenecks in delivery or data gaps. Over time, Ethiopia can increase domestic funding for routine costs while using partner funds to innovate and close gaps. Clear rules, transparent procurement, and follow-through on audit actions protect value for money and save lives.

References — Section 12.12

• **Federal Ministry of Health (Ethiopia) — Health Sector Financing & NMCP plans —** https://www.moh.gov.et/

• **Global Fund — Country portfolio & guidance —** https://www.theglobalfund.org/en/portfolio/country/

• **PMI — Ethiopia Malaria Operational Plans —** https://www.pmi.gov/where-we-work/ethiopia/

• **World Bank — Health financing & procurement resources —** https://www.worldbank.org/

• **WHO — National strategic plans & M&E guidance —** https://www.who.int/teams/global-malaria-programme

Chapter 12 — Vectored Diseases: Malaria (Ethiopia focus + global lens)

Landing-page summary

12.1 Concepts, Burden & Transmission Ecology

Malaria in Ethiopia is heterogeneous and seasonal. Transmission is driven mainly by Plasmodium falciparum and P. vivax, with major vectors including Anopheles arabiensis (widespread, often zoophilic), An. funestus s.l. in wetter lowlands, and the invasive An. stephensi in urban/peri-urban settings. Risk rises after the main rains and around irrigation schemes and floodplains. Highland fringes are epidemic-prone due to climate variability and partial population immunity, while parts of the lowlands and large irrigation belts experience more perennial exposure. This eco-epidemiology underpins the chapter's emphasis on stratification and tailored mixes of interventions.

12.2 Diagnostics

Accurate, timely diagnosis is the gateway to effective care and surveillance. Ethiopia routinely uses RDTs and microscopy, with quality assurance through proficiency testing, on-site supervision, and cross-checks. Program performance hinges on test positivity rate (TPR) trends, stock continuity, and adherence to "test-and-treat". In P. vivax areas, species-specific detection matters for radical cure decisions. Strengthening supply chains, QA/QC, and linkage of lab data to DHIS2 improves both patient outcomes and the fidelity of surveillance.

12.3 Surveillance & Indicators

A lean set of indicators allows routine course-correction: API (cases per 1,000), TPR, severe malaria admissions & CFR, and core service coverage metrics (net use, IRS coverage, diagnosis and treatment timeliness). Ethiopia's surveillance aims for complete, on-time reporting at facility and community level, with dashboards that disaggregate by region, woreda, season, and risk stratum. Data quality—verification, consistency, and integrity—is treated as a program deliverable, not an afterthought.

12.4 Stratification & Targeting

Because risk is uneven, Ethiopia stratifies by eco-epidemiological zone, transmission intensity, climate seasonality, elevation, irrigation, and recent incidence. Stratification drives where to deploy LLINs universally versus where to layer IRS or LSM, how to pre-position commodities and surge teams for epidemic-prone highlands, and where to intensify SBC and community case management.

12.5 Case Detection & Community Systems

Health Extension Workers (HEWs) and iCCM platforms extend access to testing and timely treatment. Community-based active/reactive case detection (especially in low-transmission foci) helps find residual infections and triggers local responses. The last mile—referral readiness, transport, and feedback loops—is a recurrent bottleneck addressed through micro-planning and routine review.

12.6 Case Management & Treatment Protocols

Effective care rests on rapid confirmation and guideline-concordant treatment:

Uncomplicated P. falciparum: first-line ACTs at correct dose/duration; day-3 review in selected contexts.

Severe malaria (any species): immediate injectable artesunate, supportive care, then full oral ACT on stabilization.

P. vivax: blood-stage treatment plus radical cure (primaquine/tafenoquine) after G6PD testing to prevent hemolysis.

Program priorities include reducing stock-outs, improving antibiotic stewardship (avoid unnecessary co-prescription), speeding referrals, and tracking effectiveness via Therapeutic Efficacy Studies (TES).

12.7 Vector Control I — ITNs/LLINs

Nets remain the backbone. Success is measured by access (enough nets in the household) and use (slept under last night). Ethiopia blends mass campaigns with continuous distribution through ANC/EPI, schools, and community channels. Use-to-access gaps are addressed with locally tuned SBC that tackles heat, net condition, and outdoor sleeping. Where pyrethroid resistance is high, next-generation nets (PBO or dual-active) can restore efficacy. Durability monitoring (survivorship, bioefficacy, hole index) informs replacement timing and procurement choices.

12.8 Vector Control II — IRS & Larval Source Management

IRS is targeted to moderate/high-risk or epidemic-prone areas, with product rotation guided by resistance data and attention to residual wall efficacy and timely pre-season spraying. LSM (biolarvicides, source reduction, habitat manipulation) fits best where breeding sites are few, fixed, and findable—notably urban/peri-urban settings and irrigation schemes, including contexts at risk from An. stephensi. Cost and feasibility vary, so hybrid mixes (IRS in high-risk districts + LSM in dense towns + LLINs everywhere) are commonplace.

12.9 Resistance Monitoring & Insecticide Management

Ethiopia's IRM tracks vector susceptibility via WHO tube assays (with/without PBO), resistance markers (e.g., kdr, Ace-1), LLIN bioefficacy, and IRS residual life. Results inform which net type to distribute and which IRS product to deploy, and when to rotate classes. Urban emergence of An. stephensi adds urgency to container management and tailored control. The guiding principle: change tactics before resistance becomes a crisis.

12.10 Surveillance–Response & Epidemic Preparedness

Highland fringes and climate variability require early warning systems with clear alert thresholds (statistical baselines), rapid verification, and pre-planned responses (diagnostic surges, targeted vector control, risk communication). Programs monitor alert-to-action timeliness, maintain buffer stocks (RDTs, ACTs, IRS supplies), and integrate climate and mobility signals (rainfall anomalies, displacement) into decision-making. After-Action Reviews (AARs) close the loop.

12.11 Monitoring, Evaluation & Learning (MEL)

A practical MEL system uses a small, reliable indicator set, regular data quality audits, and recurring joint performance reviews to drive decisions. Evaluations (TES, durability monitoring, cost and efficiency studies) and operational research inform mid-course corrections. The "learning agenda" prioritizes questions like closing the use-to-access gap, optimizing net and IRS mixes under resistance, and speeding alert-to-action.

12.12 Financing, Governance & Partnerships

Sustained progress depends on predictable financing, transparent procurement, and coherent governance from MOH/NMCP to regions and woredas. Pooled procurement and supply-chain safeguards protect value for money. Quarterly joint reviews align partners (Global Fund, PMI, UN/NGOs, private sector) and accelerate problem-solving. Over time, a sustainability roadmap grows domestic co-financing for recurrent costs while leveraging partners for innovation and gap-filling.

Cross-Cutting Messages & Practical Implications

Targeting matters: Ethiopia's varied topography and climate create highly uneven risk. Stratify rigorously and plan interventions by season, elevation, irrigation, and urbanization (including An. stephensi risk).

Do the basics better: Reliable diagnostics, stock continuity, and adherence to treatment guidelines save lives as surely as any new tool.

Use data as a lever: High-quality, timely data—paired with routine review—enables faster epidemic control and better resource allocation (e.g., where to deploy next-gen nets or which IRS product to rotate in).

Plan for resistance: Assume insecticide resistance will evolve. Maintain multiple effective classes, monitor continuously, and rotate or combine proactively.

Mind the last mile: Community systems (HEWs, referral pathways) and SBC determine whether access translates into use and timely care.

Finance and governance are enablers: Execution and absorption rates, pooled procurement, and regular joint reviews often matter as much as budget size.

Priority Actions (Ethiopia Focus)

Sharpen stratification with the newest incidence, entomology, climate, and urbanization layers; explicitly map An. stephensi risk zones.

Upgrade net portfolios toward PBO/dual-active LLINs in resistant areas; maintain durability cohorts to guide replacement.

IRS where it counts: Time spraying before rains; rotate products per IRM; verify residual life; focus on epidemic-prone belts.

Scale G6PD testing to unlock safe P. vivax radical cure; track completion and hemolysis AEs via pharmacovigilance.

Cut alert-to-action delays: Pre-approve surge playbooks, logistics, and budgets; monitor turnaround times every season.

Institutionalize MEL: Keep the indicator set lean, run DQAs, and close actions from reviews/AARs; publish learning briefs that feed the next micro-plan.

Sustainability roadmap: Increase domestic co-financing for routine costs (nets top-ups, surveillance), while using partner resources for innovation and scale-up.

GLOSARY

ACT: Artemisinin-based Combination Therapy for uncomplicated falciparum malaria.

API: Annual Parasite Incidence: confirmed cases per 1,000 population per year.

AAR: After-Action Review after an outbreak response.

An. stephensi: Invasive urban malaria vector breeding in containers.

CFR: Case fatality rate among malaria cases or admissions.

DHIS2: Platform for routine health information reporting.

EPR: Epidemic Preparedness and Response system.

G6PD testing: Test prior to vivax radical cure with primaquine/tafenoquine.

IRS: Indoor Residual Spraying of long-lasting insecticide on interior walls.

ITN/LLIN: (Long-lasting) insecticide-treated bed net.

kdr / Ace-1: Genetic markers linked to pyrethroid or carbamate/OP resistance.

LSM: Larval Source Management of breeding sites.

PBO: Piperonyl butoxide synergist used with pyrethroids.

TPR: Test positivity rate among those tested for malaria.

TES: Therapeutic Efficacy Study of antimalarial drugs.

References & URLs (Chapter 12)

• **Federal Ministry of Health (Ethiopia) — National Malaria Programme —** https://www.moh.gov.et/

• **EPHI — Surveillance/entomology resources —** https://www.ephi.gov.et/

• **WHO — Global Malaria Programme —** https://www.who.int/teams/global-malaria-programme

• **PMI — Ethiopia Malaria Operational Plans —** https://www.pmi.gov/where-we-work/ethiopia/

• **Global Fund — Country portfolio —** https://www.theglobalfund.org/en/portfolio/country/

• **IVCC — IRS product profiles & resistance management —** https://www.ivcc.com/

• **FIND — G6PD testing and radical cure —** https://www.finddx.org/malaria/

• **CDC — Malaria diagnosis & treatment —** https://www.cdc.gov/malaria/

• **Alliance for Malaria Prevention — LLIN resources —** https://allianceformalariaprevention.com/

• **FEWS NET — Climate outlooks (EPR context) —** https://fews.net/

• **Ethiopian Meteorological Agency — climate bulletins —** https://www.ema.gov.et/