Independent Evaluation of Capacity, Quality and Decision-making in Sub-national Tailoring of Malaria Interventions

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Evaluation of Capacity, Quality and Decision-making in Sub-national Tailoring of Malaria Interventions

Evaluation Report

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PILGRIM AFRICA

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The team responsible for this evaluation included:
- Leads: Dorothy Echodu, Humphrey Wanzira
- Project Manager: Diana Nasike
- Members: Pascalina Chanda-Kapata, Thomas Eganyu, Vanessa Elias, Adriana Lanting, Diana Measham, Thierry Ouedraogo

LIST OF ACRONYMS

ACT	Artemisinin Combination Therapy
AI	Artificial Intelligence
AMC	Anti-Malarial Campaign
ANC	Antenatal Clinic
API	Annual Parasite Incidence
C19RM	COVID-19 Response Mechanism
CCM	Country Coordinating Mechanism
CFP	Permanently Closed-Seam Nets
CHAI	Clinton Health Access Initiative
CHW	Community Health Worker
CM	Case Management
COE	Challenging Operating Environment
COOP	Cost Optimized Operational Plan
CRG	Community, Rights and Gender
CSO	Civil Society Organization
DDDM	Data-driven Decision-making
DfID	UK Department for International Development
FDHIS2	District Health Information Software 2
DQ	Data Quality
DRC	Democratic Republic of the Congo
ECG	External Consultation Group
EIR	Entomological Inoculation Rate
ELO	Evaluation and Learning Office
FGD	Focus Group Discussion
FR	Funding Request
GAVI	Global Alliance for Vaccines and Immunizations
GC	Grant Cycle
GMEP	Global Malaria Eradication Programme
GMP	Global Malaria Programme
GTS	Global Technical Strategy
HBC	High-Burden Country
HBHI	High Burden High Impact
iCCM	Integrated Community Case Management
IEP	Independent Evaluation Panel
IHI	Ifakara Health Institute
IMCI	Integrated Management of Childhood Illness
IPTp	Intermittent Preventive Treatment in Pregnancy
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
KEMRI	Kenya Medical Research Institute
KII	Key Informant Interview
KPI	Key Performance Indicator
LAO	Local Administrative Organization
LFA	Local Fund Agent
LGA	Local Government Area
LINK	Local Information for National Control
LLIN	Long Lasting Insecticidal Net
LLM	Large Language Model

LIST OF ACRONYMS, CONTINUED

LSHTM	London School of Hygiene and Tropical Medicine
LSM	Larval Source Management
M&E	Monitoring and Evaluation
MAP	Malaria Atlas Project
MARA	Mapping Malaria Risk in Africa
MDR	Malaria Data Repository
MPR	Malaria Programme Review
NGO	Non-governmental Organization
NMCP	National Malaria Control Program
NMEP	National Malaria Elimination Program
NMP	National Malaria Program
NMSP	National Malaria Strategic Plan
NSP	National Strategic Plan
PA	Pilgrim Africa
PAAR	Prioritized Above Allocation Request
PATH	Program for Appropriate Technology in Health
PHC	Primary Health Care
PMC	Perennial Malaria Chemoprevention
PMI	United States of America President's Malaria Initiative
PNG	Papua New Guinea
PR	[Global Fund] Principal Recipient
PUDR	Progress Update and Disbursement Request
QOC	Quality of Care
RBM	Roll Back Malaria
RFP	Request for Proposal
ROS	Rapid Online Survey
RSSH	Resilient and Sustainable Health System Strengthening
SBC	Social and Behavior Change
SES	Socio-Economic Status
SMC	Seasonal Malaria Chemoprevention
SNT	Sub-national Tailoring
STPH	Swiss Tropical and Public Health Institute
TOC	Theory of Change
TRP	Technical Review Panel
TWG	Technical Working Group
WHO	World Health Organization

EXECUTIVE SUMMARY

Background: Sub-national tailoring (SNT) refers to the use of local data and contextual information to determine the appropriate mix of interventions and delivery strategies for a given area, for optimum impact on transmission and burden of disease.

Evaluation Purpose and Objectives: In March 2024, the Global Fund commissioned an independent evaluation of capacity, quality and decision-making in SNT of malaria interventions from Pilgrim Africa. Timed to inform GC8, the evaluation aims to provide the Secretariat, Strategy Committee, Board and global malaria community with evidence on progress, challenges and opportunities in translating SNT theory and process into optimized malaria programs in high-burden countries (HBCs). The evaluation aims to identify and recommend actionable pathways for advancing SNT and financial optimization through the GC8 investment process.

More specifically, the evaluation's objectives were to assess (1) capacity, quality of data and decision-making in SNT of malaria interventions; (2) how the Global Fund and other stakeholders have incentivized and can incentivize the use of sub-national data and financial optimization to maximize impact; and (3) the role of national and sub-national leadership, agency and capacity in producing effective SNT, including optimized national malaria strategic plans (NMSPs) and funding applications to the Global Fund.

Theory of Change and Evaluation Domains: The evaluation is framed against both a conceptual model of the extended SNT process, and a proposed Theory of Change (TOC). The conceptual model articulates the links between SNT data, analytics and intervention mix decision-making at multiple levels, including country-level strategy, policy, planning, resource allocation and resource mobilization, with a particular focus on Global Fund funding allocations. The TOC considers the SNT process in the context of data and political economy enablers and disablers of national and subnational agency, leadership, and capacity. The TOC positions national and subnational actors as primary drivers of SNT maturity and success, as articulated by this key assumption: *Stronger national and sub-national leadership and capacity, including capacity for innovation, actively supported by the Global Fund and all partners, along with better access to quality data and analytics for decision-making, are primary drivers of a high level of SNT maturity. SNT maturity will produce a context-appropriate sub-nationally tailored malaria response that optimizes resource use for maximum impact on malaria transmission and burden.* Six evaluation domains (excluding impact) were developed based on this assumption and mapped to evaluation questions, including all those from the original Request for Proposal (RFP) as well as additional questions. Findings and conclusions are presented by evaluation domain.

Methods: A total of 35 countries were evaluated, 30 primarily high-burden countries in a primary sample, and 5 transition/eliminating countries for high-level review. The evaluators used a mixed methods approach, including both primary and secondary data, collected using seven approaches:

1. Document and data review for the 30 HBCs, supported where possible by Natural Language Processing (NLP)-Artificial Intelligence (AI) aided data extraction
2. Key informant interviews (KII)/focus group discussions (FGD) at the sub-national, national, regional, and global levels, both remotely and in person
3. A review of relevant novel developments in data management and intervention science that may affect the future SNT landscape
4. Visits to six countries (Democratic Republic of Congo, Ghana, Kenya, Madagascar, Nigeria, and Papua New Guinea) for in-depth, in-country evaluation of SNT maturity, quality, capacity and decision-making at national and sub-national levels

5. A rapid online survey (ROS) in visited countries
6. An innovation review
7. An historical review of five additional transition or eliminating countries outside Africa (Cambodia, Costa Rica, Guatemala, Panama and Sri Lanka), for lessons on SNT strategies employed during transition from high to low burden.

The evaluators emphasized qualitative techniques across these data streams and sources, with some descriptive statistics and limited quantitative analysis. As part of the portfolio analysis, the evaluators conducted detailed reviews of GC6 and GC7 funding requests (FRs), the NMSPs that support them, and associated literature for 18 of the 30 HBCs, and a higher-level review for the other 12. The evaluators also developed an SNT Maturity Index that considers both quantitative and qualitative indicators (*Annex C: SNT Maturity Scorecards*) and analyzed scores with respect to potential correlates of SNT maturity. The evaluators conducted a meta-review of the Global Fund and other stakeholder results frameworks, assessments, indicators and dashboards related to SNT progress and maturity. Finally, the evaluators triangulated across sources and methods and graded all findings for strength of evidence.

Findings by Domain

Findings in Domain 1: National program leadership and capacity, including capacity for innovation

Program leadership: The evaluation found that national program and government leadership, capacity and ownership are key drivers of effective SNT. Stakeholders agree that national program leadership is essential to successful SNT, and that effective program leadership requires ownership of disease goals. Program leadership and effectiveness are expressed in capacity for coordination and organization, at all levels. Strong programs coordinated external partners effectively and had good communication with sub-national units. SNT empowers national programs, promotes innovation, and increases awareness of resource constraints. SNT can act as a driver of domestic resource mobilization. For example, in Ghana an SNT-based resource mobilization strategy involved pitching IRS expansion to parliamentarians, resulting in the inclusion of two high-burden districts and engagement of a private sector partner with an efficient cost model.

Climate risk: Five countries in the main sample are among the 10 countries in the world most affected by climate risk. Many GC7 FRs highlight climate change effects, like flooding and internally displaced populations, but few consider climate data in malaria intervention mix decisions or do advance climate impact mitigation. In visited countries, formal multi-sectoral coordination or policy between ministries of health and environment or meteorology was not seen. In remote interviews with national programs, however, both climate risk mitigation awareness and informal multi-sectoral coordination on climate impact on disease were found to be increasing. Global malaria stakeholders see opportunity in the growth of impact mitigation financing and partner support. Roll Back Malaria (RBM) provides access to interactive maps on prospective climate metrics with district-level resolution, and the World Health Organization (WHO)/Global Malaria Programme (GMP) has integrated climate-related data into SNT processes and MDR guidance.

Findings in Domain 2: Sub-national governance and leadership

Barriers and enablers for sub-national decision-making for SNT: Enablers of effective sub-national SNT decision-making were identified across the six visited countries, as shown in the following table:

Enablers of Effective Sub-national Decision-making

Enablers	Well-paced political and fiscal decentralization
	Stronger sub-national health governance structures
	A high level of digitization
	Regular communication between national and sub-national levels on malaria data validity, interpretation and use
	Increased resources at sub-national level
	Capacity building of sub-national teams in data analysis and use
	Adequate human resources
	More systematic community engagement

Decentralization and political economy factors: The evaluators examined the relationship between decentralization, effective sub-national leadership and SNT maturity. While effective decentralization, clear governance structures and good coordination between national and sub-national units are observed to promote excellent sub-national leadership and a mature SNT malaria response, disorganized or over-rapid decentralization without strong, central technical leadership was much less effective. Increased sub-national budgetary autonomy and increased sub-national resources are good measures of increased devolution. In KIIs, country programs requested more flexibility in funding lines to adequately fund sub-national units as needed, which is perceived to be difficult within existing global funding mechanisms and disbursement timelines. ROS and remote NMP interview respondents reported that national political considerations do influence execution of SNT plans, even in SNT mature countries.

Community health systems expansion: There have been significant improvements and rapid expansions in community health systems across the portfolio, leading to a widening range of sub-national data for decision-making. These efforts are supported by a growing diversity of funders, including the Global Financing Facility (GFF) and Gavi, among others. Donors focus on health systems strengthening and, in some cases, financing for malaria commodities and interventions. Better coordination and leverage of this resource base will help optimize overall resources for resilient and sustainable system strengthening (RSSH), a vital foundation of effective SNT.

Findings in Domain 3: Actively supported and assisted by the Global Fund and all partners

SNT technical assistance: WHO, the Global Fund, the President's Malaria Initiative (PMI) and the Gates Foundation have all played major roles in driving and incentivizing SNT uptake and in supporting both short- and longer-term TA. While most SNT support to NSPs and FR development is provided by WHO, the 30 countries receive a wide array of SNT TA, and access is highly variable based on donor priorities. Based on key informant interviews and portfolio analysis, the evaluation found that longer-term TA partnerships, embedded with the national program and focused on capacity building and skills transfer, have significantly enabled SNT advancement; these are preferred. Country respondents express a strong desire for local ownership of and in-house capacity for modelling and analysis. Some already benefit from national research expertise.

Tensions: Interviews with international stakeholders surfaced the need for significant improvements in alignment and coordination among key SNT support partners, as well as awareness of the pressure that partner priorities exert on country-level decision-making. Interviews with national stakeholders noted significant differences of opinion between some country programs and guidance from partners on SNT strategic plans. National program leads expressed concerns that partners may not sufficiently consider local implementation expertise and elements of the national decision-making consensus process. Several national KII respondents expressed a desire for better inclusion and input into global malaria policy and strategic decision-making.

Vector control effectiveness is an area of misalignment between country programs and donors: Many country programs referred to partner reluctance to fund Indoor Residual Spraying (IRS) in very high-burden sub-national areas as prioritized in their SNT plans, due to its cost. This shift in global strategy is enshrined proscriptively in recent WHO guidance as a new recommendation against scaling IRS in resource-constrained contexts (WHO, 2024, Guiding Principles). Some respondents raised concerns about the long-term cost implications of scale-down for countries that remain committed to IRS and consider it essential to achieving their goals. Some advice from partners is perceived as more aligned with universal coverage than with SNT. An example was a recommendation to substitute broader, more shallow coverage with Long-Lasting Insecticide Treated Nets (LLINs) in all sub-national areas in place of higher per capita coverage in high burden areas/lower per capita coverage in low burden areas.

Entomological surveillance: While many countries report appreciation for progress and partner support for entomological surveillance, some programs would like more capacity for routine, ongoing measurement of entomological indicators. New low-cost technology utilizing AI-aided morphological identification of anophelines on smartphones is extremely easy to use and can be linked easily with DHIS2. Expanded surveillance would help evaluate the effectiveness of vector control.

Developments and innovations in partnership: Several initiatives aim to make data for global decision-makers more available and accessible, and to improve transparency and harmonization across partner funding and activities. One such effort is the promotion of a single cost optimized operational plan (COOP), enabling countries to construct a costed plan against which partners will transparently declare the portions they will fund. The Program for Appropriate Technology in Health (PATH) has developed a tool (provisionally called "The SNT Explorer") that quickly calculates the costs of alternative intervention scenarios and allows countries to iterate dynamically within their resource envelope. Uncertainties in the calculation of costs (See Domain 6 findings) will require discussion and harmonization as the use of COOPs grows. Recent enhancements to the RBM dashboard have increased stakeholders' ability to determine and track country support from technical partners as well as country progress in areas that are relevant to SNT.

Findings in Domain 4: Better access to quality data and analytics for decision-making

Sub-national data quality, availability and use: Since 2018, when the focus on SNT intensified and expanded across high burden countries, there have been notable improvements in data availability, quality and use – building, in many countries, on many prior years of progress. Almost all countries are using and reporting sub-national data into District Health Information Software 2 (DHIS2), with monthly or weekly reporting. Despite the pandemic, completeness of routine reporting improved between 2018 and 2022. Data provided through the Global Fund Explorer show higher than 90% testing rates for suspected malaria cases; testing rates for PMI-supported countries averaged 97%. Most countries in the sample disaggregate data at least by age bands (<5 and >5), and nine countries use additional age bands. Among countries reporting to the RBM surveillance dashboard, most have access to district-level data, approximately 30% reported electronic reporting at health facility, and fewer reported it at the community level. In the evaluation sample, almost all countries had a dedicated individual responsible for data analyses at the district level; a third had such an individual available below the district level. Increasing digitization of data systems, community reporting, and coverage campaigns for Long Lasting Insecticidal Net (LLIN) and Seasonal Malaria Chemoprevention (SMC) has enhanced sub-national and national decision-making.

Sub-national data and analysis used for SNT: The table below shows sub-national data and analysis used for epidemiological stratification, intervention targeting and tailoring, optimization, and evaluation of SNT plans.

Sub-national Data and Analysis Informing Elements of SNT

SNT Activities	Data and Analysis Used
Risk stratification	By GC7, 28 of 30 countries included sub-nationally stratified maps of epidemiological risk in their FRs, nine according to the method disseminated during WHO stratification workshops.
Intervention targeting and tailoring	There has been a significant increase in the availability of spatially and temporally relevant sub-national data for targeting and tailoring interventions and delivery strategies, including for quality improvement. These include insecticide resistance, species distribution, therapeutic efficacy, service quality, access to care, and both performance and coverage data from digitized campaigns and CHWs.
Intervention mix decision-making, optimization, and prioritization	Most countries used some form of prioritization exercise or matrix to develop consensus on intervention mix priorities; fewer used modelling, and fewer still modeled costed intervention mix scenarios in the context of resource constraints.
Evaluation	Impact evaluation of SNT plans remains a weaker link in SNT. Evidence on effectiveness of interventions or combinations of interventions in varied contexts is thin.

Challenges: Despite widespread improvements in data quality and use between GC6 and GC7, sub-national data quality, use and analysis were cited by virtually all stakeholders as one of the most critical challenges to effective SNT. Even country programs with relatively high-quality data highlighted the ongoing urgency for better data and training in analysis and strategic data use at the sub-national level. Stakeholders expressed a high appetite for data quality improvement, especially in routine data. Routine data is preferred as a real-time tool for observing and responding to malaria trends.

Findings in Domain 5: A high level of SNT maturity and a context-appropriate, sub-nationally tailored malaria response

SNT maturity index: The evaluators scored 15 of 30 countries using draft SNT maturity scorecards. On a 22-point scale, three countries scored under 33%, six between 33%-66%, and six greater than 66%.

Intervention trends in GC7: Together with an increased focus on SNT in FRs, there has been a trend toward more varied, granular, and customized intervention sets in GC7 as opposed to GC6. Greater focus on quality of care is expected to emerge as targeting becomes more precise.

Intervention Trends Emerging in GC7 vs. GC6

De-prioritization of urban LLIN coverage
Increased use of larval source management (LSM), most of it funded by national governments
Interest in sub-national elimination, even in HB countries
Widespread scale-down of IRS
Increased use of new nets and away from standard LLINs; increased diversity in LLIN targeting
Increased emphasis on/expansion of community health systems
Greatly increased use of seasonal malaria chemoprophylaxis (SMC)
Increasing, customized versions of intermittent preventive treatment (IPT) for pregnant women, children or schoolchildren
Increased use of e-learning, digital supervision/mentoring and telehealth

Gender, Human Rights and Health Equity: There were significant improvements in attention to gender, human rights and malaria between GC6 and GC7. Countries report increasing use of relevant analytic methods, particularly the Malaria Matchbox tool, to generate plans to address gender and human rights barriers. In GC7, emerging gender responsive strategies included: strengthened engagement with reproductive health programs at community level, as well as with women's groups (Congo); active promotion of men's support for women's use of prevention and treatment services (Benin, Liberia); and

increased involvement of women in vector control (Tanzania, Zambia), (GC7 FRs, Benin, Congo, Liberia, Tanzania, Zambia, 2023). KII respondents differ in understanding how the Global Fund's Community, Rights and Gender (CRG) objectives align conceptually with the goal of ending disease. Some felt that CRG objectives were vital but could distract from the primary goal of malaria reduction. Others saw health equity, SNT and progress against disease as indissolubly linked.

Malaria Vaccines: Though most countries targeted vaccines to moderate and high transmission areas as advised by WHO, few integrated vaccine considerations into broader malaria intervention mix targeting in GC7. While this was largely due to timing, international stakeholders desire guidance on how best to incorporate vaccines into SNT plans. Some country programs and international stakeholders expressed concern about vaccine (RTS,S) cost-effectiveness, and noted that continued attention to the most cost-effective interventions remains a high priority.

Findings in Domain 6: Optimized Resource Use

Malaria Funding Gaps and Resource Optimization: In GC7, the 30 countries in the sample needed $11.9B for malaria but secured only $6.7B, leaving an estimated 44% funding gap (RBM data). Lack of resources is widely cited as the largest disabler of SNT and progress against disease. Most FRs focus on efficiency via integration and cost savings rather than cost effectiveness. True resource-optimized SNT plans are rare due to complexity. Prioritization determines feasible actions within resource limits, with 70–80% of malaria funding allocated to vector control. Disease reduction depends on having sufficient prevention in place. Stakeholders showed interest in mobilizing domestic resources for vector control, including Public-Private or Public-Private-Philanthropic Partnerships **(**PPPs or PPPPs).

Resource optimization faces several challenges: Calculating the true cost of intervention delivery is difficult and varies with context. Intervention effectiveness data needed to calculate cost per impact is lacking, especially for layered interventions (e.g. LLINs + SMC). Commodity costs are subject to market shaping. All these factors multiply uncertainties in the optimization process that need to be managed as the use of COOPs grows. For instance, when dual active ingredient (dual AI) nets are purchased on a very large scale, the price per unit goes down. IRS is frequently deprioritized because of its substantial cost. Some worry about the long-term prospects of elimination due to these market realities.

Public-Private-Philanthropic Partnerships (PPP) for SNT Resource Mobilization: Engaging the private sector, government funding and cost-sharing with non-governmental organizations (NGOs)/community-based organizations can boost intervention sustainability and cost-effectiveness. These have potential to help meet critical funding gaps in SNT NSPs.

Given the global crisis in malaria financing, SNT approaches are essential. To reignite and accelerate declines in cases, however, new resources and localized, lower-cost approaches are needed. SNT of malaria interventions sharpens focus on desired impact, the means to obtain it, and the constraints that endanger its achievement. It builds ownership of the data- and goal-driven decision-making essential for successful elimination. National and sub-national governments are unlikely to invest in strategic approaches over which they feel little agency. To change the future of malaria, stakeholder countries must provide more of the resources (human as well as financial), generate more of the ideas, and chart more of the direction in the global effort. Expanded domestic commitments could in turn prompt a renewed flow of international funds. As the world's largest donor of malaria funds strongly committed to country-level leadership, the Global Fund is uniquely positioned to lead a bold, disruptive sea change in global malaria strategy and planning, one that focuses on impact, makes room for countries to innovate and lead, and expects more shared investment of human and financial resources. Progress against malaria globally may depend upon it.

Conclusions

Domain	Description	Rating
Domain 1	Strong program leadership is central to SNT success.	Strong
	SNT mature countries demonstrate strong ownership of SNT process, products, and decision-making, and vice versa.	Strong
	SNT sharpens focus on the impact of resource constraints at both national and sub-national levels and is a driver of domestic resource mobilization.	Strong
	Effective climate-malaria partnerships remain nascent at both country and global levels, but awareness is growing in preparation for GC8.	Moderate
Domain 2	Countries with more robust sub-national decision-making on malaria have many of the following enabling factors: well-paced political and fiscal decentralization; stronger sub-national health governance structures; a high level of digitization; regular communication between national and sub-national levels on malaria data validity, interpretation, and use; increased resources at sub-national level; capacity building of sub-national teams in data analysis and use; adequate human resources; and more systematic community engagement.	Strong
	Even national programs with a high level of SNT maturity navigate political factors that influence execution of SNT plans.	Moderate
	Flexibility in donor financing may facilitate sub-national devolution of funding, and vice versa: decentralized fiscal structures may also facilitate sub-national donor alignment.	Limited
	Rapid, extensive CHW expansion and community data integration across the portfolio have significantly enabled SNT progress. Coordination of growing, multi-donor investment in community health worker programs (including malaria components) and district/sub-national systems is perceived to be weak but improving.	Strong
Domain 3	Longer-term, NMCP-embedded, systems-oriented SNT TA has been a significant enabler of SNT advancement.	Strong
	Countries are focused on building local capacity; TA should focus on skills transfer.	Strong
	Among global stakeholders, there was widespread acknowledgment of intra-partner misalignment as a "disabler" of effective SNT. Initiatives aimed at partner coordination (e.g., COOP, RBM dashboard) are steps toward addressing transparency and harmonization concerns.	Strong
	Many programs highlighted concerns that national consensus and local expertise are undervalued by partners. Many global stakeholders acknowledge this as a persistent and significant issue, despite significant partner efforts to address it.	Strong
	Differences exist between TRPs/FR TA and some country programs, especially around vector control; some advice has felt "de-stratifying"; local expertise is not always appreciated; recent WHO guidance for resource-constrained contexts enshrines a more proscriptive stance toward IRS that is out of step with what some national programs believe is necessary for elimination.	Strong
	Country stakeholders prioritized scale-up of routine entomological surveillance as a source of data needed for decision-making on vector control interventions.	Strong
	Some country programs would like more inclusion in global strategic planning and decision-making fora.	Moderate
Domain 4	There were significant improvements in sub-national data availability, completeness and accuracy between 2018 and the GC7 round. RSSH investments (including under C19RM) were a catalyst for sub-national data architecture, availability, analysis, and use.	Strong
	There is a growing array of data available for informing intervention targeting, tailoring and decision-making, but evaluation of SNT is hindered by lack of evidence on effectiveness of layered interventions.	Strong
	Despite improvements, stakeholders identified limitations in sub-national data quality, use and analytics as the largest barriers to effective SNT.	Strong
	Routine, real-time data are preferred by programs for planning, monitoring, and response. Continued improvement in routine data is prioritized by programs; all acknowledge significant issues with quality remain.	Strong
Domain 5	The portfolio's increasing SNT sophistication is reflected in evaluator scores of SNT maturity in 15 countries (40% high, 40% moderate and 20% low maturity).	Moderate
	SNT in GC7 is more focused on choices among new interventions or combinations of layered interventions and less directed toward improving the quality of existing interventions through improvements in delivery, QOC, and use, though these are improving as SNT becomes more granular.	Strong

	The integration of gender, human rights, and vulnerable population concerns into NSPs and FRs is progressing slowly, with increasing use of related assessments, analytic tools, and TA, and emerging program exemplars. Stakeholders differ on whether community, human rights, and/or gender objectives are separate from, or crucial to, disease impact goals.	Strong
	With some exceptions, the malaria vaccine was not considered in the context of broader SNT intervention targeting and tailoring decisions in GC7. National and international stakeholders expressed concern about the relative cost-effectiveness of the malaria vaccine (with most referring implicitly or explicitly to the original vaccine as opposed to the newer, more efficacious one).	Strong
Domain 6	Lack of resources is a significant disabler of progress against disease, even in the context of robust SNT: a prioritized plan may not achieve impact because funding levels are consistently below NSP needs. Programs emphasize need to improve domestic resource mobilization for prioritized, tailored programs, including public-private engagement.	Strong
	FRs more commonly reference optimization in terms of efficiencies created by integration or economies, rather than in terms of greater impact for a given cost.	Strong
	Programs encounter significant challenges in operationalizing resource optimization and cost effectiveness. Difficulties associated with obtaining accurate cost data and calculating cost effectiveness, particularly for layered/mixed interventions for which the research base is thin, multiply uncertainties.	Strong
	Opportunities to engage the private sector in vector control (and in other aspects of health service delivery) have potential to increase access to interventions that countries believe are essential to achieving their goals.	Strong
	The Global Fund and PMI play important market-shaping roles in commodity purchasing due to the sensitivity of manufacturer pricing to market volumes, and countries are highly affected by donor purchasing priorities.	Strong
	Evaluation and documentation of the costs and impact of layered interventions in varied contexts in stakeholder countries could fill a critical evidence gap.	Strong

Recommendations of evaluation and corresponding level of priority

No.	Recommendation	Priority
1	Strengthen the inclusion of country program perspectives in global consultative processes at malaria policy, strategy and planning meetings.	**Critical**
2	Reinforce national and sub-national program ownership of sub-nationally tailored strategic plans by supporting local capacity building and south-south collaboration, learning and examples.	**Critical**
3	Encourage national investment in sub-national leadership and capacity, and in sub-national data systems, analytic capacity and data use through new indicators and a strengthened RSSH information note.	**Critical**
4	Recognize and creatively incentivize SNT as a driver of domestic resource mobilization, including public-private or public-private-philanthropic partnerships.	**Critical**
5	Support the generation of evidence on the effectiveness of new interventions and intervention layering strategies in varied contexts.	**Critical**
6	Evaluate the long-term equity impacts of market shaping of costs. Offer countries strategic engagement in global market shaping in exchange for national funding commitments towards commodity purchases.	**Important**
7	Better leverage external (non-Global Fund) investment in sub-national and community health systems.	**Important**
8	Apply the core principles of the Lusaka Agenda to the core malaria SNT partnership.	**Important**
9	Streamline the FR to make the data and planning on which SNT planning is based more visible; support active integration of sub-national data on climate, the malaria vaccine, malaria-relevant health equity factors in SNT planning, and access to and quality of care.	**Important**

1.0 BACKGROUND AND CONTEXT

Malaria Burden

Significant progress in reducing malaria cases and deaths has been made over the past two decades, but progress has stalled in HBC despite substantial investment and improved implementation. The World Malaria Report 2023 estimates that there were 249 million malaria cases and 608,000 deaths in 2022, compared with 244 million cases and 610,000 deaths in 2021. Achieving impact requires tailored, context-specific approaches and strategic resource reallocation at the sub-national level.

History and Context of Sub-National Tailoring of Malaria

SNT of malaria interventions refers to the use of local data and contextual information to determine the appropriate mix of interventions and delivery strategies for a given area or population for optimum impact on transmission and burden of disease. Epidemiological risk mapping documented as early as 1901 in Sierra Leone to map breeding sites to human settlements (Stephens, 1901; Snow, 2015). Epidemiological mapping and descriptions of transmission, vectors, topography and climate were features of control planning in Africa during the Global Malaria Eradication Programme (GMEP) in the 1950s (NMCP, INFORM and LSHTM, 2015). From 1996 to 1999, the Mapping Malaria Risk in Africa (MARA) project, led by the South African Medical Research Council, compiled prevalence data across eight countries in sub-Saharan Africa. In 2005, the Wellcome Trust, the Malaria Atlas Project (MAP) at the Kenya Medical Research Institute (KEMRI) expanded this work globally. The Swiss Tropical and Public Health Institute and the Gates Foundation helped the initiative reach 20 countries in 2006. In the 2010s, expanded resources allowed increased interventions, including LLINs and Artemisinin Combination Therapies (ACTs) to achieve significant declines in malaria morbidity and mortality. In 2014, the Gates Foundation, the Global Fund, and PMI supported country transition in low-to-moderate transmission environments from universal coverage to SNT to accelerate progress toward zero malaria.

Focus on High Burden Countries (2018–2025)

In response to stalled progress in high-burden countries, where 70% of malaria cases and deaths were concentrated, the WHO and Roll Back Malaria (RBM) partnership launched the High Burden to High Impact (HBHI) initiative in 2018. This led to a focus on a transition from universal coverage to more targeted and tailored responses that were felt to be critical due to stagnating progress, population growth, rising drug and insecticide resistance, and constrained funding (Cohen et al., 2022). The transition requires improved data systems, analytics, adaptive management, multi-stakeholder decision-making and more granular routine data for planning and execution. The WHO began leading stratification workshops for HBCs in 10 countries (Onyango et al., 2024) to emphasize identifying malaria hotspots at sub-national levels, leveraging data on transmission intensity and guiding targeted interventions, such as insecticide-treated nets (ITNs), indoor residual spraying (IRS) and case management. In 2020, WHO developed technical guidance for all countries submitting Global Fund malaria funding requests (FRs) that laid out steps for the collection of “strategic information” into malaria data repositories (MDRs) for use during malaria programme reviews (MPRs), and then for informing National Strategic Plans (NSPs) (WHO, 2018–2020) (see *Annex B: Evolution of Sub-national Tailoring*). In 2021, WHO extended its SNT support initiative to 28 countries and continued workshops and individual country support to help countries conduct detailed epidemiological analyses and carry out eight steps of SNT, conceived as a natural part of national strategic planning (Onyango et al., 2024). As of January 2025, an updated SNT manual is set for release, building on insights shared at the RBM meeting in Kampala in October 2023 (see *Annex B: Evolution of Sub-national Tailoring)*.

2.0 PURPOSE, OBJECTIVES, THEORY OF CHANGE AND EVALUATION QUESTIONS

2.1 Evaluation Purpose and Objectives

In March 2024, the Global Fund commissioned an independent evaluation of capacity, quality and decision-making in SNT of malaria interventions from Pilgrim Africa. Timed to inform GC8, the evaluation aims to provide the Secretariat, Strategy Committee, Board and global malaria community with evidence on progress, challenges and opportunities in translating SNT theory and the SNT process into more optimized malaria programs, as well as recommendations for advancing SNT through the GC8 investment process and associated country support.

The contract began on June 19, 2024, with the inception period ending August 19, 2024. Completed deliverables include the project work plan, inception report, report of preliminary findings, draft evaluation report, draft recommendations workshop and draft final report. The second recommendations workshop occurred January 13, 2025, and the final report was delivered January 24, 2025.

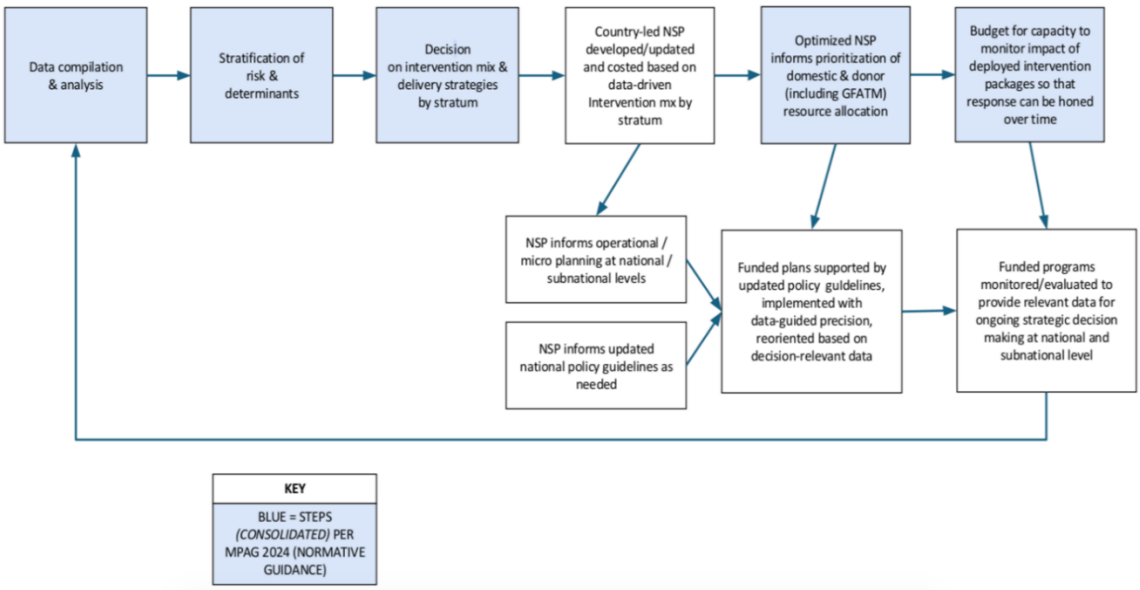
The objectives of this evaluation were to

1. Assess the capacity, quality of data and decision-making in SNT of malaria interventions.
2. Assess how the Global Fund and other stakeholders have and can incentivize the use of sub-national data and financial optimization to maximize impact.
3. Examine the role of national and sub-national leadership, agency and capacity in implementing effective SNT, including the development of optimized NMSPs and funding applications to the Global Fund.

2.2 Revised Conceptual Model: Extended SNT Process

The evaluation is framed against both a conceptual model of the extended SNT process, and a proposed Theory of Change (TOC). The conceptual model articulates the links between SNT data, analytics and intervention mix decision-making at multiple levels, including country-level strategy, policy, planning, resource allocation and resource mobilization, with a particular focus on Global Fund funding allocations. The TOC, developed in the context of political, economic and data-driven decision-making (DDDM) theory, considers the SNT process amid the complexities of the national and extra-national malaria ecosystem, with a focus on the agency, leadership and capacity of national and sub-national programs as primary drivers of SNT maturity and success. The colored squares in Figure 1 represent consolidated steps of SNT process as described in WHO's Malaria Policy and Advocacy Group's 2024 Report (WHO, 2024) while the white squares represent additional steps taken by country programs.

Figure 1: Conceptual Model: Extended SNT Process



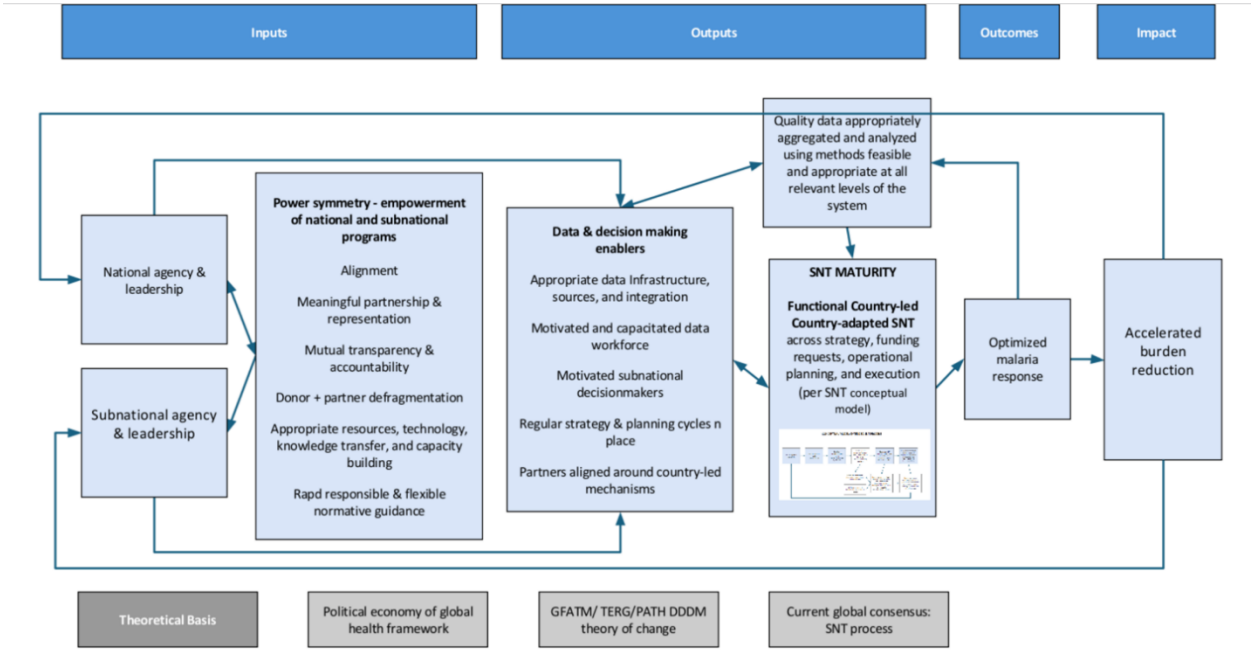
2.3 Theory of Change

The TOC embeds the SNT process in its political economy context, which may be enabling or disabling, to make explicit the assumptions that underlie the extended conceptual model (Goldsworthy, 2021; AECF, 2022). Malaria control in sub-Saharan Africa is often seen as a technical process driven by data. However, research highlights a more complex reality where global actors and funding frameworks significantly shape national strategies, requiring a balance between global goals, local contexts and coordination with non-state stakeholders (Parkhurst, 2021). Political economy theory[1] forefronts the core concept of national and sub-national ownership and agency, which the evaluators posit will both advance SNT and be advanced by SNT. These frameworks and a growing literature register the influence of non-state actors and inter-governmental financing mechanisms on country decision-making processes, positing that power asymmetries in the global health system have the potential to disable country ownership (Clark, 2014; Shiffman, 2014; Afshari et al., 2020).

The evaluation TOC also integrates assumptions around data system enablers and disablers, with a focus on those related to data infrastructure, data sources and the "data workforce" foundational to the availability, analysis and effective use of data for SNT decision-making (The Global Fund, 2023). Similarly, an SNT process that draws on these data in programmatically relevant, impact-oriented ways can motivate decision-makers and the data workforce in a manner that reinforces a virtuous cycle.

[1] See conceptual frameworks of power asymmetries in global health governance (Kentikelenis and Rochford, 2019) and analysis of the political–economic determinants of health inequities (Brown et al., 2023).

Figure 2: Theory of Change



2.4 Evaluation Domains

To map the core elements of the TOC and SNT extended conceptual model to associated questions, themes and indicators, the evaluators framed a key set of assumptions, which were used to structure an evaluation framework with six domains: *Stronger national and sub-national leadership and capacity, including capacity for innovation, actively supported by the Global Fund and all partners, along with better access to quality data and analytics for decision-making, are primary drivers of a high level of SNT maturity. SNT maturity produces a context-appropriate sub-nationally tailored intervention mix that optimizes resource use for maximum impact on malaria transmission and burden.* Except for impact, each clause of this key assumption serves as a domain in the evaluation framework. Findings and conclusions are reported by domain.

Domain 1: *Stronger national leadership and capacity, including capacity for innovation* (primary driver): The more country-led, country-owned and country-driven the management of malaria, the more appropriate and tailored it will be to context.

Domain 2: *Stronger sub-national leadership and capacity, including capacity for innovation* (primary driver): The more locally understood, informed and managed the prevention and treatment of malaria, the more appropriate and tailored it will be to context.

Domain 3: *Actively supported by the Global Fund and all partners* (key enabling/potentially disabling input): All HBCs rely on extra-national funding and technical partners to support at least a portion of their NMSP. The more collaborative and equitable the relationship between a national program and the Global Fund and other partners, the more conducive the environment will be for achieving impact within resource constraints. This domain both encompasses and is embedded within a framework of political economy factors that impact the technical process of malaria response planning.

Domain 4: B*etter access to quality data and analytics for decision-making* (inputs): Improved data infrastructure, capacity-building, data systems support and improved access to appropriate, quality data and analytics will inform decisions in the context of strategy, planning, execution and course correction.

Domain 5: *High level of SNT maturity and a context-appropriate sub-nationally tailored malaria response* (desired output/outcome): The evaluators define SNT maturity as how effectively and appropriately a country adapts its policies and programs to local contexts in service of an overarching impact goal and financial constraints.

Domain 6: *Optimized resource use* (desired outcome): It is difficult to evaluate the maximum health impact achievable by a given set of resources. Instead, optimal resource use must be assessed with respect to evidenced and reasoned alignment with the impact goals chosen by stakeholder countries, with evidence of cost effectiveness used to support intervention mix choices, and with a logical prioritization of constrained resources.

2.5 Evaluation Questions

The complete set of original RFP evaluation questions was retained and reorganized from the original five domains in the RFP into the six evaluation domains in *Annex F: Evaluation Matrix,* along with additional questions under these domains proposed by the evaluators. *Annex D: RFP Questions Mapped to Findings by Domain* maps the RFP questions to findings in the report.

2.6 Changes in Approach from the Inception Report

1. **Portfolio analysis and document review with Natural Language Processing (NLP) analysis.** Because of the large number of documents to be reviewed, the evaluators proposed to use NLP analysis to aid both in literature review and portfolio analysis. Collaborating with the Global Fund IT team, the evaluators worked to leverage the previously developed Global Fund-IT NLP workspace as well as a new custom-built Python tool. After encountering challenges, human analysis was used for most documents, aided by increasingly ubiquitous AI functionalities embedded in common software environments like Word, Adobe, etc. (e.g., automatic translation of documents from French into English). Many of these functionalities were added during the time of the engagement, which speaks to the near-future practicality of deploying NLP tools for future evaluations. A more detailed discussion of the AI-aided software tools is submitted as a "Lessons Learned" document.
2. **Question number and placement.** Some of the evaluation questions added by the evaluation team in inception to the set of RFP questions were removed as it became clear they were either redundant or less relevant to the evaluation. *Annex F: Evaluation Matrix* records the full set used in the final evaluation. All RFP questions were retained and addressed, but the organization of findings under the six evaluation domains evolved during report writing. *Annex D* maps the evaluation questions from the RFP to report sections and findings.
3. **Quantitative analysis.** The inception report planned a factor analysis of the SNT maturity scores. Factor analysis was not performed, as intra-category variation was too low in the data provided.
4. **Strength of evidence.** The inception report detailed a plan to first rank findings as either "major" or "minor" before rating the strength of evidence. The procedure the evaluators followed was that evidence was first evaluated for relevance to objectives and/or RFP questions of interest, by evaluation domain (as described in section 2.4) and then summarized and elevated as conclusions. Conclusions were then ranked for strength of supporting evidence (strong, moderate, limited) in three ways, as detailed below in section 3.2.

3.0 EVALUATION DESIGN

Evaluation design: The evaluation used a mixed methods approach, involving both qualitative and quantitative data collection and emphasizing rigorous qualitative research. It included both primary and secondary data collection across six methods, allowing the triangulation of evidence in domains of interest (see *Annex F: Evaluation Matrix*).

Sample size: At the request of the Global Fund, the evaluation sample was expanded from an original sample of 28 HBCs to a total of 35 countries. This includes a primary sample of 30 countries (mainly HBC, with some from Asia and Oceania representing different transmission intensities) for comprehensive analysis across methods and 5 lower transmission/eliminating countries for high-level, historical review (see *Annex G: List of Countries* and *Annex K: Elimination/Transition Countries: Historical Review*). Countries were selected based on a combination of factors, including geographic representation, transmission intensity, income level, areas of programmatic relevance (e.g., high levels of insecticide resistance, uptake of the malaria vaccine, donor and technical partner mix) and guidance from the Global Fund.

3.1 Data Collection Methods

The evaluation employed seven methods of primary and secondary data collection.

1. **Literature review covering the 30 malaria HBCs.** The evaluators reviewed peer-reviewed and gray literature on SNT using defined search criteria[2], in addition to country-specific searches, and analyzed data from dashboards and country profile documents of the Global Fund, CHAI, PATH, WHO, PMI and RBM. Portfolio documents reviewed are described under Portfolio Analysis, below. Consultations with stakeholders inside and outside the Global Fund provided access to emerging, non-public data relevant to SNT. As outlined below, document review for the country case studies included a wide range of NMP program, policy, and operational documents. Literature reviewed for transition/eliminating countries is referenced in *Annex K: Elimination/Transition Countries: Historical Review.*
2. **Stakeholder consultations.** The Pilgrim Africa team held high-level consultation meetings with stakeholders inside and outside the Global Fund to align on similar evaluation efforts, maintain contact with the Evaluation and Learning Office (ELO), and engage with the Independent Evaluation Panel (IEP), User Group (UG) and External Consultation Group (ECG) as per ELO's Standard Operating Procedures (SOPs) on key elements of the evaluation, including the extended model, theory of change, key assumptions, country selection, etc. (see *Annex H: Strategic Stakeholder Engagements*).
3. **Remote stakeholder interviews.** The evaluators conducted 51 formal remote Key Informant Interviews (KIIs)/ Focal Group Discussions (FGDs) with global, regional and national stakeholders, including NNMP leads from 15 of 24 countries that were not selected for country visits. Global and regional stakeholders included staff from the Global Fund, malaria donor agencies, WHO, SNT technical support partners, modelers and advocates (see *Annex I: Remote Stakeholder Consultation List*). The aim of these interviews/FGDs was to assess perspectives on and engagement in SNT and its political economy and data system enablers.
4. **Country visits.** Six countries were selected from the primary sample for in-depth evaluation, hereafter referred to as "visited countries" or "country visits." These were Democratic Republic of

[2] Search terms included "malaria," "sub-national tailoring," "tailoring," "modeling," "targeting," "risk mapping," "resource optimization," "financial optimization," and "cost effectiveness," with a focus on publications from 2018. Topic-specific searches on key themes of interest continued through early December, with a recent bolus of publishing on SNT in the last three months.

the Congo (DRC), Ghana, Kenya, Madagascar, Nigeria, and Papua New Guinea (PNG). The selection process, conducted jointly with the Global Fund, aimed to diversify countries by relative burden, income, level of decentralization and region/sub-region. The sub-sample represented two countries in the top 10 tier for burden (Nigeria and DRC); two ranked in the second highest tier (Ghana and Kenya); and two representing special circumstances of particular interest (an African island nation with elimination potential, Madagascar; and an HB country in a different region, PNG). Country visits took place between 23 September and 1 November 2024 (see *Annex J: Country Visit Details*).

Evaluation activities in the six visited countries included:

- Desk review of NMP programmatic, policy and operational documents.
- In-country stakeholder interviews with NMP leadership and key team members; SNT-related technical working groups (TWGs); the Country Coordinating Mechanism (CCM); Global Fund Principal Recipients (PRs); international and local NGOs; WHO; and representatives of multi-lateral, bilateral and private funding agencies. Interviews focused on SNT process and perspectives, malaria decision-making, funding and resource mobilization, malaria data systems, sub-national capacity and engagement, and facility, community, and partner engagement. Evaluators also conducted an innovation review and completed an MDR checklist.
- Evaluators also conducted site visits at a sub-national level in a higher burden area (making visits at regional and district and in most cases also at community level) chosen in consultation with the national program to document key elements of and challenges to SNT, through KIIs and observational checklists with relevant malaria, SNT and Monitoring and Evaluation (M&E) focal persons and technical partners.

5. **Rapid Online Survey (ROS).** An ROS including both multiple choice and open responses was conducted to elicit the anonymous perspectives of national and sub-national SNT stakeholders in the visited countries. The survey focused on advancements and gaps in capacity, data systems and use; national and sub-national systems needed for SNT; and the role of malaria funding structures and partners in decision-making (see *Annex E: ROS Survey*). Programs and PRs aided in creation of a gender-balanced list of respondents, weighted to sub-national respondents. The evaluators also took steps to maximize survey responses, including in-country distribution, up to four reminders and support from the NMP or PR. Of 226 surveys delivered, 118 were completed (52.2% response rate), surpassing the average online survey response rate of 32% (Frohlic, 2002). Among respondents, 31% were sub-national, and 35% were female.
6. **Innovations, global trends and pilot projects relevant to SNT.** The evaluators conducted a selective, purposeful review of innovations relevant to SNT (in, e.g., digital health, data management, surveillance, interactive scenario modeling, coverage measurement), with a focus on innovations mentioned by interviewees and other relevant innovations in the last five years likely to impact GC8. Evaluators also highlighted country-specific innovation as identified through the analysis of the portfolio and the country visits.
7. **Historical review of five transition/eliminating countries.** The evaluators conducted a high-level historical review of an additional five countries: Cambodia, Costa Rica, Guatemala, Panama and Sri Lanka, hereafter referred to as "elimination/transition countries." The review focused on historical pathways from past high/moderate burden to current near-elimination or elimination status, including the role of data-driven targeting and tailoring, down to foci and case level, that drove transmission declines; implementation challenges; best practices; and lessons learned with potential utility for HBCs. This review is presented in *Annex K: Elimination/Transition Countries: Historical Review*.

3.2 Data Analysis

The evaluation employed the following data analysis techniques.

1. **Qualitative data analysis of KIIs and ROS.** All audio-recorded interviews and FGDs were transcribed verbatim using Fireflies, an AI-driven transcription tool. The process included a manual quality check against the original audio. These verified transcripts were imported into MAX Qualitative Data Analysis (MAXQDA) software for qualitative data management and analysis. A hybrid coding approach was applied, combining deductive codes based on predefined evaluation matrix domains with inductive codes to capture unexpected themes or important insights. Each transcript was coded systematically to ensure consistency, and coding reliability was validated.

   Thematic analysis was used to identify patterns and insights, with a dual focus on country-specific emerging themes and cross-country comparisons among the six visited countries. This included analysis of SNT experiences reported by respondents from these and other relevant regions. One team member conducted the primary coding, and the broader team reviewed the coded data iteratively to refine themes and interpretations. All interviews were also read in full by at least one team member who did not conduct the interview.
2. **Quantitative data analysis.** Quantitative analysis focused primarily on descriptive statistics in areas that were hypothesized to demonstrate SNT progress or maturity, or to be associated with SNT progress or maturity, and were derived using data sets available from or provided either by primary data collection (i.e., the ROS), or secondary data collected from the Global Fund, WHO, PMI, RBM, PATH, and CHAI. The statistical relationship between a country's SNT maturity index score and several potential correlates, including malaria prevalence, changes in malaria cases over time, Global Peace Index rating, GDP per capita, health spending as a percentage of GDP, health spending per capita, and the Global Fund (malaria funding per person and per case were examined. Ordinary least squares regression was used for both univariate and multivariate analyses.
3. **Portfolio analysis of the Global Fund funding requests, NSPs and related policy documents.** The evaluators conducted a portfolio analysis of GC6 and GC7 funding requests focused on SNT quality, capacity and decision-making, and of GC7 NSPs and briefing notes. These policy documents were triangulated where necessary and possible with other sources, including annexes, published literature, grey literature, and national program presentations and publications on SNT. A phased method of analysis was adopted, described below.

   For the 30 countries, GC7 FRs, associated NSPs, and TRP briefing notes were reviewed. Details of data used for epidemiological stratification and mapping (see Table 10), as well as targeting and tailoring strategies and intervention mixes were reviewed. Gender, health equity, climate, community health systems, decentralization, quality of care, entomological surveillance, vaccines, country-led innovation and resource optimization received additional attention.

   For a subset of 18 countries (the six visited countries plus 12 others), both GC6 and GC7 FRs and associated NSPs were reviewed in their entirety, together with selected published literature, to allow a GC6/GC7 comparison. These 18 countries were chosen to provide exposure to a range of geographies in West/East Africa and outside of Africa, moderate to high burden endemicities, challenging and peaceful operating environments, and putative levels of SNT maturity (*Annex G: List of Countries*).

   For 15 countries, additional searches of published and grey literature were completed (the six visited countries plus 9 others) and these countries were scored for SNT maturity (see *Annex C: SNT Maturity Scorecards*).
4. **SNT Maturity Index.** To better compare countries across the complexity of the SNT landscape, the evaluators proposed an SNT maturity index, defined as a systematic measure of how effectively and appropriately a country adapts its policies and programs to local contexts in service of an impact goal (*Annex C: SNT Maturity Scorecards*). The index measures components of a country's alignment with an impact goal, governance and policy framework, planning and implementation, M&E,

institutional capacity, and data availability and architecture through the lens of fitness for SNT. The scoring allows countries to be assigned an overall "SNT maturity rank," as well as a scorecard rank for sub-elements of the index, so that the index acts as an "SNT scorecard." The tool was developed during inception, refined through consultation with the UG and the IEP (version 1.0), further refined post-portfolio analysis (version 2.0), and used in what the evaluation team understood to be a draft version. The two versions of the SNT maturity index may be found in *Annex C: SNT Maturity Scorecards*. The evaluators scored 15 of the 30 countries in the main sample. Version 1.0 was used for three that were scored before version 2.0 was developed.

5. **Meta-review of frameworks, indicators and dashboards.** The evaluators conducted a meta-review of frameworks, indicators, dashboards and other SNT-relevant data obtained publicly (e.g., the Global Fund data explorer, RBM dashboard, PMI country profiles, WHO/World Malaria Report country data, the Global Fund KPIs) and extracted data from these sources to aid in cross-country comparisons. Sub-national indicator use data on sample countries were generously provided by Metrics 4 Measurement as one element of SNT maturity scoring. The evaluators were partially successful in obtaining data through individual consultation with key SNT global partners, including WHO (DHIS2 penetration, MDR maturity), CHAI and PATH (surveillance assessments for a small subset of countries). While PATH shared its SNT evaluation indicators, they did not share the SNT progress frameworks that they used. A review of national DHIS2 dashboard overlays used for program monitoring was conducted as part of the case study process to identify opportunities for improvement, along with an examination of the integration and interoperability of these systems with existing Health Information Systems and the usability and accessibility of these dashboards for various stakeholders.

3.3 Ensuring High Data Quality

To ensure high data quality, the following approaches were adopted. An evaluation matrix was developed to address evaluation questions with indicators and customized queries in a range of data collection tools; data collection tools were pretested and refined; the evaluation team was oriented on data collection procedures and best practices; findings were triangulated across multiple data sources; qualitative interview data was coded by an evaluator who was not involved in its collection; all interviews were read by humans as well as coded; and analysis proceeded in a collaborative manner, with peer-to-peer debriefing.

3.4 Ethics

The evaluation team is committed to to the United Nations Evaluation Group (UNEG) Norms and Standards, which ensure integrity, accountability and respect for stakeholders. Key ethical principles include:

1. Independence, Impartiality and Credibility. The evaluation was conducted independently, with all team members disclosing potential conflicts of interest. Methods and findings were designed to uphold impartiality and credibility, using triangulated evidence to ensure objectivity. Reflexive bias was also declared prior to the analysis.
2. Informed Consent and Respect for Participants. All participants in KIIs, FGDs and the ROS were informed of the evaluation's purpose and their rights, including the ability to withdraw at any time. Consent was obtained verbally or in writing.
3. Privacy, Confidentiality and Data Security. Confidentiality was prioritized, with personal identifiers anonymized or omitted. Data were securely stored in encrypted systems, and access was limited to authorized personnel to ensure compliance with data protection standards.
4. Dignity, Diversity and Inclusion. The evaluation emphasized respect and inclusion, valuing diverse perspectives, particularly those from sub-national stakeholders. Findings were presented equitably, ensuring balanced representation across regions and groups. ROS data were disaggregated and analyzed by gender as well as by national/sub-national levels.

5. Mitigation of Potential Harm. To minimize discomfort, sensitive questions were framed carefully, and participants could skip questions if desired.
6. Transparency and Accountability. The process was transparent, with regular updates to stakeholders and consultative workshops to review findings.

3.5 Classification of Conclusions and Strength of Evidence

Evidence and emerging themes from different collection methods were compiled, discussed and triangulated by domain. Summarized conclusions were then ranked as Strong, Moderate, or Limited (see Table 1 definitions, below). The evaluators ranked conclusions for strength of supporting evidence in three ways:

1. Number of data collection sources in which the same findings occur (country case studies, ROS, DR, PA, KIIs)
2. Number of countries or KIIs in which the same findings occur (dependent on context, but >3 considered strong)
3. Evaluator agreement

The triangulated data sources included findings/emerging themes from literature review documents, coded themes and quotations from the KIIs, country case studies, descriptive statistics, extracts from portfolios and the ROS under each of the six evaluation matrix domains. The evaluators used the following strength of evidence categories to grade the evidence associated with a conclusion (Table 1).

Table 1: Strength of Evidence

Strong evidence: Evidence is composed of multiple data sources (good triangulation), which are generally of decent quality
Moderate evidence: Evidence is composed of multiple data sources (good triangulation) of lesser quality, or the finding is supported by fewer data sources (limited triangulation) of decent quality but that appear more perception-based than factual
Limited evidence: Evidence is composed of few data sources (limited triangulation) and is perception-based or generally based on data sources of lesser quality

Conclusions are presented at the end of each domain and ranked for strength of evidence in Table 17.

3.6 Limitations of the Evaluation

Human rather than NLP analysis of the large number of documents, together with a compressed country visit schedule due to scheduling conflicts with NMPs, necessitated a phased system of portfolio analysis as described above. The findings may be slightly weighted toward the 18 countries for which the full GC6/GC7 comparison analysis was performed. These were chosen to provide a balance between nations in West and East Africa, to represent diverse endemicities, to contain a balance of challenging and peaceful operating environments, and to represent presumptively diverse SNT maturity (*Annex G: List of Countries*).

Each evaluator brought a reflexive bias to the team that could have influenced their analysis during country visits, KIIs, SNT scoring and literature review. Though descriptive statistics and some limited statistical analyses were employed, the evaluation was weighted toward qualitative analysis, in which the reflexive bias of the evaluators may have played a stronger role. These biases were acknowledged by the evaluators in the inception report and balanced by group analysis and written feedback and team review. SNT scoring of countries was done by the evaluators most familiar with those countries, with notes to justify the scoring. Some topic areas were inherently more subjective, and the team noted that some evaluators "graded harder" on the scale than others. This could be corrected by moving to purely quantitative scoring in a revised version of the tool.

4.0 FINDINGS AND CONCLUSIONS BY EVALUATION DOMAIN

4.1 Domain 1 Findings and Conclusions

National Program Leadership and Capacity, Including Capacity for Innovation

The TOC postulates that program and national and sub-national leadership and capacity are key drivers of effective SNT. This section presents evidence on key elements of leadership, capacity and ownership at the national level.

Leadership is seen as critical for successful SNT. There is wide agreement across both in-country and remote national and global KIIs that national program leadership is an essential component of successful SNT. "Leadership" in the sense used incorporates qualities of effectiveness like organization, drive, capacity, mission and agency. As noted in discussion of political economy factors informing the TOC, global actors and funding frameworks significantly shape national strategies (Parkhurst, 2021). Programs with effective technical leadership tend to compel respect and enable more symmetrical relationships with donors, e.g. *"This program…they know what they want to do" (KII, National Partner).*

Program ownership. Effective program leadership also requires country ownership. In Kenya, for example, both ownership and leadership are strong, and partners respond flexibly to the program's SNT reprogramming needs: PMI is working in a new geographical area due to emerging information on relative burden and the need for immediate response as communicated by the national program.

Table 2: Stakeholder Reflections on the Importance of Country Program Ownership

Country/General	Example Reflections on Program Ownership	Source
General	If you don't have the Ministry of Health buying into and owning the outputs of SNT, really owning the process, owning the questions, then you're not going to have donors in alignment with it. The Ministry of Health ownership piece is paramount.	KII, Global
General	Countries love the SNT process, but if you had to distinguish what we've done in terms of TA... the country has genuinely felt like they owned the process.	KII, Global
General	Country ownership in the process of applying the Global Fund is very important. Flexibility from the Global Fund is very important to include some of the local priorities.	KII, Tanzania
Malawi	We have strong collaboration with partners like WHO and PMI, ensuring that decisions are aligned with Malawi's needs and that we own the process.	KII, Malawi
Zambia	Ownership goes with the countries. Do they want to do it? Are they investing in it? Are they demanding for it?	KII, Zambia

Effective national program leadership requires ownership of disease goals as well: *"If you don't feel in your heart that you should eliminate malaria, then forget about it" (KII, Transition Countries).*

Program execution. Strong technical leadership is distinguished by reliability in execution, making it obviously essential to effective SNT. As an example, one program with a multi-generational legacy of strong program leadership and excellent recruiting practices was noted for its high level of organization: *"They work according to schedule. They are very organized...if the malaria program says they are having this activity in July, it is July. But it might not be so for many other programs" (KII, National).*

4.1.1 Program Leadership and Capacity Assessed in Country Case Studies

Program capacity and human resources. NMP human resources vary greatly. Within the six visited countries, NMP resources ran the gamut from a program with five staff (PNG) to Kenya's program with different expert-staffed divisions. Countries with more mature SNT processes (Ghana, Kenya, Nigeria) had established M&E departments that were supported by partners to conduct malaria burden stratifications. Nigeria and Ghana had NMP staff members who were currently enrolled in modeling learning fellowships. Countries with limited SNT maturity (Madagascar, PNG) did not have staff with advanced data analytics skills nor experts with defined roles such as entomologist or epidemiologist. Stability of human resources was also an issue, with frequent turnover often cited as a disabling factor for strong national leadership.

Adequacy of national systems for coordination. The adequacy of available structures, mandates, policies, guidelines and processes for coordinating decision-making between national and sub-national levels varied among the countries evaluated. None of the countries visited had formal implementation guidelines or manuals to guide SNT, but in countries with a strong grasp of the SNT process, sub-national stratification and tailoring was considered an intrinsic part of the NSP process. As recommended by WHO, the malaria TWGs coordinated or provided guidance on SNT implementation. In Kenya, the policy and governance context is optimal, backed by relevant legal and institutional frameworks and policy guidance. The existing governance structures (e.g., Health Sector Working Group, Committee of Experts and County Management Committees) are utilized for SNT processes. In Madagascar, a malaria steering committee and technical sub-groups that work in the different areas of malaria manage the malaria response and presumably will also manage SNT as it comes aboard. In DRC, NGOs are taking the lead role in data monitoring, and coordination at the central level is more fragmented. Ghana's District, Regional and Hospital Malaria Focal Persons are involved in the TWGs, are members of the team of national trainers and benefit from regular capacity building with the national program staff, ensuring a recruitment pool of future leaders and a strong shared culture between national and sub-national levels.

Coordination is a "multi-level skill." Partners with strong coordination at the national level, such as those in Ghana and Kenya, typically demonstrate relatively strong sub-national coordination as well. Coordination at the national program-partner level in Ghana was demonstrated by the high degree of alignment with the national program and the national strategic plan expressed by partners, and at the national/sub-national level, by the high response rate to the weighted survey list, with 90% of responses coming from sub-national respondents. In contrast, the NMP in DRC (PNLP) faces significant challenges in coordination. Decision-making remains centralized in Kinshasa, and frequent staff changes disrupt continuity and effectiveness. No sub-national responses to the ROS were recorded. The ability to align partner interventions with the national plan is also limited. In Madagascar, where sub-national survey respondents represented only 4% of the total, the NMCP has made recent progress in coordinating partners. However, weaknesses in human resources and burdensome administrative procedures slow down the implementation of interventions. While sub-national coordination is perceived as functional, improvements are needed to ensure a consistent and timely response, particularly in rural and high-transmission areas. In PNG, the NMP faces similar challenges, including geographic dispersion and limited infrastructure. Coordination with partners is hindered by fragmented epidemiological data and insufficient capacity at the sub-national level. While efforts are underway to strengthen decentralization and regional autonomy, collaboration remains difficult, requiring increased support to harmonize efforts with the national plan (see Table 3, below).

Table 3: Coordination Efforts and Sub-national Response

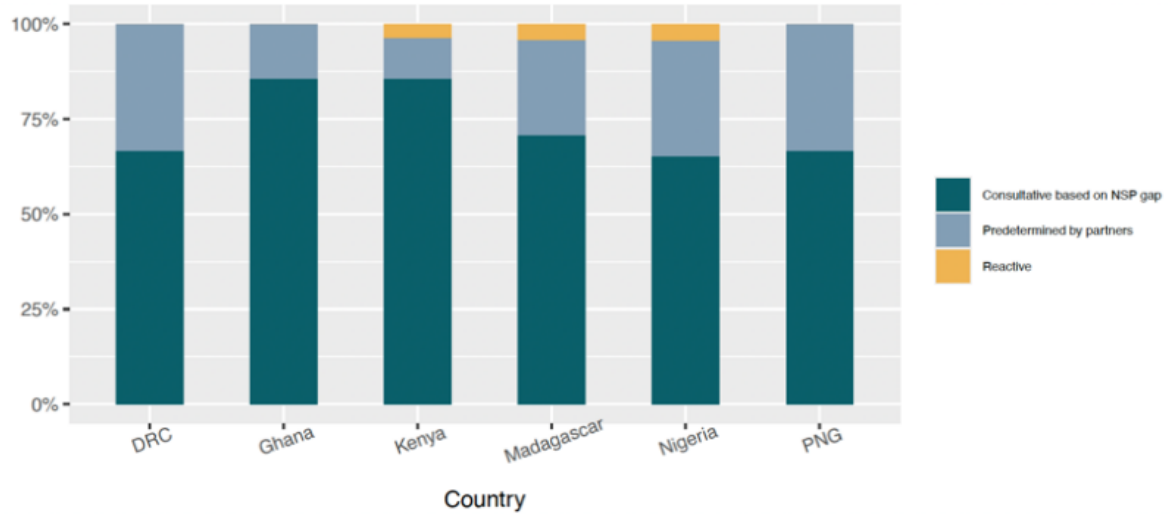
Country/ROS respondents	Coordination Efforts	Challenges	% of Sub-national ROS Respondents
Ghana (22)	Demonstrated strong coordination at both national and sub-national levels. Strong shared culture of data validity and alignment on implementation goals.	Limited sub-national budget autonomy and limited implementation finances. Insufficient sub-national training in management and leadership.	90%
Kenya (31)	Demonstrated strong national/sub-national coordination. Effective decentralization: excellent policy and governance context and legal framework with clear national/sub-national roles and mandates.	Limited finances at sub-national levels. Human resource gaps.	36%
DRC (9)	Coordination remains centralized in Kinshasa, limiting sub-national engagement.	Frequent staff turnover disrupts continuity. No sub-national responses recorded in the ROS. Limited alignment of partner interventions with the national plan.	0%
Nigeria (23)	Well-coordinated program with a long history of SNT, strong partner coordination and support for SNT	Inadequate funding for SNT processes Need to adapt and simplify the SNT piloting process conducted in Kano and Kaduna states with CHAI support – for a sustainable uptake by the NMEP	43%
Madagascar (24)	Some recent progress in partner coordination by the NMCP.	Weak human resources and burdensome administrative processes slow implementation. Inconsistent responses in rural areas.	4%
PNG (9)	Efforts underway to strengthen decentralization and regional autonomy.	NMP has very limited human resources. Geographic dispersion and limited infrastructure hinder coordination. Fragmented epidemiological data and insufficient sub-national capacity complicate collaboration.	22%

4.1.2 Program Leadership, Capacity and Sophistication of SNT

In the six visited countries, evaluators noted that strong program leadership and capacity and high maturity and sophistication of the SNT response were found together (for SNT maturity scoring by the evaluation team, see Domain 5). Confident leadership and mature stratification and intervention plans with a high degree of granularity were demonstrated in Ghana, Kenya and Nigeria. Ghana's GC7 Funding Request covered key malaria interventions under vector control, case management, specific prevention interventions (IPT, SMC, MDA and Malaria Vaccine) and cross cutting Health Systems Strengthening (eg data capture and quality, LMIS etc.) (GC7 FR, Ghana, 2023) targeted to sub-national risk strata, and the country is ambitiously pursuing sub-national elimination, with technical assistance from WHO. The Ghana and Kenya programs are unafraid to "push back" against partners and report where they have significant differences: in Ghana's case, this was demonstrated with respect to vector control recommendations of the TRP, and in Kenya's case, with the choice to substitute KEMRI's statistical risk stratification based on incidence for one developed by modeling TA based on older survey data the program deemed less relevant. Despite, or perhaps because of, this capacity for self-assertion, partners and program reported being well aligned in both countries.

Figure 3: Country Responses to ROS #3, Funding Decisions by Partners

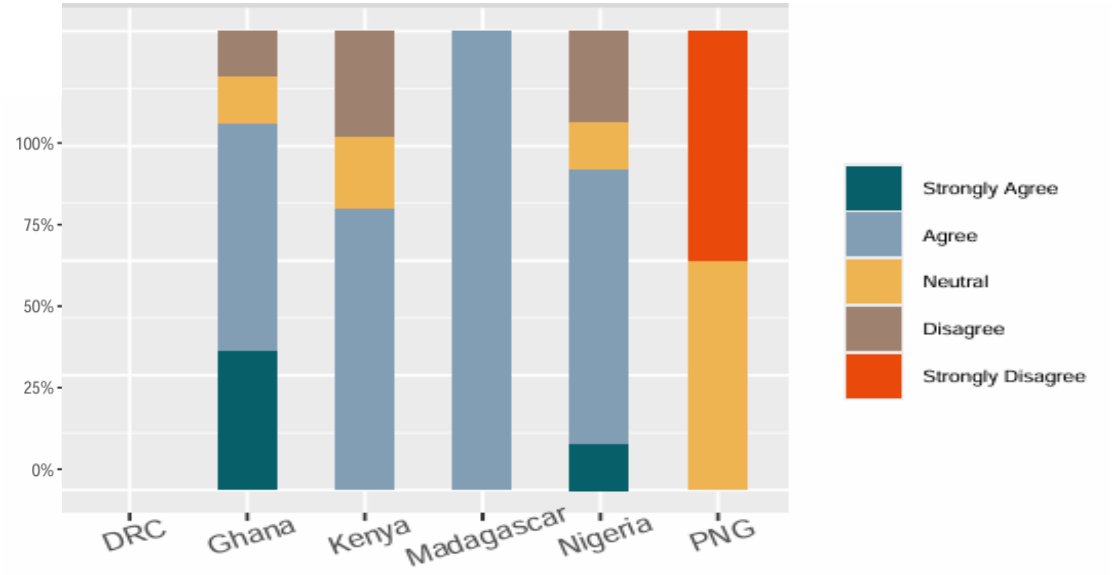
ROS Question #3: *How are funding decisions by partners primarily made in support of the National Malaria Strategic Plan?*



The agreement between evaluator ranking of national program capacity in SNT and ranking by in-country respondents is equally revealing (see Figure 4). Sub-national respondents in countries with lower SNT maturity scores from evaluators exhibited less confidence in the capacity of the national program.

Figure 4: Sub-national Responses to ROS #9, National Program Capacity for Tailored Interventions

ROS Question #9: *The national program has the capacity (technical, managerial, financial) to effectively implement and adapt tailored interventions.*



The evaluation TOC does not assume that a relationship between strength of leadership and SNT maturity is unidirectional, with strong leadership or ownership creating maturity in SNT process.

SNT also empowers national programs, incentivizing both data improvements and innovation. In a study of NMP experience and perspectives with malaria SNT in Burkina Faso, Ghana, Guinea, Nigeria and Togo

between 2019 and 2023, Onyango et al. (2024) found that the high-level SNT process incentivized data improvements and motivated programs to develop greater capacity to conduct and devolve SNT. Growth in data use culture was illustrated by the creative ideas for stratification at more granular levels and was accompanied by a common call to include peripheral and health facility staff more intentionally in SNT efforts.

SNT promotes innovation. Uptake of innovation is demonstrated in adaptations of SNT process, adoption of global innovations (e.g., digitization), data-driven solution-finding across vector control, a broadening range of prevention strategies, and case management. Some brief examples from country case studies, KIIs and portfolio analysis:

- In **Ghana**, smartphone penetration is over 70%, and the Ministry of Health employs a full-time programmer to produce malaria-related apps as needed for use with existing phones. Digitized LLIN distribution is managed with a "bring your own device (BYOD)" approach. (RBM, 2024, Country visit). Kenya and Nigeria have even higher smartphone penetration (>100%) than Ghana and could consider something similar (Ekanem, 2024).
- **Guinea** integrates multiple health interventions into Seasonal Malaria Chemoprophylaxis (SMC), including on-site vaccination and treatment of sick individuals. This approach has improved vaccination coverage, reduced disease burden and garnered community support.
- **Rwanda** has strengthened entomological surveillance and climate data monitoring. The program targets high-risk groups (e.g., miners) with repellents and education. CHWs not only provide free malaria diagnosis and treatment but also conduct larval source management. Innovations are seen as shareable with other countries.
- **Togo** emphasizes digital transformation with real-time monitoring systems (e.g., Digi2), digitized malaria death audits and monthly data validation meetings. Togo plans to train malaria focal points in high-risk regions for epidemic threshold monitoring.

Awareness of resource constraints: National programs determined to eliminate malaria and exercising technical leadership to drive a sub-nationally tailored strategic plan geared for impact are acutely aware of the consequences of resource constraints. The planning process that produces tailored plans throws the problem of achieving impact disease reduction with limited resources into sharp relief. Program personnel are aware that international resources are not growing, and that reliance on external funding for malaria is unsustainable, and frequently mention the need for increased domestic resource mobilization.

National government leadership: National governmental support for malaria elimination, including funding for the NMSP as distinguished by general health sector funding, is critical but elusive; there is no easy formula for its achievement. It is considered by some to be the most important county-level political economy enabler of national SNT progress: *"What distinguishes the 'outstanding' [SNT performers]? Political will at the highest levels" (KII, Global).* Political will, action and commitment from national governments are on the rise, though slowly; between 2000 and 2016, malaria spending per capita rose on average at more than twice the rate of GDP per capita in the 30 highest burden countries, with wide spending variation by country (Feachem et al., 2019). The enabling force of presidential-level leadership and accountability is clear in several geographies (e.g., Benin, Zambia, Rwanda) but is not yet the norm. One global respondent noted with approval that a country fired a program manager for being unable to explain a rise in cases but lamented that such accountability is uncommon (KII, Global).

SNT can facilitate domestic resource mobilization. The awareness of resource constraints coupled with growing country ownership can be a good spur to action. According to recent literature, and confirmed by country visits and stakeholder consultations, SNT is a facilitator of domestic resource mobilization, including at a peripheral level where resources for malaria are particularly scarce.

Table 4: Program Activity to Mobilize Domestic Resources

Country	Program Activity	Details of Program
Ghana	Pitched parliamentarians on supporting IRS expansion as part of their SNT strategy.	Included two high-burden districts funded by the support of Members of Parliament; a private sector partner with a low cost was selected for implementation.
Kenya	Referred to the utility of SNT plans in mobilizing local resources.	County-level focus is enabling localized support.
Nigeria	iCCM efforts that included resource mobilization from supported communities in Niger State.	A three-year iCCM project received an estimated $74 in support per CHW from community members through cash, farming support, building materials, fuel, and transport.[3]
Zambia	Copper mines in high-burden areas assist the national malaria program to expand prevention.	Mining companies extended malaria interventions to surrounding areas, benefiting both employees and nearby communities.

Increasing the agency of key community stakeholders and economic actors can mobilize additional resources. Rice farmers in Rwanda who organized and conducted their own community-based larviciding campaigns had higher willingness to pay after the intervention than did farmers who sprayed their fields under expert supervision (Rulisa, 2023).

4.1.3 Climate

Among the 30 evaluation countries, many rank extremely high on the climate risk index, with Niger, South Sudan, India, Malawi, and Mozambique among the top 10 most affected countries in the world. The impact of climate change on malaria risk and preparedness and response strategies is increasingly well documented and understood (WHO, 2023)[4]. In view of the need for countries to prepare for climate impacts on disease, the evaluation assessed the level of multi-sectoral coordination between ministries of health or national malaria control programs and ministries of environment or meteorology, as well as the integration of climate data into SNT plans.

The evaluation's portfolio analysis was based on a review of 30 FRs and several associated NSPs in GC6 and GC7. Updates since 2023 are limited to information obtained during the six country visits and global and national remote stakeholder consultations. In GC6, virtually no explicit attention was paid to the potential impact of climate change on malaria and related remedial strategies in GC6, and this improved only slightly in GC7. More countries referred in GC7 to the impact of climate on malaria risk, primarily in terms of flooding and the growth of internally displaced populations highly vulnerable to malaria, as well as rainfall changes that impact frequency and timing of SMC. Few referred to climate change considerations in their targeting and intervention mix decisions, offered proposals for risk mitigation, or referred to relevant partnerships. Remote stakeholder interviews with NMP representatives confirmed that awareness and action have improved since that time and anticipate greater attention in GC8, particularly in the wake of an influential climate meeting for NMP managers in Rwanda. Global respondents noted a context of growing resources for climate change impact mitigation, including for malaria.

In the six visited countries there was little relationship between meteorology departments and NMPs, a fact unsurprising to one global stakeholder, who recounted visiting Madagascar and noting that meteorological bulletins on climate sensitive diseases are shared with the Ministry of Health but that "*The NMCP coordinator had never seen it, didn't know of its existence" (KII, Global),* as climate discussions happen *"at*

[3] Alegbeleye, 2019
[4] In highland areas of Ethiopia and Columbia, for example, varying annual temperatures expand or contract the spatial extent of malaria, with implications for future warming trends (Siraj et al., 2014).

a head of state and relevant ministries level, and often the ministry of health isn't at the table" (KII, Global). On the other hand, country-based respondents to the ROS included climate data as among their top three priorities for the kinds of data or analytics that would most benefit SNT decision-making (see Figure 8: Priority Data for SNT). A few examples of relationships between NMPs and ministries of meteorology emerged from remote interviews. In Cameroon, for example, collaboration with meteorological services is reported to be providing precise data to inform decision-making, and the program intends to integrate these data in their MDR as it develops. In Malawi, the ministry of meteorology coordinates with the national program to warn of impending cyclones. This points to the ongoing importance of empowering and enabling NMCPs and ministries of health to participate more fully in national climate decision-making and resource allocation for infectious disease mitigation.

Global KII respondents and partner dashboard review confirmed increasing country and partner attention to the climate-malaria intersection. According to global KII respondents, WHO is integrating climate change–related data in its SNT and MDR guidance. RBM has developed a dashboard providing access to interactive maps on prospective climate metrics down to district-level resolution. Climate change resources are growing; global respondents referred particularly to the Green Climate Fund, which includes mitigation funding, including for malaria. In the words of one global respondent, "*Climate spending has doubled in the last two years to $1.3 trillion…. that whooshing sound we're hearing is all the money going to climate change*" *(KII, Global).* Structures are being built for climate-sensitive disease areas to help shape how those dollars are spent, and as reported by respondents, there's a call to coordinate technical assistance in ways that make it easier for countries to apply to a range of institutions simultaneously (KIIs, Global). As an example of what may become the norm for more countries, in its review of Malawi's GC7 FR, the TRP recommended that "the Global Fund prioritize coordination with climate change stakeholders, advocate for actions and funding from other sources such as the Green Climate Fund … document these emerging trends and develop lessons learned to guide future funding and reviews." (GC7 TRP Funding Request Review and Recommendation Form, Malawi) This recommendation bore fruit: Malawi received a first coordinated investment from the Global Fund and the GCF, including malaria commodities, SMC, nets and early warning systems (KII, Global), totaling over USD 120 million (Green Climate Fund/countries/Malawi).

4.1.4 Domain 1 Conclusions

Our TOC posits that strong national program and government leadership is a *primary driver* of an optimized SNT response. Our findings confirm the centrality of program and government leadership to effective SNT and show that the SNT process also contributes to increasing national ownership and agency.

1. Strong program leadership is central to SNT success.
2. SNT mature countries demonstrate strong ownership of SNT process, products and decision-making, and vice versa.
3. SNT sharpens focus on the impact of resource constraints at both national and sub-national levels and is a driver of domestic resource mobilization.
4. Effective climate-malaria partnerships remain nascent at both country and global levels, but awareness is growing in preparation for GC8.

4.2 Domain 2 Findings and Conclusions

Sub-national Government and Program Leadership and Capacity, Including Capacity for Innovation

The TOC posits sub-national leadership as a key driver of SNT maturity. Sub-national governance, leadership and capacity were evaluated in the six visited countries where evaluators had a chance to visit regional, district and facility (and/or community) levels and conduct KIIs and FGDs, as well as explored in portfolio analysis and literature review.

Sub-national governance disablers and enablers of SNT maturity. Across the visited countries, the following sub-national governance-related enablers and disablers or barriers of sub-national tailoring of malaria interventions were emphasized by national and sub-national KII respondents.

Enablers

1. **Well-paced political and fiscal decentralization:** devolution of decision-making for health to sub-national governments within strong technical norms from an organized central malaria program; increased budgetary autonomy.
2. **Strong sub-national health governance structures** with clear roles, structures and guidelines for national/sub-national coordination.
3. **Excellent communication between national and sub-national units:** good structures for regular two-way communication around data validity, interpretation, and related decision-making for action.
4. **Increased resources at sub-national level:** adequate resources to fulfill mandates of the sub-nationally tailored plan, and flexibility in funding allocation to address local needs.
5. **Capacity building**: training sub-national teams in data analysis, use, supervision and management, and supporting community health workers to deliver interventions, collect and report community-level data, and identify and serve in hard-to-reach areas.
6. **Digital systems**: use of digitized tools for data collection and real-time monitoring (see Domain 4).
7. **Human resource availability**: human resources to support sub-national data use and planning.
8. **Systematic community engagement:** consideration of needs of priority groups in intervention design and implementation.

Barriers

1. **Limited decision-making autonomy:** limited authority of sub-national level leadership.
2. **Weak governance structures**: unclear roles and responsibilities between national and sub-national entities.
3. **Delayed procurement and disbursement:** delayed distributions affecting programmatic timelines.
4. **Inadequate financial resources**: budgetary constraints at the sub-national level. Insufficient resources to implement all identified SNT priorities. Demotivation of local health teams due to repeated unmet funding needs.

Adequacy of sub-national systems for coordination. In Kenya, Ghana and Nigeria, all countries that scored well on SNT maturity (see Domain 5), the evaluation team observed clear and well-defined frameworks for collaboration and decision-making, with established mechanisms for information-sharing, resource allocation and joint planning between national and sub-national stakeholders as illustrated by this sub-national key informant: "[*there are] structures for coordination and communication: County management team then have sub-county management team; in-charges of facility and community structure managed by CHO/CHAs*" *(KII, Sub-national).* In other countries, the coordination structures and processes tended to be more ad hoc and/or driven by partners, creating challenges in aligning priorities, harmonizing interventions and ensuring consistent implementation across sub-national areas.

To address the need for coordination, respondents in the six visited countries reported working with the Global Fund, WHO, PMI and other partners/stakeholders to strengthen the institutional and operational linkages between national and sub-national levels by developing national guidelines and standard operating procedures for SNT, establishing dedicated coordination platforms or task forces/TWGs, and building capacity of sub-national teams to use available evidence in decision-making for programmatic improvements and resource mobilization efforts, including to some extent how resources are allocated.

4.2.1 Decentralization and SNT Decision-making

Decentralization can be defined as the transfer of power, authority or responsibility in decision-making, planning and management from national to sub-national levels (Mills, 1990; Smith Gueye, 2016). Many low- and middle-income countries carried out health sector reform in the 1980s and 1990s, the majority of which involved some degree of decentralization (Cobos, 2017).

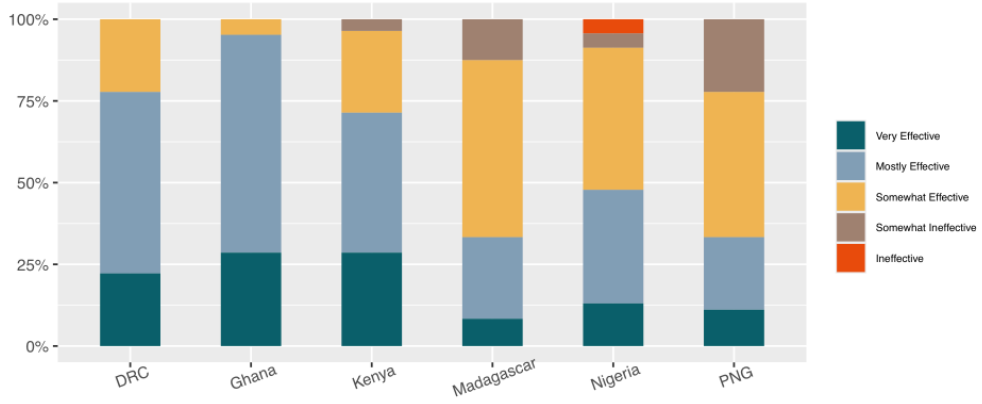
The degree of autonomy and decision-making authority at the sub-national level varied among the six visited countries. In Kenya, Nigeria and Ghana, sub-national health teams had a high degree of autonomy and made decisions on the design and implementation of prioritized malaria interventions applicable to their contexts. Sub-national health leadership in these countries reported having autonomy to make decisions based on their specific epidemiological and operational realities. Defined structures exist for coordination, data review and stakeholder engagement.

In Kenya, counties control the bulk of funds for primary health care service delivery (Musava et al., 2024); the main hindrance is reported to be limited resources to respond to emerging needs: *"In times of epidemics sometimes we fail to respond as a County and need govt/partners" (KII, Sub-national).*

Ghana's health system has a good degree of structural decentralization, and reporting lines, structures and roles are organized and clearly defined, but the malaria program is highly centralized in its decision-making, leaving sub-national levels little budgetary autonomy. Nevertheless, the national program is rated as highly effective by both in-country partners and sub-national respondents, who comprised 90% of Ghana's ROS sample (Figure 5).

Figure 5: Country Responses to ROS #14, Effectiveness of Coordination of the NMCP

ROS Question #14: *Is the NMCP effective in coordinating partners working in different areas of the country (or with different agendas) to align them with the NMSP?*



Based on both sub-national and national engagements and KIIs, this is linked to excellent two-way coordination, communication and mutual respect between national and sub-national teams, and a strong

shared culture of data use. Ghana also has an excellent subsidized tertiary education system: there is minimal sociocultural differentiation between the central and peripheral levels of the health system.

In PNG, another centralized context, decision-making authority rests with national authorities who retain control over intervention selection and resource allocation. There are no malaria-specific budgets at the sub-national level, and sub-national action plans are rarely supported by a budget for implementation. Most PNG respondents ranked the national program as only somewhat effective or somewhat ineffective.

DRC has a long history of decentralization and regional identity at the province level, but is hindered by poorly defined roles, structures, guidelines and communication lines between national/regional authorities, making coordination a large challenge. Program effectiveness was ranked as mostly or very effective by most respondents, all of whom were national level; as reported above, there were no sub-national responses to the DRC ROS.

Though the evaluation's main analysis of sub-national governance centered on the six visited countries, portfolio analysis yielded other examples illustrating the complexity of centralization/decentralization and organized vs. more informal/ad hoc legal and regulatory frameworks. There are examples of politically decentralized systems with unclear legal and regulatory frameworks that make it difficult to produce unified guidelines for implementation, and to mount a coordinated response. Other better-organized programs have higher and lower degrees of devolution. Mali benefits from a decentralized, highly organized health governance structure with capable, effective malaria programs, despite huge challenges related to political turmoil and insecurity. "The government has introduced a decentralization policy that serves as a framework for the implementation of all development actions. Mali has 819 communes, divided into rural and urban communes. Each commune is administered by a communal council. Since 1991, the socio-political context has been marked by the country's commitment to democracy, good governance and decentralization." (Mali NSP 2023–2028). Burkina Faso, also a challenging operating environment with a strong commitment to health equity, has pursued organized decentralization since 1991, but devolution of fiscal authority has been slow; only 3% of health expenditure is currently controlled by communes, and though per capita spending on health has increased in the last decade, per capita health expenditure through local governments has remained constant (Offosse, 2022).

Both national strength and sub-national strength are needed. Our review of successfully eliminating countries underlined the necessity of a decentralized, highly capacitated health system together with an effective national structure capable of providing technical guidance and coordination. Sri Lanka, for instance, was characterized by a very capable, decentralized health system steered by strong, consistent technical leadership from the national AMC, resulting from deliberate, well-paced decentralization (*Annex K: Overview of Elimination Countries, KIIs, Elimination/Transition*).

Based on global KIIs, the will to advance decentralized decision-making is prominent in national rhetoric in HBCs, but insufficiently matched by political will, support, and resources: *"In some countries, the national level has said, 'You know best, we trust you to make the best decision with what you have'….[but] normally what happens is like, 'Okay, you're getting nets and here's the number you have. Stop complaining. Do it'" (KII, Global).* Recent political economy analysis of sub-national health management in Kenya, Malawi, and Uganda highlighted multiple enablers and disablers of sub-national decision-making even in formally decentralized contexts, finding that "governance arrangements, management systems, and power dynamics" among both national and global partner actors can have significant effects on sub-national decision-making in practice (Rodriguez et al., 2023).

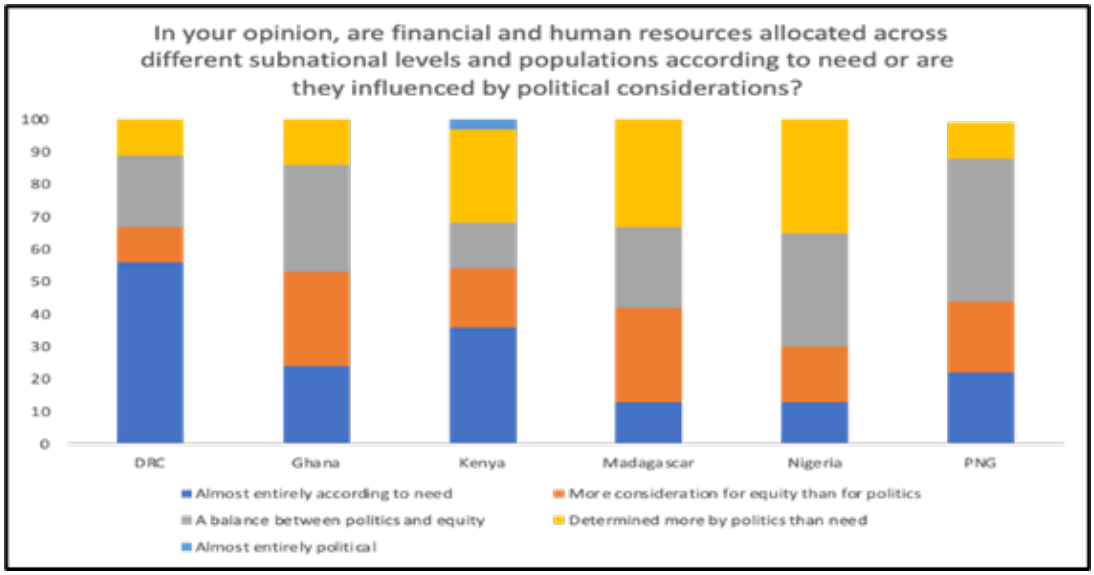
4.2.2 Influence of Political Economy Factors

The ROS confirmed that in the six visited countries, respondents perceive sub-national resource allocation for malaria to be significantly influenced by national political considerations; in five countries respondents

rated allocation as more influenced by politics rather than by need/equity considerations (in DRC, respondents were exclusively national) (Figure 6). These considerations are mostly outside the control of national programs and may hinder well-laid SNT plans, as noted by global respondents: *"One thing that SNT doesn't and will not take into account are politics. So, you may have...an SNT that says if you have limited resources, you don't cover urban areas with bed nets...But then it's an election year, so...no matter what, they're going to want to distribute nets in the urban areas" (KII, Global).* Even respondents in countries rated highly for SNT maturity agree on these political realities. National programs face the challenge of leading effectively in this context.

Figure 6: Country Responses to ROS #7, Role of Political Considerations

ROS Question #7: *In your opinion, are financial and human resources allocated across different sub-national levels and populations according to need or are the influenced by political considerations?*



National programs do report that reliance on data and SNT planning is some buffer against community perceptions of unfairness and help explain why some areas receive some interventions and some do not. There is also growing focus on sub-national ownership across the portfolio.

4.2.3 Increasing District-level Ownership

District-level leadership and capacity is a significant new focus in FRs and National Malaria Strategic Plans (NMSPs) and has been driven partly by SNT, given growing recognition of the key role of sub-national data in both national, and sub-national decision-making. Other qualitative evaluations of SNT have noted this as well, and specifically the impact on district health officers, finding that as they iterate through the SNT process cycle, they take greater interest in their data, have increased ownership and increasingly make prioritization and planning decisions based on routinely collected data (Onyango et al., 2024).

While portfolio improvements are promising, ROS respondents emphasized more sub-national inclusion and decision-making influence among priorities for Global Fund improvements (see Table 5).

Table 5: Recommended Improvements to Global Fund Technical Assistance or Funding Request Process to Facilitate SNT (ROS #28)

Country	KII Quote
DRC	Improve coordination between national and sub-national actors to ensure all stakeholders are aligned with sub-national tailoring objectives. This includes better coordination with development and implementing partners.
	Adopt a more deliberate bottom-up approach to decision-making, involving local communities in understanding the incidence of malaria and the drivers of transmission. This would promote community-tailored interventions and ensure accountability for the interventions delivered at lower levels.
	Ensure that funding applications allow for flexibility to adapt interventions to local epidemiological, geographic, and socio-cultural variations. This would support tailored interventions that address specific sub-national needs.
Kenya	Enhance flexibility and autonomy of sub-national entities to tailor interventions.
	Ensure inclusion of sub-national stakeholders in all funding application processes to improve transparency.
Nigeria	Develop mechanisms for better engagement with local stakeholders to align interventions.
PNG	Provide real-time feedback to implementing partners to align resources with community needs.

4.2.4 Sub-national Budgetary Authority

The degree of sub-national budgetary authority and available sub-national resources are measures of decentralization. Insufficient or unequal funding limited the ability of local teams to implement context-specific interventions: *"Even though mandates are clear, we have economic challenges because of limited funds disbursements; counties sometimes need funds which are not always available...in times of epidemics sometimes we fail to respond" (KII, Sub-national)*. However, global donor funding mechanisms do not always facilitate easy transfer of "un-pre-programmed" resources to sub-national levels. "Shifting towards a district or provincial level approach will necessitate deliberate planning…Donors will need to alter current practice, allowing for flexible funding to be controlled at sub-national levels" (Gosling et al., 2020).

The need for continuous use of data for strategic decision-making, prioritized by most stakeholders and reflected in the directions of country programs, poses a special challenge for Global Fund grantmaking, where reprogramming is allowed but must be approved and is not necessarily rapid. Some decisions can be made easily, but on more substantial reprogramming, *"We speak out of two sides of our mouth... [On] one, 'yes, of course, if you have a new data point, reprogram,' and then, on the other… 'reprogramming is such a pain in the neck, please don't do it that often'" (KII, Global).*

4.2.5 Community Health System Expansion

There have been significant improvements and expansions in community health systems in many countries across the portfolio, some supported by innovative funding mechanisms. Sixteen percent of all cases in the PMI countries in the sample are tested and treated by CHWs. CHWs are also increasingly digitized, and rates of digitization are growing rapidly as smartphone penetration grows. They are playing expanding roles in malaria service delivery, such as community-based Intermittent Preventive Treatment in Pregnancy (IPTp). This lends urgency to the need to empower district-level facilities, as health workers at facilities often oversee CHWs with only a few weeks of formal health training.

Visible benefits include malaria program access to a widening range of sub-national data for decision-making, including district-level Integrated Management of Childhood Illness (IMCI) and Expanded Programme on Immunization (EPI) data on CHW performance, and data on district-level health sector functioning, with accompanying resources for district and community systems strengthening from a growing number of bi- and multi-lateral, non-malaria or malaria-adjacent sources in a number of countries in the portfolio, including but not limited to Gavi, the Global Financing Facility, The World Bank, UNICEF, and European governments.

Stronger, more integrated community health systems enable SNT in multiple ways but can increase the complexity of targeting and tailoring focused on malaria outcomes and tracking of the "malaria dollar." In multi-donor contexts, the investments of Health Systems Strengthening/Primary Health Care (PHC)/CCM focused entities (e.g., World Bank, Germany, EU, others) provide critical sub-national data and additional resources for both system-wide and malaria-specific interventions, including entomologic surveillance and commodities. Two of six countries with performance-based community agent funding models (Burundi and Guinea) funded districts that were divided across donors: "*To date, several donors have lined up for Guinea's prefectures" (KII, Global).* Zambia has also pursued a sub-national CHW expansion-focused resource mobilization strategy with several innovative donors, including Rotary International and Isdell Flowers. Mobilizing, harmonizing, tracking and coordinating the investments of different funders to maximize RSSH benefits to the health system is a large task, but is perceived by global respondents to be improving slowly as the CHW policy landscape strengthens.

CHW ownership, innovation and local domestic resource mobilization. In Burkina Faso, the National Steering Committee for Community Health (CNPS) has adopted as its main mission advocating to make better use of private sector actions and a significant mobilization of domestic resources for funding health in general and TB, HIV and malaria in particular. "Seeking innovative and private sector funding will help offset declines in government and foreign aid allocations and fund other priority sector interventions" (GC7 FR, Burkina Faso, 2023).

Table 6: Selected Country Examples of CHW Ownership, Innovation, and Resource Mobilization

Country/General	Examples of CHW ownership, innovation and resource mobilization	Source
Burkina Faso	Community-based health workers and head nurses analyze CPS data to identify villages with the most cases and address gaps in interventions, taking ownership of the approach.	KII, Burkina Faso
Rwanda	Community health workers are trained to manage mosquito breeding sites and provide targeted interventions, leveraging IVM to enhance localized efforts.	KII, Rwanda
Zambia	PMI has been training community health workers, and the End Malaria Council mobilized resources to provide bicycles, facilitating CHWs' access to remote areas for malaria intervention.	KII, Zambia
Malawi	Malawi is recruiting more health workers, including community health workers, to improve access to care in hard-to-reach areas, supported by resource mobilization efforts.	KII, Malawi

4.2.6 Domain 2 Conclusions

1. Countries with more robust sub-national decision-making on malaria have many of the following enabling factors: well-paced political and fiscal decentralization; stronger sub-national health governance structures; a high level of digitization; regular communication between national and sub-national levels on malaria data validity, interpretation and use; increased resources at the sub-national level; capacity building of sub-national teams in data analysis and use; adequate human resources; and more systematic community engagement.
2. Even national programs with a high level of SNT maturity navigate political factors that influence execution of SNT plans.
3. Flexibility in donor financing may facilitate sub-national devolution of funding, and vice versa: decentralized fiscal structures may also facilitate sub-national donor alignment.
4. Rapid, extensive CHW expansion and community data integration across the portfolio have significantly enabled SNT progress. Coordination of growing, multi-donor investment in community health worker programs (including malaria components) and district/sub-national systems is perceived to be weak but improving.

4.3 Domain 3 Findings and Conclusions

Actively Supported and Assisted by the Global Fund and All Partners

The evaluation TOC assumes that external partners in a political economy landscape have the potential to either facilitate or hinder the country ownership and leadership central to effective SNT of malaria. The evaluation examined guidance and technical assistance offered by partners to country programs and explored the political economy factors that influence technical decision-making.

4.3.1 Normative Guidance and Technical Assistance for SNT

Normative guidance to countries is provided principally by WHO and indirectly by the Global Fund through the Malaria Information Note, the Resilient and Sustainable System for Health (RSSH) Information Note, and the format of FRs.

As detailed in Section 1 and *Annex B: Evolution of Sub-national Tailoring*, WHO has long supported the strategic use of information and guidance in SNT (as has the Global Fund). The Global Technical Strategy (GTS) (2016) and HBHI instilled the importance of targeted and tailored approaches, driving uptake of data-driven approaches (Ghilardi, 2020). Stakeholders across KIIs highlighted WHO's critical role in fostering more widespread alignment around SNT and the urgency of targeted and tailored strategies in HBCs, given stalled progress and growing resource constraints. Respondents commended the roles of both the GMP and AFRO teams in providing direct support to core SNT processes across 28 countries by 2023. Key WHO guidance on SNT includes the updated Global Technical Strategy (WHO, 2021), 2024 guidance on prioritizing malaria interventions in resource-constrained country contexts to achieve maximum impact (WHO, 2024), and an upcoming SNT manual.

As illustrated in Table 7, SNT Technical Assistance to countries takes two primary forms:

1. Shorter-term SNT NSP and FR support (stratification, intervention mix decision-making, prioritization/optimization), provided primarily by WHO, secondarily by CHAI and PATH, and by other partners in partnership with analytic and modeling groups, generally in advance of NMSP and Global Fund FR development.
2. Longer-term, in-country SNT support and capacity building, including support to data architecture and systems, integrated analytics and modeling, and strategic, operational micro-planning, at national and sub-national levels, provided by partners supported by the Gates Foundation and PMI (particularly in surveillance and data systems).

Countries also receive support with NMSP and FR development and writing through the RBM country support mechanism.

Table 7: SNT TA Partnerships Across 27 High-Burden Countries

Country	SNT TECHNICAL SUPPORT		MODELING		
	Principal SNT partner (core SNT process – stratification, targeting, intervention mix prioritization)	**Intensity of longer term SNT TA (measured by number of projects)*** **High (H): 7–10** **Medium (M): 4–6** **Low (L): 0–3**	**GC6**	**GC7**	**Group**
Angola	CHAI	Medium	nd	Yes	STPH
Benin	CHAI	Medium	nd	Yes	STPH
Burkina Faso	CHAI + WHO	High	Yes	Yes	Northwestern
Burundi	WHO	Low	Yes	No	IDM
Cameroon	WHO	Medium	Yes	Yes	STPH
CAR	PATH/MACEPA	Low	No	Yes	UniGe
Chad	nd	Low	No	Yes	nd
Congo	nd	Low	No	No	n/a
Côte d'Ivoire	WHO	Low	No	Yes	nd
DRC	CHAI, PATH/MACEPA, WHO	High	Yes	Yes	PATH
Ghana	WHO	Medium	Yes	Yes	Self
India	PHFI / ICMC-VCRC / NVBDCP	Low	nd	No	n/a
Indonesia	WHO	Low	nd	nd	nd
Kenya	WHO	Medium	No	Yes	STPH
Liberia	WHO	Low	nd	nd	nd
Madagascar	WHO (*vaccine only*)	Medium	nd	Yes	STPH
Malawi	PATH/MACEPA	Low	nd	Yes	PATH
Mali	WHO	Medium	Yes	Yes	Mali Univ & PATH
Mozambique	WHO, CHAI	Medium	No	Yes	STPH
Niger	WHO	Low	Yes	Yes	PATH
Nigeria	WHO, PATH MACEPA, CHAI	High	Yes	Yes	Northwestern
Sierra Leone	WHO	Medium	No	Yes	Imperial
South Sudan	nd	Low	No	No	nd
Sudan	WHO	Low	No	Yes	Imperial
Tanzania	nd	Medium	nd	Yes	STPH
Togo	WHO	Low	No	Yes	Northwestern
Zambia	PATH/MACEPA	Medium	Yes	No	PATH

*Based on # SNT-related partners and associated projects (the majority funded by the Gates Foundation and PMI/USAID), including: ALMA (scorecards); CHAI (SNT TA, common georegistries, digitization, surveillance assessments); Chemonics (iMAP); ICF/PMI Measure Malaria; Ifakara Health Institute (IHI); JHPIEGO (IFHS, STAIP); JSI (CHISU); MAP; MC (CHIPS, PATH, Surveillance, upSCALE); MSH (PMI); PATH (MACEPA/SNT TA); MENTOR (PMI); PSI (HFA, PMI Impact Malaria); PSI; RTI/Notre Sante (USAID); STPH. ***Sources:*** RBM country support dashboard; Global Fund malaria team TA excel tracker; MPAG, 2024; Galatas, B., personal communication). The evaluators resolved inconsistencies in source of TA across multiple agency trackers and dashboards to the extent possible given constraints of time and respondent availability.

4.3.2 Roles of the Primary Donors in SNT

The Global Fund, PMI, and the Gates Foundation have all played major roles in driving and incentivizing SNT uptake.

The Global Fund. Donor requirements, especially those of the Global Fund, have been pivotal, both over the years (Ghilardi, 2020) and more recently (KIIs), in incentivizing sub-national data generation, aggregation, quality and use, as well as via significant investment in data architecture, digitization, visualization, and other innovations across the sample countries. The infusion of COVID-19 Response Mechanism (C19RM) resources for RSSH has helped lay stronger data and sub-national governance foundations for SNT that are already benefiting malaria control efforts. These investments currently end in 2025; the implications of this fiscal cliff were called out as a significant concern by several key respondents given urgent needs for ongoing data systems and analytics strengthening in support of effective SNT.

PMI. SNT is a prominent element of current PMI strategy, building on years of engagement in surveillance strengthening and an emphasis on data-driven decision-making. PMI has significantly enabled the generation of critical and increasingly sub-national data, through, for example, Service Access and Readiness Assessments (SARAs), expanded entomologic surveillance and insecticide resistance monitoring, therapeutic efficacy monitoring, and net durability studies, with clear impact across PMI countries. PMI has also played a significant role in SNT diffusion: in Angola, for example, PMI supported 57 sub-national SNT workshops (Angola 2024 MOP). PMI has also supported piloting, diffusion and scale-up of several innovative and increasingly digitized approaches to training, coaching and supportive supervision of health workers at all levels. While some view PMI's sub-national execution focus as a strength, others worry that these often externally led efforts are insufficiently replicable or scalable.

The Gates Foundation. In 2014, the Gates Foundation began expanding investment in strategic, technical and operational SNT support to national programs in Asia, Latin America and Africa in partnership with both PMI and the Global Fund. Efforts focused initially on low-to-moderate transmission environments across southern Africa, including Angola, Mozambique and Zambia, as well as Ethiopia and Senegal. In 2018, The Gates Foundation's malaria strategy shifted to a focus on HBCs, with an explicit emphasis on advancing SNT in these contexts. Country support has included country-embedded, SNT support across the full strategy continuum provided by CHAI and PATH/MACEPA, in partnership with additional surveillance, data architecture, analytic and modeling partnerships. Under the 2018 strategy, significant support has been extended to the following additional countries in the evaluation sample: Benin, CAR, DRC and Nigeria. While these efforts were recognized by many KII respondents, the Gates Foundation was more often than other partners identified as being insufficiently transparent about its activities.

4.3.3 Country Program Appreciation of SNT TA

Country programs express strong support and appreciation for SNT TA partnerships in general. Some programs expressed a mismatch between shorter-term SNT TA and fast-moving NSP planning and FR writing timelines. For example, one program that relied closely on a longer-term embedded partner for assistance with both stratification and the creation of a new sub-national elimination plan noted that time delays between model iterations for interventional tailoring and forecasting offered by shorter-term remote TA did not fit well with the rapid feedback and reforecasting required in the consensus-based preparation of the funding request. Programs also expressed a strong desire for local ownership of modeling analytics and

for the highly technical capacity-building that makes this possible. International stakeholders see longer-term, more embedded partnerships as much more supportive of country ownership and encourage future SNT TA to be similarly constructed.

Selected Reflections on TA from International Stakeholders (KIIs)

Where we've seen the greatest successes is where there are those long-standing relationships.

I really like the way CHAI provides support… They're doing capacity building. Overall, my experience is that it's not patronizing.

Nothing can compare to being based in the country, sitting day by day alongside the malaria program, helping to figure [things] out and helping to understand and respond to the different challenges that arise.

The ideal is an ongoing process where NMPs, with their key partners and donors, are in regular conversation [on] what interventions are being considered in what settings and for what reasons. And … modeling groups are brought in to help use their data, use refined country models to help answer the questions that are most pertinent for the country.

We need to turn [SNT] from…a one-off giant exercise…into something that's systematized and actually in the hands of the government.

4.3.4 Partner Issues and Feedback

International Perspectives

- **Improvement in intra-partner coordination needed.** Among multiple global ecosystem "disablers" of SNT raised by stakeholders, the need for significant improvements in SNT partner communication, alignment and coordination came up frequently. *"We're all busy, and we just don't think to prioritize communication" (KII, Global).* The evaluation team's work in putting together a picture of SNT TA support efforts from across multiple formal and informal sources (see Table 7) speaks to the need to map and coordinate SNT efforts globally on an ongoing basis, e.g. *"You can't optimize if you have uncoordinated spending" (KII, Global).*
- **Partner awareness of power asymmetries.** Global stakeholders are aware of the political economic factors that shape country-led decision-making, especially in the preparation of FRs. They note it may be difficult for country programs to express divergences of opinion from funding partners.

Reflections on Political Economy Factors from International Stakeholders (KIIs, Global)

Donors generally say, 'We allocate based on what the countries want…We want to support the countries.' And then you talk to the countries and they say, 'Yeah, we have the meetings, but basically we're told what the donors are willing to fund, and we're asked to submit a proposal that aligns with that reality.' And so then they get the proposal, and the donor says, 'See, this is what the country asked for.'

Partners influence the country's decision on how resources are prioritized, for better or for worse.

There is so much miscommunication about what will or will not be allowable [by the Global Fund]. And nobody wants to go develop this whole funding application and have it be rejected…because they're being told that the TRP won't sign off on the things that they want.

[The] Global Fund needs to define what its expectations are. If the Global Fund doesn't define what it needs, it will lead to 100 different interpretations.

[PMI's] priorities aren't necessarily … the country's. That's a struggle for some of the countries I cover.

National Perspectives

- **Tension between SNT recommendations at country level and guidance from partners.** National program personnel consistently emphasize the importance of donors and partners genuinely listening to their perspectives and aligning support with country-driven priorities. *"Listen, don't impose" (KII, National*). While donors, including the Global Fund, express a strong commitment to this approach, some challenges persist in harmonizing funding decisions with the needs and priorities of country programs. In the ROS, all six countries surveyed identified "managing partner agendas" as one of the key challenges in implementing SNT, and five of the six countries also found "international funding partners insufficiently responsive to country needs and priorities as stated in the NMSP." During country visits, programs emphasized that local understanding of community preferences is widely overlooked and yet can make the difference between, e.g., net use of 50% and 70%, a substantial impact on resource use. In an open-ended response, one sub-national respondent noted: *"The Global Fund appears to be very rigid in its choice of what to fund. This approach stifles the emergence of innovative ideas from the sub-national levels" (ROS respondent, question 28).*
- **Some advice feels "de-stratifying."** A few countries with strong prevention-oriented SNT plans (e.g., Tanzania, Ghana, Niger) note both in their FRs and, in the case of Ghana, through KIIs, that their data-informed plans to provide alternative and integrated methods of vector control per stratum, including IRS and larval source management (LSM), were not approved. In Ghana's case, the program, which partners in country consider exceptionally well managed, pushed back on the TRP decision and produced a well-reasoned case to retain IRS in very hot northern districts where prevalence is high and net use is historically low, a resolution that satisfied both Global Fund respondents and program personnel (KIIs). Many country programs have suggested shortening the interval between net distribution rounds, citing net durability data, but Mozambique is the only country to move successfully from a 36-month to a 30-month interval, highlighting a looming issue for GC8. One program noted that partner advice to reduce the national strategic plan requirement for net coverage of 85% in high-burden areas to 80%, to spread net coverage more widely, went against the program's SNT planning (KII, National).

Vector control is an area of misalignment between national programs and donors. The widespread growth in use of LSM as part of sub-nationally tailored plans in GC7 is striking, as with very few exceptions this activity is funded by national governments. Interviews with national program leads confirm a view that partners are unwilling to fund the intervention. Recent evidence of the considerable effectiveness of Bacillus *thuringiensis* var. *israelensis* (Bti*))* in Côte d'Ivoire (Tia et al, 2024) and in Rwanda (Munyakanage et al, 2024), together with new WHO guidance recommending LSM in urban settings (WHO, UN Habitat, 2022), call into question the older consensus that larviciding or LSM add little to a national vector control toolbox. The donor community has been slow to respond to widespread interest from national programs in practical larval control, and there is now a strong call for the creation of a community of practice to promote the use of effective products and implementation methods (Newby et al, 2025).

Another notable trend in GC7 is a move away from IRS as a key vector control method. This began with Malawi based on the program's data-driven assessment that one district of IRS could cover almost 20m people with a mass ITN campaign (GC7 FR, Malawi). However, the recent 2024 WHO *Guiding principles for prioritizing malaria interventions in resource-constrained country contexts to achieve maximum impact* has enshrined the move away from IRS in GC7 with what amounts (for most HBCs, in resource-constrained contexts) to a strong new caution that IRS should not be scaled up and perhaps not sustained (WHO, 2024, Guiding principles). This guidance is a marked departure from the less restrictive guidance on vector control intervention methods (updated in 2021) in the GTS which specifies that the choice of "provision of, use and timely replacement of ITNs or the regular application of IRS" should depend on country context (WHO, 2015).

Respondents at both national and international levels raised concerns about what this move means for countries that are still interested in and committed to carrying out IRS in high burden areas. There was a clear concern from the respondents in the six visited countries that the TRP may not favor IRS funding, leading countries to exclude IRS from their proposals, a concern echoed by some international stakeholders: *"Often the argument is made, if you don't cover everyone with a bed net, for example, as your first thing, you're killing kids. If you don't put better bed nets or IRS in some areas, you're also killing kids. And it is not up to the Global Fund to decide which kids to kill" (KII, Global).*

In the ROS, five of the six visited countries identified IRS as an unfunded priority (Table 8). This concern was echoed in KIIs with national program managers outside the visited countries sample: *"Every time you talk about IRS, they [partners] say it's expensive. Instead of IRS, you could get this many mosquito nets. I've always said, if we really want to move towards elimination, it's time we implement IRS, especially in high transmission zones. As for mosquito nets, I've said it doesn't necessarily mean they are used in certain areas. You might even see them being used as fences for livestock. Why waste money if you see they're not being used?" (KII, National).*

Table 8: Interventions in the NSP That Require Funding but Do Not Have Support (from ROS Open-ended Responses)

Multiple	Scaling up IRS to other endemic regions Expansion of PMI supporting IRS Deployment of IRS to respond to malaria surges
Madagascar	Expansion of districts IRS CAID Computer-Assisted Mapping and Drone Technology to assist IRS in elimination zones
Nigeria	High operational costs limit IRS funding by partners Mixed interventions, including IRS and LSM, are needed alongside ITNs IRS and LSM to address vector control challenges
PNG	IRS and Glucose-6-Phospate Dehydrogenase testing Additional financial support required to implement IRS effectively

Entomological surveillance. While many countries report appreciation for progress and partner support for entomological surveillance in the form of insecticide resistance testing and sentinel site surveillance, many programs, including in visited countries, also expressed concern and a desire for stronger focus in this area. Routine, widespread measurement of entomological indicators allows evaluation of the impact of vector control against vectors, rather than against epidemiolocal indicators—a distinct advantage in evaluating combinations of interventions that all affect such indicators. Programs also wish to measure transmission indicators as the most direct malariological measure. This is an area in which technology and innovation can help. Low-cost technology (involving smartphones coupled to cheaply 3-D printed collection trays) for the use of CHWs has demonstrated that rapid AI-aided morphological identification of a tray of mosquitoes collected and presented by CHWs can be uploaded directly to DHIS2. Community-directed hardware development has made some prototypes especially robust, inexpensive and easy-to-use, and have put low-cost real-time entomological surveillance within reach of realistic program budgets (Dasari, 2024).

These findings are highlighted for two reasons: 1) The Global Fund's focus on entomological surveillance in the newest strategy (The Global Fund, 2023) and 2) excellent entomological surveillance has been a keystone for elimination success in the eliminating/transition countries. A few country examples: **Niger's** NSP has a strong entomological focus: "Any malaria control strategy should be based on a thorough understanding of the characteristics of malaria transmission, which involves both theoretical studies...and empirical observations. Entomological parameters are the basis for such studies. These are also important to estimate the expected impact of the various control measures... [we need to] initiate studies on the impact of combinations of interventions (LLINs, IEC/BCC, IRS, vector control, etc.)" (Niger, NSP 2023-2026, [trans.], 2022). **Tanzania** proposed additional entomological surveillance in its GC6 Prioritized Above Allocation Request (PAAR), as Entomological Inoculation Rate (EIR) is an indicator in their NSP. The TRP refused the requested additional surveillance, seeing no need for it, and recommended against EIR as an indicator due to "challenges in its estimation". (TRP, GC6 Funding Review and Recommendation Form,

Tanzania) Given a long partnership between Tanzania's NMP and the entomology experts at Ifakara Health Institute, both national and international KIIs expressed that this feedback seemed discouraging. EIR was an intentionally selected outcome indicator in their national strategic plan. A ROS respondent from **Nigeria**, asked what additional capacity the program needed for effective SNT, explained that the program lacked an entomologist, a critical gap in the world's highest burden country. Another national program representative noted: *"we do not have entomological data in a decentralized way so that we can say 'in such-and-such a region this is the situation'" (KII, National).*

4.3.5 Development and Innovations in Partnerships

Innovations/initiatives aimed at increased partner harmonization, transparency and coordination. Several recent initiatives aim to make key data for global decision-makers more available and accessible, improving transparency across partner funding and activities, and facilitating harmonization. Major global malaria donors have identified five or six major strategic levers (sometimes referred to as "The Big Push") needed over the next five years to lay the groundwork for a concerted joint effort for malaria and a *"mass influx of dollars" (KII, Global).* The idea is: *"What would we need to put in place today to sort of get everything primed and ready to go?" (KII, Global).* The "expanded access to care" enabled through the growth of CHW programs in a growing funding ecosystem, as described in Domain 1, is one of the key levers identified. Another key strategic lever is dedicated to aligning the global ecosystem. One effort within that area is *"making sure that PMI and the Global Fund operate on the same cycle" [i.e., a move for PMI to adopt a three-year rather than a one-year cycle]" (KII, Global).* One respondent referenced a possible six-year cycle for the Global Fund (KII, Global). Another key effort with the aim of greater partner alignment, mentioned by several stakeholders, is the promotion of a single cost-optimized operational plan (COOP). The hope is that countries will construct a costed plan, and partners will transparently declare which portions they are funding, to increase synergy and avoid duplication.

COOP pilot. WHO will be running a COOP pilot in GC8 in a group of countries, and several tools have been prepared to assist countries. PATH has developed a tool (provisionally called "The SNT Explorer") that quickly calculates the costs of different intervention scenarios and allows countries to iterate dynamically within their resource envelope. It has been trialed in Nigeria. There are also tools to automate prediction for certain intervention sets: the Malaria Intervention Tool (MINT) is designed as a plug-and-play vector control scenario modeling tool, and there are almost certainly others being designed as well.

Recent enhancements to the RBM dashboard. These have significantly increased stakeholders' ability to determine and track country support provided across technical partners in areas that are highly relevant to SNT and provided early visibility into key malaria domains of relevance to SNT: a new, deep dive into country surveillance system readiness from national to sub-national levels, and a new CHW dashboard.

4.3.6 Local Ownership and Capacity

Strong preference for local ownership of analysis and modeling. Literature and both remote and in-county national KIIs support program preference for the development of country-led and country-owned expertise. Quite a few NMPs, even one with a less successful experience with short-term TA, have sent personnel to train in modeling fellowships. Other programs are eager to learn from examplar countries with more local expertise (KIIs, National). Kenya enjoys a long history of data-driven approaches to risk stratification and preferred to use statistically sophisticated routine data modeling from in-country experts at KEMRI over any external modelling assistance. The preference for country-owned expertise was echoed by modelers working with countries, one of whom a expressed a dream to see *"an embedded modeler in every program" (KII, Global).* Several modelers are using personal grant funding streams to create opportunities for in-country analysts and modelers to receive extended, high-level training.

Countries benefiting from local capacity. Kenya's long-term relationship with KEMRI-Wellcome Trust has been central to that country's SNT successes and particularly to their microscale stratification based on routine incidence (Ghilardi, 2020; Alegana, 2021). Mali's GC7 intervention modeling was done by the Malaria Research and Training Center, University of Sciences, Bamako (Cissoko, 2022, 2024). Tanzania's National Malaria Elimination Program (NMEP) partners with both the National Institute of Medical Research (NIMR) and Ifakara Health Institute (IHI), whose entomological experts have assisted in the setup, operation and use of Tanzania's innovative country-wide community routine entomological surveillance system (Mwalimu, 2024). This system, supported by the Global Fund, fulfills convictions expressed by Tanzanian entomologists over a decade ago that a country-wide surveillance system is "vital in planning and implementing evidence-based malaria vector control programmes as well as in monitoring the current malaria control interventions." (Kabula, 2011). The African Centre of Excellence for Genomics of Infectious Diseases at Redeemer's University in Ede, Nigeria investigates emerging infectious diseases, microbial threats and resistance in Nigeria and other West African countries. Many international KII respondents made a strong call for focused efforts to better leverage existing local capacity and to develop further local capacity for SNT-related TA.

Countries would like to have a greater voice in global decision-making. Several respondents, both national and global, noted that *"all these decisions are made…and Africa is not at the table" (KII, National).* Multiple respondents directly or indirectly referenced the Lusaka agenda and its core recommendations aimed at addressing power asymmetries in global health decision-making and their enablers and disablers. Many program managers do not feel heard at the highest levels "*Maybe for PMI, we may [have enough influence in priority-setting]. ...but for [The] Global Fund, it's definitely no..." (KII, National)*, and one clarified that national government representation on the Global Fund Board or Subcommittees is not a substitute for malaria program representation in global policy and strategy meetings, as these representatives may not have malaria expertise.

4.3.7 Domain 3 Conclusions

1. Longer-term, NMCP-embedded, systems-oriented SNT TA has been a significant enabler of SNT advancement.
2. Countries are focused on building local capacity; TA should focus on skills transfer.
3. Among global stakeholders, there was widespread acknowledgment of intra-partner misalignment as a "disabler" of effective SNT. Initiatives aimed at partner coordination (e.g., COOP, RBM dashboard) are steps towards addressing transparency and harmonization concerns.
4. Many programs highlighted concerns that national consensus and local expertise are undervalued by partners. Many global stakeholders acknowledge this as a persistent and significant issue, despite significant partner efforts to address it.
5. Differences exist between TRPs/FR TA and some country programs, especially around vector control; some advice has felt "de-stratifying"; local expertise is not always appreciated; recent WHO guidance for resource-constrained contexts enshrines a more proscriptive stance toward IRS that is out of step with what some national programs believe is necessary for elimination.
6. Country stakeholders prioritized scale-up of routine entomological surveillance as a source of data needed for decision-making on vector control interventions.
7. Some country programs would like more inclusion in global strategic planning and decision-making fora.

4.4. Domain 4 Findings and Conclusions

Better Access to Quality Data and Analytics for Decision-making

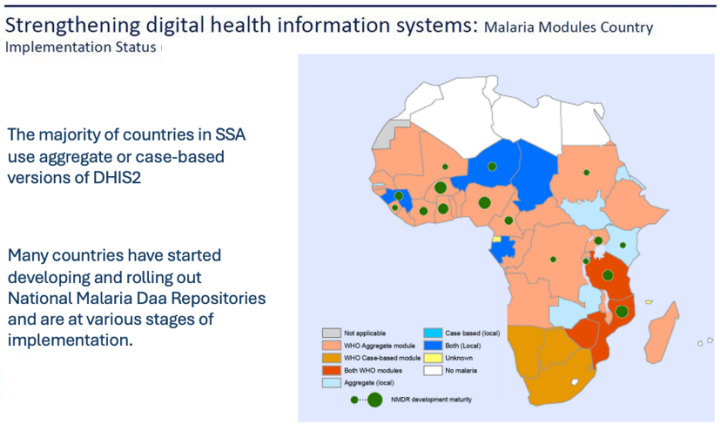
The TOC used in this evaluation highlights that better access to data, analytics, and infrastructure is essential for effective SNT. Stakeholders strongly associate SNT with continuous improvements in data availability, quality, and use, often defining it as data-driven decision-making (DDDM).

This section presents findings on improvements and challenges in sub-national data and systems for SNT, and then addresses the use of sub-national data for SNT risk stratification, intervention tailoring, intervention mix decision-making and optimization, and evaluation. The evaluators also address challenges related to sub-national data quality, analysis, and use, with a focus on country case study findings.

4.4.1 Sub-national Data and Data Systems

Significant improvement in sub-national data and data systems needed to support SNT. Across the portfolio, there has been significant improvement in data and analytics presented in support of targeting and tailoring decisions, particularly in GC7. Data quality metrics are exemplary in some countries, while major gaps persist in others. Improving the availability, quality, and use of sub-national data for decision-making is a major focus of country FRs, with some notable exceptions (e.g., India, which has yet to operationalize a planned electronic data platform). While there has been responsiveness to MPR and TRP recommendations and progress across countries, significant challenges remain in establishing sustainable foundational data systems for effective SNT across HBCs, as confirmed by both national and global KIIs. Sub-national data use and systems need further strengthening even in countries with high SNT maturity. Despite investments by the Global Fund and other partners, the scale of investment needed to make SNT fully feasible in many countries remains immense. Many global KII respondents, including those at the Global Fund, spoke of tradeoffs between data systems investments needed for better SNT phasing, and the dwindling resources available, particularly as the C19RM funding cliff approaches.

Figure 7: August 2024 Map of DHIS2 Use (WHO-AFRO, 2025)



Public sector case management data. Digitized health information systems facilitate the availability of quality data for timely decision-making in execution (Thawer, 2023; ALMA, 2023), as well as for SNT decision-making. Almost all countries in the sample are using and reporting sub-national data into DHIS2, almost all with monthly or weekly reporting, building on years of support, engagement, diffusion, and penetration to increasingly peripheral levels over time (see Figure 7). However, levels of quality, aggregation, visualization, and use for decision-making vary. Completeness of routine reporting was found

to have generally improved between 2018 and 2022, with the most improvement (>10%) reported for Ghana, Liberia, and Niger. Data provided through the Global Fund Explorer show higher than 90% testing rates for suspected malaria cases. For PMI countries, the reporting rate averaged 97%, with a 5.5% improvement since 2018 (PMI Country Profile data, 2024).

Private sector reporting. All visited countries reported using data from private sector health clinics to inform malaria SNT, but with a few exceptions, progress in integrating the private sector, both to ensure adherence to guidelines and in reporting of data, remains slow. As one country case study respondent explained, "*We have no stick [to compel private facilities to report]*" *(KII, National).* Even a decade ago, more than half of all caregivers in Chad, DRC, Ghana and Nigeria sought treatment in the private sector, yet private sector reporting into national health information systems remains limited (Berlin et al., 2024). Tanzania has tried a regulation-based approach with an accredited network of drug shops (Kilian, 2024), with some success limited by low enforcement, while several countries are using a "carrot" approach with subsidized commodities (Berlin et al., 2024).

Disaggregation. The level of disaggregation for routine malaria data varied across the countries evaluated. Most reported disaggregation at least by age bands (<5 and >5) and less frequently by sex; the lowest level of disaggregation was facility and/or community for most countries reported in the RBM dashboard, with only one limited to national disaggregation, and very few others to district/LGA level. Among 18 evaluation countries who self-report to RBM, five reported sex disaggregation of case data down to the community level. Few countries refer in their NSPs or FRs to specific plans to enhance or devolve data disaggregation, and rarely provide specificity. Chad, for example, simply indicates that "disaggregation will be improved to improve decision-making," Ghana is an exemplar in the sample, with sex-disaggregated data in 5-year age bands, but at least 9 other countries are disaggregating by more than >/<5.

Surveys. Malaria indicator surveys (MIS) and demographic and health surveys (DHS) are the main sources of parasitemia data, though in many countries, surveys are not regularly performed due to expense, and the most recent survey may be several years old. Some countries, like Tanzania and parts of DRC, obtain prevalence data from annual or bi-annual school-based malaria prevalence surveys. During risk stratification, an older survey was the most common reason cited by countries as the reason for relying on incidence data alone. The use of antenatal clinic surveys offers great promise as a low-cost means of tracking burden trends in a representative population, and is being trialed currently in Benin, Burkina Faso, Mozambique, Nigeria, Tanzania, and Zambia; infection rates in pregnant women will be compared with those obtained from household surveys (Gutman et al., 2023). Lot Quality Assurance Sampling (LQAS) is a sampling technique that shows promise in a variety of settings, as a more localized alternative to DHS or as a way of improving performance during SMC or LLIN campaigns (Swana et al., 2018; Anoke et al., 2015; Biedron et al., 2010). Service Availability and Readiness Assessment (SARA) surveys in PMI countries help inform targeting of health access expansion and quality of care.

Death audits. Though case data is understandably aggregated in high-burden geographies, mortality data is heading toward line-listed reporting. Countries vary in their ability to carry out malaria death audits, but more and more countries are adopting them and making use of sub-national data to direct facility- and community-based performance improvements.

Population denominators. Common sources for population denominators (e.g., for a /1000 metric in DHIS2 or for LLIN coverage) include the national census and/or campaign or CCM enumerations, with the use of enumerations preferred in many countries since a census does not typically provide up-to-date estimates. As census figures are rarely granular or accurate at the level of a facility catchment area, estimations are involved in their use, a problem that is being tackled in several ways, including geospatial methods and use of satellite imagery to obtain more accurate population estimates. Studies in Namibia found that improving

denominators changed incidence by as much as 30% (Tatem, 2022; Rerolle et al., 2024). This problem is receiving increasing attention as focus shifts to sub-nationally targeted campaigns.

Data infrastructure: electronic reporting. Among countries included in the RBM surveillance dashboard, approximately 30% reported electronic reporting down to the health facility level, and even fewer to the community level. Many countries have human resource or data system challenges at the facility or community level, but mobile approaches are gaining ground. For example, transcription issues due to limited human resources at the facility or Local Government Area (LGA) have been addressed successfully in some countries by rolling out KoboCollect (e.g., Nigeria, Chad).

Technological advancements. SNT has been supported by tools like geographic information systems (GIS), mobile data collection platforms, digitization of campaigns and routine services, data visualization advancements, e-platforms for provider (including CHW) training, coaching, mentoring, and supportive supervision, and use of social media for SBCC and satellite data to enhance population estimation, land use, and other variables.

Digitization of data systems, CHWs, LLIN and SMC campaigns, e-learning and supervision systems. Digitization has greatly enhanced the availability, quality and timeliness of sub-national and national data for strategic and real-time decision-making. The benefits of digitization were reflected across multiple countries in the portfolio, and demand remains high, based on requests completed and pending from the RBM country support dashboard, and echoed by both international and national stakeholders: "D*igitized LLIN, SMC, and IRS campaigns enabled targeted supervision, and net distributions were monitored from warehouses to distribution points" (KII, National).* Digitization also enhances targeted supervision: *"If for instance a campaign worker was not moving but was sitting somewhere ...[we] would call his attention and say 'Dr. John, you're supposed to be moving from village A to B. You are still in A' ... movement of the net from the warehouses to the distribution points were also tracked" (KII, National).* Digital tools providing real-time feedback were also reported to improve LLIN distribution efficiency in Northern Bahr el Ghazal State, South Sudan (Khan, 2024). E-learning to support training and supervision is growing in popularity.

Malaria data repositories. WHO has been working in coordination with national Health Management Information System (HMIS) departments to establish structured, dynamic databases, with an adaptable repository structure in DHIS2 and guidance on relevant data elements and indicators, their definitions and computation. See Table 9 and Figure 7 for progress in MDR development as defined by WHO.

Table 9: MDR by Country (March 2024)

Country	Status of MDR
Burkina Faso, Cameroon, Ghana, Mozambique, Nigeria, Tanzania	Advanced stage of development
Cote D'Ivoire, DRC, Kenya	Initiated MDR
Angola	MDR planned

In MDRs, routine case data is complemented by survey data on malaria intervention coverage and behaviors, though these surveys are infrequent and lack the granularity and timeliness needed for district-level SNT. Additional data, including geographical distributions of anopheline species, insecticide resistance, rainfall for SMC, instability and refugee movements, and occasionally SES, further inform funding allocations.

During the country case study process, the repositories in Nigeria and Ghana were examined for types of data stored, cleaning, curation, use and easy function with DHIS2. In both countries, the MDR is accessed as intended from within DHIS2 and is interoperable with it but is not used as a standalone repository for cleaned, warehoused case data from past years, which may require caution when DHIS2 is updated.

Additional data noted above are standard inclusions, including where digitized LLIN and IRS campaign coverage data. Climate data is not yet included in either country, but there are plans to do so soon.

Sub-national systems for epidemic, or timely response and adaptive management. Most respondents in the six visited countries, national and sub-national, reported looking at least monthly at cleaned sub-national DHIS2 data presented as a malaria bulletin; only in PNG do the majority indicate they cannot see summarized trend data. All visited countries except DRC reported having rapid epidemic response teams in place (ROS, KIIs), while DRC reports monitoring malaria surveillance data weekly to detect and respond quickly (ROS). Several countries reported the availability of systems, through multisectoral engagement, for additional data on meteorological forecast, population mobility and vulnerability (e.g. Kenya, Nigeria, Zambia, Malawi) to inform the epidemic response.

Malawi example: DQ improvement and growing SNT maturity between GC5 and GC7. In general, FRs reflect an explicit transition from surveys (GC6) to the use of routine data (GC7) to improve spatial and temporal resolution. Malawi improved data completeness, timeliness, and accuracy to over 90% by 2022, up from just 7% accuracy in 2017. By GC7, quarterly district malaria data review had expanded to all 29 districts (GC7 FR, Malawi, 2023). Malawi also established epidemic thresholds, a notification system, and case tracking every two weeks. A growing SNT sophistication accompanied these efforts: universal coverage was prioritized in GC6 except for IRS, which was reserved for HB areas, but by contrast, in GC7, a prioritization matrix was deployed to illustrate how "interventions were considered in a sequential-stepwise approach" (GC7 FR, Malawi, 2023). The matrix listed all interventions and their identified impact, with a scoring system to determine which to include in the FR. The Global Fund KII respondents confirmed that these prioritization matrix approaches, which were seen in several other FRs, are organic and bespoke.

4.4.2 Sub-national Data and Analysis **(Informing Stratification, Intervention Mix Decision-Making, Quality of Care, and Evaluation)**

Below the evaluators describe the sub-national data and analysis used for different "steps" in the SNT process, including stratification, targeting and tailoring, intervention mix decision-making and prioritization.

Risk stratification: data and decision-making. Between GC6 and GC7, awareness and use of epidemiologically informed malaria risk stratification increased significantly. By GC7, 28 of the 30 primary evaluation countries included stratified risk maps in their NMSPs, and most in their FRs, sometimes as annexes, though these were often incomplete or hard to locate in the context of extensive FR documentation (see Table 10). Based on this assessment, nine countries used WHO's prevalence-based stratification technique with MAP assistance, combining routine incidence data and all-cause mortality, while five others used a combination of incidence and prevalence. Others stratified using prevalence alone, incidence/API alone, or bespoke combinations of data (e.g. incidence and vulnerability). Several countries now carefully adjust incidence data based on health care access and use.

Table 10: Stratification by Country (Portfolio Analysis)

Country	Burden share 2023 WMR*	Epi stratification as of GC7 in either NSP or FR	Stratification maps in the FR	Which GF round(s)	Type & data sources used GC7
Angola	Cases 3.4%, Deaths 3.2%	Yes	Yes	GC7	Risk stratification - modeled combining modeled DHS prevalence & 2018-20 incidence
Benin	Cases 2.1%, Deaths 1.8%	Yes	Yes	GC6 &7	WHO -- Combines prevalence, incidence, and all-cause mortality.
Burkina Faso	Cases 3.2%, Deaths 2.7%	Yes	Yes	GC 6&7	WHO - Combines prevalence, incidence, and all-cause mortality.

Burundi	Cases 1.4%, Deaths 1.2%	Yes	Yes	GC7	Prevalence & incidence
Cameroon	Cases 2.6%, Deaths 2.2%	Yes	Yes	GC6 & GC7	WHO -- Combines prevalence, incidence, and all-cause mortality.
CAR	Cases 0.7%, Deaths 0.9%	Yes	No, but maps of prevalence and incidence	GC7	Maps of deaths, incidence and prevalence in the NSP but no formal stratification.
Chad	Cases 1.5%, Deaths 2.2%	Yes	Yes	CG7	Detailed incidence maps
Congo	Not specified	Yes	Yes	GC7	By incidence
Côte d'lvoire	Cases 3.0% Deaths 1.8%	Incomplete	Yes	GC7	Two separate maps of risk strata were presented—one with four strata in the FR and another with five in the MTR
D.R. Congo	Cases 12.3%, Deaths 11.6%	Yes	Yes	GC7	WHO procedure; reliance on older prevalence survey and routine incidence data; all-cause mortality data under-weighted due to reliability concerns.
Ghana	Cases 2.1%, Deaths 1.9%	Yes	Yes	GC6 & GC7	WHO -- Combines prevalence, incidence, and all-cause mortality.
Guinea	Cases 1.8%, Deaths 1.7%	Yes	No	Unknown	In NSP, geographical stratification by incidence in three strata (less than 50, 50-75, >75) -- example of stratification of a country much lower than some in our sample, and demographic stratification by prevalence-- children 5-14 found to be most highly affected.
India	Cases 1.4%, Deaths 0.9%	Yes	Yes	GC 6&7	API Stratification - GC7 included four categories.
Indonesia	Unknown	Yes	No	Unknown	API Stratification
Kenya	Cases 1.4%, Deaths 1.9%	Yes	Yes	Unknown	Prevalence map was developed using data from the KMIS, as the most recent indicator survey was conducted in 2015 and did not include district-level resolution.
Liberia	Cases 0.7%, Deaths 0.6%	No	No	Unknown	No map, but tables of parasite prevalence and API by region
Madagascar	Cases 1.4%, Deaths 1.5%	Yes	Yes	GC6 & GC7	Historical incidence in NSP 2018-2022-- most recent NSP not available
Malawi	Cases 1.8%, Deaths 1.2%	Yes	No	Unknown	WHO -- Combines prevalence, incidence, and all-cause mortality.
Mali	Cases 3.2%, Deaths 3.2%	Yes	Yes	GC6 & GC7	Incidence data is used. Prevalence map also included for reference
Mozambique	Cases 4.2%, Deaths 3.5%	Yes	Yes	GC 6&7	Maps are developed based on modeled incidence and prevalence.
Niger	Cases 3.1%, Deaths 5.6%	Yes	Yes	Unknown	Stratification: Divided into four categories.
Nigeria	Cases 26.8%, Deaths 31.1%	Yes	Yes	GC 6&7	Based on prevalence, reported cases, and malaria mortality. EIR map is also available.
Papua New Guinea	Cases N/A, Deaths 0.6%	No	No, but map of incidence	GC6 NA	Unknown
Rwanda	Not specified in cases or deaths.	Yes	Yes	GC7	API, with 4 levels, where "low" is less than 100>1000, and high is >450/1000
Sierra Leone	Cases 1.1%, Deaths 1.3%	Yes	Yes	Unknown	In NSP, prevalence + incidence maps. Demographic stratification of prevalence.
Sudan	Cases 1.1%, Deaths 1.3%	Yes	Yes	Unknown	Incidence + prevalence (KEMRI) + all-cause mortality (IHME)

South Sudan	Cases 1.1%, Deaths 1.1%	Yes	No	No	Population adjusted prevalence maps in the NSP
Tanzania	Cases 3.2%, Deaths 4.4%	Yes	Yes	GC6 & GC7	Stratification divided councils into four burden and one urban using five indicators: 1.) Prevalence from school-based parasitemia surveys 2.) Fever TPR, 3.) API from lab data.4.) Confirmed malaria incidence from outpatient departments 5.) TPR from ANC.
Togo	Cases 0.8%, Deaths 0.6%	Yes, details in a reference	No, but maps of incidence and prevalence		Historical incidence and prevalence maps in GC7
Zambia	Cases 1.5%, Deaths 1.4%	Yes	Yes	GC7	Incidence, but of excellent quality-- stratified by HFCA

*Source: World Malaria Report, 2023

Examples. Tanzania, which conducts bi-annual school-based parasitemia surveys, has a unique country-led data-driven approach. The program performed a composite risk stratification of councils into 4 burden strata + 1 non-epi stratum (urban) based on five indicators: prevalence from the school-based parasitemia surveys, fever test positivity rate and Annual Parasite Incidence (API) from the laboratory, confirmed malaria incidence from OPD, and Test Positivity Rate (TPR) from Antenatal Clinics (ANC) (National Malaria Strategic Plan 2021-2025, Tanzania, 2020). Kenya used statistical modeling of case data from KEMRI for stratification at county/sub-county levels in GC7, as survey data was considered too old to be reliable (KII, National).

At the lower end of capacity, South Sudan's epidemiological risk map, included in the NMSP but not the FR, is considered by international respondents to be unreliable due to flawed MIS data: *"WHO tried to look at it and came back and said the data is…poor quality*" *(KII, Global),* with only 40% of facilities reporting cases (KII, Global). This is unsurprising given the ongoing humanitarian crisis, including two million displaced persons (OCHA, 2023) and its 2022 ranking of 192/193 on the UNDP Human Development Index; practically speaking South Sudan is targeting based on presumed vulnerability and operational feasibility. The TRP requested South Sudan to "'*do SNT' within a year*" *(KII, Global),* but feasibility is uncertain.
PNG has yet to conduct formal risk stratification but has historically stratified by altitude. Countries like South Sudan and PNG are exceptions, however: the sophistication of risk stratification is growing across the portfolio.

Do stratification levels make sense?

The WHO prioritization document "*Guiding principles for prioritizing malaria interventions in resource-constrained country contexts to achieve maximum impact*" (WHO, 2024) uses very specific definitions of risk strata as the basis for targeting and tailoring of recommendations. This precision allows practical guidance on, e.g., vaccine targeting, intended for moderate and high transmission areas. On the other hand, the actual practice of country stratification follows no clear rules, as is illustrated by an example of three countries who stratified by API in GC7. Guinea has three strata: <50, 50-75, and >75. Rwanda, with a much higher incidence, has four strata: low is <100, and high is >450. At the other extreme, India has 4 API levels, and the highest is >10/1000. This confusion over what constitutes a "high" burden is not lost on national programs: "*There's no clear understanding of the stratification process... If I go to Tanzania, they've got a different stratification. If I go to another country, they've got a different stratification. I think that is one of the key bottlenecks because we are targeting these strata with the appropriate interventions based on how we have stratified them…" (KII, National).*

Increase in data used for intervention targeting and tailoring. Since 2018 there has been a significant increase in the availability of spatially and temporally relevant data for SNT and a proliferation of increasingly visual, dashboard-informed or interactive ways of presenting it. Per the portfolio review, confirmed by global KIIs, targeting is most often determined on an intervention-by-intervention basis, with needed supplementary data (like insecticide resistance mapping or rainfall data) used to inform allocation decisions. As vector control expenditures dominate country allocations (see Domain 6) and as awareness of growing insecticide resistance and the costs of effective tools grows, attention is being paid to targeting these interventions more precisely. With assistance from PMI and the Global Fund, most countries are measuring insecticide resistance and species distribution in at least sentinel sub-national geographies. A small number of countries are attempting routine real-time entomological surveillance (e.g., of densities) that could be used to measure the impact of vector control interventions. Many are also measuring vulnerability (for demographic targeting), insecurity (for operational feasibility), access, movement and rainfall data (for SMC). Portfolio analysis and country support data from RBM shows a rapid and growing uptake of malaria matchbox assessments and other approaches to assessing gender and human rights priorities and barriers to access for vulnerable populations (see Domain 5). Among the availability of data categories considered important to more effective SNT, both population movement (intra- and cross-national) and climate change data were emphasized, along with more relevant, actionable data on gender, human rights, and vulnerable populations.

Ghana conducted epidemiological risk stratification using the WHO technique; the program exhibits high confidence in all three sources in GC7, as the country practices line-listing of death audits, had a recent malaria survey, and possesses a strong culture of data validity. Case data is disaggregated by sex in 5-year age bands. On top of epidemiological stratification, Ghana used additional sub-national disaggregated insecticide resistance data, sentinel site entomological data, user preference data, climate data, vulnerability and health access data to inform the targeting of different intervention combinations.

Level of disaggregation. While there is significant global conceptual alignment on the value and necessity of stratification data to inform targeting, KIIs revealed some disagreement on the level of data disaggregation and granularity required and appropriate for stratification and intervention mix decision-making, given feasibility, costs, and level of country readiness, and the high value of local knowledge in supplementing data that can be more feasibly collected and analyzed. In Cote d'Ivoire, for example, the cost to stratify Abidjan to target the most vulnerable urban communities would have required half of the overall LLIN budget available for the city. Instead, targeting was based on a combination of available data and expert judgment: *"it's imperfect, but we probably have gotten it mostly right" (KII, Global)*.

Use of operational and quality of care data for targeting and tailoring. Several international respondents expressed concern that the SNT process has neglected operational feasibility and quality of care concerns and has focused too heavily on newer interventions (e.g., the expansion of chemoprevention) rather than on "*how to strengthen the coverage and quality of existing interventions" (KII, Global).* Several national and global KII respondents emphasized ongoing improvements in this area, even if not reflected in formal SNT "outputs"; portfolio analysis also revealed progress across multiple countries on more targeted and tailored training, supervision, coaching, and mentoring to improve the quality of the malaria response. "*We do a separate, SNT type approach, bringing in all relevant data… to estimate where to… extend CCM, but it was a bit parallel to the SNT"* process (KII, National). Examples from PA are provided in Table 11.

Table 11: Key Strategies, Challenges and Outcomes Reported by Various Countries in Improving the QOC

Country	Key Strategies	Key Challenges	Outcomes
Malawi	QOC stratification targets mentorship for poorly performing facilities; mandatory district health management team mentorship programs address non-adherence to CM guidelines and supervision gaps; Health Network Quality Improvement System standardizes supportive supervision, linked to DHIS2; e-learning improves training access and is adopted nationally.	Non-adherence to CM guidelines; inconsistent supervision; improving real-time data integration.	Standardized supervision and mentorship; improved training access; enhanced real-time data availability and analysis.
Angola	CHAI-supported stratification informed by spatial analysis of burden, urbanicity, treatment, reporting rates, feasibility, and capacity; targeted approaches address low care-seeking and poor QOC contributing to severe cases.	Addressing low care-seeking behaviors; spatial analysis integration; improving urban implementation feasibility.	Targeted interventions informed by spatial data; addressed care-seeking gaps and severe CM.
Burkina Faso	Sub-district stratification targets support needs; 2021 HFA highlights QOC gaps, leading to prioritized training on severe malaria care (only 2% adequate QOC at basic facilities); malaria management score was 55%, prompting focus on provider training.	Severe malaria care quality gaps at basic facilities; limited provider training; data-driven QOC prioritization.	Improved QOC prioritization and tailored training for severe malaria; increased focus on data-driven decisions.
Togo	Introduced dual approach training (distance and face-to-face); piloted mentoring and formative supervision strategies for CHWs; implemented standards-based auditing with LSTM and University of Lome, increasing service use rate from 30% to 56%.	Limited CHW supervision (only 56% in 2022); improving operational capacity through innovative training methods.	Improved service use rate and operational capacity; enhanced CHW supervision and training effectiveness.

Source: GC7 FRs, Angola, Burkina Faso, Malawi, Togo, 2023.

Intervention prioritization, intervention mix decision-making, and scenario modeling. Obtaining clear information on the specific processes deployed and data used for intervention prioritization, intervention mix decision-making and scenario modeling through the FRs and NMSPs was a significant challenge. Some countries, like Malawi, deployed a prioritization matrix approach to illustrate how "interventions were considered in a sequential-stepwise approach" listing all interventions and their assessed impact (H/M/L), and a "scoring system to determine which to include." (GC7 FR, Malawi, 2023). The Global Fund KII respondents confirmed that these approaches, which were seen in several funding requests, are organic and bespoke. Malawi scored its priorities on a scale based on a consensus assessment of which were most likely to "enable achievement of impact targets" (scored high) or essential, but "cannot significantly affect achievement of impact targets" (scored moderate), moving priorities scored lowest to the PAAR (GC7 FR, Malawi, 2023).

Examples of intervention mix modeling. A number of countries conducted intervention mix modeling, though these were rarely elaborated with any detail in FRs. Recent country data published and/or presented by countries and partners provide a more accessible overview of progress and exemplars, along with information on specific country decision priorities, the limitations of data inputs, and uncertainties around modeling results and incorporation of these factors into decision-making. Mathematical modeling was used by **Guinea** to identify the most appropriate intervention package by district in the context of resource constraints, adding risk map layers based on seasonality, insecticide resistance, and intervention (including vaccine) coverage. Simulations of IG2 net targeting were undertaken with the goal of maximizing the number of cases averted; modeling was also used to prioritize districts for SMC expansion, as well as to determine the optimum number and timing of SMC cycles, to target a limited supply of vaccine (R21), and to determine the potential impact of PMC with or without the vaccine (Diallo et al., 2024). Guinea's prior planning process "applied interventions evenly in all districts, regardless of suitability." Guinea relied on

external partners for the data management and analysis for this exercise. While capacity has grown, it will take "much longer" (and concerted effort) for the program to develop geostatistical and mathematical modeling capacity (Diallo et al., 2024).

Angola conducted modeling built on a municipal-level stratification informed by burden, access, and operational feasibility and produced a ranking of priority municipalities, with CHAI support (Kialanda, 2024). This was followed by a budget-constrained prioritization of CFP nets to optimize deployment against prevalence and cases averted in under-fives. Seven scenarios were assessed, representing combinations of: lower coverage with CFP nets/higher coverage with less effective nets; urban areas with higher reported incidence/rural areas with lower reported incidence; current Global Fund provinces/a new province for CFP nets. The scenarios prioritizing CFPs over higher coverage demonstrated the highest reductions, among which Angola chose the scenario associated with relative ease of implementation. In a final example, Benin considered two possible extensions of its SMC strategy, either extending to ages 5-10 in currently targeted areas, or to under-fives in five new areas, with support from CHAI and STPH, finding that geographic extension would avert at least four times more severe malaria cases than the demographic extension and was thus likely more cost-effective (Houndjo, 2022; Lemant et al., 2024).

Evaluation of malaria SNT. National programmatic evaluation of the effects of their targeting and tailoring strategies is typically done through retrospective analysis during midterm reviews, and in advance of NMSP updates. At these times, stratifications may be updated, and intervention mix adjustments considered, as described above. A few formal evaluations were built into RSSH/M&E FRs, but most focused on single interventions; none were identified that examined layered strategies/innovative intervention mix decisions across a growing suite of new tools and delivery strategies. Global KII respondents expressed concern at the dearth of robust data on particular intervention mix decision questions. The step-by-step process for evaluating the effectiveness of tailored plans and updating them based on country-specific impact evidence, rather than solely monitoring for quality or detecting upsurges and epidemics, is poorly detailed in FRs and NSPs. This represents a "weaker link" in the SNT cycle, despite being a significant focus of discussions during mid-term reviews. As one person involved in providing technical assistance to NMPs explained, programs "*spend so much time on M, they don't do any E*" *(KII, Global).* There is considerable organic difficulty in evaluating the differential impact of one of several layered interventions; single interventions are not typically deployed in isolation under controlled conditions. The evidence base of effectiveness research on layered interventions remains scanty despite the ubiquity of their programmatic use (Conteh et al., 2021, White et al., 2011).

Indicators. Many stakeholders agree that the "right" KPIs or other indicators would be a significant enabler, if they could be aimed precisely: *"because 'at risk' spans several orders of magnitude in burden. 'At risk'" could be at risk of 100 infectious bites per year to one infectious bite every 10 years. You know, that's a factor of a thousand difference. And so, the bed net that's protecting a young kid in the hundred infectious bites per year setting is going to be... doing a thousand times more than the bed net protecting someone from one infectious bite every 10 years" (KII, Global).* There is a drive to measure more sub-national data, and a set of new sub-national indicators is now in use. Their use is voluntary, but many of the HB countries have adopted them.

Many respondents also recommended KPIs take better aim at burden and mortality, and that the Global Fund, in the words of one international respondent, *"Step back, invest in data, and focus on results" (KII, Global).* There is widespread agreement that KPIs need to change: *"Partly because the malaria indicators are modeled after HIV indicators and so they don't apply for an acute disease versus a chronic one. And because indicators are following the money and not necessarily the impact and the coverage of the interventions that we do" (KII, Global).* Their evolution, however, is expected to be slow: *"The challenge they face is trying to standardize across however many countries they're giving malaria grants to.... they're trying to have some sort of consistency so that it's easier for them to collate information and now, how many*

bed nets did we give out last year? ... So, when you generalize too much ...It makes it really challenging" (KII, Global).

4.4.3 Critical Challenge: Sub-national Data Quality, Use and Analysis

Despite the systemic data improvements noted in 4.4.1, and the growing complexity of SNT analysis and decision-making noted in 4.4.2, lack of key data, poor data quality, and need for improved sub-national data use/analysis capacity were cited overwhelmingly by all stakeholders as the most critical challenges to effective SNT (see Table 12). Portfolio analysis also revealed strong awareness of these deficits, with a growing focus on remedial efforts. As noted by both national and global stakeholders, this was evident in countries with both relatively strong data systems (e.g., Tanzania, Zambia) and those striving to improve data quality (e.g., Liberia).

Sub-national data quality in the six visited countries varied widely due to limited digitized data collection, reliance on paper-based methods, inadequate funding for audits, and insufficient skills. By design, countries represented a range of likely SNT experiences. Sub-national data availability, quality, and a strong data-use culture at sub-national levels was found together with higher stratification sophistication in Ghana, Kenya, and Nigeria, but respondents in all three countries reported high need for additional data quality improvement and none of three has full facility level electronic reporting. Improved sub-national data use and analysis capacity was identified as a priority by respondents in all six visited countries. ROS respondents identified several specific sub-national data priorities for improved effectiveness. (See *Annex L: Sub-national Capacities Requested*). These include the urgent requirement for real-time data availability at both national and sub-national levels to inform decision-making and interventions. Sub-national institutions need enhanced capacity for data analysis and interpretation, including specialized training in cartography and spatial analysis to tailor interventions effectively. Monitoring and evaluation were highlighted as a critical area, with respondents emphasizing the need for quality audits of malaria data and the integration of M&E and data management training into routine processes. Building a culture of data-driven decision-making was deemed essential, including periodic reviews and strategic prioritization based on locally generated data to address malaria decision-making.

Table 12: Data Quality Needs Expressed by Programs

National KII
During data review meetings, we review data per health facility as part of surveillance... In terms of data quality, there's a lot of deliberation regarding improvement.
The most important thing and the most challenging thing is the quality data... most health facilities are overwhelmed by tasks, which impacts data quality, though efforts are made to improve it.
Data quality is one of the priorities for the Global Fund, but also for us, because we need to make informed decisions based on data.
Global KII
Sometimes partners hold intervention data that the program doesn't have... data quality is sometimes a challenge.
Quality data is essential... it's hard to optimize if you don't know what you're optimizing for.
There's still a lot of issues with the quality of case data. If there's a desire to get more granular with targeting intervention, then aggregate data is less useful.

Sub-national analysis capacity: Limited data analytics skills, especially at the sub-national level, were also identified by key respondents as key barriers to effective SNT in planning and execution. While national-level analytic capacity has improved, FRs highlight the need to strengthen capacity across all levels. Based

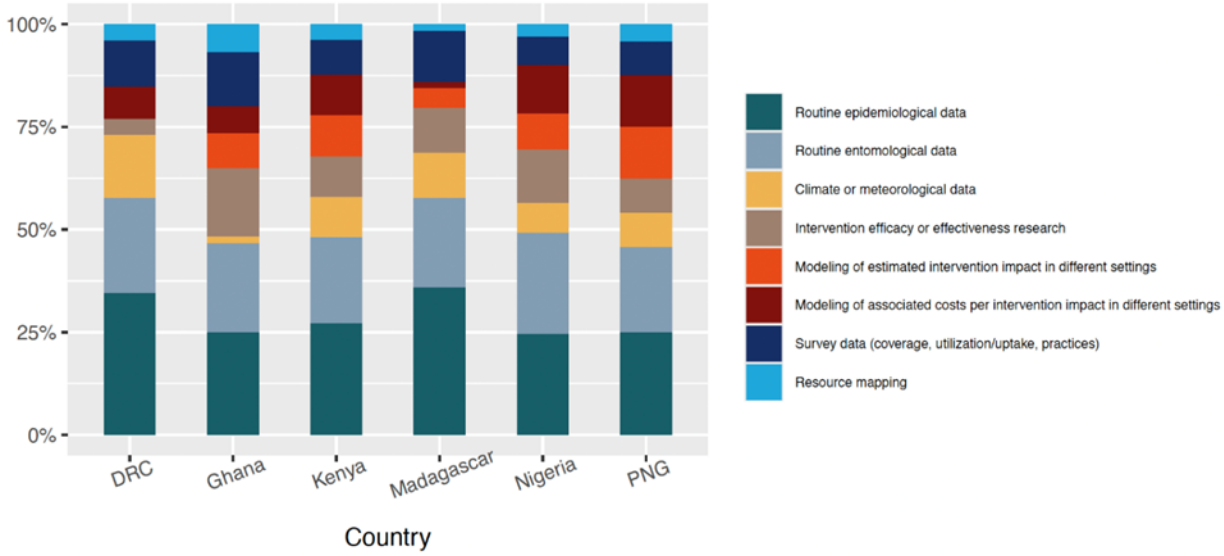
on data for 18 countries reporting, most countries had a dedicated data analyst at the district level, but fewer than a third had one below that level (RBM dashboard data).

4.4.4 Country Preferences for Ongoing Sub-national Decision-making

Preference for routine data for decision-making and data quality (DQ) improvement). In the ROS and country case studies, both national and sub-national stakeholders expressed a strong preference for routine data for ongoing, responsive SNT decision-making, as it is their real-time tool to observe and respond to malaria trends. When asked to specify the types of data/analysis improvements that would most benefit SNT, respondents evinced a particularly strong demand for routine epidemiologic and entomologic data improvements (see Figure 8). Both the review of the portfolio and KIIs make clear that this demand has been spurred in part by the SNT process, which has brought the limitations of routine data into stark relief.

Figure 8: Country Responses to ROS #21: Data Improvements That Would Most Benefit SNT

ROS Question #21: *Which of the following kinds of data or analyses, if improved, would most benefit sub-national tailoring decision-making? (check up to three)*



Notes on LFA. When asked "What is the right balance between funding Global Fund LFAs for data verification and transmission versus supporting data reviews and use sub-nationally?", an evaluation question derived from the RFP, respondents from national programs clarified that results from LFA visits are not shared with national programs. NMP members assured the evaluators that they respected the Global Fund's right to monitor their investments, but did not regard LFA visits as a means of improving data quality in country.

4.4.5 Domain 4 Conclusions

1. There were significant improvements in sub-national data availability, completeness, and accuracy between 2018 and the GC7 round. RSSH investments (including under C19RM) were a catalyst for sub-national data architecture, availability, analysis and use.
2. There is a growing array of data available for informing intervention targeting, tailoring, and decision-making, but evaluation of SNT is hindered by lack of evidence on effectiveness of layered interventions.
3. Despite improvements, stakeholders identified limitations in sub-national data quality, use and analytics as the largest barriers to effective SNT.

4. Routine, real-time data are preferred by programs for planning, monitoring and response. Continued improvement in routine data is prioritized by programs; all acknowledge significant issues with quality remain.

4.5 Domain 5 Findings and Conclusions

High Level of SNT Maturity and a Context-appropriate, Sub-nationally Tailored Malaria Response

The evaluation TOC assumes that the previous input domains (national and sub-national leadership, partner support, and better data and analytics) will bidirectionally produce/be produced by a high level of SNT maturity and a context-appropriate, sub-nationally tailored malaria response. Such a response includes data-driven stratification, intervention tailoring, prioritization, planning, implementation, monitoring, surveillance, evaluation and adjustment. This section presents analysis of SNT definitions, SNT maturity scores, trends across the portfolio in the context of increasing SNT maturity, gender considerations emerging from both secondary and primary data collection, and a discussion of malaria vaccines.

4.5.1 Analysis of Respondents' Definitions of SNT

Many national and international key respondents do not consider SNT to be new, and most interpret it as extending beyond stratification and intervention mix decision-making and prioritization in advance of NMSPs and funding requests, incorporating elements of the evaluation's extended conceptual model. Many of the approaches at the heart of the global SNT movement were pioneered by countries in and outside the main sample. The evaluation probed definitions of SNT across all stakeholder categories. There was general agreement on the purpose and elements of SNT in both international and national KIIs, though with some subtle differences. The phrase itself is referred to differently in francophone countries, whose respondents were more likely either not to have heard of SNT, or to equate SNT with risk stratification alone; this may indicate a need to do additional focused SNT process workshops in francophone countries. Tables 13 and 14 highlight key similarities and differences among global and national remote KII responses.

Table 13: Definitions of SNT (Global KIIs)*

# Respondents	Key components of SNT definition identified by KIIs	Expanded description of key component by respondents
15	Use of data and expertise to plan and define optimal approaches	Data-driven planning, expertise integration, and evidence-based approaches to optimize outcomes
10	Adaptation to local context and needs	Customizing strategies to fit local health challenges and priorities, ensuring context-specific solutions
8	Focus on achieving equity in health outcomes	Equity-driven goals, with focus on reaching underserved populations and reducing disparities
12	Prioritization of resource allocation based on impact	Strategic allocation of resources to maximize effectiveness and return on investment
9	Integration of real-time data for decision-making	Leveraging timely, real-time data to adapt interventions dynamically and improve responsiveness

*Individual responses may include multiple aspects of SNT definitions.

Table 14: National KII Definitions of SNT

# Respondents	Key components of SNT definition identified by KII	Expanded description of key component by respondents
9	Customizing health interventions and resource allocation based on local needs	Data-driven, evidence-based decision-making tailored to epidemiology and local needs
8	Using local data and contextual information to determine intervention mix	Integration of local data and contextual insights to inform decisions
7	Stratifying disease burden to prioritize resources and interventions	Focus on burden stratification (high, moderate, low) to optimize resources
6	Strategizing interventions using local data for impactful disease control	Strategic adaptation for achieving disease control goals using local insights
6	Utilizing local data to prioritize interventions within resource constraints	Resource-focused prioritization to deliver outcomes within constraints

5	Efficient resource allocation for maximizing return on investment	Maximizing efficiency and measurable impact through resource allocation
5	Comprehensive data collection and analysis at multiple levels	Multi-level data analysis and application to drive decision-making
4	Adapting interventions to local realities instead of uniform solutions	Acknowledge diverse local needs to refine interventions effectively
4	Targeted deployment of interventions guided by data	Emphasis on precision targeting to maximize intervention impact

4.5.2 SNT Maturity

The evaluators present SNT scores for 15 of the 30 countries, three countries scored using v. 1.0 and 12 countries scored according to v. 2.0 (Figures 9 and 10). Five evaluators on the team scored countries, and each evaluator only scored a single country.

Figure 9: SNT Scorecard (v. 2.0)

Theme	NMSP & context-appropriate interventions	Governance and policy framework	Planning and implementation	M&E	Institutional capacity for SNT	Data availability, quality and architecture	SNT Maturity Score	MAX possible	% of max
Angola	0.5	1	1	1	0.25	1	14.25	21	0.68
Benin	0.5	0.5	0.5	NS	0.5	0.5	11.5	21	0.55
Burkina Faso	0.5	0.5	1	NS	1	1	14.5	21	0.69
Burundi	0.5	1	1	NS	0.5	0.5	11.5	20	0.58
Ghana	1	0.5	1	1	1	1	19	22	0.86
Guinea	1	1	1	NS	0.5	1	12.5	21	0.6
India	0.5	0	0.5	NS	0	0	6	21	0.29
Malawi	0.5	1	1	NS	1	1	16.5	21	0.79
Nigeria	1	0.5	0.5	1	0.5	0.5	14	22	0.64
PNG	0	0	0.5	0.5	0	0.5	5.5	22	0.25
South Sudan	0	0	0.5	NS	0	0.5	5	19	0.26
Tanzania	1	1	1	1	1	1	15.5	21	0.74

Figure 10: SNT Scorecard (v. 1.0)

Theme	1a	1b	1c	1d	2a	2b	2c	2d	3a	3b	3c	3d	4a	4b	4c	4d	5a	5b	5c	5d	SNT	possible	% of max
DRC	0.5	0.25	0.5	0.5	0.5	0.3	0.5	0.5	0.5	0.3	0.3	0.5	0.25	0.25	0.5	0.5	0.5	0.3	0.5	0.5	7.75	20	39%
Kenya	1	1	1	1	1	1	1	0.5	1	1	0.5	1	1	1	0.5	0.5	1	1	1	0.5	16.5	20	83%
Madagascar	0.75	0.25	0.5	0.5	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	10.5	20	53%

4.5.3 Quantitative Analysis of SNT Correlates

Using ordinary least squares regression, the evaluation examined the statistical relationship between a country's SNT maturity index score and potential correlates, including malaria prevalence, changes in malaria cases over time, Global Peace Index rating, GDP per capita, health spending as a percentage of GDP, health spending per capita, and the Global Fund (malaria funding per person and per case). The results showed a marginally significant negative association between the Global Peace Index rating and SNT maturity score ($\beta = -0.07$, $p = 0.077$), indicating that countries with higher peace index ratings tended to have slightly lower SNT scores. However, this association disappeared in the multivariate model, suggesting that

other variables may confound or mediate this relationship. No other variables showed statistically significant associations with SNT maturity in either model. The small sample size limited the ability to draw definitive conclusions, emphasizing the need for further analysis with a larger dataset to validate these findings.

4.5.4 SNT Awareness in FRs and NSPs

SNT is not consistently or clearly reflected in Funding Requests (FRs), making it difficult to discern how countries incorporate SNT into their strategic plans. As highlighted in Domain 4, understanding the data and decision-making processes behind country SNT plans is often challenging based on the information presented in FRs. During an in-country visit, one respondent indicated: "*The application request should specifically require applicants' submission to reflect sub-national tailoring" (ROS)*.

However, FRs already contain a lot of information, prompting numerous comments from both national and international stakeholders that the FR process needs streamlining to enhance clarity and ensure that the country is in the driver's seat of providing the most relevant information. As one global correspondent noted about the funding request development: "*We became more prescriptive. We want to know everything about every country and have all the information. The level of detail [we ask for]is increasing. We had one third more annexes in [GC7] than in the previous… a small country will submit more than 1,000 pages …. And we have built huge technical capacity in the secretariat to be able to dive into the country level and then give very detailed guidance. So, it's the opposite of the country being in the driver's seat" (KII, Global).* While this approach enables thorough review of a country's current malaria program and status, it risks overshadowing the importance of country ownership and clarity, highlighting the national plans and data that drive the country's NSP and grant funding requests.

4.5.5 Intervention Strategies in the Context of Increasing SNT Maturity

Highly developed SNT plans are associated with a significant diversification of intervention strategies. Domain 4 highlighted some significant ways in which QOC is increasingly emphasized in sub-national targeting and tailoring of quality improvement strategies in some countries. However, SNT planning in GC7 in general tends to focus more strongly on choices among new interventions or intervention modalities, rather than efforts toward improvements in delivery, QOC and use. SNT planning tends to produce more complex combinations of layered interventions as the degree of SNT maturity rises, with interventions targeted to a more granular areas or demographics. SNT plans from countries with lower SNT maturity scores tend to practice intervention targeting at a regional level. As focus on SNT data use and planning grows, targeting moves to district level and lower. QOC targeting may be seen more rarely in GC7 FRs because it makes the most sense at a sub-district level. If this is accurate, it will be more likely to emerge as SNT capacity continues to grow across the portfolio.

Table 15: Trends Emerging in GC7 vs. GC6

Trends Emerging in GC7 vs. GC6
De-prioritization of urban LLIN coverage
Increased use of larval source management (LSM), most of it funded by national governments
Interest in sub-national elimination, even in HB countries
Widespread scale-down of IRS
Increased use of new nets and away from standard LLINs; increased diversity in LLIN targeting
Increased emphasis on/expansion of community health systems
Greatly increased use of seasonal malaria chemoprophylaxis (SMC)
Increasing and increasingly customized versions of intermittent preventive treatment (IPT) for pregnant women, children or schoolchildren
Beginning use of e-learning and telehealth

4.5.6 Gender in GC6 and GC7 FRs

In GC6, countries reviewed demonstrated a limited understanding of the intersection of gender and malaria across the malaria risk and intervention spectrum. In some, attention to gender was considered sufficient

based on provision of malaria in pregnancy services and free commodities; in others limited sex differentials in available burden data were used to argue that gender is not relevant to malaria program decision-making. Some countries argued that malaria elimination is inherently equitable, as "any person of any gender engaged in any high-risk behavior is a beneficiary" (GC7 FR, Indonesia, 2023). To the extent that countries specified action in response to gender-related malaria drivers, it was generally vague, e.g., "For all interventions there will be intentional mainstreaming of gender equality, equity and social inclusion." (GC7 FR, South Sudan, 2023)

The use of gender analytic tools in GC6 was rare, though many countries proposed such analyses, usually a Malaria Matchbox Assessment, to generate more specific and actionable data. The RBM country support tracker confirms growing demand for and use of the Malaria Matchbox Tool both in advance of and during the GC7 round funding. In GC7, several countries acknowledged, like Togo, that "gender equality and human rights were poorly reflected in previous grants" and proposed remedial steps (GC7 FR, Togo, 2023). Others showed demonstrable progress in use of malaria-relevant gender data in their strategic thinking. Several FRs emphasized growing women-centered, community-based services through CHWs and partnerships with maternal, newborn and child health departments, greater engagement of women's groups (e.g., Congo) and promoting men's roles in facilitating women's access to care, including model-husband groups (Benin) and "husband schools" with town hall meetings (Liberia) (GC7 FRs, Benin, Congo, Liberia, Togo, 2023). Zambia and Tanzania both reported aiming for equal female participation in vector control, including IRS and larviciding (GC7 FRs, Tanzania, Zambia, 2023). Mozambique was unique in having performed a full gender and social inclusion analysis that generated recommendations at legislative, health organization, community, interpersonal and individual levels and a household survey including relevant sex disaggregation of key impact and outcome indicators for further analysis (GC7 FR, Mozambique, 2023).

During the case study visits, PNG stakeholders emphasized robust, gender-responsive planning as a priority for technical support, and in Kenya, stakeholders pointed to investments from the Global Fund as key to ensuring support to human rights, gender, and vulnerable groups based on community and CSO inputs.

Lack of consensus on how Global Fund strategic objectives are related to SNT. KII respondents at both the national and global levels revealed differing understandings of the way in which Community, Human Rights and Gender (CRG) objectives align with the main goal of ending disease. Many agree that health equity, SNT, and progress against disease are indissolubly linked. As one global respondent put it: "*At a fundamental level SNT is about equity... the diagram of equity where it shows a fence and three different heights of people. Equality is everyone gets a single box. You know what an equity-based approach is? The person who's already staring over the fence doesn't need a box. The person who one box gets them over the fence, gets one box*" *(KII, Global).*

Some stakeholders were critical of the Global Fund's CRG approaches, arguing that they remain siloed. A move to comprehensive sub-national tailoring, they say, should obviate the need for separate articulation of gender responsiveness. A few felt that the CRG objectives, while laudable, had potential to distract from efforts to achieve the primary goal of malaria reduction, noting that relative urgency of disaggregating malaria data by sex might depend on context and is not cost-free in terms of health force workload. Others noted the need to put more focus on SES linked disparities (KIIs, National).

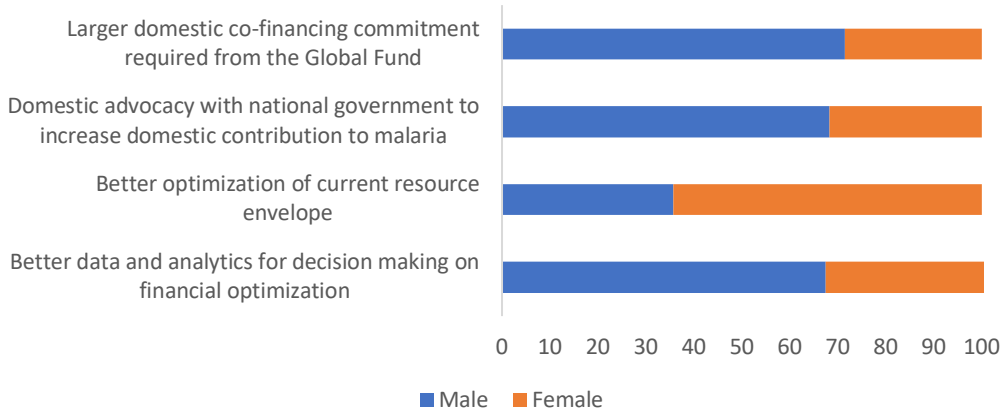
4.5.7 Gendered Responses to ROS Questions

The evaluation team evaluated sex-disaggregated data from the ROS to see whether gender-related difference in responses (36% of which were from females) emerged. As an example, see Figure 11, which shows that in considering which of four resource mobilization or resource optimization options is most likely to lead to increased disease impact, many more females than males preferred optimization of the current

resource envelope, while males and females preferred domestic advocacy, more pressure from the Global Fund or better data and analytics for decision-making in roughly representative portions.

Figure 11: Gender Responses to ROS #4, Disease Impact Avenues

ROS Question #4: *Which avenue is MOST likely to result in additional disease impact? (All country respondents, by gender)*



In an open-ended question, respondents were asked what resources or capacities besides funding the program needs to be effective. Males emphasized leadership, program coordination, ICT infrastructure, and data systems for monitoring and reporting. Females focused more than males on advocacy, community engagement, and addressing gender-specific needs, such as resources tailored to gender and human rights. Both genders indicated the importance of capacity building.

ROS respondents additionally were asked which data if improved would most benefit SNT decision-making and were asked to select up to three responses. Overall, females focused on resource allocation and practical impact, with top priorities being resource mapping, survey data (coverage, utilization and uptake) and modeling of estimated intervention impact in different settings. In contrast, males prioritized technical and data-driven approaches, with their top three preferences being climate or meteorological data, intervention efficacy research and routine entomological data.

4.5.8 Malaria Vaccines

Gavi supports the procurement, rollout and delivery of the malaria vaccines, including ancillary equipment and cold chain support. The Global Fund provides broad support for malaria prevention and control and RSSH-Pandemic Preparedness and Response (PPR) interventions. The Global Fund does not currently finance procurement of malaria vaccines and ancillary equipment, as this is under Gavi's mandate.

The evaluation's analysis of vaccine consideration in overall malaria targeting and tailoring interventions was based primarily on a review of 30 FRs and associated NSPs in GC6 and GC7. As such, it is limited in its ability to provide updates since 2023, except through the six country case studies and perspectives and experience shared through remote stakeholder consultations, both global and national. While progress has been made in advancing the Global Fund-Gavi partnership (Gavi, 2024; The Global Fund, 2024), the report is focused on evidence generated by the evaluation.

The three vaccine pilot countries (Ghana, Kenya, Malawi) were among the 30 countries in the main sample, and all have integrated the vaccine into routine immunization systems; an additional 12 have vaccine roll-out policies or guidelines in place (Osoro et al., 2024). In both Ghana and Kenya, vaccine targeting was conducted as required for the pilot, based on high burden and good overall immunization coverage, including extension to control areas in the second round. By the third round, the vaccine was integrated with SNT and the NSP as part of a set of interventions targeted to HB areas. In Ghana's case, the vaccine was explicitly included in 12 formal intervention combinations targeted to sub-national risk strata in the NSP, but no impact projection modeling was performed on the combinations. (Ghana NMESP 2024-2028, 2023). In Kenya,

vaccine targeting decisions were made through the national TWGs based on predetermined criteria to target at-risk children in selected HB counties (KII, National). KIIs with NMPs in vaccine countries confirmed that countries have conducted sub-nationally targeted vaccine deployment based on WHO guidance to direct vaccine to areas with high and moderate transmission (KIIs, National).

While Global Fund–Gavi guidance issued in late 2024 emphasizes the importance of considering "the optimal mix of malaria control interventions, including malaria vaccines, to optimize the use and impact of all available resources" (Global Fund & Gavi, 2024), specific SNT guidance related to vaccine integration into the broader intervention mix is pending. With exceptions, consideration of the vaccine in the context of broader SNT was limited in GC7 requests due both to timing and, based on KIIs with national programs, because funding sources for the vaccine are separate. Even in Malawi, where the vaccine was piloted and has been integrated into routine systems, the vaccine appeared as an afterthought in the GC7 FR (GC7 FR, Malawi, 2023). That said, there were several notable exceptions. Guinea, for example, used mathematical modeling to identify the most appropriate intervention package by district, to target its limited supply of the R21 vaccine, and to determine the potential impact of PMC with or without the vaccine (Diallo et al., 2024). Mozambique integrated the vaccine into its intervention mix modeling, reaching the conclusion that based on cost effectiveness, it would choose to scale up SMC before prioritizing the vaccine as part of its malaria intervention mix (Candrinho, 2024).

Cost-effectiveness concerns. Several global and national respondents expressed concerns about the relative cost effectiveness of vaccines and how they should be deployed in relation to other tools. Partners and countries expressed the need to integrate the vaccine into broader malaria intervention mix decision-making and the lack of relevant data to facilitate those decisions. Assessing cost effectiveness is quite complex, as the evidence base is thin: *"We have no data [on] the potential impact of PMC plus vaccine" (KII, Global)*. A recent modeling analysis (Topazian et al., 2023) attempted to take on this complexity, concluding that investment in expanded LLIN coverage or SMC is more cost effective than the introduction of the RTS,S vaccine, and that the latter is cost effective only when these other measures are in place (Topazian et al., 2023). Modeling conducted with the national program in preparation for a national strategic plan update in Kenya found as a key message that "the impact of vaccination appears to be relatively moderate compared to the health benefits gained from bed nets" (Selinger et al, 2023). Several stakeholders expressed concerns about the vaccine taking focus from other priority interventions: "*you layer in [RTS,S] and that gives you … at the most 30% reduction in severe disease… we shouldn't distract ourselves from the fact that we still need prompt diagnosis and treatment…the IRS, the nets, we still need IPTp" (KII, National).*

Based on KIIs, the full progress of the Global Fund's evolving partnership with Gavi has not yet permeated the SNT stakeholder community and was felt to be a priority for continued attention, along with better country and stakeholder communication and the development of actionable guidance. A Global Fund respondent noted: *"It's terribly difficult for institutions to merge … processes, they all have their timing, their procedures, their inspector generals. But the conversation has gone further, particularly in terms of support for joint, country-level strategic and operational planning" (KII, Global).*

4.5.9 Domain 5 Conclusions

1. The portfolio's increasing SNT sophistication is reflected in evaluator scores of SNT maturity in 15 countries (40% high, 40% moderate, and 20% low maturity).
2. SNT in GC7 is more focused on choices among new interventions or combinations of layered interventions and less directed toward improving the quality of existing interventions through improvements in delivery, QOC and use, though these are improving as SNT becomes more granular.
3. The integration of gender, human rights and vulnerable population concerns into NSPs and FRs is progressing slowly, with increasing use of related assessments, analytic tools and TA, and emerging

program exemplars. Stakeholders differ on whether community, human rights and/or gender objectives are separate from, or crucial to, disease impact goals.

4. With some exceptions, the malaria vaccine was not considered in the context of broader SNT intervention targeting and tailoring decisions in GC7. National and international stakeholders expressed concern about the relative cost effectiveness of the malaria vaccine (with most referring implicitly or explicitly to the original vaccine as opposed to the newer, more efficacious one).

4.6 Domain 6 Findings and Conclusions

Optimized Resource Use

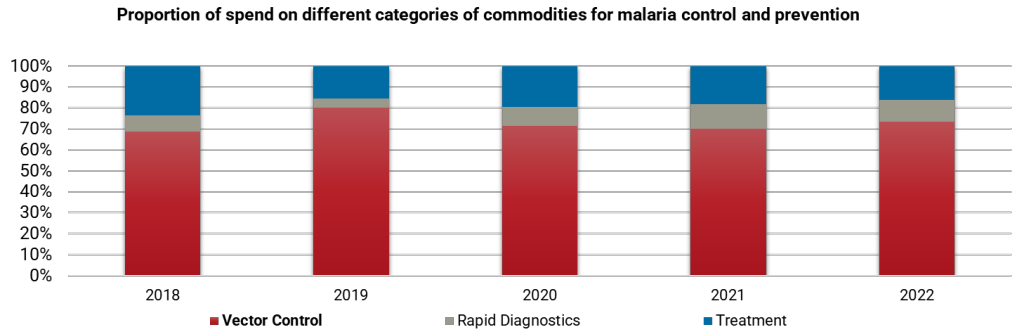
The challenge of allocating limited resources in the effort to achieve impact against malaria is enormous. Across the sample of 30 countries in GC7, 11.9 billion USD was needed in malaria financing, of which 6.7 billion USD was financed, leaving a gap of 44% (analysis of RBM data). The widespread dissemination of the SNT process has sharpened the focus on resource constraints. SNT encourages countries to propose optimized interventions at granular levels, exposing significant resource gaps. This can either drive despair or spur investment: *"[one other thing is] demotivation, especially to health staffs at the council level. We have said they prepare micro certification maps, local ones... identify priority areas where they would like to invest based on the burden of disease. But they don't get the resources to implement...I think you can imagine how reluctant they will be in the following years" (KII, National).*

In FRs, resource optimization is often framed in terms of efficiency through integration and cost savings, rather than cost-effectiveness or cost per unit of impact. True resource-optimized SNT plans, in which proposed intervention sets with estimated impacts and relative costs per impact are compared, and an "optimal" one chosen, are still rare, given the difficulty of the exercise.

The construction of optimized and costed interventions and strategies, created to achieve the maximum disease impact possible for funds spent, is, in terms of WHO process steps outlined in the upcoming SNT manual, meant to be followed by resource mobilization and then by prioritization—the process by which countries decide what the resource envelope can support. Given that 70-80% of funding for malaria commodities goes towards vector control (see Figure 12), resource optimization—and prioritization-- in this area of malaria is particularly significant.

Interviews with stakeholders revealed interest in pursuing domestic resource mobilization for additional vector control from a few different angles, including public-private-philanthropic (PPP) partnerships for vector control (KIIs, National (several countries), Global).

Figure 12: Proportion of Global Spend on Commodities for Malaria Control and Prevention, 2018–2022 (McGuire, 2023)



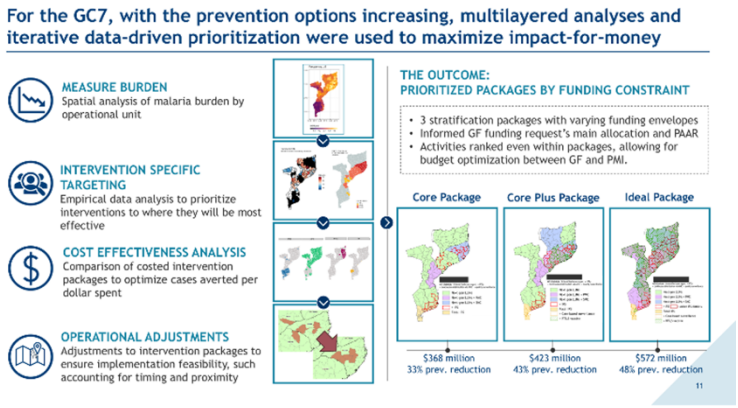
4.6.1 Resource Optimization

Defining and operationalizing resource optimization. As part of this evaluation, key informants were asked how they define *resource optimization*. As noted previously, resource scarcity is the shared foundation for optimization discussions and a driver of the revitalized focus on SNT. Overall, among global respondents, key informants underscore that resource optimization involves operating within limited resource envelopes; however, it is more common in FRs to discuss optimization in terms of efficiencies created by integration or economies, rather in terms of greater impact for a given cost. Interviews also highlighted significant challenges in defining and operationalizing resource optimization and cost effectiveness.

Formal resource optimization modeling for malaria remains uncommon. According to a recent Oxford systematic review (Ngwafor, 2024), resource optimization is defined as "the use of mathematical techniques to identify the best possible strategies or determine the optimal mix and coverage levels of interventions of the geographic targeting of resources for achieving specific objectives." The review identified only 15 studies meeting its criteria, approximately half of which were conducted in Africa. Most models lacked clear articulation of analytic perspectives, tabulation parameters, and cost inputs. Furthermore, cost sensitivity analyses were rarely performed, limiting the robustness of these models. Countries *do* conduct prioritization exercises, though these are not usually supported by the modeled cost of different intervention sets.

A rare example: Mozambique. Mozambique's sub-nationally costed SNT plan aimed at maximizing impact with limited resources. For GC7, Mozambique employed a multilayered, data-driven approach incorporating spatial analysis of malaria burden by operational unit to prioritize interventions and optimize resource allocation. Cost-effectiveness analyses were conducted to compare three stratified intervention packages with different costs and projected impacts. Operational adjustments ensured that the selected intervention packages were feasible, accounting for timing, proximity, and implementation capacity (GC7 FR, Mozambique, 2023).

Figure 13: Mozambique's Resource Optimized SNT Plan



Challenges of Resource Optimization

- **Calculus of costs is challenging**. Costs depend on context. Calculating the true expenditure cost of an intervention, beyond the unit cost of commodities, is difficult. The cost of the social and behavior change communication needed to ensure use of the net, of *"not only of putting a bed net in a hand but ensuring that the person sleeps under it every night" (KII, Global),* varies enormously by geography, lifestyle, sociocultural factors, temperature and a host of other factors. Recent reviews of cost effectiveness studies in many countries note the difficulty of comparing malaria costs across different contexts (Conteh et al., 2021; Andrade et al., 2022). International stakeholders agree: "*There's actually quite a poor understanding of the actual cost of implementing an intervention..." (KII, Global).* Though programs are moving from budget costs to expenditure costs, the problem resists easy solution: "*We cost out the same programs in completely different ways... The variability is so intense that we cannot have one truth on financial optimization*" *(KII, Global).*
- **Determining cost per impact is challenging.** Assuming a true cost is obtained, it is even more difficult to calculate a cost per impact for a particular intervention. Impact varies by transmission stratum, by geography, by vector, by lifestyle, by intervention method, and of course, by whatever other interventions are layered with it. As noted previously, the evidence base of effectiveness research on layered interventions remains scanty despite the ubiquity of their programmatic use (White et al., 2011; Conteh et al., 2021. Not only are there not enough studies performed in enough transmission environments to manage the uncertainties in effectiveness, even where they are

performed there are no agreed-on measures of cost effectiveness. There are multiple ways to calculate cases averted, denominators of health facility catchment areas, etc. Without a clear consensus on how to measure cost per impact, efforts to optimize resources risk being misleading or contentious.

- **Unit costs may not be stable, as they are shaped by donor purchasing power.** Even the costs of commodities are not fixed. When global donors purchase commodities, they shape the market. For instance, when dual active ingredient nets are purchased on a very large scale, the price per unit goes down. A national stakeholder noted that the reverse is also true: *"if you scale down, the cost per head goes up…If we have IRS as much as we have bed nets, IRS will be cheaper than the bed nets that we hail so much" (KII, National).* Despite its proven impact on malaria transmission, IRS is frequently deprioritized because of its substantial cost, including in the latest WHO guidance. Lowered demand for the next generation insecticides recently developed in the WHOPES pipeline may affect unit costs for these products. A respondent expressed concern about the long-term prospects for elimination in a world where IRS use ceases: "*When countries stop using IRS, the manufacturers raise the prices because quantities are smaller. It becomes more expensive for the countries that still do it, and then where will IRS be when we need it?" (KII, National).*

These uncertainties, unless acknowledged and managed transparently, may complicate the use of COOPs, the SNT Explorer, the MINT tool and other innovations that require evidence-based agreement around cost and cost effectiveness inputs.

4.6.2 Need for improvement in impact evaluation

As noted in section 4.4.2, impact evaluation is a "weaker link" in the SNT process cycle, with implications for resource optimization and prioritization for countries. A standardized framework on best practices for measuring cost-effectiveness is urgently needed, as well as an improved evidence base for intervention effectiveness. Many recent intervention trends (growing use of LSM, switch from IRS to dual AI, changes in SMC cycle length) are not based on formal efficacy or effectiveness trials. Trials have compared dual AI LLINs with other LLINs, but not directly with IRS (PATH, 2023). Different layered combinations of SMC and LLINs have also not been comprehensively trialed; however, NMPs are conducting numerous natural experiments in varied contexts. The need for an improved evidence base might be partially met in a low-cost manner by many in-country studies of ongoing interventions, using an implementation research framework (Theobald et al., 2018, Feachem et al., 2019). Even where formal implementation research funds are not available, careful observation, monitoring, evaluation and documentation of sub-national and national impact can help determine which interventions are most effective for a given context.

4.6.3 Public-Private-Philanthropic Partnerships (PPP) **(for SNT Resource Mobilization)**

One lever identified in "The Big Push" (see 4.3.5) is improving access to interventions that already exist (KII, Global). Within the current global environment of limited donor capacity and funding, private sector or multisectoral engagement, domestic funding from government, and shared cost models with NGOs and local CBOs could all increase the cost-effectiveness and sustainability of interventions at the sub-national level (Jones et al., 2020). Given the rise in vector-borne disease, increases in the funding gap, efficiencies and resources available to non-government actors, and interest in partnerships between ministries of health and private sector and actors, there is interest in a broad multisectoral approach led by the health sector to expand and promote them.

A national technical partner recommended to the Global Fund to make room in the decision-making process for countries to choose to mobilize domestic resources: *"if the country is saying 'we want indoor residual spraying,' the country should know that it is not cheap. If they want it, [tell them]: "Please, how much can you support?" They might find their own money to add. Instead of telling them that 'no, we will give you this one [instead]'" (KII, National).* This point was made even more strongly by international stakeholders:

several respondents noted that SNT by itself will not solve resource constraints, and new partnerships and new resources are urgently needed: *"Implementation with the current funding gap is impossible… what's the point of doing the sub-national tailoring if we've got limited resources and we can only do X, Y and Z interventions. How do we optimize the impact of those interventions? By targeting them or creating new partnerships that identify complementary resources" (KII, Global).*

Selected Case Studies of Sub-national PPP Projects: Ghana, India, Nigeria

- **Ghana: two sub-national PPP case studies.** In 26 specific districts in Ghana, IRS was deemed the most effective intervention, but donor funding was not available. Instead, the government of Ghana provided funding for two of the 26 districts and a local pest control operation in Ghana was trained in and carried out a less resource-intensive version of IRS implementation. The campaign was recently completed and data collection on comparative cost-effectiveness is ongoing (KIIs, National and Global). (2) From 2005-2009 AngloGold Ashanti, a mining company, built a partnership with the Ghanaian government to implement a malaria control program in the Obuasi community in the vicinity of the mine. The program included vector control, rapid treatment, education and surveillance. In four years, average monthly malaria cases declined by 83% and cost of malaria treatment declined by 82%. These results helped secure Ghana a USD 138 million grant from the Global Fund. TAngloGold Ashanti Malaria Control Ltd (AGAMal) was the principal recipient, the first time a private company performed a lead role for a Global Fund grant in Africa (Mouzin et al., 2011). AGAMal has sprayed Obuasi consistently since 2006. From a starting prevalence of 43%, Obuasi's prevalence today is .9% (KII, National). AGAMal received an A1 grade in GC7.
- **India: Malaria Elimination Demonstration Project (MEDP).** Sun Pharmaceuticals collaborated with the National Institute of Research in Tribal Health (NIRTH) and the Government of Madhya Pradesh starting in 2015 to work toward elimination of malaria in Mandla, a high endemic district with a mostly indigenous population in 1233 villages with both demographic and access challenges, and to apply what was learned to the rest of Madhya Pradesh and the country. The main interventions were surveillance and CM through deploying additional grassroot workers and supervisory staff. Over 15 months, the project saw a reduction of malaria cases by over 80% and by ~90% in blocks with high transmission (Lal et al., 2019).

Cost-effectiveness of sub-national PPP. Further analyses are needed to compare the cost-effectiveness of traditional approaches to these "mixed" forms of public-private implementation at the sub-national level, but they offer the possibility of more sustainable financing. One stakeholder recommended that the Global Fund help document and incentivize localized, cost-effective delivery mechanisms for IRS. These mechanisms could also be leveraged for other vector control tools like spatial repellants (Swai et al., 2024).

Concluding note. Given the global crisis in malaria finances, SNT approaches are non-optional; optimized resource use is essential. To have maximal impact, however, new resources and localized, lower-cost approaches are needed. SNT of malaria interventions sharpens focus on desired impact, the means to obtain it, and the constraints that endanger its achievement. It builds agency and ownership of the data- and goal-driven decision-making essential for successful elimination. This is critical as national and sub-national governments are unlikely to invest in strategic approaches over which they feel little agency. To accelerate progress, stakeholder countries must provide more of the resources (human as well as financial), generate more of the ideas, and chart more of the direction in the global malaria effort. Expanded commitments from stakeholder governments could in turn prompt a renewed flow of international funds. As the world's largest donor of malaria funds strongly committed to country-level leadership, the Global Fund is uniquely positioned to lead a bold, disruptive sea change in global malaria strategy and planning, one that focuses on impact, leaves more room for countries to innovate and lead, and expects more shared investment of human and financial resources. Progress against malaria globally may depend on it.

4.6.4 Domain 6 Conclusions

1. Lack of resources is a significant disabler of progress against disease, even in the context of robust SNT: a prioritized plan may not achieve impact because funding levels are consistently below NSP needs. Programs emphasize need to improve domestic resource mobilization for prioritized, tailored programs, including public-private engagement.
2. FRs more commonly reference optimization in terms of efficiencies created by integration or economies, rather than in terms of greater impact for a given cost.
3. Programs encounter significant challenges in operationalizing resource optimization and cost effectiveness. Difficulties associated with obtaining accurate cost data and calculating cost effectiveness, particularly for layered/mixed interventions for which the research base is thin, multiply uncertainties.
4. Opportunities to engage the private sector in vector control (and in other aspects of health service delivery) have potential to increase access to interventions that countries believe are essential to achieving their goals.
5. The Global Fund and PMI play important market-shaping roles in commodity purchasing due to the sensitivity of manufacturer pricing to market volumes, and countries are highly affected by donor purchasing priorities.
6. Evaluation and documentation of the costs and impact of layered interventions in varied contexts in stakeholder countries could fill a critical evidence gap.

5.0 LESSONS FROM ELIMINATION/TRANSITION COUNTRIES

The evaluation team conducted an historical review of five countries that have either achieved elimination (Sri Lanka) or are in transition to elimination (Cambodia, Guatemala, Laos, and Panama), outlining key milestones on each country's pathway to greatly reduced burden. The aim was to elucidate commonalities, differences, and best practices on overcoming challenges on the path to elimination which may soon be faced by HBCs (see *Annex K: Elimination/Transition Countries: Historical Review*). Using a common set of domains to analyze each country, the evaluation team conducted a cross-country comparison. Table 1**6** below presents the results of a cross-country analysis.

Table 16: Cross-Country Comparisons

Domain	Sri Lanka	Costa Rica	Guatemala	Panama	Cambodia
Political will and commitment	High political will during civil war and at national level	Sustained political and financial commitment	Improved political will post-2005	Prioritized malaria elimination as a national goal	Political will indicated through the National Strategic Plan for Elimination (2011–2025)
Strong surveillance systems	Robust surveillance integrated with other diseases	Comprehensive surveillance with rapid response systems	Enhanced surveillance with active case detection	Centralized Vector Control Task Group	VMW-based surveillance and forest pack distribution
Community engagement	NGO partnerships, training of non-medical personnel	Volunteer collaborators for case detection and education	Community health workers trained and engaged	Indigenous community-focused initiatives	Community-based VMWs and health education
Effective vector control measures	IRS, DDT introduction, later replaced with pyrethroids	IRS, MDA, reactive vector control	IRS, LLINs, vegetation removal at breeding sites	IRS, larviciding, and bed net distribution	LLINs, reactive IRS, IPTf for forest-goers
Adoption of innovative treatment protocols	ACT introduction and observed prophylaxis for soldiers	7-day chloroquine/primaquine protocol	Chloroquine/primaquine for stratified interventions	Unclear	Radical cure programs for P. vivax

Support from international partners	Global Fund support, WHO collaborations	PAHO guidelines, regional recognition (Malaria Champion award)	Global Fund, Elimination of Malaria in Mesoamerica and Hispaniola Island (EMMIE) regional collaboration	Roll Back Malaria, WHO, Global Fund support	WHO, PMI, and international donor support
Integrated health system strengthening	Integrated malaria with other public health initiatives; paced decentralizatio n	Leveraged UHC for malaria elimination	Health worker recruitment and training expansion	Decentralized malaria program with enhanced focus	Integrated malaria into health system reforms
Adaptability to challenges (e.g., conflict, natural disasters)	Adapted to civil war constraints	Addressed ecological complexities like primate reservoirs	Addressed agricultural and migratory challenges	Adapted to cross-border and migratory challenges	Managed antimalarial resistance
Targeted interventions for high-risk populations	Focused on conflict zones and high-risk areas	Proactive targeting of imported cases and mobile populations	Focused on coastal and cross-border hotspots	Targeted indigenous regions and remote areas	Targeted forest-goers and mobile populations

6.0 CONCLUSIONS AND STRENGTH OF EVIDENCE RANKING

Table 17: Strength of Evidence Ranking of Conclusions

	Description	Data Sources	Rating
Domain 1	Strong program leadership is central to SNT success.	KII, ROS, ET	Strong
	SNT mature countries demonstrate strong ownership of SNT process, products, and decision-making, and vice versa.	PA, CV, KIIs, DR, ET	Strong
	SNT sharpens focus on the impact of resource constraints at both national and sub-national levels and is a driver of domestic resource mobilization.	PA, CV, KIIs, DR, MR	Strong
	Effective climate-malaria partnerships remain nascent at both country and global levels, but awareness is growing in preparation for GC8.	PA, KIIs, DR, MR	Moderate
Domain 2	Countries with more robust sub-national decision-making on malaria have many of the following enabling factors: well-paced political and fiscal decentralization; stronger sub-national health governance structures; a high level of digitization; regular communication between national and sub-national levels on malaria data validity, interpretation, and use; increased resources at sub-national level; capacity building of sub-national teams in data analysis and use; adequate human resources; and more systematic community engagement.	KIIs, CV, DR, ET	Strong
	Even national programs with a high level of SNT maturity navigate political factors that influence execution of SNT plans.	KIIs, CV, ET	Moderate
	Flexibility in donor financing may facilitate sub-national devolution of funding, and vice versa: decentralized fiscal structures may also facilitate sub-national donor alignment.	DR, KIIs	Limited
	Rapid, extensive CHW expansion and community data integration across the portfolio have significantly enabled SNT progress. Coordination of growing, multi-donor investment in community health worker programs (including malaria components) and district/sub-national systems is perceived to be weak but improving.	PA, KIIs, DR, CV, MR	Strong
Domain 3	Longer-term, NMCP-embedded, systems-oriented SNT TA has been a significant enabler of SNT advancement.	PA, global KIIs, DR, CV, MR	Strong
	Countries are focused on building local capacity; TA should focus on skills transfer.	KIIs, CV, DR, MR, ET	Strong
	Among global stakeholders, there was widespread acknowledgment of intra-partner misalignment as a "disabler" of effective SNT. Initiatives aimed at partner coordination (e.g., COOP, RBM dashboard) are steps toward addressing transparency and harmonization concerns.	Global KIIs, DR, MR	Strong
	Many programs highlighted concerns that national consensus and local expertise are undervalued by partners. Many global stakeholders acknowledge this as a persistent and significant issue, despite significant partner efforts to address it.	KIIs, CV, ET	Strong
	Differences exist between TRPs/FR TA and some country programs, especially around vector control; some advice has felt "de-stratifying"; local expertise is not always appreciated; recent WHO guidance for resource-constrained contexts enshrines a more proscriptive stance toward IRS that is out of step with what some national programs believe is necessary for elimination.	KIIs, PA, CV, ROS	Strong
	Country stakeholders prioritized scale-up of routine entomological surveillance as a source of data needed for decision-making on vector control interventions.	PA, CV, ROS, in-country KIIs, ET	Strong
	Some country programs would like more inclusion in global strategic planning and decision-making fora.	National KIIs, CV	Moderate

Domain 4	There were significant improvements in sub-national data availability, completeness and accuracy between 2018 and the GC7 round. RSSH investments (including under C19RM) were a catalyst for sub-national data architecture, availability, analysis, and use.	PA, global KIIs, DR	Strong
	There is a growing array of data available for informing intervention targeting, tailoring and decision-making, but evaluation of SNT is hindered by lack of evidence on effectiveness of layered interventions.	PA, KIIs, DR, CV	Strong
	Despite improvements, stakeholders identified limitations in sub-national data quality, use and analytics as the largest barriers to effective SNT.	KIIs, ROS	Strong
	Routine, real-time data are preferred by programs for planning, monitoring, and response. Continued improvement in routine data is prioritized by programs; all acknowledge significant issues with quality remain.	National & global KIIs, ROS, DR, PA	Strong
Domain 5	The portfolio's increasing SNT sophistication is reflected in evaluator scores of SNT maturity in 15 countries (40% high, 40% moderate and 20% low maturity).	SNT maturity index was based on analysis across CV, PA, DR, MR	Moderate
	SNT in GC7 is more focused on choices among new interventions or combinations of layered interventions and less directed toward improving the quality of existing interventions through improvements in delivery, QOC, and use, though these are improving as SNT becomes more granular.	PA, KIIs, DR	Strong
	The integration of gender, human rights, and vulnerable population concerns into NSPs and FRs is progressing slowly, with increasing use of related assessments, analytic tools, and TA, and emerging program exemplars. Stakeholders differ on whether community, human rights, and/or gender objectives are separate from, or crucial to, disease impact goals.	PA, MR, KIIs, DR, CV	Strong
	With some exceptions, the malaria vaccine was not considered in the context of broader SNT intervention targeting and tailoring decisions in GC7. National and international stakeholders expressed concern about the relative cost-effectiveness of the malaria vaccine (with most referring implicitly or explicitly to the original vaccine as opposed to the newer, more efficacious one).	PA, global KIIs, DR, CV	Strong
Domain 6	Lack of resources is a significant disabler of progress against disease, even in the context of robust SNT: a prioritized plan may not achieve impact because funding levels are consistently below NSP needs. Programs emphasize need to improve domestic resource mobilization for prioritized, tailored programs, including public-private engagement.	DR, CV, PA, ROS, global KIIs, MR	Strong
	FRs more commonly reference optimization in terms of efficiencies created by integration or economies, rather than in terms of greater impact for a given cost.	PA, DR, KIIs	Strong
	Programs encounter significant challenges in operationalizing resource optimization and cost effectiveness. Difficulties associated with obtaining accurate cost data and calculating cost effectiveness, particularly for layered/mixed interventions for which the research base is thin, multiply uncertainties.	National KIIs, ROS, transition case studies, CV, DR	Strong
	Opportunities to engage the private sector in vector control (and in other aspects of health service delivery) have potential to increase access to interventions that countries believe are essential to achieving their goals.	KIIs, DR	Strong
	The Global Fund and PMI play important market-shaping roles in commodity purchasing due to the sensitivity of manufacturer pricing to market volumes, and countries are highly affected by donor purchasing priorities.	KIIs, DR, CV	Strong

	Evaluation and documentation of the costs and impact of layered interventions in varied contexts in stakeholder countries could fill a critical evidence gap.	Global KIIs, ROS, CV, DR	Strong

Key:

CV	Country visits
DR	Document review
KIIs	Found in all three KII sets
Global KIIs	Key informant interviews with international informants from a variety of institutions
In-Country KIIs	Key informant interviews with a range of respondents during country visits
MR	Meta-review of frameworks & indicators
National KIIs	Key informant interviews with remote national program leads
PA	Portfolio analysis
ROS	Rapid Online Survey
ET	Elimination/Transition country case studies

7.0 RECOMMENDATIONS

Recommendations were categorized according to the Global Fund criteria for independent evaluations as either Critical, Important, or Potential Considerations.

No.	Recommendations	Expected Result
1	Strengthen the inclusion of country program perspectives in global consultative processes at malaria policy, strategy, and planning meetings.	A stronger global malaria strategic planning process benefiting from key insights from countries will generate new ideas to shorten the path to eradication.
2	Reinforce national and sub-national program ownership of sub-nationally tailored strategic plans by supporting local capacity building and south-south collaboration, learning, and examples.	Stronger program ownership and capacity will drive more effective national planning, more effective execution of sub-nationally tailored national strategic plans, and more effective domestic resource mobilization for increased disease impact.
3	Encourage national investment in sub-national leadership and capacity, and in sub-national data systems, analytic capacity, and data use through new indicators and a strengthened RSSH information note.	Stronger sub-national systems will make better data-driven decisions for increased disease impact.
4	Recognize and creatively incentivize SNT as a driver of domestic resource mobilization, including public-private or public-private-philanthropic partnerships.	Increased resources for malaria prevention and treatment, together with stronger national and sub-national ownership of those resources, will increase disease impact.
5	Support the generation of evidence on the effectiveness of new interventions and intervention layering strategies in varied contexts.	A strengthened focus on impact and better evidence on intervention effectiveness can inform more optimal investment for increased disease impact.
6	Evaluate the long-term equity impacts of market shaping of costs. Offer countries strategic engagement in global market shaping in exchange for national funding commitments toward commodity purchases.	Optimized and increased resources for malaria together with increased African ownership and investment in strategically directing the malaria eradication agenda, will increase disease impact.
7	Better leverage external (non-Global Fund) investment in sub-national and community health systems.	Better, more accessible maps of needs and analysis of funding flows will help optimize RSSH investments in sub-national and community health systems.
8	Apply the core principles of the Lusaka Agenda to the core malaria SNT partnership.	A better, more coordinated partner-scape will support a stronger global malaria eradication planning process.
9	Streamline the FR to make the data and planning on which SNT planning is based more visible; support active integration of sub-national data on climate, the malaria vaccine, malaria-relevant health equity factors in SNT planning, and access to and quality of care.	Both national and Global Fund awareness of NSP decision-making and data foundations will increase and strengthen focus on disease impact, as well as aiding in impact evaluation.

Recommendation 1: Strengthen the inclusion of country program perspectives in global consultative processes at malaria policy, strategy, and planning meetings.

1	Guidance Rank	Guidance Type	Supporting Conclusions	Recommendation & Actions
	Critical	**Strategic**	Domain 3: Many programs highlighted concerns that national consensus and local expertise are undervalued by partners. Many global stakeholders acknowledge this as a persistent and significant issue, despite significant partner efforts to address it.	Strengthen the inclusion of country program perspectives in global consultative processes at malaria policy, strategy, and planning meetings. *For the Secretariat:*

			Differences exist between TRPs/FR TA and some country programs, especially around vector control; some advice has felt "de-stratifying"; local expertise is not always appreciated; recent WHO guidance for resource-constrained contexts enshrines a more proscriptive stance toward IRS that is out of step with what some countries believe is necessary for elimination success. Some country programs would like more inclusion in global strategic planning and decision-making fora.	Develop and institutionalize a constructive input mechanism (e.g., a confidential qualitative survey) for anonymous national program input on strategy and policy issues, as well as country/partner engagement issues, in advance of, e.g., MPAG or WHO TWG meetings, with contributions to be shared and discussed at the meetings.
			Domain 6: The Global Fund and PMI play important market-shaping roles in commodity purchasing due to the sensitivity of manufacturer pricing to market volumes, and countries are highly affected by donor purchasing priorities.	

Strategic: Just as national programs include sub-national programs in planning, it is important for global stakeholders to have stronger and more frequent dialogue with country stakeholders around the policy and strategy of the global technical strategy and any possible global malaria eradication plan. It is also important for the success of this effort to resolve differences between partners and stakeholder countries and ensure an open flow of two-way information. Due to a power differential between funders and fundees, and the natural concern that national programs may have to "rock the boat" by expressing strong or unpopular opinions on the direction of the global malaria eradication agenda, a mechanism for *truly anonymous* input from programs is needed. Such a mechanism could easily be low-cost (e.g., an online qualitative survey handled by a third party) and has the advantage of allowing the engagement of national program personnel who are not funded to travel to in-person meetings in Geneva.

Recommendation 2: Reinforce national and sub-national program ownership of sub-nationally tailored strategic plans by supporting local capacity building and south-south collaboration, learning, and examples.

2	Guidance Rank	Guidance Type	Supporting Conclusions	Recommendation & Actions
	Critical	**Strategic**	Domain 1: Strong program leadership is central to SNT success. SNT mature countries demonstrate strong ownership of SNT process, products, and decision-making, and vice versa.	Reinforce national and sub-national program ownership of sub-nationally tailored strategic plans by supporting local capacity building and south-south collaboration, learning and examples. *For CTs:* Work with national programs to map the capacity of local (and regional) research institutions and, if appropriate, develop a plan for increased engagement.
			Domain 3: Longer-term, NMCP-embedded, systems-oriented SNT TA has been a significant enabler of SNT advancement. Countries are focused on building local capacity; TA should focus on skills transfer.	

			Domain 4: Stratification, often with multiple indicators, and intervention mix targeting is practiced by most countries. Intervention mix is informed by an array of data types of growing specificity, and countries are making increasingly sophisticated data-driven SNT decisions with the help of modeling and analysis.	*For CTs and regional managers:* Highlight country-led national and sub-national innovation and novel implementation approaches to the malaria technical team for consideration, engagement with global stakeholders and dissemination.
			Domain 5: The portfolio's increasing SNT sophistication is reflected in evaluator scores of SNT maturity in 15 countries (40% high, 40% moderate, and 20% low maturity).	

Strategic/Operational: Program ownership is critical to an optimized SNT malaria response, and SNT mature countries demonstrate strong ownership of national malaria planning and execution. SNT maturity is growing across the portfolio, and country programs have expressed interest in building local capacity. GC8 provides an opportunity to highlight and strengthen country ownership of modeling, analysis, implementation, and innovation.

Recommendation 3: Encourage national investment in sub-national leadership and capacity, and in sub-national data systems, analytic capacity, and data use through new indicators and a strengthened RSSH information note.

3	Guidance Rank	Guidance Type	Supporting Conclusions	Recommendation & Actions
	Critical	**Strategic/ Operational**	Domain 2: Countries with more robust sub-national decision-making on malaria have many of the following enabling factors: well-paced political and fiscal decentralization; stronger sub-national health governance structures; a high level of digitization; regular communication between national and sub-national levels on malaria data validity, interpretation, and use; increased resources at sub-national level; capacity building of sub-national teams in data analysis and use; adequate human resources; and more systematic community engagement. Rapid, extensive CHW expansion and community data integration across the portfolio have significantly enabled SNT progress. Coordination of growing, multi-donor investment in community health worker programs (including malaria components) and district/sub-national systems is perceived to be weak but improving.	Encourage country investment in in sub-national leadership and capacity, and in sub-national data systems, analytic capacity, and data use through new indicators and strengthened RSSH information note. *For the Programmatic Monitoring Department (PMD):* We suggest two new module indicators: Under the Finance module (as a coverage indicator): % of the national budget assigned to sub-national activities. Under M&E: % districts (admin-3) units producing quarterly analytical reports of programmatic and surveillance data.
			Domain 3: Countries are focused on building local capacity; TA should focus on skills transfer. Country stakeholders prioritized scale-up of routine entomological surveillance as a source of data needed for decision-making on vector control interventions.	
			Domain 4:	

			Despite improvements, stakeholders identified limitations in sub-national data quality, use, and analytics as the largest barriers to effective SNT. Routine, real-time data are preferred by programs for planning, monitoring, and response. Continued improvement in routine data is prioritized by programs; all acknowledge significant issues with quality remain. The portfolio's increasing SNT sophistication is reflected in evaluator scores of SNT maturity in 15 countries (40% high, 40% moderate, and 20% low maturity).	We also suggest strengthening the RSSH information note to encourage country investment in sub-national data systems and people. Highlight options to invest in expanding all the following: (a) training in management and supervision, (b) use of mDHIS2 (mobile platforms), (c) transitions from paper-based to digital reporting, (d) data quality audits at the district (or lower) level, and routine entomological surveillance with low-cost AI tools that make monitoring accessible at community level.

Strategic/Operational: Improving the quality and usability of routine data at sub-national levels is crucial, as it is the program's best, real-time tool for monitoring, evaluating, and planning. It is equally critical to invest in the capacity of the sub-national work force, especially given CHW expansion. Because fiscal devolution is both an enabler for sub-national, data-driven tailoring, implementation, and course correction, and is also hard to track, the evaluation proposes adding a financial indicator measuring the percentage of funding directed to sub-national RSSH. Regular analysis and use of data, along with regular data quality checks at admin-3 and lower levels, help build a strong data culture and good national and sub-national coordination.

The evaluation team explored several suggestions for directly increasing investment in sub-national data quality and use. However, given that important board deadlines for catalytic investments have already passed for GC8, the use of indicators and a strengthened RSSH note seem to be the most accessible options. The RSSH information note recommendations emphasize opportunities for countries to invest in training, digitization, and data quality improvement at peripheral levels of the health system, and increased entomological surveillance, something in which many programs are interested, to better evaluate vector control intervention effectiveness (see Recommendation 5).

Recommendation 4: Recognize and creatively incentivize SNT as a driver of domestic resource mobilization, including public-private or public-private-philanthropic partnerships.

4	Guidance Rank	Guidance Type	Supporting Conclusions	Recommendation & Actions
	Critical	**Strategic**	Domain 1: SNT mature countries demonstrate strong ownership of SNT process, products, and decision-making, and vice versa. SNT sharpens focus on the impact of resource constraints at both national and sub-national levels and is a driver of domestic resource mobilization.	Recognize and creatively incentivize SNT as a driver of resource mobilization. *For Country Teams:* 1. Hold a best practice forum with countries highlighting those that have successfully engaged their private sector. 2. Landscape and document social marketing/private sector low-cost or shared-cost implementation models. *For the Private Sector Engagement Department (perhaps linked to CT landscaping effort) and if needed the Health Finance Department:*
			Domain 6:	

			Lack of resources is a significant disabler of progress against disease, even in the context of robust SNT: a prioritized plan may not achieve impact because funding levels are consistently below NSP needs. Programs emphasize need to improve domestic resource mobilization for prioritized, tailored programs, including public-private engagement. Opportunities to engage the private sector in vector control (and in other aspects of health service delivery) have potential to increase access to interventions that countries believe are essential to achieving their goals.	3. Consider the use of matching incentives (e.g., for private sector/NGO vector control companies) in funding requests. 4. Provide countries with matching grant TA to help prioritize and qualify investments for matching funds.

Strategic: Advancing SNT's potential to drive national and sub-national resource mobilization is timely given (a) the ever-present need for improved resources for malaria, (b) a sharpened focus on sub-national resource mobilization, (c) the entrance of new PPPs for vector control that allow countries to support additional prevention, and (d) multi-sectoral opportunities arising through increased mainstreaming of malaria. As challenging as the project of increasing domestic investment seems, national programs are highly aware of shrinking donor resources, and express strong interest in partnering with private sector, engaging multi-lateral sectors, and conducting national budget advocacy to increase resources. The Global Fund has several strategic levers available to incentivize increased domestic investment and should pursue their use with urgency.

Recommendation 5: Support the generation of evidence on the effectiveness of new interventions and intervention layering strategies in varied contexts.

5	Guidance Rank	Guidance Type	Supporting Conclusions	Recommendation & Actions
	Critical	**Strategic**	Domain 3: Country stakeholders prioritized scale-up of routine entomological surveillance as a source of data needed for decision-making on vector control interventions. Among global stakeholders, there was widespread acknowledgement of intra-partner misalignment as a "disabler" of effective SNT. Initiatives aimed at partner coordination (e.g., COOP, RBM dashboard) are steps toward addressing transparency and harmonization concerns.	Support the generation of evidence on the effectiveness of new interventions and intervention layering strategies in varied contexts. *For Malaria Team and Technical Advice and Partnerships to liase with WHO on roadmaps and best practices for SNT to disseminate throughout the Global Fund:* Maximize opportunities using reported and routine country data to assess impact of priority intervention mix scenarios and scenario shifts; consider greater use of interrupted time series analysis as a potential tool. *For CT's, FR TA, and SNT TA:*
			Domain 4: There is a growing array of data available for informing intervention targeting, tailoring, and decision-making, but evaluation of SNT is hindered by lack of evidence on effectiveness of layered interventions.	
			Domain 5: SNT in GC7 is more focused on choices among new interventions or combinations of layered interventions and less directed toward improving the quality of existing interventions through improvements in delivery, QOC, and use, though these are improving as SNT becomes more granular.	

			The integration of gender, human rights, and vulnerable population concerns into NSPs and FRs is progressing slowly, with increasing use of related assessments, analytic tools, and TA, and emerging program exemplars. Stakeholders differ on whether community, human rights, and/or gender objectives are separate from, or crucial to, disease impact goals. With some exceptions, the malaria vaccine was not considered in the context of broader SNT intervention targeting and tailoring decisions in GC7. National and international stakeholders expressed concern about the relative cost-effectiveness of the malaria vaccine (with most referring implicitly or explicitly to the original vaccine as opposed to the newer, more efficacious one).	Support methodologically robust costing of interventions and intervention strategies. When assisting stakeholder countries with cost effectiveness/resource optimization calculations, communicate the multiple uncertainties in calculating cost effectiveness, including: (a) variability of true costs, (b) impact of market shaping on commodity costs, and (c) the evidence base for comparative intervention effectiveness.
			Domain 6: Programs encounter significant challenges in operationalizing resource optimization and cost effectiveness. Difficulties associated with obtaining accurate cost data and calculating cost effectiveness, particularly for layered/mixed interventions for which the research base is thin, multiply uncertainties. Evaluation and documentation of the costs and impact of layered interventions in varied contexts in stakeholder countries could fill a critical evidence gap.	

Strategic: The emphasis on a single costed optimized operational plan (COOP), to be piloted in GC8 in eight countries, makes it necessary to address the complexity of conducting national resource optimization. The current evidence base for comparing intervention impacts is limited; for example, no cluster-randomized trial has directly compared dual AI LLINs with IRS with a next generation insecticide. The evidence for the effectiveness of multiple layered interventions is even more scanty. Improvements in routine data (which require further improvement, as noted in Recommendation 3), create opportunities to learn from "natural experiments" being currently conducted. Collecting and sharing sub-national data on the effectiveness of implemented strategies in a variety of contexts is a low-cost means of strengthening the evidence gap. Working with countries to use reported and routine country data to assess impact of priority intervention mix scenarios in GC8 will also strengthen the SNT planning process for the next cycle.

The Global Fund and strategic partners could also develop a multi-donor grant mechanism to support country-prioritized evaluations and convene programs to prioritize the top five-to-ten most cost, effectiveness, and cost-effectiveness evidence gaps that hinder intervention targeting and intervention mix decision-making.

Recommendation 6: Evaluate the long-term equity impacts of market shaping of costs. Offer countries strategic engagement in global market shaping in exchange for national funding commitments toward commodity purchases.

6	Guidance Rank	Guidance Type	Supporting Conclusions	Recommendation & Actions

	Important	**Strategic/ Financial**	Domain 3: Some country programs would like more inclusion in global strategic planning and decision-making fora. Domain 6: The Global Fund and PMI play important market-shaping roles in commodity purchasing due to the sensitivity of manufacturer pricing to market volumes, and countries are highly affected by donor purchasing priorities. Programs encounter significant challenges in operationalizing resource optimization and cost effectiveness. Difficulties associated with obtaining accurate cost data and calculating cost effectiveness, particularly for layered/mixed interventions for which the research base is thin, multiply uncertainties. Opportunities to engage the private sector in vector control (and in other aspects of health service delivery) have potential to increase access to interventions that countries believe are essential to achieving their goals.	Evaluate the long-term equity impacts of market shaping of commodity costs. Offer countries strategic engagement in global market shaping in exchange for national funding committed to commodity purchases. *For Supply Operations and the Market Shaping team:* Consider the potential for long-term equity impacts in determining market shaping. For example, if a tool (e.g., IRS, spatial emanators) will be needed in the long term to eliminate malaria, to manage insecticide resistance, or to dramatically reduce burden, there may be need to consider strategies to reduce prices in the present for future equity gains. *For the Market Shaping Team:* Invite country program participation in the Market Shaping Strategy's Sourcing Strategic Review Meetings and/or other suitable high-level fora to improve attention to their perspectives, particularly on integrated vector management or tools needed to advance sub-national elimination priorities, provided new national commitments to health commodity purchasing are obtained. These could be initially modest but would be expected to grow over time.

Strategic/Financial: Global market shaping decisions play a key role in determining what interventions are used in the malaria fight. These decisions have long-term impact on manufacturers and suppliers and will affect what tools are available at scale in the future. It is unclear whether global market shaping strategy has considered the future equity impacts of allowing prices to rise on needed commodities that are not currently purchased at large volumes. Countries are highly affected by these market shaping decisions, and at least some programs want more representation and participation in strategic global decision-making fora. To further encourage domestic resource mobilization, invitations to these meeting could be restricted to countries that have voluntarily increased national funding commitments for commodity purchases.

Recommendation 7: Better leverage external (non-Global Fund) investment in sub-national and community health systems.

7	Guidance Rank	Guidance Type	Supporting Conclusions	Recommendation & Actions

	Important	**Operational**	Domain 2: Rapid, extensive CHW expansion and community data integration across the portfolio have significantly enabled SNT progress. Coordination of growing, multi-donor investment in community health worker programs (including malaria components) and district/sub-national systems is perceived to be weak but improving.	Better leverage external (non-Global Fund) investment in sub-national and community health systems. *Through FR Structure, Guidance, and Strategic TA:* Improve clarity in NMSPs/FRs on the roles played by and funding received through all malaria-related investors, public and private, both within and outside the traditional malaria partnership, to better align limited Global Fund RSSH resources with the highest community and sub-national system strengthening priorities. *For the Global Fund-Gavi-GFF:* Improve communications on and reporting of progress against the goals of this fast-evolving partnership to ensure better awareness and understanding across global and country stakeholders, with a focus on country-level implications, opportunities, and inputs.
			Domain 3: Among global stakeholders, there was widespread acknowledgment of intra-partner misalignment as a "disabler" of effective SNT. Initiatives aimed at partner coordination (e.g., COOP, RBM dashboard) are partial steps toward addressing transparency and harmonization concerns.	
			Domain 4: Despite improvements, stakeholders identified limitations in sub-national data quality, use, and analytics as the largest barriers to effective SNT.	
			Domain 6: Lack of resources is a significant disabler of progress against disease, even in the context of robust SNT: a prioritized plan may not achieve impact because funding levels are consistently below NSP needs. Programs emphasize need to improve domestic resource mobilization for prioritized, tailored programs, including public-private engagement.	

Operational: Investment in sub-national and community systems is vital to SNT progress and will require both new financing and better mapping, coordination, and leverage of non-Global Fund (and often non-malaria) resources.

Recommendation 8: Apply the core principles of the Lusaka Agenda to the core malaria SNT partnership.

8	**Guidance Rank**	**Guidance Type**	**Supporting Conclusions**	**Recommendation & Actions**

	Important	**Strategic**	Domain 3: Among global stakeholders, there was widespread acknowledgment of intra-partner misalignment as a "disabler" of effective SNT. Initiatives aimed at partner coordination (e.g., COOP, RBM dashboard) are steps toward addressing transparency and harmonization concerns. Longer-term, NMCP-embedded, systems-oriented SNT TA has been a significant enabler of SNT advancement. Countries are focused on building local capacity; TA should focus on skills transfer. Many programs highlighted concerns that national consensus and local expertise are undervalued. Many global stakeholders acknowledge this as a persistent issue, despite partner efforts to address it.	Apply the core principles of the Lusaka Agenda to the core malaria SNT partnership. *For the Global Fund and Its Principal SNT Partners:* (1) Improve cross-partner the alignment, coordination and transparency of SNT core TA for GC8 preparation. (2) Improve access to longer-term SNT TA based on country priorities and focused on skills transfer and capacity building. ((3) Support improvement of and better access to reliable, timely data on core SNT process, TA, and progress metrics.

Strategic: Clear and aligned guidance, well-coordinated TA and country support, and cross-partner visibility into SNT-related investments and their progress are vital to SNT progress.

Recommendation 9: Streamline the FR to make the data and planning on which SNT planning is based more visible; support active integration of sub-national data on climate, the malaria vaccine, malaria-relevant health equity factors in SNT planning, and access to and quality of care.

9	**Guidance Rank**	**Guidance Type**	**Supporting Conclusions**	**Recommendation & Actions**

	Important	**Operational**	Domain 5: SNT in GC7 is more focused on choices among new interventions or combinations of layered interventions and less directed toward improving the quality of existing interventions through improvements in delivery, QOC, and use, though these are improving as SNT becomes more granular. The integration of gender, human rights, and vulnerable population concerns into NSPs and FRs is progressing slowly, with increasing use of related assessments, analytic tools, and TA, and emerging program exemplars. Stakeholders differ on whether community, human rights, and/or gender objectives are separate from, or crucial to, disease impact goals. With some exceptions, the malaria vaccine was not considered in the context of broader SNT intervention targeting and tailoring decisions in GC7. National and international stakeholders expressed concern about the relative cost-effectiveness of the malaria vaccine (with most referring implicitly or explicitly to the original vaccine as opposed to the newer, more efficacious one).	Streamline the FR to make the data and planning on which SNT planning is based more visible; support active integration of sub-national data on climate, the malaria vaccine, malaria-relevant health equity factors in SNT planning, and access to and quality of care. *For GC8 FR Guidance and FR TA:* Require the data on which sub-national targeting and tailoring for maximum impact are based to be included in FRs in a streamlined manner. Support and guide systematic integration in SNT stratification and intervention targeting of: a) quality of care and operational considerations. b) vaccine coverage data/projections. c) sub-national climate metrics. d) actionable, relevant health equity data (including CRG). Develop guidance focused on importance of, and methods for, these data into SNT, and integrate into pre-GC8 TA.

Operational: Facilitating presentation and perception of sub-nationally tailored strategic plans will strengthen a focus on impact and will also facilitative operational impact evaluation of intervention mixes (see Recommendation 5).

ANNEXES

Annex A: References

References

Afshari, M., Ahmadi Teymourlouy, A., Asadi-Lari, M. et al. (2020). Global Health diplomacy for noncommunicable diseases prevention and control: a systematic review. *Global Health, 16*(41). https://doi.org/10.1186/s12992-020-00572-5

Agbemafle, E.E., Kubio, C., Bandoh, D., Odikro, M.A., Azagba, C.K., Issahaku, R.G., & Sackey, S.O. (2023) Evaluation of the malaria surveillance system - Adaklu District, Volta Region, Ghana, 2019. *Public Health in Practice, 6*. https://doi.org/10.1016/j.puhip.2023.100414

Akua, N. (2023). A turning point: Cameroon rolls out world's first malaria vaccine. *GAVI. The Vaccine Alliance.* https://www.gavi.org/vaccineswork/turning-point-cameroon-rolls-out-worlds-first-malaria-vaccine

Alegana, V. A., Suiyanka, L., Macharia, P. M., Ikahu-Muchangi, G., & Snow, R. W. (2021). Malaria micro-stratification using routine surveillance data in Western Kenya. *Malaria Journal, 20*(22), 1-9. https://doi.org/10.1186/s12936-020-03529-6

Alegbeleye A., Dada, J., Oresanya, O., Jiya, J., Counihan, H., Gimba, P., Ozor, L., & Maxwell, K. (2019). Community engagement and mobilisation of local resources to support integrated Community Case Management of childhood illnesses in Niger State, Nigeria. *Journal of Global Health, 9*(1), 010804. https://doi.org/10.7189/jogh.09.010804

Alohoutade, S., Hounsell, R., Silal, S. (2024). Estimating the impact of the RTS,S/AS01 malaria vaccine in Benin: A mathematical modelling study. *medRxiv*. https://doi.org/10.1101/2024.07.20.24310712

African Leaders Malaria Alliance. (ALMA). 2023 Africa Malaria Progress Report. https://alma2030.org/heads-of-state-and-government/african-union-malaria-progress-reports/2023-africa-malaria-progress-report/.

Andrade, M.V., Noronha, K., Diniz, B.P.C. et al. (2022). The economic burden of malaria: a systematic review. *Malaria Journal, 21*, 283. https://doi.org/10.1186/s12936-022-04303-6

Anoke, S. C., Mwai, P., Jeffery, C., Valadez, J. J., & Pagano, M. (2015). Comparing two survey methods of measuring health-related indicators: Lot Quality Assurance Sampling and Demographic Health Surveys. *Tropical Medicine & International Health*, *20*(12), 1756-1770.

Apeagyei, A.E., Cogswell, I., Patel, N.K. et al. (2024). Examining malaria treatment and prevention spending efficiency in malaria-endemic countries, 2000–2020. *Malaria Journal, 23,* 333. https://doi.org/10.1186/s12936-024-05165-w

Ashton, R.A., Prosnitz, D., Andrada, A., Herrera, S., & Yé, Y. (2020). Evaluating malaria programmes in moderate- and low-transmission settings: practical ways to generate robust evidence. *Malaria Journal, 19*(1), 1-14.

Awine, T., & Silal, S.P. (2020). Accounting for regional transmission variability and the impact of malaria control interventions in Ghana: a population level mathematical modeling approach. *Malaria Journal, 19,* 423. https://doi.org/10.1186/s12936-020-03496-y

Barclay, V.C., Smith, R.A., & Findeis, J.L. (2012). Surveillance considerations for malaria elimination. *BioMed Central, 11*(1), 304. https://doi.org/10.1186/1475-2875-11-304

Bashir, I.M., Nyakoe, N., & van der Sande, M. (2019). Targeting remaining pockets of malaria transmission in Kenya to hasten progress towards national elimination goals: an assessment of prevalence and risk factors in children from the Lake endemic region. *Malaria Journal, 18*(1):233. https://doi.org/10.1186/s12936-019-2876-x Benin, National Council for the Fight against HIV/AIDS, Tuberculosis, Malaria, Hepatitis, Sexually Transmitted Infections and Epidemics, 2023. Funding request submitted to The Global Fund.

Bennett, A., Avanceña, A. L. V., Wegbreit, J., Cotter, C., Roberts, K., & Gosling, R. (2017). Engaging the private sector in malaria surveillance: a review of strategies and recommendations for elimination settings. *Malaria Journal*, *16*(1), 252. https://doi.org/10.1186/s12936-017-1901-1

Berlin, E., Lourenço, C., & Poyer, S. (2024). Surveillance for Action: Operationalizing Private Sector Surveillance and Service Delivery across the Malaria Transmission Continuum. *The American Journal of Tropical Medicine and Hygiene*, *112*(1_Suppl), 66–69. https://doi.org/10.4269/ajtmh.23-0447

Biedron, C., Pagano, M., Hedt, B. L., Kilian, A., Ratcliffe, A., Mabunda, S., & Valadez, J. J. (2010). An assessment of Lot

Quality Assurance Sampling to evaluate malaria outcome indicators: extending malaria indicator surveys. *International journal of epidemiology*, *39*(1), 72-79.

Bisanzio, D., Sudathip, P., Kitchakarn, S., Kanjanasuwan, J., Gopinath, D., Pinyajeerapat, N., Sintasath, D., & Shah, J.A. (2023). Malaria Stratification Mapping in Thailand to Support Prevention of Reestablishment. *The American Journal of Tropical Medicine and Hygiene, 110*(1):79-82. https://doi.org/10.4269/ajtmh.23-0595

Black, D.P. (accessed 2024). Creating a commercial market for insecticide-treated bed nets in Ghana. *Johns Hopkins Center for Communication Programs.* https://ccp.jhu.edu/projects/private-sector-malaria-prevention/

Bliss. K. (2024). Malaria Vaccines: The New Tools Fighting a Longtime Public Health Threat. *Center for Strategic and International Studies*. https://features.csis.org/malaria-vaccines/
Brown, G. W., Rhodes, N., Tacheva, B. et al. (2023). Challenges in international health financing and implications for the new pandemic fund." *Global Health, 19*, 97. https://doi.org/10.1186/s12992-023-00999-6

Bulthuis, B., Kok, M., Amon, S., et. al. (2021). How district health decision-making is shaped within decentralised contexts: A qualitative research in Malawi, Uganda and Ghana. *Global Public Health. 16:1*, 120-135, DOI: 10.1080/17441692.2020.1791213

Burkina Faso, (PR selection ongoing at time of submission), 2023. Funding request submitted to The Global Fund.

Buse, K., & Walt, G. (2000). Global public-private partnerships: Part I--A new development in health? *Bulletin of the World Health Organization, 78*(4), 549.

Cataldo, Claudia, Bellenghi, M., Masella, R., & Busani, L. (2023). One Health Challenges and Actions: Integration of Gender Considerations to Reduce Risks at the Human-Animal-Environmental Interface. *One Health, 16*, 100530. https://doi.org/10.1016/j.onehlt.2023.100530

Candrinho, B. (2024). "Analytical approach to stratification and resource mobilization in Mozambique." Presentation at the MIM Conference, Kigali, Rwanda.

CCM Burundi, Applicant Self-Assessment to Inform Program Continuation (2017), GC5, The Global Fund.

CCM Liberia, Applicant Self-Assessment to Inform Program Continuation (2017), GC5, The Global Fund.

Chenes, C. J. C., et al. (2022). Use of physical accessibility modelling in diagnostic network optimization: A review. *Diagnostics, 12(1),* 103. https://doi.org/10.3390/diagnostics12010103

Chirombo, J., Ceccato, P., Lowe, R., Terlouw, D.J., Thomson, M.C., Gumbo, A., Diggle, P.J., & Read, J.M. (2020). Childhood malaria case incidence in Malawi between 2004 and 2017: spatio-temporal modelling of climate and non-climate factors. *Malaria Journal, 19*(1):5. https://doi.org/10.1186/s12936-019-3097-z

Cibulskis, R., Alonso, P L., Aponte, J., Aregawi, M., Barrette, A., Bergeron, L., Fergus, C., Knox, T., Lynch, M., Patouillard, E., Schwarte, S., Stewart, S., & Williams, R. (2016). Malaria: Global progress 2000 – 2015 and future challenges. *BioMed Central, 5*(1). https://doi.org/10.1186/s40249-016-0151-8

Cissoko, M., Sagara, I., Landier, J. *et al.* (2022). Sub-national tailoring of seasonal malaria chemoprevention in Mali based on malaria surveillance and rainfall data. *Parasites Vectors 15,* 278. https://doi.org/10.1186/s13071-022-05379-4

Cissoko, M., Magassa, M., Sanogo, V., Ouologuem, A., Sangaré, L., Diarra, M., ... & Sagara, I. (2022). Stratification at the health district level for targeting malaria control interventions in Mali. *Scientific Reports, 12*(1), 8271.

Cissoko, M., Sagara, I., Guindo, A., Dembélé, P., Bationo, C. S., Dieng, S., ... & Gaudart, J. (2024). Impact of control interventions on malaria incidence in the general population of Mali. https://doi.org/10.21203/rs.3.rs-4934704/v1

Clark J. (2014). Medicalization of global health 1: has the global health agenda become too medicalized? *Global Health Action, 7*, 23998. doi: 10.3402/gha.v7.23998. PMID: 24848659; PMCID: PMC4028930.

Cobos Muñoz, D., Merino Amador, P., Monzon Llamas, L., Martinez Hernandez, D., & Santos Sancho, J.M. (2017). Decentralization of health systems in low and middle income countries: a systematic review. *International Journal of Public Health, 62*, 219-229. https://doi.org/10.1007/s00038-016-0872-2

Cohen, J.M., Okumu, F., & Moonen, B. (2022). The fight against malaria: Diminishing gains and growing challenges. *Science Translational Medicine, 14*(651). https://doi.org/1126/scitranslmed.abn3256
Conteh, L., Shuford, K., Agboraw, E., et al. (2021). Costs and Cost-Effectiveness of Malaria Control Interventions: A Systematic Literature Review. *Value in Health 24*(8), 1213-1222. https://doi.org/10.1016/j.jval.2021.01.013

Correia, M. & Giovarelli, R. (2023). Gender Analysis Guide: A practical tool to support investment design. *Global Center for Gender Equality*. https://www.gatesgenderequalitytoolbox.org/wp-content/uploads/gcfge-gender-analysis-guideli nes-l5.pdf.

Cox, J., Craig, M., Le Sueur, D., & Sharp, B. (1999). Mapping malaria risk in the highlands of Africa. MARA/HIMAL Technical Report. https://idl-bnc-idrc.dspacedirect.org/server/api/core/bitstreams/786f1d7d-f05d-409d-9252-2cb5a9bc6d51/content

Cozzarolo, C-S., Sironi, N., Glaizot, O., Pigeault, R. & Christe, P. (2019). Sex-Biased Parasitism in Vector-Borne Disease: Vector Preference?" *PLOS ONE, 14*(6), e0216360. https://doi.org/10.1371/journal.pone.0216360
Damien, B., Sode, A., Bocossa, D., et. al. (2022). Bayesian spatial modelling of malaria burden in two contrasted eco-epidemiological facies in Benin (West Africa): call for localized interventions. *BMC Public Health. 22*:1754. https://doi.org/10.1186/s12889-022-14032-9

Dasari S, Gopinath B, Gaulke C, Patel S, Merali K, Sunil Kumar A, Acharya S. (2024). A Handheld Tool for the Rapid Morphological Identification of Mosquito Species (VectorCam) for Community-Based Malaria Vector Surveillance: Summative Usability Study *JMIR Hum Factors 11*:e56605 https://humanfactors.jmir.org/2024/1/e56605 DOI: 10.2196/56605

DeBoer, K.R., Vaz, L.M., Ondo Mfumu, T.A., et al. (2023). Assessing IRS Performance in a Gender-Integrated Vector Control Programme on Bioko Island, Equatorial Guinea, 2010–2021. *Malaria Journal, 22*(1), 323. https://doi.org/10.1186/s12936-023-04755-4
Democratic Republic of Congo, Ministry of Health and civil society PR TBD, 2023. Funding request submitted to The Global Fund.

Derua YA, Kweka EJ, Kisinza WN, Githeko AK, Mosha FW. Bacterial larvicides used for malaria vector control in sub-Saharan Africa: review of their effectiveness and operational feasibility. Parasite Vectors. 2019;12 :426.

Diallo, O. O., Diallo, A., Toh, K. B., et al. (2024). Sub-national tailoring of malaria interventions to prioritize the malaria response in Guinea. *edRxiv*. https://doi.org/10.1101/2024.06.26.24309532

Diiro, G.M., Affognon, H.D., Muriithi, B.W., et al. The Role of Gender on Malaria Preventive Behaviour among Rural Households in Kenya. *Malaria Journal. 15*(1), 14. https://doi.org/10.1186/s12936-015-1039-y

Djaskano, M. I., Cissoko, M., Diar, M. S. I., Israel, D. K., Clément, K. H., Ali, A. M., ... & Sagara, I. (2023). Stratification and adaptation of malaria control interventions in Chad. *Tropical Medicine and Infectious Disease*, *8*(9), 450. https://doi.org/10.3390/tropicalmed8090450

Doe, J., Kouadio, K., Traoré, M., Diomande, D., Koffi, B., Kone, S., Smith, G.C., Ahmed, J., & Smith, J.L. (2024). Identifying and characterizing high-risk populations in pilot malaria elimination districts in Ivory Coast: a mixed-methods study. *Malaria Journal, 23*(1):160. https://doi.org/10.1186/s12936-024-04980-8

Ekanem, S. (2024). Top 5 African countries with the highest number of mobile phones. *Business Insider Africa.* https://africa.businessinsider.com/local/markets/african-countries-with-the-highest-number-of-mobile-phones/lzqj62z

Feachem, R. G. A., Chen, I., Akbari, O., Bertozzi-Villa, A., Bhatt, S., Binka, F., Boni, M. F., Buckee, C., Dieleman, J., Dondorp, A., Eapen, A., Sekhri Feachem, N., Filler, S., Gething, P., Gosling, R., Haakenstad, A., Harvard, K., Hatefi, A., Jamison, D., Jones, K. E., … Mpanju-Shumbusho, W. (2019). Malaria eradication within a generation: ambitious, achievable, and necessary. Lancet (London, England), 394(10203), 1056–1112. https://doi.org/10.1016/S0140-6736(19)31139-0

Fernando, D., Wijeyaratne, P., Wickremasinghe, R., Abeyasinghe, R. R., Galappaththy, G. N. L., Wickremasinghe, R., Hapugoda, M., Abeywickrema, W. A., & Rodrigo, C. (2018). Use of a public-private partnership in malaria elimination efforts in Sri Lanka; a case study. *BMC health services research*, *18*(1), 202. https://doi.org/10.1186/s12913-018-3008-y

Ferrao, J., Earland, D., Novela, A., Mendes, R., Ballat, M., Tungadza, A., & Searle, K. (2022). Modelling sociodemographic factors that affect malaria prevalence in Sussundenga, Mozambique: a cross-sectional study. *F1000Research*, *11*, 185. https://doi.org/10.12688/f1000research.75199.2

Fountain, A., Ye, Y., Roca-Feltrer, A., Rowe, A. K., Camara, A., Fofana, A., Candrinho, B., Hamainza, B., Ndiop, M., Steketee, R., & Thwing, J. (2022). Surveillance as a Core Intervention to Strengthen Malaria Control Programs in Moderate to High Transmission Settings. *The American journal of tropical medicine and hygiene*, *108*(2_Suppl), 8–13. https://doi.org/10.4269/ajtmh.22-0181

Frohlich, M T. (2002). Techniques for improving response rates in OM survey research. *Wiley, 20*(1), 53-62. https://doi.org/10.1016/s0272-6963(02)00003-7Future of Global Health Initiatives. (2023). *The Lusaka Agenda: Conclusions of the Future of Global Health Initiatives process.* https://d2nhv1us8wflpq.cloudfront.net/prod/uploads/2023/12/Lusaka-Agenda.pdf

Galatas, B., Saúte, F., Martí-Soler, H., et al. (2020). A multiphase program for malaria elimination in southern Mozambique (the Magude project): A before-after study. *Public Library of Science, 17*(8), e1003227-e1003227. https://doi.org/10.1371/journal.pmed.1003227

Gallup, J. L., & Sachs, J. D. (2000). The economic burden of malaria. *CID Working Paper Series*.

Gavi: The Vaccine Alliance. (2021). Gavi Board approves funding to support malaria vaccine roll-out in sub-Saharan Africa. https://www.gavi.org/news/media-room/gavi-board-approves-funding-support-malaria-vaccine-roll-out-sub-saharan-africa

Gavi & Global Fund. (2024). Malaria Vaccine: Guidelines on Gavi and Global Fund support for complementary interventions to facilitate the deployment of malaria vaccines. https://www.gavi.org/sites/default/files/board/minutes/2024/4-5-december13%20-%20Annex%20C%20-%20Malaria%20Vaccine_JointGuidelines%20on%20Gavi%20and%20Global%20Fund%20support.pdf

Gebreegziabher, E., Raoliarison, A., Ramananjato, A., Fanomezana, A., Rafaliarisoa, M., Ralisata, S., ... & Smith Gueye, C. (2024). Identifying and characterizing high-risk populations in pilot malaria elimination districts in Madagascar: a mixed-methods study. Malaria Journal, 23(1), 121. https://doi.org/10.1186/s12936-024-04927-w

Ghana, Ministry of Health, Ghana Health Service and AngloGold Ashanti Malaria Control Ltd (AGAMal) (2023). Funding request submitted to the Global Fund.

Ghana, National Malaria Elimination Program, Ghana Health Service, Ministry of Health(2023). National malaria elimination strategic plan (NMESP) 2024–2028.

Ghasemi, M., Amini-Rarani, M., Zadeh, N. S., & Karimi, S. (2022). Role of public-private partnerships in primary healthcare services worldwide: A scoping review. Health scope, 11(3). https://doi.org/10.5812/jhealthscope-129176

Ghilardi, L., Okello, G., Nyondo-Mipando, L. et al. (2020). How useful are malaria risk maps at the country level? Perceptions of decision-makers in Kenya, Malawi and the Democratic Republic of Congo. Malaria Journal 19, 353. https://doi.org/10.1186/s12936-020-03425-z

Global Health 50/50. (2020). The Global Health 50/50 Report 2020: Power, Privilege and Priorities. https://globalhealth5050.org/wp-content/uploads/2020/03/Power-Privilege-and-Priorities-2020-Global-Health-5050-Report.pdf.

Goldsworthy, K. (2021). What is a theory of change? *Australian Institute of Family Studies.* https://aifs.gov.au/sites/default/files/publication-documents/2109_what_is_theory_of_change_0.pdf

Gosling, R., Chimumbwa, J., Uusiku, P. *et al.* (2020). District-level approach for tailoring and targeting interventions: a new path for malaria control and elimination. *Malaria Journal 19*, 125. https://doi.org/10.1186/s12936-020-03185-w

Gowelo, S., Meijer, P., Tizifa, T., Malenga, T., Mburu, M. M., Kabaghe, A. N., Terlouw, D. J., van Vugt, M., Phiri, K. S., Mzilahowa, T., Koenraadt, C. J. M., van den Berg, H., Manda-Taylor, L., McCann, R. S., & Takken, W. (2022). Community Participation in Habitat Management and Larviciding for the Control of Malaria Vectors in Southern Malawi. *The American journal of tropical medicine and hygiene*, *108*(1), 51–60. https://doi.org/10.4269/ajtmh.21-1127

Green Climate Fund. (2023). Green Climate Fund and Global Fund join forces to tackle impact of climate crisis on health. https://www.greenclimate.fund/news/green-climate-fund-and-global-fund-join-forces-tackle-impact-climate-crisis-health

Green, L.J. (2022). We the Tormentors: Death, Emotions, and Gender in the Life and Work of the Entomologist Margaret Fountaine. *Journal for the History of Knowledge, 3*(1). https://doi.org/10.55283/jhk.11714.

Gueguen, C., Snel, N., & Mutonji, E. (2022). Turning mobile big data insights into public health responses in times of pandemics: Lessons learnt from the Democratic Republic of the Congo. *Data & Policy, 4*, e8. https://doi.org/10.1017/dap.2021.30

Gupta, G.R., et al. (2019). Gender Equality and Gender Norms: Framing the Opportunities for Health. *The Lancet, 393*(10190), 2550–62. https://doi.org/10.1016/S0140-6736(19)30651-8

Gutman, J. R., Mwesigwa, J. N., Arnett, K., Kangale, C., Aaron, S., Babarinde, D., ... & Robertson, M. (2023). Using antenatal care as a platform for malaria surveillance data collection: study protocol. *Malaria Journal*, *22*(1), 99.

Gwitira, I., Mukonoweshuro, M., Mapako, G., Shekede, M. D., Chirenda, J., & Mberikunashe, J. (2020). Spatial and spatio-temporal analysis of malaria cases in Zimbabwe. *Infectious Diseases of Poverty*, *9*(05), 45-58. https://doi.org/10.1186/s40249-020-00764-6

Hafsa, N. (2019). Mixed Methods Research: An Overview for Beginner Researchers. *Journal of Literature, Languages and Linguistics, 58*. https://doi.org/10.7176/jlll/58-05

Hartshorn, J.A., et al. Attracting and Retaining Women in Forest Entomology and Forest Pathology. Forest Policy and Economics, 154, 103022. https://doi.org/10.1016/j.forpol.2023.103022.

Hay, S.I, Noor, A.M., Simba, M., Busolo, M., Guyatt, H.L., Ochola, S.A., & Snow, R.W. (2002). Clinical epidemiology of malaria in the highlands of western Kenya. Emerging Infectious Diseases, 8(6), 543. https://doi.org/10.3201/eid0806.010309

Hay, Katherine, et al. (2019). Disrupting Gender Norms in Health Systems: Making the Case for Change. The Lancet, 393(10190), 2535–49. https://doi.org/10.1016/S0140-6736(19)30648-8

Heise, Lori, et al. (2019). Gender Inequality and Restrictive Gender Norms: Framing the Challenges to Health. The Lancet, 393(10189), 2440–54. https://doi.org/10.1016/S0140-6736(19)30652-X
Hershey, C. L., Bhattarai, A., Florey, L. S., McElroy, P. D., Nielsen, C. F., Ye, Y., ... & Salgado, S. R. (2017). Implementing impact evaluations of malaria control interventions: process, lessons learned, and recommendations. The American Journal of Tropical Medicine and Hygiene, 97(3 Suppl), 20. https://doi.org/10.4269/ajtmh.17-0064

Hipólito, Juliana, et al. (2021). The Gender Gap in Brazilian Entomology: An Analysis of the Academic Scenario. Neotropical Entomology, 50(6), 859–72. https://doi.org/10.1007/s13744-021-00918-7

Hoek Spaans, R., Mkumbwa, A., Nasoni, P., Jones, C. M., & Stanton, M. C. (2024). Impact of four years of annually repeated indoor residual spraying (IRS) with Actellic 300CS on routinely reported malaria cases in an agricultural setting in Malawi. PLOS Global Public Health, 4(4). https://doi.org/10.1371/journal.pgph.0002264
Houndjo, W. (April 22). Use of a mathematical model to guide the choice of geographic or demographic expansion of Seasonal Malaria Chemoprevention (SMC) in Benin. Presentation at the MIM Conference, Kigali, Rwanda.
Ingabire, C. M., Hakizimana, E., Rulisa, A., Kateera, F., Van Den Borne, B., Muvunyi, C. M., ... & Alaii, J. (2017). Community-based biological control of malaria mosquitoes using Bacillus thuringiensis var. israelensis (Bti) in Rwanda: community awareness, acceptance and participation. Malaria Journal, 16, 1-13. https://doi.org/10.1186/s12936-017-2046-y

Jepperson, R., & Meyer, J. W. (2011). Multiple levels of analysis and the limitations of methodological individualisms. Sociological Theory, 29(1), 54-73.

Johnson, K., Kamara, A., Sesay, F., Bangura, S., Conteh, A., Jalloh, M., Smith, G.C., Ahmed, J., & Smith, J. L. (2024). Identifying and characterizing high-risk populations in pilot malaria elimination districts in Sierra Leone: a mixed-methods study. Malaria Journal, 23(1):150. https://doi.org/10.1186/s12936-024-04965-3

Jones, R. T., Tusting, L. S., Smith, H. M. P., Segbaya, S., Macdonald, M. B., Bangs, M. J., & Logan, J. G. (2020). The Role of the Private Sector in Supporting Malaria Control in Resource Development Settings. The Journal of infectious diseases, 222(Suppl 8), S701–S708. https://doi.org/10.1093/infdis/jiaa488

Kabaria, C. W., Gilbert, M., Noor, A. M., Snow, R. W., & Linard, C. The impact of urbanization and population density on childhood Plasmodium falciparum parasite prevalence rates in Africa. Malaria Journal, 16, 49. https://doi.org/10.1186/s12936-017-1694-2

Kabula, B., Derua, Y. A., Tungu, P. K., Massue, D. J., Sambu, E., Mosha, F. W., & Kisinza, W. N. (2011). Malaria entomological profile in Tanzania from 1950 to 2010: a review of mosquito distribution, vectorial capacity and insecticide resistance. Tanzania journal of health research, 13(5).

Katz, E. & Hartley, A. (2020). Gender and Malaria Evidence Review. Bill & Melinda Gates Foundation.

Kentikelenis, A. and Rochford, C. (2019). Global asymmetries in global governance for health: A conceptual framework for analyzing the political economic determinants of health inequities. Global Health, 15(Suppl 1), 70. https://doi.org/10.1186/s12992-019-0516-4

Kenya Malaria Global Fund Funding Request, 2024-2027.

Khan, J., Mubiru, D., Chestnutt, E. G., Cook, L., Lual Riiny, L., Okot, F., ... & Nnaji, C. A. (2024). Usability of a digital tool to support long-lasting insecticide net distribution in Northern Bahr el Ghazal State, South Sudan. Malaria Journal, 23(1), 318. https://doi.org/10.1186/s12936-024-05092-w

Kialanda, K. (2024). Data-driven stratification of ITNs to optimize impact of a limited funding envelope in three provinces of Angola. Presentation at the MIM Conference, Kigali, Rwanda.
Kifle, M. M., Teklemariam, T. T., Teweldeberhan, A. M., Tesfamariam, E. H., Andegiorgish, A. K., & Azaria Kidane, E. (2019). Malaria risk stratification and modeling the effect of rainfall on malaria incidence in Eritrea. Journal of Environmental and Public Health, 2019(1), 7314129. https://doi.org/10.1155/2019/7314129

Kilian, A., (2024). The private sector and malaria. In A.L. Harding & T. Montague (Eds.). Embracing Mixed Health Systems: Navigating the Development Trap (pp. 187-228). World Scientific Publishing Co. Pte. Ltd. https://doi.org/10.1142/13803

Killeen, G. F., Tami, A., Kihonda, J., Okumu, F. O., Kotas, M. E., Grundmann, H., ... & Lengeler, C. (2007). Cost-sharing strategies combining targeted public subsidies with private-sector delivery achieve high bednet coverage and reduced malaria transmission in Kilombero Valley, southern Tanzania. BMC Infectious Diseases, 7, 1-20. https://doi.org/10.1186/1471-2334-7-121

Kim, D., Fedak, K., & Kramer, R. (2012). Reduction of malaria prevalence by indoor residual spraying: a meta-regression analysis. The American Journal of Tropical Medicine and Hygiene, 87(1):117-24. https://doi.org/10.4269/ajtmh.2012.11-0620

Kim, S., Luande, V.N., Rocklöv, J., Carlton, J.M., & Tozan, Y. (2021). A Systematic Review of the Evidence on the Effectiveness and Cost-Effectiveness of Mass Screen-and-Treat Interventions for Malaria Control. The American Journal of Tropical Medicine and Hygiene, 105(6):1722-1731. https://doi.org/10.4269/ajtmh.21-0325

Kramer, K., Mandike, R., Nathan, R., Mohamed, A., Lynch, M., Brown, N., Mnzava, A., Rimisho, W., & Lengeler, C. (2017). Effectiveness and equity of the Tanzania National Voucher Scheme for mosquito nets over 10 years of implementation. Malaria Journal, 16(1), 255. https://doi.org/10.1186/s12936-017-1902-0
Kunnuji, M., Shawar, Y.R., Neill, R., Manoj, M., & Shiffman, J. (2023). Why 'elevating country voice' is not decolonizing global health: A frame analysis of in-depth interviews. PLOS Glob Public Health 3(2), e0001365. https://doi.org/10.1371/journal.pgph.0001365 Lal, A. A., Rajvanshi, H., Jayswar, H., Das, A., & Bharti, P. K. (2019). Malaria elimination: Using past and present experience to make malaria-free India by 2030. Journal of Vector Borne Diseases, 56(1), 60-65. https://doi.org/10.4103/0972-9062.257777 Larson, P. S., Eisenberg, J. N., Berrocal, V. J., Mathanga, D. P., & Wilson, M. L. (2021). An urban-to-rural continuum of malaria risk: new analytic approaches characterize patterns in Malawi. Malaria Journal, 20, 1-14. https://doi.org/10.1186/s12936-021-03950-5
Le Menach, A. (2023). Moving from Theory to Practice: Key Concepts and Operational Factors to Transform Surveillance as a Core Intervention. The American Journal of Tropical Medicine and Hygiene, 108(2 Suppl), 1. https://doi.org/10.4269/ajtmh.23-0019

Lemant, J., Champagne, C., Houndjo, W., et al. (2024). Modelling to support decisions about the geographic and demographic extensions of seasonal malaria chemoprevention in Benin. medRxiv. https://doi.org/10.1101/2024.04.25.24306333
Levy, J. K., Darmstadt, G. L., Ashby, C., Quandt, M., Halsey, E., Nagar, A., & Greene, M. E. (2020). Characteristics of successful programmes targeting gender inequality and restrictive gender norms for the health and wellbeing of children, adolescents, and young adults: a systematic review. The Lancet Global Health, 8(2), e225-e236. https://doi.org/10.1016/S2214-109X(19)30495-4 Liberia, (PR selection ongoing at time of submission), 2023. Funding request submitted to The Global Fund.

Likwela, J. L., Ciula, J. K., Ntumba, A. K., Kumbi, A. N., & Ngwala, P. L. (2023). A roadmap for the digital management of long-lasting insecticide-treated mosquito nets (LLINs) distribution campaigns in the Democratic Republic of Congo. Pan African Medical Journal, 44(1).

Lindsay, S.W., & Martens, W. (1998). Malaria in the African highlands: past, present and future. Bulletin of the World Health Organization, 76(1), 33.

Malawi, Ministry of Health, 2023. Funding request submitted to The Global Fund, p.14, 35.

Mategula, D., Gichuki, J., Chipeta, M. G., Chirombo, J., Kalonde, P. K., Gumbo, A., ... & Terlouw, D. J. (2023). Two decades of malaria control in Malawi: Geostatistical Analysis of the changing malaria prevalence from 2000-2022. Wellcome Open Research, 8. https://doi.org/10.12688/wellcomeopenres.19390.1

Mategula, D., Mitambo, C., Sheahan, W., et. al. (2023). Malaria Burden Stratification in Malawi- A report of a consultative workshop to inform the 2023-2030 Malawi Malaria Strategic Plan. Wellcome Open Research, 8(178). https://doi.org/10.12688/wellcomeopenres.19110.1

Maxwell, K., Chestnutt, E. G., Uhomoibhi, P., Kompaoré, C., Opigo, J., & Tibenderana, J. K. (2023). All hands on deck: Malaria control urgently needs workable public-private-philanthropic partnerships (PPPP). PLOS global public health, 3(4), e0001891. https://doi.org/10.1371/journal.pgph.0001891

McGuire, D. (2023). Overview of vector control for malaria elimination. Presentation at the Annual Meeting of the American Society of Tropical Medicine & Hygiene, Chicago.

Mechael, P. and Chaney Cunard, S. (2022). Gender-Intentional Digital Health Intervention & Enablers: A Rapid Guide for Analysis, Planning, and Monitoring. Global Alliance for Vaccines and Immunization. https://www.comminit.com/global/content/gender-intentional-digital-health-intervention-enablers-rapid-guide-analysis-planning-an.

Mfisimana, L.D., Nibayisabe, E., Badu, K., Niyukuri, D. (2022). Exploring predictive frameworks for malaria in Burundi. Infectious Disease Modelling, 7(2), 33-44. https://doi.org/10.1016/j.idm.2022.03.003

Mills A., Vaughan J.P., Smith D.L., & Tabibzadeh I. (1990). Health system decentralization: concepts, issues and country experience. Edited by Anne Mills…[et al.]. World Health Organization.

Munyakanage, D., Niyituma, E., Mutabazi, A., Misago, X., Musanabaganwa, C., Remera, E., ... & Muvunyi, C. M. (2024). The impact of Bacillus thuringiensis var. israelensis (Vectobac® WDG) larvicide sprayed with drones on the bio-control of malaria vectors in rice fields of sub-urban Kigali, Rwanda. Malaria Journal, 23(1), 281.

Mouzin, E., Sedlmayr, R., Miller, J., Steketee R., Banda, P., Chiyota G., & Kabaghe C. (2011). Business investing in malaria control: economic returns and a healthy workforce for Africa. Roll Back Malaria Progress & Impact Series, 6. https://media.path.org/documents/MCP_rbm_pi_rpt_6.pdf?_gl=1*1no05sh*_gcl_au*ODU0MTkxNDI3LjE3MzUyNDA2NDQ.*_ga*NzM3MDk5NDUyLjE3MzUyNDA2NDU.*_ga_YBSE7ZKDQM*MTczNTI0MDY0NC4xLjAuMTczNTI0MDY0NC42MC4wLjA.

Musuva, A., Chandani, Y., Njenga, E., Nyingi, S., Mbuthia, B., Murira, F., Kennedy, D., Mwangi, J., Wasta, B., Marangu, M., Vîlcu, I., & Boxshall, M. (2024.) Examining How Counties Finance, Procure, and Manage Essential Medicines and Supplies: A case study of four counties in Kenya. Kenya Report 2. Nairobi: ThinkWell, InSupply Health, and the Chartered Institute of Procurement and Supplies

Mwalimu, C. D., Kiware, S., Nshama, R., Derua, Y., Machafuko, P., Gitanya, P., ... & Kisinza, W. N. (2024). Dynamics of malaria vector composition and Plasmodium falciparum infection in mainland Tanzania: 2017–2021 data from the national malaria vector entomological surveillance. Malaria journal, 23(1), 29. Mwangungulu, S. P., Sumaye, R. D., Limwagu, A. J., Siria, D. J., Kaindoa, E. W., & Okumu, F. O. (2016). Crowdsourcing vector surveillance: using community knowledge and experiences to predict densities and distribution of outdoor-biting mosquitoes in rural Tanzania. Plos one, 11(6), e0156388.

Mozambique, Ministry of Health of Mozambique, World Vision International, Fundação para o Desenvolvimento da Comunidade and Centro de Colaboração em Saúde, 2023. Funding request submitted to The Global Fund.

National Malaria Control Program, National Malaria Strategic Plan 2021-2025: Transitioning to Malaria Elimination in Stagers (2020) The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children.

National Malaria Elimination Strategic Plan (NMESP) 2024–2028 (2023) National Malaria Elimination Programme (NMEP) Ghana Health Service Ministry of Health, Republic of Ghana

National Action Plan for Acceleration of Malaria Elimination 2020-2026, Directorate General of Disease Prevention and Control Ministry of Health of The Republic of Indonesia

Newby, G., Chaki, P., Latham, M., Marrenjo, D., Ochomo, E., Nimmo, D., ... & Macdonald, M. (2025). Larviciding for malaria control and elimination in Africa. Malaria Journal, 24(1), 16.

Ngadjeu, C. S., Talipouo, A., Kekeunou, S., Doumbe-Belisse, P., Ngangue-Siewe, I. N., Djamouko-Djonkam, L., ... & Antonio-Nkondjio, C. (2022). Knowledge, practices and perceptions of communities during a malaria larviciding randomized trial in the city of Yaoundé, Cameroon. Plos one, 17(11), e0276500.

Ngwafor, R., Pokharel, S., Aguas, R., White, L., & Shretta, R. (2024). Models for malaria control optimization-a systematic review. Malaria journal, 23(1), 295. https://doi.org/10.1186/s12936-024-05118-3 Nishtar, S. (2004). Public–private ‘'partnerships' in health–a global call to action. Health research policy and systems, 2, 1-7.

Niger, Ministere de la Sante Publique, de la Population et des Affaires Sociales, Secretariat General, Direction de Lutte Contre la Maladie, Programme National de Lutte Contre le Paludisme (2020). Plan Strategique National de Lutte Contre Le Paludisme 2023-2026: acceler la reduction de l’incidence du palludisme au Niger, [English trans.] p.46.

Njau, R.J., de Savigny, D., Gilson, L., Mwageni, E., & Mosha, F.W. (2009). Implementation of an insecticide-treated net subsidy scheme under a public-private partnership for malaria control in Tanzania—challenges in implementation. Malaria Journal, 8, 201. https://doi.org/10.1186/1475-2875-8-201

NMCP, INFORM, and LSHTM (2015). Sierra Leone: A Profile of Malaria Control and Epidemiology.

Noor, A. M., Kibuchi, E., Mitto, B., Coulibaly, D., Doumbo, O. K., & Snow, R. W. (2015). Sub-national targeting of seasonal malaria chemoprevention in the Sahelian countries of the Nouakchott Initiative. Plos one, 10(8), e0136919. https://doi.org/10.1371/journal.pone.0140414

OCHA, Humanitarian Crisis in Sudan: Statement by the Humanitarian Coordination Forum (HCF) (2023), https://www.unocha.org/publications/report/sudan/humanitarian-crisis-sudan-statement-humanitarian-coordination-forum-hcf#:~:text=Sudan%20is%20the%20world's%20largest,have%20fled%20to%20neighbouring%20countries.

Offosse N., Marie-Jeanne. (2022.) Devolution of the Health Sector to Communes: A Misfit in the National Health System Governance Framework and Management Shortfalls in Burkina Faso. Case Study Series on Devolution, Health Financing, and Public Financial Management. Ouagadougou: ThinkWell.

Onyango, L., Ouédraogo-Ametchie, G., Ozodiegwu, I., Galatas, B., & Gerardin, J. (2024). Sub-national tailoring of malaria interventions for strategic planning and prioritization: experience and perspectives of five malaria programs. medRxiv https://doi.org/10.1101/2024.09.18.24313938

Osoro, C., Ochodo, E., Kwambai, T., et. al. (2024). Policy uptake and implementation of the RTS,S/AS01 malaria vaccine in sub-Saharan African countries: status 2 years following the WHO recommendation. BMJ Global Health, 9, e014719. https://doi.org/10.1136/bmjgh-2023-014719 Ozodiegwu, I. D., Ambrose, M., Galatas, B., Runge, M., Nandi, A., Okuneye, K., ... & Gerardin, J. (2023). Application of mathematical modelling to inform national malaria intervention planning in Nigeria. Malaria journal, 22(1), 137. https://doi.org/10.1186/s12936-023-04563-w

Paintain, L., Kpabitey, R., Nyanor-Fosu, F., Piccinini Black, D., Bertram, K., Webster, J., ... & Lynch, M. (2022). Using donor funding to catalyse investment in malaria prevention in Ghana: an analysis of the potential impact on public and private sector expenditure. Malaria journal, 21(1), 203.

Parker, L. A., Zaragoza, G. A., & Hernández-Aguado, I. (2019). Promoting population health with public-private partnerships: Where's the evidence? BMC public health, 19(1), 1438. https://doi.org/10.1186/s12889-019-7765-2

Parkhurst, J., Ghilardi, L., Webster, J., Snow, R. W., & Lynch, C. A. (2021). Competing interests, clashing ideas and institutionalizing influence: insights into the political economy of malaria control from seven African countries. Health policy and planning, 36(1), 35-44.

Path, New Nets Final Report (2023), https://www.path.org/our-impact/resources/new-nets-project-evidence-of-effectiveness-and-cost-effectiveness-of-dual-ai-itns-from-the-observational-pilot-studiesfinal-report/

Path and Vital Wave (2016). Theory of Change for the Data Use Partnership. https://media.path.org/documents/DHS_DUP_Theory_of_Change_rpt.pdf

Phiri, M. D., McCann, R. S., Kabaghe, A. N., van den Berg, H., Malenga, T., Gowelo, S., Tizifa, T., Takken, W., van Vugt, M., Phiri, K. S., Terlouw, D. J., & Worrall, E. (2021). Cost of community-led larval source management and house improvement for malaria control: A cost analysis within a cluster-randomized trial in a rural district in Malawi. *Malaria Journal, 20*, Article 268. https://doi.org/10.1186/s12936-021-03810-7

Plank-Bazinet, J. L., Heggeness, M. L., Lund, P. K., & Clayton, J. A. (2017). Women's careers in biomedical sciences: implications for the economy, scientific discovery, and women's health. Journal of Women's Health, 26(5), 525-529. https://doi.org/10.1089/jwh.2016.6012

Poppe, O. (2021). Digital Platforms for Standardisation in Global Health: The Case of the Digital Health Packages.

Pradhan, S., Pradhan, M. M., Dutta, A., Shah, N. K., Joshi, P. L., Pradhan, K., Sharma, S. K., Grewal Daumerie, P., Banerji, J., Duparc, S., Mendis, K., Murugasampillay, S., Valecha, N., & Anvikar, A. R. (2019). Improved access to early diagnosis and complete treatment of malaria in Odisha, India. PloS one, 14(1), e0208943. https://doi.org/10.1371/journal.pone.0208943

Rahi, M., Das, P., Sharma, A. (2021). Malaria elimination in India requires additional surveillance mechanisms. Journal of Public Health. 44(3), 527–531. https://doi.org/10.1093/pubmed/fdab106

Rahi, M., Sharma, A. (2020). For malaria elimination India needs a platform for data integration. BMJ Global Health. 5: e004198. https://doi.org/10.1136/bmjgh-2020-004198 Rahi, M., & Sharma, A. (2022). India could harness public-private partnerships to achieve malaria elimination. The Lancet regional health. Southeast Asia, 5, 100059. https://doi.org/10.1016/j.lansea.2022.100059

Raman, J., Morris, N., Frean, J., Brooke, B., Blumberg, L., Kruger, P., ... & Moonasar, D. (2016). Reviewing South Africa's malaria elimination strategy (2012–2018): progress, challenges and priorities. Malaria journal, 15, 1-11. https://doi.org/10.1186/s12936-016-1497-x

Republic of Indonesia, Directorate General of Disease Prevention and Control, Ministry of Health (2020). National action plan for acceleration of malaria elimination 2020–2026.

Republic of Indonesia, Ministry of Health, Directorate General of Disease Prevention and Control, and Persatuan Karya Dharma Kesehatan Indonesia (PERDHAKI), 2023. Funding request submitted to The Global Fund, p.31.

Rerolle F, Jacobson JO, Smith Gueye C, Bennett A, Carrillo S, Ntuku H, Smith JL. Estimating the size of populations at risk for malaria: a case study in cattle herders and agricultural workers in Northern Namibia. Sci Rep. 2024 Mar 26;14(1):7160. doi: 10.1038/s41598-024-56810-y. PMID: 38531921; PMCID: PMC10965975.

Roca-Feltrer, A., Candrinho, B., Ndiop, M., Prosnitz, D., Robertson, M., & Ye, Y. (2022). Operationalizing Surveillance as a Malaria Intervention: Data Use for Action. The American Journal of Tropical Medicine and Hygiene, 108(2 Suppl), 3. https://doi.org/10.4269/ajtmh.22-0153

Rodríguez, D. C., Balaji, L. N., Chamdimba, E., et al. (2023). Political economy analysis of sub-national health management in Kenya, Malawi, and Uganda. Health Policy and Planning, 38(5), 631–647. https://doi.org/10.1093/heapol/czad021

Rulisa, A., Van Kempen, L., Hakizimana, E., & Koenraadt, C. J. (2023). Local resource mobilization for malaria vector control among Rwandan rice farmers: a pilot study into the role of community ownership. Journal of Health, Population and Nutrition, 42(1), 6.

Rugnao, S., Gonahasa, S., Maiteki-Sebuguzi, C., Opigo, J., Yeka, A., Katureebe, A., ... & Staedke, S. G. (2019). LLIN Evaluation in Uganda Project (LLINEUP): factors associated with childhood parasitaemia and anaemia 3 years after a national long-lasting insecticidal net distribution campaign: a cross-sectional survey. Malaria Journal, 18, 1-12. https://doi.org/10.1186/s12936-019-2838-3

Runge, M., Thawer, S. G., Molteni, F., Chacky, F., Mkude, S., Mandike, R., ... & Pothin, E. (2022). Sub-national tailoring of malaria interventions in Mainland Tanzania: simulation of the impact of strata-specific intervention combinations using modelling. Malaria Journal, 21(1), 92. https://doi.org/10.1186/s12936-022-04099-5

Ruwanpura, V. S., Grietens, K. P., Price, R. N., & Thriemer, K. (2024). Evidence uptake is only part of the process: stakeholders' insights on WHO treatment guideline recommendation processes for radical cure of P. vivax malaria. PLOS Global Public Health, 4(3), e0002990.

Sanders, K. C., Rundi, C., Jelip, J., Rashman, Y., Smith Gueye, C., & Gosling, R. D. (2014). Eliminating malaria in Malaysia: the role of partnerships between the public and commercial sectors in Sabah. Malaria Journal, 13, 24. https://doi.org/10.1186/1475-2875-13-24

Scott, W. R. (1995). Institutions and Organizations. Thousand Oaks. Cal: Sage Publications.

Selinger, C., Jeandron, A., Pontiggia, G., & Pothin, E. (2023). Modelling the impact of programmatic interventions in Kenya to support update of the National Strategic Plan: Brief report for high endemic areas [unpublished workshop report, annex to Kenya's GC7 Funding Request]. Swiss TPH.

Semakula, M., Niragire, F., & Faes, C. (2020). Bayesian spatio-temporal modeling of malaria risk in Rwanda. PloS one, 15(9), e0238504. https://doi.org/10.1371/journal.pone.0238504

Sharma, S., Verma, R., Yadav, B., Kumar, A., Rahi, M., & Sharma, A. (2022). What India can learn from globally successful malaria elimination programmes. BMJ Global Health, 7(6), e008431. https://doi.org/10.1136/bmjgh-2022-008431

Shiffman, J. (2014). Knowledge, moral claims and the exercise of power in global health. International journal of health policy and management, 3(6), 297.

A. S. Siraj et al. (2014). Altitudinal Changes in Malaria Incidence in Highlands of Ethiopia and Colombia. Science 343, 1154-1158. https://doi.org/10.1126/science.1244325

Smith, A., Ouedraogo, R., Diarra, A., Traore, B., Zongo, I., Diallo, S., Coulibaly, M., Tinto, H., & Smith, G.C. (2024). Identifying and characterizing high-risk populations in pilot malaria elimination districts in Burkina Faso: a mixed-methods study. Malaria Journal 23(1):145. https://doi.org/10.1186/s12936-024-04950-y

Smith Gueye, C., Newby, G., Tulloch, J. et al. (2016). The central role of national programme management for the achievement of malaria elimination: a cross case-study analysis of nine malaria programmes. Malaria Journal, 15, 488. https://doi.org/10.1186/s12936-016-1518-9

South Sudan, UNICEF, 2023. Funding request submitted to The Global Fund, p.29.

Snow, R. W., & Noor, A. M. (2015). Malaria risk mapping in Africa: The historical context to the Information for Malaria (INFORM) project. Nairobi: UKaid and the Wellcome Trust.

Stephens, J.W.W. & Christophers, S.R. (1901). The proposed site for European residences in the Freetown Hills. Reports to the Malaria Commission of the Royal Society, 1-5.

Sudathip, P., Dharmarak, P., Rossi, S., Promda, N., Newby, G., Larson, E., ... & Prempree, P. (2022). Leveraging geo-referenced malaria information to increase domestic financial support for malaria elimination in Thailand. Malaria Journal, 21(1), 213.

Swai, J. K., Ntabaliba, W. S., Mbuba, E., Bakari, H. A., Makungwa, N. O., Mseka, A. P., ... & Moore, S. J. (2024). SC Johnson Guardian™ spatial repellent shows one-year efficacy against wild pyrethroid-resistant Anopheles arabiensis, with similar blood-feeding inhibition efficacy to Mosquito Shield™ in a Tanzanian experimental hut trial. medRxiv, 2024-11.

Swana, E. K., Yav, T. I., Ngwej, L. M., Mupemba, B. N., Suprianto, Mukeng, C. K., ... & Bangs, M. J. (2018). School-based malaria prevalence: informative systematic surveillance measure to assess epidemiological impact of malaria control interventions in the Democratic Republic of the Congo. Malaria Journal, 17, 1-22.

Tannenbaum, C., Ellis, R. P., Eyssel, F., Zou, J., & Schiebinger, L. (2019). Sex and gender analysis improves science and engineering. Nature, 575(7781), 137-146. https://doi.org/10.1038/s41586-019-1657-6

Tanzania, Ministry of Finance and Planning, 2023. Funding request submitted to The Global Fund.

Tatem AJ. Small area population denominators for improved disease surveillance and response. Epidemics. 2022 Sep;40:100597. doi: 10.1016/j.epidem.2022.100597. Epub 2022 Jun 17. PMID: 35749928; PMCID: PMC9212890.

Tia, J. P. B., Tchicaya, E. S., Zahouli, J. Z., Ouattara, A. F., Vavassori, L., Assamoi, J. B., ... & Koudou, B. G. (2024). Combined use of long-lasting insecticidal nets and Bacillus thuringiensis israelensis larviciding, a promising integrated approach against malaria transmission in northern Côte d'Ivoire. Malaria Journal, 23(1), 168.

Togo, Primature de la Republique Togolaise, 2023. Funding request submitted to The Global Fund, p.50.

Topazian H.M., Schmit N., Gerard-Ursin I., Charles G.D., Thompson H., Ghani A.C., Winskill P. Modelling the relative cost-effectiveness of the RTS,S/AS01 malaria vaccine compared to investment in vector control or chemoprophylaxis. Vaccine. 2023 May 11;41(20):3215-3223. doi: 10.1016/j.vaccine.2023.04.011. Epub 2023 Apr 18. PMID: 37080831.
Bottom of Form

Tesfazghi, K., Hill, J., Jones, C., Ranson, H., & Worrall, E. (2016). National malaria vector control policy: an analysis of the decision to scale-up larviciding in Nigeria. Health policy and planning, 31(1), 91-101.

Tesfazghi, K., Traore, A., Ranson, H., N'Fale, S., Hill, J., & Worrall, E. (2015). Challenges and opportunities associated with the introduction of next-generation long-lasting insecticidal nets for malaria control: a case study from Burkina Faso. Implementation Science, 11, 1-12.

Thawer, S. G., Golumbeanu, M., Lazaro, S., Chacky, F., Munisi, K., Aaron, S., ... & Alegana, V. A. (2023). Spatio-temporal modelling of routine health facility data for malaria risk micro-stratification in mainland Tanzania. Scientific Reports, 13(1), 10600. https://doi.org/10.1038/s41598-023-37669-x

Thawer, S. G., Chacky, F., Runge, M., Reaves, E., Mandike, R., Lazaro, S., ... & Molteni, F. (2020). Sub-national stratification of malaria risk in mainland Tanzania: a simplified assembly of survey and routine data. Malaria journal, 19, 1-12. https://doi.org/10.1186/s12936-020-03250-4

Theobald, S., Brandes, N., Gyapong, M., El-Saharty, S., Proctor, E., Diaz, T., Wanji, S., Elloker, S., Raven, J., Elsey, H., Bharal, S., Pelletier, D., & Peters, D. H. (2018). Implementation research: new imperatives and opportunities in global health. Lancet (London, England), 392(10160), 2214–2228. https://doi.org/10.1016/S0140-6736(18)32205-0

The Annie E. Casey Foundation (AECF). (2022). Theory of change. The Annie E. Casey Foundation, Baltimore, Maryland.

The Global Fund (2024). ELO concept note for C19RM lessons learned. https://docs.google.com/presentation/d/1rynuWQYJZi_ah67b0fhqzwBxoqlTnvBf/edit#slide=i d.p1
The Global Fund. (2024). Options for joint working group presented to strategy committee. In Collaboration between the Global Fund, Gavi, and the Global Financing Facility (GFF): Report to the Board (BM51/21). https://archive.theglobalfund.org/media/14300/archive_bm51-21-collaboration-global-fund-gavi-gff_report_en.pdf

The Global Fund. (2024). Annex 1: Climate interventions within the Global Fund modular framework. In Malaria and climate change: Reprogramming guidelines for GC7, pp. 26–30. https://www.theglobalfund.org/media/15257/fundingmodel_malaria-climate-reprogramming-gc7_guidelines_en.pdf

The Global Fund (2023). Technical evaluation reference group: Thematic evaluation of data-driven decision-making (DDDM). TERG Position Paper, Management Response, and Final Report. https://archive.theglobalfund.org/media/13063/archive_terg-data-driven-decision-making_report_en.pdf

The Global Fund. (2023). Technical Brief Gender Equality. https://www.theglobalfund.org/media/5728/core_gender_infonote_en.pdf.

The Global Fund. (2023). We Must Not Let Climate Change Derail the Fight Against Malaria. https://www.theglobalfund.org/en/opinion/2023/2023-12-01-we-must-not-let-climate-change-derail-the-fight-against-malaria/

The Global Fund. (2023). Fighting Pandemics and Building a Healthier and More Equitable World: Global Strategy (2023-2028). https://www.theglobalfund.org/media/11612/strategy_globalfund2023-2028_narrative_en.pdf

United Republic of Tanzania, National Malaria Control Program, Ministry of Health, Community Development, Gender, Elderly and Children (2020). National malaria strategic plan 2021–2025: transitioning to malaria elimination in stages.

United Republic of Tanzania. Technical Review Panel (2020). Funding Request Review and Recommendation, p.5.

U.S. President's Malaria Initiative (2023). Country Profiles. https://pmi.gov [This website no longer exists].

U.S. President's Malaria Initiative (2023), Angola Malaria Operational Plan, FY 2023. https://pmi.gov [This website no longer exists].

U.S. President's Malaria Initiative (2023). Cambodia Malaria Operational Plan, FY2023. https://pmi.gov [This website no longer exists.]

Utzinger, J., Wyss, K., Moto, D. D., Tanner, M., & Singer, B. H. (2004). Community health outreach program of the Chad-Cameroon petroleum development and pipeline project. Clinics in occupational and environmental medicine, 4, 9-26.

Van Bortel, W., Mariën, J., Jacobs, B. K., Sinzinkayo, D., Sinarinzi, P., Lampaert, E., ... & Leclair, C. (2022). Long-lasting insecticidal nets provide protection against malaria for only a single year in Burundi, an African highland setting with marked malaria seasonality. BMJ Global Health, 7(12), e009674.

Walker, K.A. Females Are First Authors, Sole Authors, and Reviewers of Entomology Publications Significantly Less Often Than Males. Annals of the Entomological Society of America, 113(3), 193–201. https://doi.org/10.1093/aesa/saz066

Walker, K.A. Longitudinal Career Survey of Entomology Doctoral Graduates Suggests That Females Are Disadvantaged in Entomology Job Market. Annals of the Entomological Society of America, 115(6), 472–80. https://doi.org/10.1093/aesa/saac018

Weber, M. (1978). Economy and society: An outline of interpretive sociology (Vol. 1). University of California press.

Wei, L., & Lin, H. (2017). Not a one-size-fits-all methodology: A survey of mixed methods. Journal of Advances in Education Research, 2(2), 97-102.

White, M.T., Conteh, L., Cibulskis, R. et al. (2011). Costs and cost-effectiveness of malaria control interventions - a systematic review. Malaria Journal, 10, 337, https://doi.org/10.1186/1475-2875-10-337

World Health Organization. (2025). Updated map for Figure 7 provided by WHO-AFRO, email communication 2.14.2025.

World Health Organization. (2025). Malaria vaccine introduction status. https://app.powerbi.com/view?r=eyJrIjoiZmZjN2RkOGYtYzM4NS00MWYxLThhYmMtYzg3YjMwYjU2ZDA4IiwidCI6ImY2MTBjMGI3LWJkMjQtNGIzOS04MTBiLTNkYzI4MGFmYjU5MCIsImMiOjh9

World Health Organization. (2024). Guiding principles for prioritizing malaria interventions in resource-constrained country contexts to achieve maximum impact. In Guiding principles for prioritizing malaria interventions in resource-constrained country contexts to achieve maximum impact.

World Health Organization. (2024). Update on sub-national tailoring of malaria interventions and strategies. Malaria Policy Advisory Group Meeting, March 4-5, 2024.

World Health Organization. (2023). Sub-national tailoring of malaria interventions and strategies, RBM Regional Meeting October 2023, Kampala. Dr. Beatriz Galatas, Strategic Information and Response Unit, Global Malaria Program.

World Health Organization, Global Malaria Programme. (2023). Climate change, malaria, and the global response. World Malaria Report, 94-106. https://www.who.int/publications/i/item/9789240086173
World Health Organization, UN Habitat. Global framework for the response to malaria in urban areas. Geneva: World Health Organization, 2022. https://apps.who.int/iris/handle/10665/363899. Accessed 2 Nov 2022.

World Health Organization. (2020). WHO technical brief for countries preparing malaria funding requests for the Global Fund (2020–2022). Global Malaria Programme (GMP). https://www.who.int/publications/i/item/9789240004139

World Health Organization. (2018). Malaria surveillance, monitoring and evaluation: a reference manual.

World Health Organization. (2015). Global technical strategy for malaria 2016-2030. World Health Organization.

Wotodjo, A N., Doucouré, S., Gaudart, J., et al. (2017). Malaria in Dielmo, a Senegal village: Is its elimination possible after seven years of implementation of long-lasting insecticide-treated nets? Public Library of Science, 12(7), e0179528-e0179528. https://doi.org/10.1371/journal.pone.0179528 [NB: article has been tagged for concerns about research ethics approval].

Yukich, J., Digre, P., Scates, S., Boydens, L., Obi, E., Moran, N., ... & Robertson, M. (2022). Incremental cost and cost-effectiveness of the addition of indoor residual spraying with pirimiphos-methyl in sub-Saharan Africa versus standard malaria

control: results of data collection and analysis in the Next Generation Indoor Residual Sprays (NgenIRS) project, an economic-evaluation. Malaria Journal, 21(1), 185.

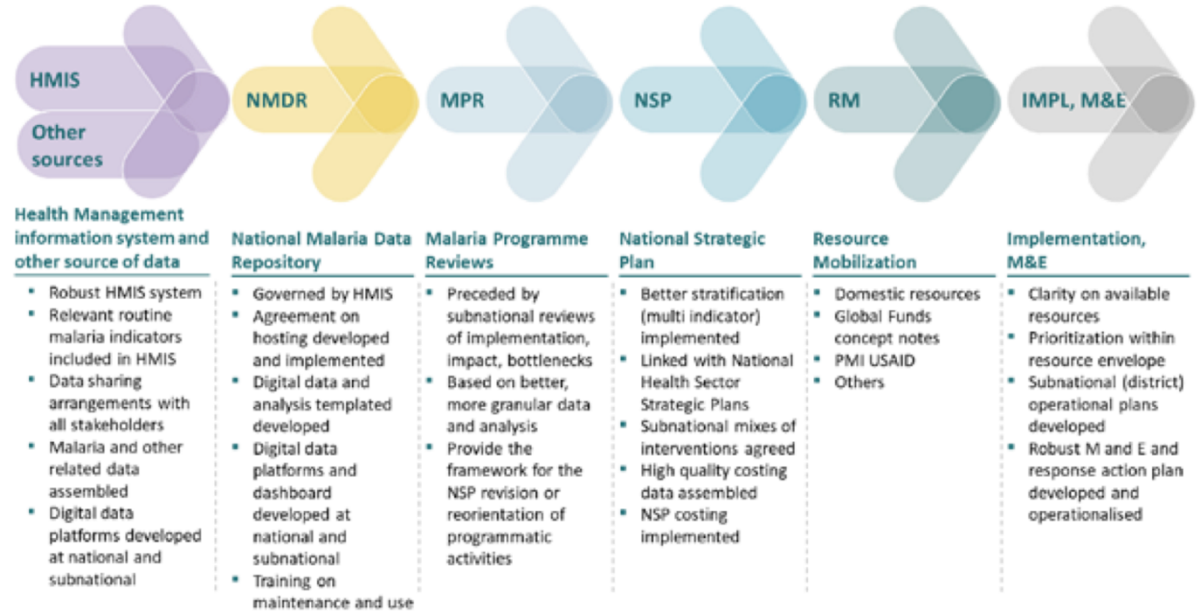
Zhou, Y., Zhang, W. X., Tembo, E., Xie, M. Z., Zhang, S. S., Wang, X. R., ... & Lu, Q. B. (2022). Effectiveness of indoor residual spraying on malaria control: a systematic review and meta-analysis. Infectious Diseases of Poverty, 11(04), 29-42.

Annex B: Evolution of Sub-national Tailoring Process Steps (WHO)

Annex B briefly describes and illustrates the evolution of the SNT process as conceptualized in WHO guidance from 2020 to the (upcoming) 2025 SNT manual.

2020: In 2020 WHO provided technical guidance for all countries filling out Global Fund malaria concept notes (FRs) (WHO, 2018-2020). This document laid out steps for the collection of what was then called "strategic information" into MDRs for use during MPRs, and then for informing National Strategic Plans (NSPs) and ended with implementation:

Figure 2: An illustrative process for the collection, collation and use of strategic information for the delivery of national malaria programmes



2021-2023: Expansion to a Broader Group (2021-2023): WHO extended its stratification initiative to include a larger group of 28 malaria-endemic countries. Workshops provided technical support and tools for countries to conduct detailed epidemiological analyses, enabling more precise intervention planning, and promoted 8 steps, conceived as a natural part of national strategic planning: (quoted directly from Onyango et al., 2024). These 8 steps included monitoring and evaluation of the impact of costed plans:

1. **Assembly of an SNT team** led by the NMP, consisting of local, regional, and/or global partners in addition to the NMP itself.
2. **Determination of criteria** to be used to target interventions under consideration in the NSP.
3. **Collection of relevant data** and **stratification of indicators** required for decision-making, including epidemiological stratification and stratification of determinants of malaria transmission.
4. **Geographical targeting of interventions** based on the defined criteria, stratification maps, and any relevant operational constraints, to prepare targeted intervention mixes for NMSPs and prioritized plans for FRs.
5. **Mathematical modeling** to evaluate the potential impact of different intervention mix scenarios posed by the NMP in the previous step.
6. **Consensus reached on the final strategic intervention mix** per sub-national area and **costing** of the NSP.

7. **Prioritization of interventions** to maximize impact if resources are insufficient to fully cover the NMSP. Steps 2 to 6 are repeated using the costed strategic plan as the basis and considering aspects such as operational feasibility, equity, acceptability, and/or cost-effectiveness.
8. **M&E** of the impact of the operationally costed plan to optimize its effectiveness and ensure maximum impact will be reached.

2023-2025: Updated SNT guidance is expected in 2025. A preview of this guidance was presented in Q4, 2023. (Sub-national tailoring of malaria interventions and strategies, RBM Regional Meeting, October 23, Kampala, Dr. Beatriz Galatas). This guidance slightly revises the 8 steps, focusing on impact and the process of costing. The 8 steps with explanations as presented:

1. Establishment of an SNT team. Lead by NMCP but includes other government departments, national, regional and global malaria partners with consent from the NMCP. This team is responsible for the whole process from data assembly, analysis, strategy development, resource mobilization and prioritization, and implementation.

2. Determination of criteria for intervention targeting. The national team compiles all interventions and strategies under consideration and develops the criteria to be used for tailoring each one of them building on the WHO normative guidance.

3. Stratification of malaria risk and its determinants. Ecological, interventional, systemic, social and other determinants are stratified at operational units of relevance and in ways that answer the specific question at hand based on the agreed-upon criteria. As such the process of stratification depends on the specific intervention or strategy under discussion and moves away from the use of epidemiological metrics alone. Here statistical and geospatial methods are useful.

4. Intervention mix scenarios. Stratified layers required to inform intervention or strategy-specific criteria are used to develop various scenarios of intervention mixes.

5. Impact Projections. The impact of these scenarios is estimated using mathematical models. At this point further refinements may be made to the scenarios. A consensus-based approach informed by the evidence is used to select the final mix of interventions and strategies.

6. Costing of agreed-upon plan. The plan is then costed and is used for resource mobilization.

7. Prioritization of investments. Once there is clarity in the available resources, the costed strategic plan is used as the basis to further inform rational prioritization of investments to maximize impact if the resources are insufficient. This is usually the most challenging part of the process. Mathematical modeling is helpful at this point to assess the impact of the various prioritization decisions.

8. Monitor impact. During the budgeting process it is expected that sufficient capacity to monitor the impact of the deployed intervention packages are set aside so that the response is sharpened over time and resources are reprioritized as needed.

Annex C: SNT Maturity Scorecards

Annex C describes the SNT Maturity Index and SNT Scorecards used to create the SNT Maturity scores presented in Domain Five Findings.

SNT Maturity Assessment Tool 1.0, Used for Kenya, Madagascar, DRC

Assessing the maturity of sub-national tailoring in a country requires a *systematic evaluation of how effectively a country adapts its policies and programs to local contexts*. The following framework is proposed to guide the SNT maturity assessment.

NMSP & CONTEXT-APPROPRIATE INTERVENTIONS
Clear Strategic Goals: Does the NMSP have a clear impact goal or strategic goals?
Is the NMSP stratified in consideration of the epidemiological and operational contexts (gender disparities, migrants, SES, cross border, cultural practices, etc.) and aligned with impact goals?
Are intervention packages determined for each stratification level?
Is there evidence of review of intervention packages to respond to epidemiological, climate change and operational contextual issues?

GOVERNANCE AND POLICY FRAMEWORK
Decentralization: Are decision-making powers and resources decentralized to sub-national levels (e.g., provinces, districts)? (*For more centralized contexts, look for evidence of rigorous data-driven execution and course correction at the sub-national level*).
Policy Flexibility: Do national policies allow for adaptation and contextualization at the sub-national level including clear guidelines and mechanisms for tailoring?
Local Ownership: Are sub-national authorities and communities involved in decision-making processes related to program design, implementation, monitoring, and course correction?
Evidence of sub-nationally tailored NSP: Does the national malaria strategic plans reflect the use of SNT in programming and resource allocation?

PLANNING AND IMPLEMENTATION
Needs Assessment: Are systematic needs assessments conducted at the sub-national level to identify local priorities, disparities, and contextual factors?
Data Use: Is data collected, analyzed and used at the sub-national level to inform planning and decision-making? (Or data generated at the sub-national level is analyzed and used mostly at the national level with sub-national engagement)
Resource Allocation: Are resources (financial, human, technical) allocated equitably and strategically to address the specific needs and priorities of different sub-national areas?
Program Adaptation: Are programs and interventions adapted to suit local contexts (e.g. epidemiology, population characteristics, gender, climate change, health system capacity, etc.)?

MONITORING AND EVALUATION
Sub-national Indicators: Are specific indicators developed and tracked to monitor the progress and impact of tailored interventions at the sub-national level?
Indicator Alignment: Are the indicators at the sub-national level aligned with the national M&E Framework?
Feedback Mechanisms: Are there effective mechanisms for collecting feedback from sub-national implementers, communities, non-health sectors and beneficiaries to inform program adjustments?
Learning and Adaptation: Is there a culture of learning and adaptation? Are findings from M&E used to

improve the design and implementation of future interventions?

INSTITUTIONAL CAPACITY

Technical Skills: Do sub-national authorities and communities have the technical skills and capacity to collect, analyze, and use data for decision-making?

Capacity-building opportunities: Are there adequate training and capacity-building opportunities?

Organizational Structures: Are there dedicated teams or units at the sub-national level responsible for coordinating and overseeing tailored interventions?

Financial Resources: Do sub-national entities have access to sufficient and sustainable financial resources to support the implementation and monitoring of tailored programs?

SNT Maturity Index (Scorecard 1.0)

Proposed Country Scorecard: Quantitative score based on the thematic areas/questions in A3; qualitative rating for each theme and overall, as per key below the table.

Theme	1.NMSP & Context Appropriate Interventions				2.Governance and Policy Framework				3.Planning and Implementation				4.M&E				5.Institutional Capacity			
Sub theme	1a	1b	1c	1d	2a	2b	2c	2d	3a	3b	3c	3d	4a	4b	4c	4d	5a	5b	5c	5d
Country 1																				
Country 2																				
Country 3																				
….30																				

Key to SNT Maturity rating:

Low: (Less than 10) Below 50%	Medium: (10-14) 50%-74%	High: (15-20) 75% and above

Notes:

The overall score is based on the response to each question across the four themes (and associated sub-themes) of the SNT maturity assessment tool. By leveraging a combination of quantitative and qualitative approaches, evaluators can gain a comprehensive understanding of the maturity of the sub-national tailoring of malaria interventions in a particular country or context. This includes analyzing the availability and quality of malaria data, assessing the alignment of intervention strategies with local epidemiological and operational realities, evaluating community engagement and ownership, and examining the capacity of health systems to effectively deliver and monitor malaria control efforts.

SNT Maturity Assessment Tool 2.0, used for all other countries.

NMSP & CONTEXT-APPROPRIATE INTERVENTIONS

Stratification Aligned with Goal(s): Is the NMSP stratified in consideration of its epidemiological, seasonal, and demographic context in terms of transmission and burden and aligned with impact goals? Are intervention packages determined for each stratification level? Evidence that operational stratifications are based on *robust mapping, modeling, and analysis?*

Resource Optimization Effectiveness under Resource Constraints: Evidence that resource investments in FRs are optimized to support impact goals in NMSP: In either the NMSP and the FR, is there a rationale that highlights tradeoffs, a rigorous cost-effectiveness analysis or forecast that predicts the amount of impact the proposed interventions will make towards the NMSP goal? Are the pros/cons of specific resource choices shown clearly? Are tradeoffs presented clearly?

Tailoring for Country-Specific Challenges: Is there evidence of interventions being targeted and tailored based on insecticide resistance, new vector species, HRP2 deletion, therapeutic efficacy, or other country-specific challenges, where appropriate? etc.

Tailoring for Equity, Socio-cultural Contexts, and Access: Is there evidence of interventions being tailored and adapted to varying operational and sociocultural contexts (e.g., gender, migrants, refugee populations, peri-urban areas, SES)? Are resources (financial, human, technical) allocated equitably to address the specific needs and priorities of different population groups (e.g., have gender, vulnerability, SES been adequately accounted for)? If a matchbox (or other CRG) evaluation has been done, does allocation follow it?

GOVERNANCE AND POLICY

Policy Flexibility/Alignment: Do national policies allow for adaptation and contextualization at the sub-national level, including clear guidelines and mechanisms for tailoring?

National Coordination Platforms & Partner Alignment: Is there evidence of a functional platform (TWG, SMEOR, other) to align national stakeholders around country led SNT decision-making?

Sub-national Ownership: Is there evidence that sub-national authorities (districts/counties) are involved in strategic decisions on sub-national priorities?

Community Ownership: Is there evidence that communities (CHWs, Neighborhood Health Committees, Traditional leaders, etc.) have opportunities to articulate their priorities and that these are considered in decision-making?

PLANNING AND IMPLEMENTATION

Adequate Sub-national Devolution: Is community-based healthcare, decentralization, etc., used adequately to improve service delivery and reduce costs? Is there optimal allocation or reallocation of resources from the national to sub-national level?

Adaptation: Is there a culture of learning and adaptation? Does the NSP or the midterm progress report show a robust strategic re-planning process to correct course where needed?

Data-driven Planning of Specific Interventions: *SA 1.3.1. Evidence of data being used to support planning and execution of context-specific intervention strategies (e.g., vaccine roll-out, IPTi, IPTp, SMC, mass campaigns, urban malaria)*

National/Sub-national Coordination/Feedback Mechanisms: Are there effective mechanisms for two-way feedback between national/sub-national levels? OR (for PA) does the organization and operation of the health system seem to enable good communication?

MONITORING AND EVALUATION

Sub-national Indicators: Are specific indicators developed and tracked to monitor the progress and impact of tailored interventions at the sub-national level? Are the indicators at the sub-national level aligned with the national M&E Framework?

Ongoing Monitoring: Evidence of data being reviewed for ongoing monitoring and course correction

(existence/regularity of routine data outputs (e.g., monthly bulletins, epidemic monitoring graphs) and mechanisms (e.g., data review meetings at each level of the health system)
Epidemic Response: Evidence of rapid "real-time" data-driven decisions to course correct in response to changing sub-national conditions? (epidemiological, entomological, climate and other) OR Evidence of data being used to initiate response activities in areas likely to experience infection?

CAPACITY
Sub-national Technical Skills: Do sub-national authorities and communities have the technical skills and capacity to collect, analyze, and use data for decision-making? (under program review) National Technical Skills: Does the NSP and the FR reflect a sophisticated understanding of SNT
Resourced, Operational Organizational Structures at the Sub-national Level: Are there dedicated teams or units at the sub-national level responsible for coordinating and overseeing interventions? Do sub-national entities have access to financial resources to support the program implementation and monitoring?

DATA AVAILABILITY, QUALITY, AND ARCHITECTURE
Data Quality: (accuracy, timeliness), completeness
Data Architecture: Existence of MDR per WHO assessment. Is there an integrated, national electronic malaria database (repository) that collects information on cases, interventions, commodities, and finances with sub-national disaggregation?
Data Architecture: digitization of CHWs (25% or more is a 1, any % is a .5) OR digitization of campaigns (e.g., LLIN, SMC, IRS, etc.)
Data Availability: Does DHIS2 reflect community-level data? Also: Is most private-sector data included in DHIS2? (1 = most, .5 = roughly half, 0 = mostly not)

Indicators intentionally left independent:
national gov support (financial, administrative) to national program
kind of governance structure, e.g., number of governance levels, the extent of devolution to sub-national levels, level of centralized command and control vs sub-national capacity at execution level…questions like: How important is devolution to successful SNT in high burden?
direct partner alignment: Partially addressed in 1.c and 2.b but soft questions on "how well are partners and program aligned" are still topics for KII.
innovation: program capacity to synthesize and utilize global innovation, as well as local innovations in programming, data management, implementation, or research.

SNT Maturity Index (Scorecard 2.0)
Proposed Country Scorecard: Quantitative score based on the thematic areas/questions in A3; qualitative rating for each theme and overall, as per key below the table.

Theme	1.NMSP & Context Appropriate Interventions				2.Governance and Policy Framework				3.Planning and Implementation				4.M&E			5.Institutional Capacity			6. Data availability, quality, and architecture				SNT Maturity Score Max 22-DD 18-PA
Sub theme	1a	1b	1c	1d	2a	2b	2c	2d	3a	3b	3c	3d	4a	4b	4c	5a	5b	5c	6a	6b	6c	6d	
Country 1																							
Country 2																							
Country 3																							
….30																							

Key to SNT Maturity rating:

Low: (Less than 10) Below 50%	Medium: (10-14) 50%-74%	High: (15-20) 75% and above

Annex D: RFP Questions Mapped to Findings by Domain

Theme	Evaluation Questions	Location in Report Where Addressed
A). Adequacy of country sub-national systems	How adequate are country sub-national systems in capturing and analyzing malaria programming data and in supporting better tailoring and programming of malaria responses? What are some of the systems and data points that are missing and that should be considered for the future?	D4: Limited data analysis and data use skills at sub-national level Recommendations
	1) What are the sub-national systems available in countries for capturing: a) malaria burden data (cases, incidence, and mortality); b) malaria intervention data (access to services, use of vector control measures and early diagnosis and treatment); and c) other contextual information (climate, socio-economic, refugee populations). What is the availability of community and private sector data? To what extent is this data collected, disaggregated, and transcribed into the routine data systems?	D4: Significant improvement in data and analytics, DHIS2 penetration and use; Disaggregation: how much is enough?; Denominators
	2) What input was obtained from sub-national level for vaccine intervention in countries involved in malaria vaccine distribution? How were focus coverage areas identified?	D4: Significant improvement in data and analytics, DHIS2 penetration and use D5: Vaccines
	3) What is the quality of data at sub-national level? Are validation, verification, and quality improvement done at sub-national level to ensure data quality? By whom? What is the right balance between funding Global Fund LFAs for data verification and transmission versus supporting data reviews and use sub-nationally?	D4: Significant improvement in data and analytics, DHIS2 penetration and use; Notes on LFA
	4) To what extent are analytical capacities in place at national, regional and district levels to analyze data and inform SNT and programming?	D4: Limited data analysis and data use skills at sub-national level
	5) To what extent do population denominators inform SNT? What are the data sources and methods used for assessing population denominators at sub-national level? How are estimates currently calculated for service coverage, distribution of commodities etc.?	D4: Denominators
	6) What is the level of awareness of SNT approach at sub-national /national levels by those implementing programs? How adequately does malaria sub-national data and disaggregated analysis inform: i. epidemiologic stratification ii. optimization of intervention mix iii. monitoring and evaluating the impact of stratification decisions. iv. quality improvement initiatives in sub- national areas	D4: Sub-national data used for different steps in the SNT process

B). Challenges in decision-making	**What are the challenges related to decision-making in SNT? How much have Global Fund investments played a role in addressing these challenges?** 1) What is the degree of autonomy at sub- national level for decision-making in SNT and malaria programming? What is the role of the overall administrative structure decision-making processes on SNT decision-making? How adequate are the structures, mandates, guidelines, and processes for coordination of national level and sub-national level decision-making? 2) What are the contextual factors—including political, legal, economic, and social dimensions—and their role in affecting decision-making at the sub-national level for SNT? 3) What political economy, governance, and other factors differ between countries where sub- national level decisions are made, in law and/or practice, and where they are not? How can the capacity for on-going decision-making at sub-national level be strengthened – short- term and long-term – in different types of decision-making systems for SNT? 4) What has been the role of Global Fund investments in supporting decision-making for SNT? Who makes the key decisions and what evidence do they use as basis for decision-making?	D2: Role of the administrative structure on SNT decision-making D2: Adequacy of sub-national systems for coordination D2: Influence of political considerations on decision-making in SNT D3: SNT Guidance; Tension between SNT recommendations at country level and guidance from partners; WHO Guidance on IRS Recommendations D3: Role of partners and technical assistance
C). FRs and SNT	**To what extent are the Global Fund malaria FRs based on SNT?** 1) How much have the key concepts of SNT been reflected in the malaria FRs? How can this be strengthened in GC8? 2) To what extent do the FRs reflect stratification and tailoring of interventions at sub-national level? What are the reasons why an initial stratification may not reflect the chosen interventions? What role do resource constraints play in the deviation from ideal interventions and interventions that are finally selected? 3) What difficulties are faced by countries in moving from input-based programming to impact-based programming based on SNT? How can Global Fund processes better incentivize FRs based on SNT and financial optimization? 4) To what extent have countries requested resources and technical assistance for sustainable data compilation and analysis, stratification, identification of intervention mixes and support for scenario-building with stakeholders, and support to modeling groups to build iterative models based on the scenarios? If so, have they been provided and prioritized?	D5: FRs do not reflect SNT thinking of countries as well as NSPs Recommendations D4: Sub-national data used for different steps in the SNT cycle D3: Tensions between country programs and partners; WHO guidance D6: Introduction; Financial optimization D3: Role of partners and technical assistance D6: Financial optimization: PPP for resource mobilization Recommendations D3: Role of partners and technical assistance

D). The Global Fund and high-quality data in SNT	**To what degree does the Global Fund promote generation of high-quality malaria data and its use at national and sub-national level? How could the Global Fund better support countries to manage, analyze and use their sub-national malaria data?**	D3: Role of partners and technical assistance
	1) To what extent has the Global Fund facilitated the creation, maintenance, and use of sub- national data systems, including consolidated and maintained MDRs in countries? What data sources do the MDRs draw from?	D4: MDRs
	2) Are the Global Fund monitoring frameworks built in a way that supports a sub-nationally tailored response in country? Do the Global Fund's Progress Update and Disbursement Request (PUDRs), the District Health Information System (DHIS) district dashboards and other tools lead to or encourage data use and action?	D4: Indicators
	3) Do the current indicators facilitate and incentivize the Secretariat and countries to work towards SNT and financial optimization? Are the indicators adequately adaptable and usable by sub-national level teams in a sub-national context and to what granularity and periodicity?	D4: Indicators
E). Role of country stakeholders	**What is the role of country stakeholders (including partners, Technical Assistance (TA) providers at global level and in-country research institutions) and national structures and strategies in facilitating SNT? How do partners engage with the country?**	D3: Role of partners and technical assistance; D3: WHO
	1) To what extent has sub-national evidence been used to inform National Malaria Strategic Plans (NMSPs), Nation Health Strategic Plans (NHSPs) and sub-national plans? What kind of data has been used and what data is needed to make stronger national strategic plans? Are there uniform and inclusive processes in- country to develop NMSPs? How does the costing of NMSPs consider the specific needs and interventions required at sub-national levels? Do the national plans reflect the use of SNT to optimize financial requests and allocations?	D4: Sub-national data used in SNT cycle D5: FRs do not reflect SNT thinking of countries as well as NSPs D6: Resource optimization
	2) What climate change and environmental management structures and policies are in place at national and sub-national level? To what extent have malaria stakeholders been engaged with climate change, environmental management and disaster risk reduction programs?	D1: "Climate"
	3) How adequate is the guidance and activity level of national reference groups (M&E working group, other relevant technical groups) with regard to SNT and financial optimization? How can it be further improved?	D1: Adequacy of national systems
	4) To what extent does technical assistance (TA) focus on SNT? How can the TA scope be expanded to focus on SNT and related financial optimization in preparation for GC8 as well as systematic local capacity building for SNT?	D3: Role of partners and technical assistance

Annex E: Rapid Online Survey (ROS)

Evaluation of Capacity, Quality and Decision-Making in Malaria Sub-national Tailoring

Survey Aim: To understand contextual political economy factors that shape sub-national tailoring efforts in malaria control.

Section A: Respondent Characteristics

1. Primarily works at (*select one*):
    - National level
    - Sub-national level
    - International level

2. Institution currently working with (*select one*):
    - National Malaria Control Program (NMCP)
    - Country Coordinating Mechanism (CCM)
    - Government
    - Implementing partner (IP)
    - Civil Society Organization (CSO)
    - Funding partner
    - Other, (specify)_____

3. Gender: _____
    - Male
    - Female
    - Other, specify_____

4. Age
    - <25
    - 25-35
    - 36-45
    - 46-55
    - >55

Country (enter name): _____

Section B: National Malaria Strategic Plan Development Process

1. Which of the following stakeholders participate in the development or update of the current NSP (*check all that apply*):
    - National Government (led) – NMCP plus line ministries.
    - Sub-national or regional malaria control structures
    - Development partners
    - Implementation partners
    - Civil Society
    - Community groups
    - Representatives of affected populations
    - Adolescent women and young girls
    - Gender-balanced representatives from all groups

- Other, specify_____

2. Is Global Fund input into the National Malaria Strategic plan process helpful? How could it be improved?
   - Yes, and could be improved in the following way: _____
   - No, and this is the main problem: _____

Section C: Resources and Financing

3. How are funding decisions by partners primarily made in support of the National Malaria Strategic Plan?
   - Consultative based on gaps expressed by program.
   - Predetermined by partners (partner preference)
   - Reactive/ad hoc

4. Which avenue is MOST likely to result in additional disease impact?
   - Domestic advocacy with national government to increase domestic contribution to malaria.
   - Larger domestic co-financing commitment required from the Global Fund
   - Better optimization of current resource envelope
   - Better data and analytics for decision-making on financial optimization
   - Other, specify_____

5. Are there specific aspects or interventions in the national plan that the program needs funding for, but partners are unwilling to support?
   - Yes (Describe what, and why program would like to implement, and why partners do not wish to support) _____
   - No

6. What information or analysis does the program, and partners need MORE of to figure out which combination of malaria prevention or treatment purchases will have the greatest impact within a resource envelope? (Select two only).
   - Research data or modeling on impacts of different interventions in different transmission contexts.
   - Data on intervention costs
   - Data on health access and vulnerable populations
   - Data on effectiveness of different social and behavior change interventions
   - Sub-national data on entomological indicators
   - Sub-national data on cases and prevalence
   - Sub-national data on percentages of patients managed for simple malaria, severe malaria, IPTp etc.
   - Sub-national data on coverage of prevention interventions
   - Other, specify_____

7. In your opinion, are financial and human resources allocated across different sub-national levels and populations according to need or are they influenced by political considerations?
   - Almost entirely according to need
   - More consideration for equity than for politics
   - A balance between politics and equity
   - Determined more by politics than need
   - Almost entirely political

Section D: Institutions and Governance

8. The leadership of the national malaria control program is effective in the creation and execution of the national malaria strategy *(please rank)*
- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

9. The national program has the capacity (technical, managerial, financial) to effectively implement and adapt tailored interventions (*select only one*)
- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

10. What resources or capacities, besides funding, does the national program need to be more effective? _____ (please list)

11. Sub-national institutions have the capacity (technical, managerial, financial) to effectively implement and adapt tailored interventions (*select only one*).
- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

12. What resources or capacities do sub-national institutions need to be more effective? _____ (*please list)*.

13. Are national malaria policies and strategies flexible enough to accommodate sub-national variations and allow for tailored approaches? (*check all that apply).*
- Adjusting decision-making authority to empower local levels
- Incorporating flexibility to adapt to local contexts
- Strengthening data feedback loops for real-time monitoring
- Integrating gender-sensitive approaches throughout the process

Section E: Coordination and Engagement in Sub-national Tailoring

14. Is the National Malaria Control Program effective in coordinating partners working in different areas of the country (or with different agendas) to align them with the National Malaria Strategic Plan?
- Very Effective
- Mostly Effective
- Somewhat Effective
- Somewhat Ineffective
- Ineffective

15. Are there mechanisms in place to ensure meaningful engagement in decision-making processes for… (*tick all that apply*)?

- Community members
- Adolescents/ Youth
- Women
- Adolescent women and young girls (as a separate group)
- Cultural minorities
- People living with disabilities
- Migrant populations
- Refugee populations
- People living in vulnerable circumstances

16. How large a role does multi sectoral engagement (e.g. with mosquito breeding sites in Agriculture, malaria Education in schools, malaria prevention in Tourism, participation of malaria-affected families in Social Protection programs, met department for climate information, etc.) play in the NMSP?

- Large-– it's one of the primary components of our strategy
- Moderate
- Small but growing
- In name only
- None

17. How would you suggest improving coordination and/or community participation? [Open]_____

Section F: Monitoring & Evaluation /Surveillance System

18. How often do you have the opportunity to review cleaned updated data on malaria trends extracted from DHIS2, for example in a periodic malaria bulletin?

- weekly
- monthly
- bi-monthly or quarterly
- we can look at DHIS2 whenever we want, but no one is providing summaries of trend data extracted from DHIS2
- never

19. What are the available primary data sources for malaria sub-national tailoring? (*tick all that apply*)

- Routine DHIS2 data, including outpatient and inpatient
- ANC data
- Data from private health clinics
- Entomological surveillance data
- Malaria Rapid Reporting Systems (tracking via mHealth approaches or other community-level approaches)
- Surveys (e.g. Malaria Indicator Survey, Health Facility surveys, Demographic Health Survey, etc.)
- Intervention coverage data
- Indicator-Based surveillance (IBS) and Event-Based Surveillance (EBS) or other early warning detection systems
- Cost data
- Other, specify_____

20. What are the available analytics for malaria sub-national tailoring? (*tick all that apply*)

- Data repositories sub analysis
- Dashboard automated analytics

- Mathematical modeling of estimated intervention impact in different settings
- Analyses or modeling of cost per intervention impact for different interventions
- Statistical and visual modeling in R, Tableau or other software
- Other, specify_____

21. Which of the following kinds of data or analyses, if improved, would most benefit sub-national tailoring decision-making (*check up to three*)?

- Routine epidemiological data
- Routine entomological data
- Climate or meteorological data
- Intervention efficacy or effectiveness research
- Modeling of estimated intervention impact in different settings
- Modeling of associated costs per intervention impact in different settings (e.g. reduction of incidence per dollar spent on LLINs in moderate transmission)
- Survey data (coverage, utilization/uptake, practices)
- Resource mapping
- Other, specify_____

22. What systems are in place for epidemic preparedness and response at sub-national level?
[Open]_____

Section G: Gender and Human Rights

23. Which of the following areas are prioritized, apart from epidemiology, for sub-national tailoring (tick all that apply?

- Gender inequalities at sub-national level
- Gender barriers to access
- Dedicated gender interventions/strategies (such as IPTp, women led CSOs/community action groups, women CHWs/spray operators, interventions targeted to adolescent women and young girls etc.)
- Interventions targeting human rights-related barriers among groups such as migrant populations, youths in boarding schools/religious sects, etc.

24. To what extent do tailored malaria interventions effectively reach and benefit women and girls, considering their specific needs and vulnerabilities within different sub-national contexts?

- To a very great extent
- To a great extent
- To some extent
- To a little extent
- Not at all

25. How effective are community engagement strategies in promoting gender-sensitive malaria control measures and ensuring the meaningful participation of women in decision-making processes?

- Very Effective
- Mostly Effective
- Somewhat Effective
- Somewhat Ineffective

26. To what extent do sub-national malaria control programs address the specific needs of pregnant women and ensure equitable access to preventive measures such as insecticide-treated nets and intermittent preventive treatment?

- To a very great extent
- To a great extent
- To some extent
- To a little extent
- Not at all

27. To what extent do tailored interventions consider and mitigate the potential negative consequences or unintended harms related to gender and human rights, such as stigma, discrimination, or violence?

- To a very great extent
- To a great extent
- To some extent
- To a little extent
- Not at all

Section H: Challenges and Recommendations

28. List some of the challenges of putting Sub-national tailoring into practice (tick all that apply)

- International funding partners insufficiently responsive to country needs and priorities as stated in NMSP
- Limited sub-national data to identify needs and track progress.
- Data sharing and accessibility challenges across different levels of the health system due to logistical, technical, or political barriers.
- Financial constraints limit the ability to invest in tailored approaches.
- Gaps in human resource capacity hinder effective tailoring (skills and numbers).
- Weak decentralization limits the flexibility and autonomy of sub-national entities to tailor interventions.
- Gaps in Coordination and between national, sub-national, and community-level actors.
- Managing partner agendas.
- Conflicting priorities among stakeholders.
- Resistance to change from stakeholders accustomed to existing systems or those with vested interests.
- Diverse geography, climate and transmission patterns.
- Various socio-cultural factors (beliefs, gender norms, practices etc.) with needs for culturally sensitive adaptation
- Security and Political instability making implementing and sustaining tailored interventions difficult.
- Other, specify_____

29. How can the Global Fund improve their technical assistance, or the process of country applications for malaria funding, to facilitate sub-national tailoring? [*Open]*_____

Annex F Evaluation Matrix

Annex F1 shows the evaluation questions (both RFP and additional) organized under the evaluation domains, and follows the structure of report findings, with any deviations noted.

Evaluation Level	Domains	Evaluation Questions
Primary Driver	Stronger national, government and program leadership and capacity, including capacity for innovation	How do different stakeholders define (and operationalize) SNT? How does the national program approach SNT? RFP Domain A, Question 4, national focus: To what extent are analytical capacities in place at national, regional and district levels to analyze data and inform SNT and programming? How effective is NMCP's national leadership in planning and execution of the NMSP? How and how well is the program incorporating global innovation/local innovation into planning and decision-making? RFP Domain E, Question 3: a) How adequate is the guidance and activity level of national reference groups (M&E working group, other relevant technical groups) with regard to SNT and financial optimization? b) How can it be further improved? Additional question: c) What is NMCP's coordination capacity for decision-making on SNT and financial optimization? How strong is national gov support for NMCP/MOH/malaria reduction? RFP Domain E, Question 2: What climate change and environmental management structures and policies are in place at national and sub-national level? To what extent have malaria stakeholders been engaged with climate change, environmental management and disaster risk reduction programs? What other kinds and degree of multisectoral engagement do malaria programs enter into collaboratively? What roles do these play in data-driven SNT? (e.g. early warning systems, vector control for neglected tropical diseases, agriculture, social and economic welfare, etc.)
Input	Stronger sub-national leadership and capacity, including capacity for innovation (as appropriate)	RFP Domain A, Question 4, sub-national focus: To what extent are analytical capacities in place at national, regional and district levels to analyze data and inform SNT and programming? RFP Domain A, Question 2: What input was obtained from sub-national level for vaccine intervention in countries involved in malaria vaccine distribution? How were focus coverage areas identified? (Moved → Domain 5 in report writing) RFP Domain B, Question 2: What are the contextual factors – including political, legal, economic and social dimensions – and their role in affecting decision-making at the sub-national level for SNT?

		RFP Domain B, question 3: What political economy, governance and other factors differ between countries where sub-national level decisions are made, in law and/or practice, and where they are not? How can the capacity for on-going decision-making at sub-national level be strengthened – short-term and long-term – in different types of decision-making systems for SNT? What levels and types of decentralization do countries employ? What is the administrative structure of decision-making? As required by level of decentralization, how effective is sub-national leadership in planning and execution of the NMSP? RFP Domain B, Question 1: What is the degree of autonomy at sub-national level for decision-making in SNT and malaria programming? What is the role of the overall administrative structure decision making processes on SNT decision making? How adequate are the structures, mandates, guidelines, and processes for coordination of national level and sub-national level decision-making? What efforts are being made to strengthen ongoing decision-making at sub-national level? RFP Domain A, Question 6, focus on sub-national: What is the level of awareness of SNT approach at sub-national levels by those implementing programs? How adequately does malaria sub-national data and disaggregated analysis inform: i) epidemiologic, stratification; ii) optimization of intervention mix; iii) monitoring and evaluating the impact of stratification
Input	Actively supported by the Global Fund and all partners	RFP Domain C, Question 4: To what extent have countries requested resources and technical assistance for sustainable data compilation and analysis, stratification, identification of intervention mixes and support for scenario-building with stakeholders, and support to modeling groups to build iterative models based on the scenarios? If so, have they been provided and prioritized? At what points does the NMSP funding landscape influence the NMSP planning process and SNT in particular? What is the role of perceived partner preferences in resource-constrained decision-making for SNT? How accountable and transparent are partners in their dealings with the country? RFP Domain E, Question 4: a) To what extent does technical assistance (TA) focus on SNT? b) How can the TA scope be expanded to focus on SNT and related financial optimization in preparation for GC8 as well as systematic local capacity building for SNT? How can partners, and GF in particular, support technical coordination for SNT and financial optimization? RFP Domain D, Question 1: To what extent has the Global Fund facilitated the creation, maintenance, and use of sub-national data systems, including consolidated and maintained malaria data repositories (MDR) in countries? What data sources do the MDRs draw from? Could changes in support produce improvements in the quality and use of sub-national data? RFP Domain C, Question 3a (FRs specifically), focus on partner alignment: What difficulties are faced by countries in moving from input-based programming to impact- based programming based on SNT? How can Global Fund processes better incentivize Funding Requests based on SNT and financial optimization? RFP Domain D, Question 2: Are the Global Fund monitoring frameworks built in a way that supports a sub-nationally tailored response in country? Do the Global Fund's Progress Update and Disbursement Request (PUDRs), the District Health Information System (DHIS) district dashboards and other tools lead to or encourage data use and action? RFP Domain B, Question 4: What has been the role of Global Fund investments in supporting decision-making for SNT? Who makes the key decisions and what evidence do they use as basis for decision-making?

		RFP Domain D, Question 3: a) Do the current indicators facilitate and incentivize the Secretariat and countries to work towards SNT and financial optimization? b) Are the indicators adequately adaptable and usable by sub-national evaluation teams in a sub-national context and to what granularity and periodicity? RFP Domain E, Question 4: a) To what extent does technical assistance (TA) focus on SNT? b) How can the TA scope be expanded to focus on SNT and related financial optimization in preparation for GC8 as well as systematic local capacity building for SNT?
Input	Better access to quality data and analytics for decision-making	RFP Domain A, Question 1: 1.1 What are the sub-national systems available in countries for capturing a) malaria burden data (cases, incidence, and mortality); b) malaria intervention data (access to services, use of vector control measures and early diagnosis and treatment); and c) other contextual information (climate, socio-economic, refugee populations). 1.2 What is the availability of community and private sector data? 1.3 To what extent is this data collected, disaggregated, and transcribed into the routine data systems? What gaps does the program identify in: a) data and analytics prioritized for community-responsive design and local adaptation? b) data and analytics prioritized for decisions around innovations, novel trends, expansion of pilot projects, etc.? c) quality and kind of data and analysis used to make financial optimization decisions? What kind of data and analysis (e.g. reliable cost effectiveness analysis) needed for financial optimization does the program feel is missing? RFP Domain A, Question 3: What is the quality of data at sub-national level? Are validation, verification and quality improvement done at sub-national level to ensure data quality? By whom? What is the right balance between funding Global Fund Local Fund Agents (LFAs) for data verification and transmission versus supporting data reviews and use sub-nationally? RFP, Domain A, Question 5: To what extent do population denominators inform SNT? What are the data sources and methods used for assessing population denominators at sub-national level? How are estimates currently calculated for service coverage, distribution of commodities, etc.? RFP Domain D, Question 1: To what extent has the Global Fund facilitated the creation, maintenance, and use of sub-national data systems, including consolidated and maintained malaria data repositories (MDR) in countries? What data sources do the MDRs draw from? RFP Domain A, Question 6: What is the level of awareness of SNT approach at national and sub-national levels by those implementing programs? How adequately does malaria sub-national data and disaggregated analysis inform: i) epidemiologic stratification; ii) optimization of intervention mix; iii) monitoring and evaluating the impact of stratification RFP Domain C, Question 2 a) To what extent do the FRs reflect stratification and tailoring of interventions at sub-national level? RFP Domain A, Question 6: How adequately does malaria sub-national data and disaggregated analysis inform: a) epidemiologic stratification; b) optimization of intervention mix; c) monitoring and evaluating the impact of stratification decisions.; d) quality improvement initiatives in sub-national areas?
Output/outcome	A high level of SNT maturity and a	What is the overall SNT maturity of each country, as measured by evaluation SNT maturity index (See SNT Maturity Annex)?

	context-appropriate, sub-nationally tailored malaria response	RFP Domain C, Question 1 (FR specifically): How much have the key concepts of SNT been reflected in the malaria Funding Requests (FRs)? How can this be strengthened in GC8? RFP Domain E, Question 1: To what extent has sub-national evidence been used to inform National Malaria Strategic Plans, Nation Health Strategic Plans (NHSPs) and sub-national plans? What kind of data has been used and what data is needed to make stronger national strategic plans? Are there uniform and inclusive processes in-country to develop NMSPs? How does the costing of NMSPs consider the specific needs and interventions required at sub-national levels? Do the national plans reflect the use of SNT to optimize financial requests and allocations?
Outcome	That optimizes resource use (for a chosen impact goal)	How are decisions around financial optimization made in the preparation of the FR? (Separately from decisions around SNT?) How do different stakeholders define (and operationalize) financial optimization? How does the national program approach financial optimization analysis? RFP Domain C, Question 2, focus on resource optimization (FRs specifically): To what extent do the FRs reflect stratification and tailoring of interventions at sub-national level? What are the reasons why an initial stratification may not reflect the chosen interventions? What role do resource constraints play in the deviation from ideal interventions and interventions that are finally selected? RFP Domain C, Question 3 (FRs specifically), focus on financial optimization: What difficulties are faced by countries in moving from input-based programming to impact- based programming based on SNT? How can Global Fund processes better incentivize Funding Requests based on SNT and financial optimization? SNT maturity index sub-domain: alignment of optimization with impact goal prioritized by country. How well does the optimization of resources in the FR match the impact goal or goals defined by the country's National Strategic Plan (NSP)?

Annex F2 presents the evaluation questions (both RFP and additional) under domains with data collection method and indicator sources. Some questions are under slightly different domains than in F1, which follows the structure of reported findings.

Domain	**Question Number**	**Evaluation Questions**	**Applies to:** (ALL= 30 countries, CV= 6 visited countries)	**Data Tool & Question # SC= stakeholder consultation PA = portfolio analysis LR = literature review IR= innovation review**	**Qualitative Questions & Associated Themes**	**Quantitative Indicators**
Stronger national (government and) program leadership and capacity, including capacity for innovation	**1a**	How do different stakeholders define (and operationalize) SNT?	All	Remote SC KII (all forms): 1a	Remote SC KII 1.a: How do you define SNT?	
				In-country CV KII - National: #A.1	In-country CV KII - National: #A.1: Definition of SNT	
	1b	How does the national program approach SNT?	All	Remote SC KII (all forms): 3	Remote SC KII 3: Please describe your approach to SNT and financial optimization?	
				In-country CV KII - National: #A.1 ET	In-country CV KII - National: #A.1: Established SNT team, structure, coordination processes, sub-national areas implementing SNT, and surveillance allowing modification of interventions as needed	
	2	RFP Domain E, Question 3: a) How adequate is the guidance and activity level of national reference groups (M&E working group, other relevant technical groups) with regard to SNT and financial optimization? b) How can it be further improved?	All, esp. CV	ROS #1, ROS #13	ROS#13: Are national malaria policies and strategies flexible enough to accommodate subnational variations and allow for tailored approaches?	ROS #1. Which of the following stakeholders participate in the development or update of the current NSP (check all that apply):
				In-country CV KII - National: #B.7	In-country CV KII - National: #B.7: Is there adequate guidance and activity level of national reference groups (M&E working group, other relevant technical groups) with regard to SNT and financial optimization? How can it be further improved?	
	3a	RFP Domain C, Question 2,	All	PA: examination of stratification in NMSP	Type of stratification and tailoring in the FRs	

		leadership and planning focus: a) To what extent do the FRs reflect stratification and tailoring of interventions at sub-national level?		In-country CV KII - National: #B.3	In-country CV KII: #B.3: Describe how national plans reflect the use of SNT to optimize financial requests and allocations	
	3b	b) What are the reasons why an initial stratification may not reflect the chosen interventions?	All	PA: Midterm Review & R-KII-NMCP 9	PA: MTR: How have decisions on intervention mix been revised? R-KII-NMCP 9: Specifically for the Global Fund funding request: Were there things you wanted to fund that you could not find funding for? For GC7, how did the country decide what to include in the Global Fund grant as opposed to other funding mechanisms/domestic resource allocations? Tell me about the role of the TRP? To what extent do TRP or other donor/partner preferences influence funding requests?	
	3c	c) What role do resource constraints play in the deviation from ideal interventions and interventions that are finally selected?	All	R-KII-NMCP 7	R-KII-NMCP 7: Can you tell me about the resource optimization process? What are the steps taken to produce an optimized funding request? What role do resource constraints play – i.e., how do you prioritize within your strategic plan in response to your budget constraint?	
				In-country CV KII - National: #A.2	In-country CV KII - National: #A.2: What role do resource constraints play in the deviation from ideal interventions assigned to sub-national areas in the NMSP and interventions that are finally selected in funding requests?	
	4	RFP Domain A, Question 4, national focus: To what extent are analytical capacities in place at national, regional and	CV (All to some extent)	R-KII-Data 8 - gaps in sub-national data systems	R-KII-Data 8: In your country/experience - What are the three highest priority gaps in sub-national data availability, analytic capacity, data use mechanisms and other key elements of preparedness for data-driven decision making?	

		district levels to analyze data and inform SNT and programming? (also an element of the SNT maturity index)		R-KII-NMCP #13	R-KII-NMC P#13: Have you requested resources and TA for key elements of SNT and have you received it? Who are your primary SNT support providers? To the extent you have received this support, to what extent has this been country-directed, aligned with your needs, and effective? How might it be improved? To what extent have partners – and particularly the Global Fund – facilitated the creation, maintenance and use of sub-national data systems, including MDRs, in your country? Suggestions for improvements? Have you received modeling support that has helped guide targeting and tailoring of interventions? By whom and what types? Were the results useful, and do you have confidence in them? Suggestions for improvements?	
				In-country CV KII - National: #C.3	In-country CV KII - National: #C.3: To what extent are analytical capacities in place at national, regional and district levels to analyze data and inform SNT and programming?	
				In-country CV KII - Sub-national: #B.7:	In-country CV KII - Sub-national: #B.7: To what extent are analytical capacities in place at regional/district/SNT levels to analyze data and inform SNT and programming?	Is there a biostatistician at the regional/district level, and what are her/his responsibilities?

	5	How effective is NMP's national leadership in planning and execution of the NMSP?	ALL	ROS #8-10, 14 R-KII-NMCP - overall impression R-KII-data 12 (indirect) PA: general impression leadership demonstrated in NMSP; clarity & coherence of goals, etc.	ROS #10 (open ended): What resources or capacities, besides funding, does the national program need to be more effective? (Please list) R-KII_NMCP 12: What 3 improvements in each of the following areas would best advance effective, country-owned SNT and optimized resource use in your country?	ROS #8: The leadership of the national malaria control program is effective in the creation and execution of the national malaria strategy (Please rank using 5 pt scale: Strongly Agree to Strongly Disagree). ROS#9: The national program has the capacity (technical, managerial, financial) to effectively implement and adapt tailored interventions (Please rank using 5 pt scale: Strongly Agree to Strongly Disagree). ROS#14: Is the National Malaria Control Program effective in coordinating partners working in different areas of the country (or with different agendas) to align them with the National Malaria Strategic Plan? (Please rank using 1-5).
	6	How is the program incorporating global and local innovation into planning and decision-making?	ALL	In-country CV KII - National: #B.10 In-country Innovation Checklist R-KII-NMCP-6 PA: NMSP discussion of innovation	In-country CV KII - National: #B.10: Areas of local innovation, either in intervention strategies, implementation, surveillance, or another area In-country innovation checklist, including local innovation R-KII-NMCP-6: Can you tell me some of the distinctives of your program? How have you introduced new interventions or responded to new challenges? (e.g., Stephensi, high levels of insecticide resistance, the impact of climate change) Is there something you have done in	

					malaria control that you think other countries should be aware of?	
				In-country CV KII - Sub-national: #A.9:	In-country CV KII - Sub-national: #A.9: Any innovations in SNT interventions or implementation that you are using in your area that are not being used nationally?	
	7	How strong is national government support for NMCP/MOH/malaria reduction?		R-KII-NMCP 7 - national decision-making (MOH +); PA: domestic resource support of NMSP; administrative position of NMCP within government		% of domestic resources allocated to prevention or commodity spend in the NSP
				In-country CV KII - National: #A.1	In-country CV KII - National: #A.1: How strong is national gov support for NMCP/MOH/malaria reduction?	
	8	RFP Domain E, Question 2: What climate change and environmental management structures and policies are in place at the national and sub-national level? To what extent have malaria stakeholders been engaged with climate change, environmental management and disaster risk reduction programs?	ALL, esp. CV	R-KII-5-NMCP (5) How have you used the SNT process to introduce new interventions or respond to new challenges? (e.g., Stephensi, high-levels of insecticide resistance, the impact of climate change) In-country tools?	R-KII-5-NMCP (5): How have you used the SNT process to introduce new interventions or respond to new challenges? (e.g., Stephensi, high-levels of insecticide resistance, the impact of climate change) In-country tools?	
				In-country CV KII - National: #B.5 In-country CV KII - National: #B.5	In-country CV KII - National: #B.5: Climate change and environmental management structures and policies in place at national and sub-national level In-country CV KII - National: #B.5: Climate change and environmental management structures and policies in place at national and sub-national level	

	9	What other kinds and degree of multi-sectoral engagement do malaria programs enter into collaboratively? What roles do these play in data-driven SNT? (e.g. early warning systems, vector control for neglected tropical diseases, agriculture, social and economic welfare, etc.)	ALL	ROS #16 PA-NMSP, FR, MOP	ROS #16: How large a role does multi-sectoral engagement (e.g. with mosquito breeding sites in Agriculture, malaria Education in schools, malaria prevention in Tourism, participation of malaria-affected families in Social Protection programs, Met. department for climate information, etc.) play in the NMSP?	
				In-country CV KII - National: #B.8	In-country CV KII: #B.8: Key SNT partners and what is the scope of their engagement.	
Stronger sub-national leadership and capacity, including capacity for innovation	**10**	RFP Domain A, Question 4, sub-national focus: To what extent are analytical capacities in place at national, regional and district levels to analyze data and inform SNT and programming?	CV	In-country CV KII - Sub-national: #B.7 Metareview of frameworks	In-country CV KII - Sub-national: #B.7: To what extent are analytical capacities in place at regional/district/SNT levels to analyze data and inform SNT and programming? Is there a biostatistician at regional/district level, and what are her/his responsibilities?	Presence of biostatistician/data analyst at district level
	11	RFP Domain A, Question 2: What input was obtained from the sub-national level for vaccine intervention in countries involved in malaria vaccine distribution? How were focus coverage areas identified?	ALL	R-KII-NMCP #8 - Role of SNT in vaccine planning	R-KII-NMCP # 8: How and by whom are key decisions made at the national level? What actors outside of the malaria/VBD program play a role in making or influencing key decisions, and in what way? To what extent do you believe donor/partner preferences influence the Global Fund and other partner funding requests, and in what way? Give examples.	
				In-country CV KII - National: #C.6:	In-country CV KII - National: #C.6: Only in countries that are rolling out the Malaria Vaccination program: What input was obtained from sub-national level for vaccine intervention in countries involved in malaria vaccine distribution? How were focus coverage areas identified?	
					In-country CV KII: #C.6: How were focus coverage areas identified?	

	12	RFP Domain B, Question 1: What is the degree of autonomy at sub-national level for decision-making in SNT and malaria programming? What is the role of the overall administrative structure decision making processes on SNT decision making? How adequate are the structures, mandates, guidelines and processes for coordination of national level and sub-national level decision-making?	CV	R-KII-NMCP- 4	R-KII-NMCP- 4: Can you tell me about the SNT process in your country- how well do you think SNT is proceeding? What structures are used to align partners around country-led SNT decision making? What are key areas for improvement?	
				In-country CV KII - Sub-national: #A.1: What is the degree of autonomy at sub-national level for decision-making in SNT and malaria programming?	In-country CV KII: #A.4: Degree of autonomy at sub-national level for decision-making in SNT and malaria programming	
	13	RFP Domain B, Question 2: What are the contextual factors – including political, legal, economic and social dimensions – and their role in affecting decision-making at the sub-national level for SNT?	ALL	R-KII-NMCP 12 - Top enablers/disablers (malaria ecosystem - political economy factors) LR	R-KII-NMCP 12 - What 3 improvements in each of the following areas would best advance effective, country-owned SNT and optimized resource use in your country? In the area of country structures, processes and relations/coordination between national and sub-national level entities?	
				PA: NMSP, FRs	Administrative and governance structures	
				ROS #7		ROS #7: In your opinion, are financial and human resources allocated across different sub-national levels and populations according to need or are they influenced by political considerations? (Scale of 1 to 5, all need to all political)

				R-KII-data 9 - Top enablers/disablers (malaria ecosystem - political economy factors)	R-KII-data 8 - Outside of the data space – what do you believe are the: a. Top 3 enablers of effective, country-owned SNT and optimized resource use? b. Top 3 disablers of effective, country-owned SNT and optimized resource use?	
				R-KII-NMCP- 4 SNT process in your country/structures used to align partners /key areas for improvement?	R-KII-NMCP- 4 SNT process in your country/structures used to align partners /key areas for improvement	
				In-country CV KII - National: #A.5: Are there any political or legal considerations that affect decision-making at the national or sub-national level for SNT? Does political interest or sub-national autonomy affect allocation to sub-national areas? What about social or cultural factors? Do partners influence sub-national allocation? If so, how?	In-country CV KII - National: #A.5: Contextual factors that affect decision-making and resource allocation at the sub-national level for SNT	
				In-country CV KII - Sub-national: #A.3: What affect decision-making and resource allocation at the sub-national level for SNT? For instance, what factors affect what interventions are targeted to your region?	In-country CV KII - Sub-national: #A.3: Contextual factors that affect decision-making and resource allocation at the sub-national level for SNT	

	14a	RFP Domain B, Question 3: What political economy, governance and other factors differ between countries where sub-national level decisions are made, in law and/or practice, and where they are not?		PA: types of governance; types of economic and social conditions; R-KII-NMCP 9 - Top enablers/disablers (malaria ecosystem - political economy factors) R-KII-data 8 - Top enablers/disablers (malaria ecosystem - political economy factors) R-KII-NMCP-4 SNT process: In your country/structures used to align partners /key areas for improvement?	PA: types of governance; types of economic and social conditions. R-KII-NMCP 9 - Top enablers/disablers (malaria ecosystem - political economy factors) R-KII-data 8 - Top enablers/disablers (malaria ecosystem - political economy factors) R-KII-NMCP-4 SNT process: In your country/structures used to align partners /key areas for improvement?	
				In-country CV KII - National: #A.5: Are there any political or legal considerations that affect decision-making at the national or sub-national level for SNT? Does political interest or sub-national autonomy affect allocation to sub-national areas? What about social or cultural factors? Do partners influence sub-national allocation? If so, how?	In-country CV KII - National: #A.5: Contextual factors that affect decision-making and resource allocation at the sub-national level for SNT	
	14b	How can the capacity for on-going decision-making at sub-national level be strengthened – short-term and long-term – in different types of decision-making systems for SNT?	ALL, but esp. CV	In-country CV KII - Sub-national: #A.4:	In-country CV KII - Sub-national: #A.4: How can the capacity for on-going decision-making at sub-national level be strengthened – short-term and long-term – in decision-making for SNT?	
				In-country reports	Impression of evaluators	

	15	As required by level of decentralization, how effective is sub-national leadership in planning and execution of the NMSP?	ALL	R-KII-NMCP 12 - Top enablers/disablers (country ecosystem) R-KII-data 9	R-KII-NMCP 12 - What 3 improvements in each of the following areas would best advance effective, country-owned SNT and optimized resource use in your country? In the area of country structures, processes and relations/coordination between national and sub-national level entities?	
				ROS #12	ROS 12: What resources or capacities do sub-national institutions need to be more effective? (Please list).	ROS #11: Sub-national institutions have the capacity (technical, managerial, financial) to effectively implement and adapt tailored interventions (Rank 1 to 5, Strongly agree to strongly disagree)
Actively supported and assisted by the Global Fund and all partners	**19**	RFP Domain C, Question 3a (FRs specifically), focus on partner alignment: What difficulties are faced by countries in moving from input-based programming to impact-based programming based on SNT? How can the Global Fund processes better incentivize Funding Requests based on SNT and financial optimization?	ALL	R-KII-NMCP 8 - TGF funding requests; partner preferences R-KII-NMCP 9 + DATA 8 - Top enablers/disablers (partner ecosystem) R-KII-NMCP 10 + DATA 11 - TGF role/areas for improvement R-KII-NMCP 11 - TGF - role in transition to SNT		
				In-country CV KII - National: #D.5: What challenges have you experience, if any, in the engagement/support you provide to the NMP for SNT decision-making and reporting? What about for financial optimization?	In-country CV KII - National: #D.5: Challenges experienced, if any, in the engagement/support you provide to the NMP for SNT decision-making and reporting. What about for financial optimization?	

				In-country CV KII - National: #D.5: What are the key challenges and suggested areas of improvement for the SNT stakeholder partnerships?	In-country CV KII - National: #D.5: Key challenges and suggested areas of improvement for the SNT stakeholder partnerships	
	20	RFP Domain D, Question 2: Are the Global Fund monitoring frameworks built in a way that supports a sub-nationally tailored response in country? Do the Global Fund's Progress Update and Disbursement Request (PUDRs), the District Health Information System (DHIS) district dashboards and other tools lead to or encourage data use and action?	ALL	Coordinate with M4M AND: "R-KII-DATA 11 - sub-national indicators R-KII-NMCP 10 - TGF role/areas for improvement (data = 11) G-R-KII-data 7 - gaps in sub-national systems"; PA_M&E frameworks		
	21	RFP Domain B, Question 4: What has been the role of Global Fund investments in supporting decision-making for SNT? Who makes the key decisions and what evidence do they use as basis for decision-making?	All	R-KII-NMCP 8 - TGF funding requests; partner preferences R-KII-NMCP 7 - national decision-making (MOH +) PA: TRP comment review. ROS, #2	ROS, Question 2: Is Global Fund input into the National Malaria Strategic plan process helpful? How could it be improved?	
				In-country CV KII - National: #A.8: What has been the role of Global Fund guidance and investments in supporting decision-making for SNT? How	In-country CV KII - National: #A.8: The role of Global Fund guidance and investments in supporting decision-making for SNT	

				have Global Fund TAs participated in sub-national tailoring?		
	22	RFP Domain D, Question 3: a) Do the current indicators facilitate and incentivize the Secretariat and countries to work towards SNT and financial optimization? b) Are the indicators adequately adaptable and usable by sub-national eval teams in a sub-national context and to what granularity and periodicity?	ALL	R-KII-data 11 - sub-national indicators	R-KII-data 11: Do the current TGF indicators facilitate SNT and financial optimization? Are the indicators adequately adaptable and usable at the sub-national level, and with what granularity and specificity?	
	23	RFP Domain E, question 4: a) To what extent does technical assistance (TA) focus on SNT? b) How can the TA scope be expanded to focus on SNT and related financial optimization in preparation for GC8 as well as systematic local capacity building for SNT?	ALL	R-KII-NMCP 13 - TA/capacity building receipt + performance R-KII-TGF 7 - TA/capacity building provision + performance	R-KII-NMCP 13- a. Have you requested resources and TA for key elements of SNT and have you received it? Who are your primary SNT support providers? b. To the extent you have received this support, to what extent has this been country-directed, aligned with your needs, and effective? How might it be improved? c. To what extent have partners – and particularly TGF – facilitated the creation, maintenance, and use of sub-national data systems, including MDRs, in your country? Suggestions for improvements? d. Have you received modeling support that has helped guide targeting and tailoring of interventions? By whom and what types? Were the results useful, and do you have confidence in them? Suggestions for improvements? R-KII-the Global Fund-7: Please describe the	

					types and aims of the technical assistance the Global Fund provides around SNT. What in your opinion is working well? Where are there gaps?	
Better access to quality data and analytics for decision-making	**24a**	RFP Domain A, Question 1: 1.1 What are the sub-national systems available in countries for capturing a). malaria burden data (cases, incidence and mortality);	CV Metareview LR	PA: NMSP; R-KII-data 8 - gaps in sub-national systems, R-KII-NMCP-13 Technical Assistance		
				In-country CV KII - National: #C.1: Sub-national systems available in countries for capturing a) malaria burden data (cases, incidence and mortality)	In-country CV KII - National: #C.1: Sub-national systems available in countries for capturing malaria burden data (cases, incidence and mortality)	
	24b	b) Malaria intervention data (access to services, use of vector control measures and early diagnosis and treatment); and	CV Metareview LR	R-KII-data 8 - gaps in sub-national systems		
				In-country CV KII - National: #C.1: Sub-national systems available in countries for capturing b) Malaria intervention data (access to services, use of vector control measures and early diagnosis and treatment)	In-country CV KII - National: #C.1: Sub-national systems available in countries for capturing malaria intervention data (access to services, use of vector control measures and early diagnosis and treatment)	

	24c	c) Other contextual information (climate, socio-economic, refugee populations).	Mainly CV	In-country CV KII - National: #C.1: Sub-national systems available in countries for capturing c) Other contextual information (climate, socio-economic, refugee populations). What is the availability of community and private sector data?	In-country CV KII - National: #C.1: Sub-national systems available in countries for capturing Other contextual information (climate, socio-economic, refugee populations). What is the availability of community and private sector data?	
	24d	1.2 What is the availability of community and private sector data? 1.3 To what extent is this data collected, disaggregated and transcribed into the routine data systems?	ALL	PA: NMSP and MTR		
	25	What gaps does the program identify in a) Data and analytics prioritized for community-responsive design and local adaptation? b) Data and analytics prioritized for decisions around innovations, novel trends, expansion of pilot projects, etc.? c) quality and kind of data and analysis used to make financial optimization decisions? What kind of data and analysis (e.g. reliable cost effectiveness analysis) needed for	ALL	In-country CV KII - National: #C.7: ROS: #6	In-country CV KII - National: #C.7: What are the key data management challenges and areas of improvement during SNT implementation? ROS #6: What information or analysis does the program and partners need MORE of to figure out which combination of malaria prevention or treatment purchases will have the greatest impact within a resource envelope? (Select two only).	

		financial optimization does the program feel is missing?				
	26	RFP Domain A, Question 3: What is the quality of data at sub-national level? Are validation, verification and quality improvement done at sub-national level to ensure data quality? By whom? What is the right balance between funding Global Fund Local Fund Agents (LFAs) for data verification and transmission versus supporting data reviews and use sub-nationally?	CV mainly	In-country CV KII - Sub-national: #B.1: What is the quality of data at sub-national level?	In-country CV KII - Sub-national: #B.1: The quality of data at sub-national level	
				In-country CV KII - Sub-national: #B.2	In-country CV KII - Sub-national: #B.2: What kinds of validation, verification and quality improvement are done at sub-national level to ensure data quality?	
	27	RFP Domain C, Question 4 (Funding Requests specifically): To what extent have countries requested resources and technical assistance for sustainable data compilation and analysis, stratification, identification of intervention mixes and support for scenario-building with stakeholders, and support to	ALL	R-KII-NMCP 13 - TA/capacity building receipt + performance R-KII-data 4 - TA/capacity building provision + performance	R-KII-NMCP 13: a. Have you requested resources and TA for key elements of SNT and have you received it? Who are your primary SNT support providers? b. To the extent you have received this support, to what extent has this been country-directed, aligned with your needs and effective? How might it be improved? c. To what extent have partners – and particularly TGF – facilitated the creation, maintenance and use of sub-national data systems, including MDRs, in your country? Suggestions for improvements? d. Have you received modeling support that has helped guide targeting and tailoring of interventions? By whom and what types? Were the results useful, and do you have	

		modeling groups to build iterative models based on the scenarios? If so, have they been provided and prioritized?			confidence in them? Suggestions for improvements?	
	28	RFP, Domain A, Question 5: To what extent do population denominators inform SNT? What are the data sources and methods used for assessing population denominators at sub-national level? How are estimates currently calculated for service coverage, distribution of commodities, etc.?	CV mainly	In-country CV KII - Sub-national: #B.4	In-country CV KII - Sub-national: #B.4 What are the data sources and methods used for assessing population denominators at sub-national level?	
				PA: NMSP and FRs and SA where available.		
	29	RFP Domain D, Question 1: To what extent has the Global Fund facilitated the creation, maintenance and use of sub-national data systems, including consolidated and maintained malaria data repositories (MDR) in countries? What data sources do the MDRs draw from?	ALL esp. CV	R-KII-data 9a - Role and progress of MDRs ++; in-country MDR checklist tool		
	30a	RFP Domain A, Question 6: How adequately does malaria sub-national data and disaggregated analysis inform: i) How adequately does	All	PA: (NMSP)	Type of sub-national data and disaggregated analysis informing epi stratification; type of stratification; priority of stratification	
				In-country CV KII - National: #C.4.1	In-country CV KII -National: #C.4.1: How SNT and disaggregated analysis adequately informs Epidemiological Stratification	

		malaria sub-national data and disaggregated analysis inform: i) epidemiologic stratification?				
	30b	How adequately does malaria sub-national data and disaggregated analysis inform: ii) optimization of intervention mix?	All	PA: examination of optimization in NMSP and FRs	Type of sub-national data and disaggregated analysis informing optimization of intervention mix	
				In-country CV KII - National: #C.4.2	In-country CV KII - National: #C.4.2 How SNT and disaggregated analysis Adequately informs optimization of intervention mix	
	30c	How adequately does malaria sub-national data and disaggregated analysis inform: iii) monitoring and evaluating the impact of stratification?	All	PA: examination of M&E in NMSP, MTR and FRs	Type of sub-national data and disaggregated analysis informing monitoring and evaluating the impact of stratification	
				In-country CV KII - National: #C.4.3	In-country CV KII - National: #C.4.3: How SNT and disaggregated analysis Adequately informs monitoring and evaluating the impact of stratification	
(Will produce) a high level of SNT maturity and a context-appropriate, sub-nationally tailored malaria response	**31**	What is the overall SNT maturity of each country, as measured by our SNT maturity index? (See Annex A.3 SNT Maturity Index)	ALL	MULTIPLE, mostly PA (See SNT maturity index tool)		
	32	RFP Domain C, Question 1 (FR specifically): How much have the key concepts of SNT been reflected in the malaria Funding Requests (FRs)? How can this be strengthened in GC8?	ALL	PA-FR		

	33a	RFP Domain E, Question 1: To what extent has sub-national evidence been used to inform National Malaria Strategic Plans (NMSPs), National Health Strategic Plans (NHSPs) and sub-national plans? What kind of data has been used and what data is needed to make stronger national strategic plans?	ALL	PA: NMSPS and FRs. R-KII-NMCP 4 - SNT across strategy-execution cycle R-KII-NMCP 8	R-KII NMCP 8: What gaps does the program identify in: a) Data and analytics prioritized for community-responsive design and local adaptation? b) Data and analytics prioritized for decisions around innovations, novel trends, expansion of pilot projects, etc.? c) Quality and kind of data and analysis used to make financial optimization decisions? What kind of data and analysis (e.g. reliable cost effectiveness analysis) needed for financial optimization does the program feel is missing?	
	33b	How does the costing of NMSPs consider the specific needs and interventions required at sub-national levels? Do the national plans reflect the use of SNT to optimize financial requests and allocations?	ALL	In-country CV: A#3	In-country CV: A#3 How is your NMSP costed? What cost information do you use, and what is lacking? Do the national plans reflect the use of SNT to optimize financial requests and allocations?	
	33c	Are there uniform and inclusive processes in-country to develop NMSPs?	ALL	PA: NMSPs ROS: 15, 22-24 GESI	ROS #15: Are there mechanisms in place to ensure meaningful engagement in decision-making processes for… (tick all that apply)? Community members, Adolescents/ Youth, Women, People living with disabilities, Migrant populations ROS #22: Which of the following areas are prioritized, apart from epidemiology, for sub-national tailoring (tick all that apply)? Gender inequalities at sub-national level, Gender barriers to access, Dedicated gender interventions/strategies (such as IPTp, women led CSOs/community action groups, women CHWs/spray operators, etc.), Interventions targeting human rights-related barriers among groups such as migrant populations, youths in boarding schools/religious sects, etc.	ROS #23: To what extent do tailored malaria interventions effectively reach and benefit women and girls, considering their specific needs and vulnerabilities within different sub-national contexts? (5 pt scale) ROS #24: How effective are community engagement strategies in promoting gender-sensitive malaria control measures and

						ensuring the meaningful participation of women in decision-making processes? (5 pt scale)
That optimizes resource use for a particular impact goal	**34**	How are decisions around financial optimization made in the preparation of the FR? (Separately from decisions around SNT?)	ALL	PA: NMSPs & FR R-KII-NMCP + DATA 7	R KII- data 7: Can you tell me about the financial resource optimization process? How do you support this and how is it going?	
	35	How do different stakeholders define (and operationalize) financial optimization? How does the national program approach financial optimization analysis?		R-KII-ALL-1b - financial optimization (definition) R-KII-NMCP 3 +DATA 7 - financial optimization (progress)	Remote SC KII 1: a. How do you define financial optimization Remote SC KII 3: Please describe your approach to financial optimization?	
	36	RFP Domain C, Question 2, focus on resource optimization (FRs specifically): To what extent do the FRs reflect stratification and tailoring of interventions at sub-national level? What are the reasons why an initial stratification may not reflect the chosen interventions? What role do resource constraints play in	ALL	PA: FRs; R-KII-NMCP 6 resource constraints	PA questions on NMSP & CONTEXT-APPROPRIATE INTERVENTIONS: b. Stratification aligned with goal(s): Is the NMSP stratified in consideration of its epidemiological, seasonal and demographic context in terms of transmission and burden and aligned with impact goals? Are intervention packages determined for each stratification level? Is there evidence that operational stratifications are based on robust mapping, modeling and analysis? c. Resource Optimization Effectiveness under resource constraints: In the case of a large funding gap in the NMSP, are limited resources allocated to support impact goals? Is there a rationale that highlights tradeoffs, a rigorous cost effectiveness analysis or forecast	

		the deviation from ideal interventions and interventions that are finally selected?			that predicts the amount of impact the proposed interventions will make towards the NMSP goal? Is there a fiscal gap analysis? Are the pros/cons of specific resource choices shown clearly? Are tradeoffs presented clearly?	
	37a	RFP Domain C, Question 3: What difficulties are faced by countries in moving from input-based programming to impact-based programming based on SNT?	ALL	R-KII-NMCP 11 & 12	R-KII-NMCP-11: What are your three highest priority gaps in sub-national data availability, analytic capacity, data use mechanisms and other key elements of preparedness for data-driven decision-making? R-KII-NMCP 12: What 3 improvements in each of the following areas would best advance effective, country-owned SNT and optimized resource use in your country? a. Partner practices, policies, and coordination - focused on but not limited to TGF b. In the area of country structures, processes, and relations/coordination between national and sub-national level entities?	
	37b	How can Global Fund processes better incentivize Funding Requests based on SNT and financial optimization?		ROS #28	ROS #28: How can the Global Fund improve their technical assistance, or the process of country applications for malaria funding, to facilitate sub-national tailoring?	

	38	SNT maturity index sub-domain: alignment of optimization with impact goal prioritized by country. How well does the optimization of resources in the FR match the impact goal or goals defined by the country's NSP?	ALL	PA- NSMP & FRs	PA questions on NMSP & Context Appropriate Interventions: a. Clarity of impact goal or goals: Does the NMSP have a clear impact goal or goals? Are the mortality and morbidity goal timelines aligned? (e.g. are we driving towards zero mortality by 2025 while only reducing burden by 30% in the same timeframe?) Is there evidence that goals are based on modeling and analysis? c. Resource Optimization Effectiveness under resource constraints: Evidence that resource investments in funding requests are optimized to support impact goals in NMSP: Are intervention mixes/malaria investment allocations chosen strategically to support NSP impact goals?	

Annex G: List of Countries in Evaluation

Annex G presents the countries evaluated in the report. Countries with an asterisk were in the GC6/GC7 analysis group.

COUNTRY	VISITED?
1. Angola*	
2. Benin*	
3. Burkina Faso*	
4. Burundi*	
5. Cameroon	
6. CAR	
7. Chad	
8. Congo	
9. Cote d'Ivoire	
10. DRC*	**Yes**
11. Ghana*	**Yes**
12. Guinea*	
13. India*	
14. Indonesia	
15. Kenya*	**Yes**
16. Liberia*	
17. Madagascar*	
18. Malawi*	
19. Mali	
20. Mozambique*	**Yes**
21. Niger	
22. Nigeria*	**Yes**
23. Papua New Guinea*	**Yes**
24. Rwanda	
25. Sierra Leone	
26. South Sudan*	
27. Sudan	
28. Tanzania *	
29. Togo*	
30. Zambia	

ELIMINATION/TRANSITION COUNTRIES
Cambodia
Costa Rica
Guatemala
Panama
Sri Lanka

Annex H: Strategic Stakeholder Engagements

Date	Stakeholder	Scope of Discussion
INCEPTION PHASE		
Fri, 21 Jun	Senior Specialist Head, Malaria	Introduction to TGF Malaria programs and SNT processes
Fri, 21 Jun	Senior Specialist, Monitoring, Evaluation Country Analysis Team	Introduction to TGF's M&E (Malaria & SNT process)
Mon, 24 Jun	Chief Evaluation & Learning Officer	Introduction
Mon, 24 Jun	Audit Manager	Introduction to OIG
Mon, 24 Jun	Manager, Emerging Technologies & Enterprise Architecture Data Scientist	Introduction to Global Fund's work on AI & NLP
Tue, 25 Jun	ELO	Catch-Up meeting
Tue, 25 Jun	Senior FPM, High Impact Africa 2	Introduction to GMD's work and malaria programs
Tue, 25 Jun	Manager, Applicant Support Head, Access to Funding Department	Introduction to Access to Funding and insights on Malaria SNT reflected in the funding application process
Wed, 26 Jun	Manager, Programmatic Results and Impact Associate Specialist, Programmatic Monitoring Department	Introduction to programmatic results and data
Wed, 3 Jul	Senior Strategy and Policy Advisor	Malaria SNT evaluation first meeting with consultants
Wed, 3 Jul	ELO	Country Case Study Finalization
Thu, 4 Jul	ELO	Follow-up Discussion on Country Case Study Finalization
Fri, 5 Jul	ELO and IEP	Introductory Meeting with IEP Leadership ad Focal Points
Wed, 10 Jul	Manager, Emerging Technologies & Enterprise Architecture, and Data Scientist	IT Support Meeting
Mon, 15 Jul	PATH and ELO	Introductory Meeting with PATH for collaboration on respective SNT Evaluations
Mon, 12 Aug	ELO, IEP, and Senior Specialist	Inception Report and SNT Maturity discussion
Tue, 13 Aug	ELO, IEP, and Senior Specialist	Theory of Change discussion
Tue, 13 Aug	ELO	Budget Discussion
Tue, 3 Sep	ECG	Meeting of ECG on Sub-National Tailoring of Malaria Interventions (SNT)
EVALUATION PHASE		
Wed, 21 Aug	ELO, Kenya CT, CCM and NMCP	Introductory Meeting on GF SNT Project Country Case Study
Mon, 29 Aug	PNG CT	Introductory Meeting on GF SNT Project Country Case Study

Tue, 3 Sep	ECG Virtual Meeting	Initial Meeting & Presentation to the ECG
Wed, 4 Sep	Ghana CT	Introductory Meeting on GF SNT Project Country Case Study
Mon, 9 Sep	Madagascar CT and NMCP	Introductory Meeting on GF SNT Project Country Case Study
Wed, 11 Sep	DRC CT and CCM	Introductory Meeting on GF SNT Project Country Case Study
Wed, 11 Sep	CHAI	Informational FGD
Mon, 16 Sep	User Group Malaria SNT	Discussion on UG comments on Inception Report and Malaria SNT Maturity Index
Thu, 19 Sep	Kenya NMCP	Pre-Visit Coordination Meeting
Tue, 24 Sep	PNG CT, NMCP	Introductory Meeting on GF SNT Project Country Case Study
Tue, 24 Sep	TGF IT, Manager, Emerging Technologies & Enterprise Architecture, and Data Scientist	Discussion on difficulties in using NLP-AI as a tool for the Malaria SNT Evaluation Project
Wed, 24 Sep	Nigeria CT, CCM NMCP	Introductory Meeting on GF SNT Project Country Case Study
Fri, 27 Sep	ELO	Discussion of IEP queries on Inception Report and next steps
Mon, 30 Sep	Ghana CCM, NMCP	Introductory Meeting on GF SNT Project Country Case Study
Thu, 3 Oct	PATH/ Pilgrim Africa	Check-in Meeting
Tues, 24 Sep	Ghana NMCP	Pre-Visit Coordination Meeting
Thu, 24 Sep	Ghana NMCP	Follow-up Pre-Visit Coordination Meeting
Thu, 7 Nov	ELO, CELO, IEP	Early Observations Workshop
Wed, 20 Nov	ELO	Timelines Discussion

Annex I: Remote Stakeholder Consultation List

Stakeholder group	Stakeholder organization or subgroup organization	# completed
THE GLOBAL FUND	Malaria Team	2
	Monitoring Evaluation and Country Analysis	1
	Malaria and RSSH	2
	Access to Funding	2
	Policy Hub	2
	Portfolio Managers	3
BILATERAL & MULTI-LATERAL & MULTI-NATIONAL	Disease Managers/Country Advisors	3
	Regional Managers	1
	US President's Malaria Initiative	2
PRIVATE DONORS	Bill & Melinda Gates Foundation	2
	Rotary International	1
ADVOCACY GROUPS	ALMA	1
	Goodbye Malaria	1
	Malaria No More	1
NGOs	CHAI	5
	PATH	5
INTER-GOV	RBM	1
	WHO	2
UNIVERSITY/RESEARCH	Northwestern University	1
NMCP COORDINATORS	Burkina Faso	1
	Burundi	1
	Chad	1
	Congo (Brazaville)	1
	Côte d'Ivoire	1
	Guinea	1
	Liberia	1
	Malawi	1
	Mali	1
	Rwanda	1
	South Sudan	declined
	Sudan	declined
	Tanzania	1
	Togo	1
	Zambia	1
ELIMINATION COUNTRIES	Sri Lanka	1
	TOTAL	**51**

Annex J: Country Visit Details

Country	Dates
Kenya	23–27 Sep 2024
Nigeria	14–21 Oct 2024
DRC	30 Sep–7 Oct 2024
Papua New Guinea	21–25 Oct 2024
Madagascar	16–20 Sep 2024
Ghana	28 Oct–1 Nov 2024

Annex K: Elimination/Transition Countries: Historical Review

Sri Lanka

Sri Lanka experienced a devastating epidemic (1934-35), which caused over 400,000 deaths, and highlighted the vulnerabilities of the public health system including delayed quinine shipments under British colonial rule. The introduction of DDT in 1946 marked a turning point, making Sri Lanka one of the first Asian countries to adopt this intervention. By 1958, a WHO-supported eradication campaign was launched, combining widespread DDT spraying and CM with chloroquine. These efforts achieved near elimination, with cases dropping to just 17 by 1963. However, premature withdrawal of interventions, resource reallocation to other diseases, and resistance to DDT led to a resurgence by 1968, with over a million cases reported. The introduction of Malathion in 1975 and later pyrethroids, alongside targeted spraying and mosaic spraying techniques, helped stabilize the program during financial and logistical constraints.

The civil war from the 1980s to 2009 created significant challenges, but the malaria program demonstrated resilience, maintaining moderate levels of surveillance and treatment even in conflict zones. Innovations like observed prophylaxis for soldiers and collaboration between government and rebel health workers ensured continued malaria control. Global Fund support in 2003 revitalized the program, focusing on conflict-affected areas, while the introduction of ACT in 2007. Community engagement, NGO partnerships, and non-medical personnel training strengthened local ownership. By 2012, Sri Lanka recorded its last indigenous malaria case and was certified malaria-free by WHO in 2016. Since then, the country has maintained robust surveillance systems, leveraging its island geography and strong health infrastructure to prevent reintroduction, serving as a model for other high-burden countries.

Historical Overview of Malaria Elimination on Sri Lanka

Early History and Initial Control Efforts (1911–1958)

- **1911:** Establishment of the first Anti-Malaria Centre in Kurunegala.
- **1913:** Identification of *Anopheles culicifacies* as a malaria vector.
- **1934–1935:** A devastating malaria epidemic caused 5.5 million cases, highlighting the need for systemic control measures.
- **1945:** Introduction of DDT for vector control, significantly reducing cases.
- **1954:** Scaling back and reinstatement of DDT spraying due to fluctuating case numbers.

Eradication and Resurgence (1958–1969)

- **1958:** Launch of the WHO-supported malaria eradication program.
- **1963:** Near elimination with only 17 cases reported, 11 of which were imported.
- **1964–1969:** Malaria resurgence with over 1.5 million cases, driven by resistance to DDT, premature cessation of IRS, and insufficient active case detection.

Focus on Control and Strategic Adjustments (1970–1999)

- **1975:** Introduction of Malathion as an alternative to DDT.
- **1986–1987:** Epidemics linked to resettlement in malaria-prone areas.
- **1992:** Widespread Malathion resistance detected; shift to pyrethroids for vector control.
- **1996:** Transition to targeted spraying in high-risk areas.
- **1999:** Roll Back Malaria Initiative launched, supporting a significant decline in malaria cases.

Pre-Elimination and Elimination Efforts (2000–2016)

- **2003:** Initiation of Global Fund support for malaria programs.
- **2008:** Launch of the pre-elimination phase with stricter protocols for case notification and response.
- **2012:** Reporting of the last indigenous malaria case.
- **2014:** Elimination of *Plasmodium vivax* achieved.
- **2016:** Official certification of malaria-free status by WHO.

Sustaining Elimination and Preventing Re-Establishment (2016–Present)

- **2016–2023:** Routine surveillance identified *Anopheles stephensi* in the north-west, prompting intensive eradication efforts.
    - Sustained focus on preventing re-establishment through surveillance, community engagement, and targeted interventions.

Key Learnings from Malaria Elimination in Sri Lanka

Political will for malaria elimination. Strong political will was a cornerstone of Sri Lanka's success in eliminating malaria. The government demonstrated unwavering commitment by prioritizing malaria elimination as a national health goal, even during the civil war (1980s–2009) and periods of financial constraints. This determination ensured sustained funding, effective policymaking, and coordinated efforts between national and provincial levels. Despite logistical and security challenges during the civil unrest, political leaders facilitated informal collaborations between government and rebel health workers, ensuring that malaria services such as diagnosis, treatment, and vector control reached conflict zones. Essential supplies like chloroquine, RDTs, and microscopy reagents were consistently delivered to war-affected areas, exemplifying a dedication to universal health access.

The government also actively engaged with international partners, securing crucial funding from the Global Fund and WHO. These collaborations supported the introduction of ACT and enabled intensified malaria control efforts in the conflict-affected northern and eastern provinces. The strong political commitment to eliminating malaria laid a foundation for consistent, impactful interventions that endured despite significant challenges, positioning Sri Lanka as a global model for malaria elimination.

Focus on health system strengthening. Sri Lanka’s robust health infrastructure was a cornerstone of its success in malaria elimination. Investments in strengthening the health system facilitated efficient resource delivery, comprehensive staff training, and the integration of malaria surveillance with other public health initiatives. For example, the AMC strategically integrated surveillance for malaria with other vector-borne diseases like dengue and filariasis, optimizing resources and maintaining vigilance even after malaria elimination.

A strong network of microscopy centers and well-trained healthcare workers enabled accurate diagnosis and timely treatment, even during the civil war. Essential supplies like microscopy reagents were consistently delivered to conflict-affected regions, highlighting the system's resilience. Collaboration with NGOs and religious institutions further strengthened community-level health services, raising awareness, encouraging fever reporting, and ensuring broad participation in elimination efforts. The AMC also invested in training healthcare workers, volunteers, and non-medical personnel to deliver treatments, apply insecticides effectively, and detect cases. These measures addressed staffing challenges, particularly in remote and underserved areas, and reinforced Sri Lanka’s capacity to eliminate malaria and sustain its progress.

Difficulties of case-based surveillance. In high-burden settings, case-based surveillance proved impractical due to the volume of cases and resource limitations. Instead, Sri Lanka initially focused on reducing morbidity and mortality through targeted interventions, such as spraying and treatment in high-risk areas. This strategy allowed the country to reduce its burden to manageable levels before implementing case-based surveillance during the elimination phase.

Decentralized implementation with central oversight. Sri Lanka placed a strong emphasis on capacity building at all levels, pairing technical expertise with a carefully controlled decentralization model. This approach ensured consistency in policies and practices while allowing flexibility for regional implementation. Unlike fully decentralized systems where inconsistencies can lead to challenges such as

resistance, Sri Lanka's hybrid model allowed provincial teams to carry out activities while the central government retained oversight of policies, procurement, and technical guidance.

By maintaining centralized control over critical decisions like treatment protocols, surveillance strategies, and insecticide use, the government ensured uniform implementation across all regions. This balance allowed local teams the flexibility to adapt to specific regional needs without compromising the overall integrity of the program. The hybrid system thus enabled effective and consistent malaria control, contributing significantly to Sri Lanka's success in elimination efforts.

Strengthened surveillance systems. Enhanced surveillance systems formed the backbone of Sri Lanka's malaria elimination efforts, playing a pivotal role in preventing the re-establishment of the disease. The integration of malaria surveillance with other disease monitoring programs ensured efficient use of resources and enabled holistic public health responses. Real-time data sharing and strong community involvement facilitated early detection and swift responses to cases, reinforcing the country's ability to maintain its malaria-free status.

Routine entomological surveys identified mosquito breeding sites and monitored the spread of malaria vectors, including *Anopheles stephensi*. These data informed targeted interventions such as larval control and insecticide spraying in high-risk areas. Technological advancements, including mobile data-sharing platforms and digital tools, further strengthened the surveillance system. These innovations enabled real-time tracking of cases and streamlined reporting and response processes across regions, ensuring prompt and effective action to address potential threats. This robust, community-centered approach remains instrumental in safeguarding Sri Lanka's hard-earned malaria-free status.

Costa Rica

Costa Rica has historically been a low-incidence country for malaria, yet its diverse ecosystems and favorable climate have made it a significant area for malaria research and control efforts. Transmission is primarily driven by at least 18 species of *Anopheles* mosquitoes, with *Anopheles albimanus* being the main vector. Early control initiatives date back to the mid-20th century, with widespread use of DDT for IRS and robust health system measures that significantly reduced malaria cases. The establishment of the Malaria Surveillance and Control Program (MSCP) in 1957 under PAHO guidelines marked a critical turning point, enabling systematic vector control and surveillance. However, challenges such as environmental resistance to DDT and disruptions from natural disasters, like the 1991 earthquake, necessitated adaptive strategies in later decades.

Recent years have uncovered ecological complexities that complicate malaria elimination in Costa Rica. Studies have revealed the presence of malaria-infected New World primates, including howler monkeys and squirrel monkeys, which may act as reservoirs for *Plasmodium* species such as *P. falciparum* and *P. vivax*. The overlap of human malaria cases with areas of high primate activity, particularly along the Pacific and Atlantic coasts, highlights a potential spillover risk of transmission between humans and wildlife. Anthropogenic changes, such as deforestation and agricultural expansion, have exacerbated these risks by increasing interactions between humans and primates while altering vector habitats.

Despite these challenges, Costa Rica has made significant progress toward malaria elimination through innovative approaches like the adoption of seven-day treatment protocols, mass drug administration campaigns, and reactive vector control strategies. Between 2013 and 2015, the country achieved a 33-month break in malaria transmission, demonstrating the effectiveness of integrated health systems and community engagement. However, imported cases from neighboring regions and ecological factors, such as primate reservoirs, remain persistent obstacles, underscoring the need for sustained surveillance and adaptable strategies to maintain Costa Rica's trajectory toward malaria elimination.

Costa Rica was honored with the PAHO Malaria Champion of the Americas 2024 award in recognition of its remarkable achievements in reducing autochthonous malaria cases, particularly in the Northern Huetar Region. Malaria cases in this region dropped from 378 in 2022 to 128 in 2023, and by the beginning of October 2024, only eight cases had been reported—a clear indicator of the country's progress toward eliminating local malaria transmission.

Historical Overview of Malaria Control in Costa Rica

Initial Efforts and Early Successes (1957–1979)

- **1941:** Creation of the Costa Rican Social Security Trust (CCSS) universalized healthcare and introduced a rudimentary malaria surveillance system.
- **1946:** Introduction of DDT for IRS in banana plantations by the United Fruit Company, achieving significant reductions in malaria cases.
- **1950s–1970s:** Widespread use of DDT for IRS significantly reduced malaria cases, especially in endemic areas like the Pacific basin.
- **1957:** Establishment of the MSCP under PAHO guidelines.

Challenges and Shifts in Strategy (1980–1999)

- **1986:** Replacement of DDT with carbamates and pyrethroids due to environmental concerns and resistance.
- **1990:** IRS deployment became reactive, focusing only on areas with active transmission.
- **1991:** A major earthquake disrupted health infrastructure, contributing to a surge in malaria cases during the 1990s.
- **1997:** Transition to a five-day treatment for *Plasmodium vivax*, which delivered insufficient primaquine doses, leading to inadequate relapse prevention.

Innovative Approaches and Major Policy Changes (2000–2012)

- **2006:** Introduction of a seven-day chloroquine and primaquine treatment protocol, improving treatment outcomes and significantly reducing malaria transmission.
- **2008:** Full adoption of the seven-day treatment across all transmission areas, establishing a pharmacokinetically effective malaria treatment.
- **2009:** Implementation of the "transmission blockage" protocol, involving reactive case detection, larval control, and focal IRS.

Achievements and Temporary Elimination (2013–2015)

- **2013–2015:** A 33-month hiatus in malaria transmission was achieved, attributed to improved treatment protocols and MDA.

Resurgence and Targeted Interventions (2016–2019)

- **2016:** Resurgence of malaria cases due to imported infections from Nicaragua, particularly in agricultural and mining areas.
- **2019:** Focal MDA in Boca Arenal targeted local transmission hotspots, achieving 90% coverage and temporarily reducing transmission.

Ongoing Challenges and Sustained Efforts (2020–Present)

- **2020 and Beyond:** Sustained surveillance and treatment strategies address challenges posed by mobile populations and imported cases. Costa Rica continues leveraging universal healthcare and robust surveillance systems to sustain progress toward malaria elimination.

Key Learnings from Malaria Control in Costa Rica

Surveillance and rapid response. Costa Rica's progress toward malaria elimination has been underpinned by a comprehensive surveillance and rapid response system, integrating both active and passive surveillance. Passive surveillance, conducted through health services, uses RDTs to detect malaria cases early during routine healthcare visits. Active surveillance complements this approach by targeting high-risk environments, such as farms, mining areas, and other workplaces prone to outbreaks. Surveillance teams perform on-site screenings, enabling the immediate detection and treatment of cases directly in the field. This strategy ensures that even asymptomatic or undiagnosed cases among mobile populations, like migrant workers, are promptly identified and managed, reducing the risk of further transmission.

When a case is confirmed, rapid response protocols are activated, including larval control measures, IRS in affected areas, and contact tracing to identify and treat potential secondary cases. These responses are often paired with MDA campaigns in selected communities to preemptively reduce parasite loads. For example, a focal MDA campaign conducted in Boca Arenal in 2019 targeted transmission hotspots, achieving 90% community coverage. This campaign successfully reduced the malaria reproduction number (Rt) below 1 for at least four months, effectively curbing transmission in the area.

Data-driven decision-making has been critical to this system's success, enabling surveillance teams to leverage real-time case data to allocate resources efficiently and focus interventions in high-risk zones. This integrated approach—combining surveillance, rapid response, and MDA campaigns—has allowed Costa Rica to address cases swiftly, contain outbreaks effectively, and significantly reduce the risk of further transmission, marking substantial progress toward the elimination of malaria.

Community and volunteer engagement. Community engagement has been a cornerstone of Costa Rica's malaria elimination efforts, ensuring that interventions reach the most vulnerable populations and high-risk areas. Volunteer collaborators, often members of local communities, played a crucial role in active surveillance, assisting with case detection, and educating their communities about malaria prevention and treatment. These volunteers were trained to use RDTs to identify malaria cases promptly and report them to health authorities, enabling swift treatment and containment of transmission. The involvement of farms and workplace managers further enhanced these efforts, as active surveillance was conducted directly at workplaces like farms and mining sites, where workers were screened and treated onsite. This integration of community members and organizations into malaria control created a sense of ownership and responsibility, making interventions more effective and sustainable. Educational campaigns and the active participation of community leaders, religious institutions, and local organizations also fostered trust and ensured widespread adherence to measures like MDA campaigns. By leveraging community networks, Costa Rica was able to amplify the reach and impact of its malaria control strategies, overcoming challenges posed by remote locations and mobile populations.

Chloroquine and primaquine treatment protocol (7DCPT). The introduction of the seven-day chloroquine and primaquine treatment protocol (7DCPT) in 2006 was a pivotal intervention in Costa Rica's malaria elimination efforts. This treatment regimen replaced the previous five-day protocol, which was considered pharmacokinetically insufficient to prevent relapses, particularly of *Plasmodium vivax*. The 7DCPT ensured that patients received adequate doses of primaquine to target both blood-stage parasites and liver-stage hypnozoites, effectively reducing the risk of recurring infections. Its supervised administration further ensured treatment adherence, particularly in remote or high-risk areas.

By 2008, the 7DCPT became the standard treatment in all transmission regions of Costa Rica. This implementation led to a dramatic 98% reduction in malaria cases between 2009 and 2018, making it the most impactful health policy change in the country's history of malaria control. The protocol's success was enhanced by Costa Rica's robust health infrastructure, which facilitated widespread access to treatment and

integrated surveillance systems. These systems allowed for the rapid identification and treatment of malaria cases, ensuring that the 7DCPT could be effectively deployed across diverse regions, including workplaces, farms, and mining areas.

Guatemala

Malaria control efforts in Guatemala date back to the mid-20th century, with the first major intervention being the launch of an IRS campaign in 1956 using dieldrin. This was soon replaced by DDT in 1958 after resistance to dieldrin emerged, resulting in a significant reduction in malaria cases from over 12,000 to 3,387 by 1960. However, resistance to DDT developed rapidly due to its overuse in agriculture, particularly in cotton-growing areas. The 1960s saw large outbreaks in newly established agricultural settlements, prompting additional interventions such as antilarval measures and mass drug administration. Despite these efforts, malaria transmission persisted, especially in rural and agricultural regions.

In the 1970s and 1980s, Guatemala faced significant setbacks due to prolonged civil war, regional political unrest, and natural disasters like hurricanes, which disrupted health services and displaced vulnerable populations. These challenges, combined with changes in agricultural practices and increased population movement, exacerbated malaria transmission. By 1982, cases peaked at 77,375, although subsequent health system decentralization and the recruitment of community volunteers helped reduce cases to 20,268 by 1996. However, a lack of political commitment, reduced funding, and limited program coverage caused a resurgence, with cases rising to 53,311 in 2000.

A turning point came in 2005 with financial support from the Global Fund, which enabled targeted interventions in high-incidence areas. The MoH launched a phased elimination strategy in 2006, focusing on reducing *Plasmodium falciparum* and *P. vivax* transmission. By 2014, malaria cases had dropped to 4,931, aided by enhanced surveillance, community-based interventions, and stratified risk-based approaches. Strengthened by regional collaboration under the EMMIE initiative, Guatemala has focused on cross-border cooperation, improved diagnostics, and tailored interventions to address remaining challenges. These efforts have positioned the country to achieve the regional goal of malaria elimination. A total of 1,856 cases of malaria were reported in Guatemala in 2022. This represents an increase of around 46 percent compared to the previous year when malaria infections amounted to 1,273. There are still active malaria transmission hotspots primarily in the southern coastal departments of Guatemala, particularly Escuintla, Retalhuleu, and Suchitepéquez. No deaths due to malaria have been reported in the country since 2008.

Historical Overview of Malaria Control in Guatemala

Early Efforts and Foundational Activities (1920s–1960s)

- **1920s–1930s:** Initial entomological surveys identified *Anopheles darlingi* as a key malaria vector, with severe malaria cases rising among construction workers.
- **1956:** Launch of an IRS campaign using dieldrin.
- **1958:** Transition to DDT for IRS due to dieldrin resistance, reducing malaria cases from over 12,000 in 1958 to 3,387 by 1960.
- **1960s:** Emergence of resistance to DDT due to agricultural overuse. Large outbreaks occurred, particularly in new agricultural settlements on the Pacific coast. Antilarval interventions and mass drug administration were introduced.

Challenges and Setbacks (1970s–1999)

- **1970s–1980s:** Civil war disrupted health services, displacing vulnerable populations. Hurricanes and regional unrest increased malaria transmission, peaking at 77,375 cases in 1982.

- **1990s:** Changes in agricultural practices, such as replacing rice and cotton with palm and bananas, created new mosquito breeding sites. Migration patterns increased cross-border transmission, while funding for malaria programs declined by over 50% between 1992 and 1998.
- **2000:** Malaria cases peaked at 53,311 due to insufficient political commitment, inadequate program coverage, and limited community awareness.

Revitalization of Malaria Control (2000–2010)

- **2005:** Global Fund support began, focusing on high-incidence northern regions with interventions like ITNs, larval control, and IRS.
- **2006:** Ministry of Health launched a phased elimination approach targeting *P. falciparum* and reducing *P. vivax* transmission.
- **2010:** Round 9 Global Fund grant expanded interventions to 22 health areas, introducing LLIN distribution, drug resistance monitoring, community-based larval control, and improved diagnostic capacity.

Accelerated Elimination Efforts (2012–2020)

- **2012:** Southern coastal departments became hotspots due to agricultural expansion, increased migration, and the creation of mosquito breeding sites.
- **2012:** Enhanced surveillance program initiated with Global Fund support:
    1. Scale-up of the passive surveillance system through a network of additional CHWs.
    2. CHWs trained to take blood smears from febrile patients and treat malaria-positive cases with chloroquine and primaquine.
    3. Active outreach to high-risk communities for education and case detection.
    4. Hiring of 25 additional health workers, doubling the workforce and dedicating 10 exclusively to malaria work.
    5. Establishment of centralized diagnostics with a reference microscopist and quality control systems.
    6. Shift in vector control strategy to vegetation removal at breeding sites instead of chemical larvicides and insecticides.
    7. Completion of a detailed census to identify populations at risk of malaria
- **2014:** Malaria cases dropped to 4,931 due to stratified risk-based interventions and improved surveillance.
- **2015–2020:** Strengthened elimination strategy under the EMMIE regional grant, including improved diagnostics, vector management, cross-border collaboration, and efforts to address challenges like population movement and malaria importation.
- **2022–2024:** Implementation of the Malaria Transitions Grant from the Global Fund to sustain elimination efforts and address remaining challenges.

Key Learnings from Malaria Control in Guatemala

Enhanced surveillance and active case detection. New surveillance strategies, supported by funding from the Global Fund, significantly improved malaria case detection and reporting. These efforts included the recruitment and training of additional CHWs, equipping them to conduct blood smears for febrile patients and ensuring timely diagnosis and treatment. The surveillance system also expanded to include centralized microscopy and quality control processes, enabling more accurate and efficient diagnostic outcomes. Active case detection was complemented by outreach to high-risk and remote communities, fostering greater access to health services. These enhancements not only increased the detection of previously undiagnosed cases but also strengthened the overall capacity of Guatemala's health system to manage and respond to malaria outbreaks.

Increased human resources. Support from the Global Fund significantly bolstered Guatemala's malaria elimination efforts by enabling the health department to double its workforce and dedicate personnel exclusively to malaria control. This expansion of human resources facilitated a wide range of activities, including active surveillance, improved case detection, and enhanced vector control measures. The additional staff allowed for targeted community engagement, such as educating populations in schools and community events, as well as labor-intensive activities like clearing mosquito breeding sites and implementing environmental management strategies. The financial resources also supported the establishment of centralized diagnostic facilities, ensuring accurate testing and consistent quality control, which collectively strengthened the overall capacity to combat malaria effectively.

Supportive regional collaboration. Regional initiatives, including support from the Global Fund and the Amazon Malaria Initiative (AMI), played a critical role in addressing challenges like imported malaria cases due to migratory labor from endemic areas. Programs like Elimination of Malaria in Mesoamerica and Hispaniola strengthened cross-border collaboration and facilitated data sharing to combat malaria across national boundaries. These efforts standardized approaches to diagnostics, treatment, and integrated vector management, ensuring consistency in malaria control strategies across the region. The initiatives also provided a platform for coordinated surveillance and operational research to tackle shared challenges, such as population movement and environmental factors, which contributed to sustained malaria transmission. Through these collaborative frameworks, Guatemala benefited from regional expertise and resources, bolstering its progress toward elimination.

Panama

Early control measures began in 1904 during the U.S.-led construction of the Panama Canal, with Colonel William Gorgas implementing integrated vector control strategies such as drainage, oiling, and larviciding. These interventions drastically reduced malaria mortality among canal workers. By 1947, the introduction of DDT for IRS further decreased malaria cases, although *Plasmodium vivax* became more prevalent due to its biological characteristics.

In 1957, Panama joined the GMEP, shifting from control to eradication. Mandatory case reporting and regular insecticide spraying yielded notable progress. However, the 1960s and 1970s witnessed a resurgence of malaria due to resistance to insecticides like dieldrin, funding limitations, and operational challenges. Political instability and economic constraints in the 1980s and 1990s further hindered progress, causing significant outbreaks, particularly in remote and indigenous regions.

The decentralization of the malaria program in 1999 marked a pivotal shift but also contributed to the reemergence of malaria in Panama. By 2002, cases surged to 2,244, with an incidence rate of 75.7 per 100,000 people—representing a 2.4-fold increase from the previous year and the highest rate in 27 years. In 2003, autochthonous *Plasmodium falciparum* transmission resumed in Kuna Yala and Eastern Panama, a situation not seen since 1970. Compounding the problem, circulating *P. falciparum* parasites showed mutations conferring resistance to chloroquine and partial resistance to antifolates, the first- and second-line treatments at the time.

From 2000 onward, Panama engaged in international initiatives like the Rollback Malaria program and, in 2016, established the NMEP, aiming to eliminate malaria by 2020. These efforts successfully reduced malaria incidence in many areas. However, challenges persist, including imported cases from neighboring countries, intercultural barriers in indigenous communities, and logistical constraints. Today, most malaria cases in Panama are concentrated in indigenous regions, underscoring systemic health inequities and the need for sustained political and financial commitment to achieve elimination.

Historical Overview of Malaria Control in Panama

Early History and Initial Control Efforts (1904–1956)

- **1904:** United States initiated malaria control during the Panama Canal construction, with William Gorgas leading efforts such as drainage, larviciding, and quinine distribution.
- **1931:** A sanitation campaign targeting banana plantations began, funded by organizations like the United Fruit Company and Rockefeller Foundation.
- **1947:** Introduction of DDT for vector control significantly reduced *Plasmodium falciparum* cases.

Eradication and Resurgence (1957–1969)

- **1957:** Panama joined the WHO-supported GMEP, establishing mandatory malaria case notifications.
- **1958:** Dieldrin used exclusively for IRS.
- **1962:** Transition from dieldrin to DDT due to logistical and cost concerns, achieving strong reductions in transmission.
- **1966:** Malaria resurgence, with over 3,600 cases reported, linked to operational challenges and inadequate resources.
- **1969:** The Ministry of Health was created, and malaria elimination became a national priority, but financial constraints hindered progress, leading to increasing case numbers.

Focus on Control and Strategic Adjustments (1970–1999)

- **1971–1972:** Detected resistance of *Anopheles albimanus* to DDT; transitioned to carbamate insecticides like Propoxur.
- **1988:** Banning of DDT due to health and environmental concerns; adoption of pyrethroids like deltamethrin for vector control.
- **1996:** Decentralization of malaria control led to weakened program execution and resource shortages, particularly in remote regions.
- **1999:** Panama joined the Roll Back Malaria Initiative, adopting more focused and coordinated control strategies.

Pre-Elimination and Elimination Efforts (2000–2016)

- **2002:** Malaria reemergence declared with 2,244 cases, marking the highest incidence in 27 years.
- **2003:** Autochthonous cases of *Plasmodium falciparum* reemerged, showing resistance to chloroquine.
- **2004:** Creation of a Vector Control Task Group to address rising cases, which peaked at over 5,000 that year.
- **2007:** Autochthonous cases of *Plasmodium falciparum* were eliminated in Guna Yala, a significant milestone.
- **2016:** Launch of the NMEP to eliminate malaria by 2020, focusing on indigenous regions where transmission persisted.

Sustaining Elimination and Preventing Re-Establishment (2016–Present)

- **2016–2019:** Persistent malaria hotspots in indigenous communities and the reemergence of *Plasmodium falciparum* in the eastern regions.
- **2018:** Establishment of the Malaria Elimination Plan (2018–2022).
- **2019:** Imported malaria cases, particularly from Colombia, highlighted the challenges of cross-border migration and global mobility in sustaining elimination.

Key Learnings from Malaria Control in Panama

Vector Control Task Group. In response to the surge in malaria cases, the establishment of the Vector Control Task Group marked a pivotal intervention. This task group centralized efforts to enhance surveillance, contain outbreaks rapidly, and IRS coverage, particularly in remote areas. A crisis budget was allocated exclusively for malaria control activities, insulated from interference by other administrative entities. Just four months after the task group was created, a significant drop in the malaria incidence rate

was observed, demonstrating the effectiveness of focused and well-resourced efforts in combating the disease.

Migratory influences. Cross-border migration, particularly from Colombia and other regions, has introduced imported malaria cases, complicating Panama's elimination efforts and causing localized outbreaks. Outbreaks of *P. falciparum* in areas where malaria transmission had previously been interrupted have been closely linked to migratory events across the Panamanian - Colombian border. Between 2000 and 2019, there was a significant and increasing proportion of imported *P. falciparum* cases. This highlights the urgent need for efficient cross-border collaboration, especially as many Mesoamerican countries are actively engaged in malaria elimination campaigns. Darién Province, which borders Colombia, has consistently reported a significant portion of Panama's malaria cases. Since the 1960s, internal conflict in Colombia has led to increased cross-border migration into Panama. This movement of people, often living in temporary housing, has made malaria surveillance and prevention more difficult, increasing the risk of malaria importation. Serving as a connector between Central and South America, Panama experiences high levels of international migration. This includes both travelers and workers passing through the Panama Canal, a global transit hub. The high mobility of migrant populations and the presence of endemic malaria in Colombia complicate Panama's malaria elimination efforts. Migrants often live in rural or poorly serviced areas, making it harder to monitor, diagnose, and treat cases effectively.

Cultural barriers and social inequities. Indigenous communities in Panama, which bear a disproportionately high burden of malaria, face numerous challenges stemming from limited access to healthcare, poor infrastructure, and cultural gaps in malaria prevention and treatment strategies. Over 90% of malaria cases in recent years have been concentrated in these regions, underscoring significant structural health inequities. Provinces such as Darién, Guna Yala, and Ngäbe-Buglé, where many indigenous populations reside, are often remote and lack adequate infrastructure, severely restricting the availability of health facilities and medical professionals. This geographic isolation hampers effective malaria surveillance, diagnosis, and treatment.

Cultural perceptions and misinformation in some communities have also contributed to resistance against certain malaria control measures, including insecticide spraying and the use of bed nets. Despite representing a smaller proportion of the national population, indigenous and rural populations account for more than half of the country’s malaria cases. This inequity highlights the urgent need for targeted and culturally sensitive interventions.

Recognizing these disparities, the government and health organizations have prioritized efforts to improve healthcare access and address cultural barriers in indigenous areas. Tailored approaches that integrate community involvement and culturally appropriate strategies are critical to overcoming these challenges and achieving malaria elimination in Panama.

Challenges in financing. The decentralization of the NMP in 1999 exacerbated financial constraints and weakened the execution of malaria control efforts. This decentralization led to inadequate resources for essential malaria control activities, particularly in remote and indigenous regions. Periodic declines in malaria cases further resulted in reduced financial support, undermining the sustainability of control programs. The lack of consistent investment created significant gaps in prevention, surveillance, and treatment, enabling malaria transmission to resurge.

Limited financial resources have severely impacted critical activities such as the IRS, the distribution of LLINs, and active case detection. These constraints have also hindered the implementation of targeted interventions in high-risk areas, particularly among Indigenous communities where malaria cases remain disproportionately concentrated.

Cambodia

Malaria has been a persistent public health challenge in Cambodia since the 1950s, largely affecting communities near forested areas along its borders with Vietnam, Laos, and Thailand. By the early 2000s, Cambodia was grappling with one of the highest malaria burdens in the region, with over 100,000 cases reported in 2006 alone. This period also saw a predominance of *Plasmodium falciparum* cases, accounting for nearly 88% of all confirmed cases that year. The need for a coordinated response became increasingly evident, leading to the establishment of a national surveillance system and the gradual integration of malaria control into broader health system frameworks.

Cambodia's fight against malaria intensified in the 2010s with the launch of the "National Strategic Plan for Elimination of Malaria (2011–2025)." This ambitious initiative aimed to eliminate malaria through a zone-based approach, targeting transmission hotspots with tailored interventions such as village malaria workers (VMWs), expanded diagnosis and treatment services, and vector control measures like insecticide-treated bed nets. The period between 2011 and 2015 also marked the implementation of the Private Public Mix (PPM) initiative, which engaged private healthcare providers in malaria control. These efforts contributed to a sharp decline in malaria incidence, with cases dropping to 1.6 per 1,000 population by 2013. However, challenges such as drug-resistant *Plasmodium falciparum* strains and inconsistent funding disrupted progress, causing a resurgence of cases between 2016 and 2018.

In recent years, Cambodia has made remarkable strides toward malaria elimination. The intensification plan initiated in 2018 successfully addressed the resurgence by focusing on high-risk groups like forest-goers and enhancing access to effective treatment regimens. By 2019, malaria incidence had dropped to 1.9 per 1,000 population, with a significant decline in *Plasmodium falciparum* cases. However, *Plasmodium vivax* remains a challenge due to its ability to relapse, necessitating targeted interventions such as radical cure strategies. Cambodia's commitment to elimination, supported by robust surveillance systems and international partnerships, has positioned the country as a leader in malaria control within the Greater Mekong Subregion. Yet, sustaining these gains will require continued innovation, investment, and vigilance to prevent a resurgence and achieve complete malaria elimination. Cambodia faces significant challenges to elimination such as antimalarial drug resistance with parasites resistant to piperaquine, and significant funding gaps in the face of declining international donor support in the country.

Historical Overview of Malaria Control in Cambodia

Early History and Initial Control Efforts (1950s–2005)

- **1950s:** Malaria emerged as a significant public health issue, with a high burden of disease in forested areas along the borders.
- **2004:** Introduction of the VMW program to provide free diagnosis and treatment in underserved areas.
- **2006:** Malaria incidence peaked at over 100,000 cases (7.4 per 1,000 population).
- **2006–2010:** Transition from unconfirmed to confirmed malaria cases in surveillance data, with enhanced diagnostic capacity.
- **2010–2014:** Malaria-related deaths decreased by 88%, attributed to ITN distribution and the VMW program.

Strategic Planning and Control Efforts (2011–2015)

- **2011:** Launch of the "National Strategic Plan for Elimination of Malaria in Cambodia (2011–2025)."
- **2011–2018:** Implementation of the Private Public Mix (PPM) initiative to engage private healthcare providers in malaria diagnosis and treatment.
- **2013:** Malaria cases dropped to 1.6 per 1,000 population, attributed to expanded vector control measures and PPM.

Intensified Efforts and Challenges (2016–2018)

- **2016:** Launch of the Cambodia Malaria Elimination Action Framework (2016–2020).
- **2016–2017:** Funding gaps led to interruptions in key malaria control activities, causing a resurgence in cases.
- **2018:** An intensification plan was launched, targeting high-risk populations such as forest-goers and mobile migrant populations, with interventions like forest pack distribution, increased testing, and improved vector control.

Elimination and Ongoing Challenges (2019–Present)

- **2019:** Malaria cases dropped to 1.9 per 1,000 population. Significant reduction in *Plasmodium falciparum* cases noted.
- **2019–2020:** Implementation of radical cure for *Plasmodium vivax* in select provinces, addressing its relapse potential.
- **2019–Present:** Efforts to address *Plasmodium vivax* relapses prioritized through radical cure programs in high-burden provinces.
- **Ongoing:** Surveillance and cross-border collaborations maintained to prevent the re-establishment of malaria transmission.

Key Learnings from Malaria Control in Cambodia

VVM network. The VMW program aimed to provide free diagnosis and treatment in remote and high-risk areas, particularly forested regions where malaria transmission was most prevalent. VMWs are community-based health workers who act as the first line of defense against malaria, ensuring that hard-to-reach populations, such as forest-goers and migrant workers, have access to timely diagnosis and effective treatment. Their efforts have contributed significantly to the dramatic reduction in malaria cases and deaths, with a 90.8% decrease in confirmed cases and an 88% reduction in deaths between 2010 and 2020. During periods of resurgence, such as 2016–2018, VMWs were instrumental in expanding testing and treatment coverage, a key component of Cambodia's Intensification Plan.

The VMWs serve as links in Cambodia’s malaria surveillance system, ensuring accurate and timely reporting of cases. The VMWs also distribute essential tools like LLINs and *forest packs*, which include repellents and hammock nets tailored for high-risk populations. Monthly supervision meetings ensure VMWs are equipped with the necessary resources and knowledge to manage cases effectively and address stockouts. Their proximity to communities and cultural familiarity have made VMWs essential for promoting health education and encouraging preventative practices. Currently, discussions focus on how to best integrate VMWs into the broader health system and locate sustained financial support to assist in malaria elimination in Cambodia.

Intermittent preventive treatment for forest goers (IPTf). IPTf is highlighted as an important intervention tailored to the unique challenges of malaria transmission in forested areas. It involves the regular administration of anti-malarial drugs, such as artesunate-mefloquine, to prevent malaria infections among forest-goers. This approach significantly reduced malaria prevalence in forested regions, with *Plasmodium falciparum* cases dropping from 2.9% to 0.5% and *Plasmodium vivax* from 21.0% to 4.7%. Cambodian malaria program endorsed IPTf as a key intervention, particularly for high-risk groups like forest-goers, who are often beyond the reach of conventional malaria control methods.

References used to develop case studies:

Sri Lanka

Datta, R., Mendis, K., Wickremasinghe, R., Premaratne, R., Fernando, D., Parry, J., & Rolfe, B. (2019). Role of a dedicated support group in retaining malaria-free status of Sri Lanka. *Journal of Vector Borne Diseases*, 56(1), 66–69. https://doi.org/10.4103/0972-9062.257778

Dharmawardena, P., Premaratne, R., Mendis, K., Wickremasinghe, R., Rodrigo, C., & Harintheran, A. (2019). Effectiveness of passive case detection for imported malaria in a hospital setting in Sri Lanka during the prevention of re-introduction phase of malaria. *International Health*, 11(1), 64–70. https://doi.org/10.1093/inthealth/ihy066

Feachem, R.G.A., Abeyasinghe, R.R., & Galappaththy, G.N.L. (2012). Malaria control and elimination in Sri Lanka: documenting progress and success factors in a conflict setting. *PLOS One*, 7(8), e43162. https://doi.org/10.1371/journal.pone.0043162

Karunaweera, N.D., Galappaththy, G.N.L., & Wirth, D.F. (2014). On the road to eliminate malaria in Sri Lanka: lessons from history, challenges, gaps in knowledge and research needs. *Malaria Journal*, 13, 59. https://doi.org/10.1186/1475-2875-13-59

Mendis, K., Wickremasinghe, R., & Premaratne, R. (2022). Malaria elimination does not cost more than malaria control: Sri Lanka a case in point. *Malaria Journal*, 21, Article number: 231. https://doi.org/10.1186/s12936-022-04249-9

Perera, W.D.H.N., Gunathilaka, P.A.D.H.N., & Taylor-Robinson, A.W. (2019). Malaria in Sri Lanka: Investigating causes of the recent elimination and making plans to prevent reintroduction. *Journal of Vector Borne Diseases*, 56(3), 179–188.

UCSF Global Health Group, Malaria Elimination Initiative. (2016). *Maintaining Zero: An Update to the Sri Lanka Malaria Elimination Case Study*. Retrieved from https://globalhealthsciences.ucsf.edu/publications/maintaining-zero-update-sri-lanka-malaria-elimination-case-study

World Health Organization. (2023). *Elimination of Malaria and Prevention of Re-establishment in Sri Lanka*. Retrieved from https://www.who.int/publications/i/item/9789240087026

Costa Rica

Chaves, A., Dolz, G., Ibarra-Cerdeña, C.N., Núñez, G., Ortiz-Malavasi, E., Bernal-Valle, S., & Gutiérrez-Espeleta, G.A. (2022). Presence and potential distribution of malaria-infected New World primates of Costa Rica. *Malaria Journal*, 21, Article number: 17. https://doi.org/10.1186/s12936-021-04036-y

Chaves, L.F., Huber, J.H., Rojas Salas, O., Ramírez Rojas, M., Romero, L.M., Gutiérrez Alvarado, J.M., Perkins, T.A., Prado, M., & Marín Rodríguez, R. (2020). Malaria elimination in Costa Rica: changes in treatment and mass drug administration. *Microorganisms*, 8(7), 984. https://doi.org/10.3390/microorganisms8070984

Chaves, L.F., Ramírez Rojas, M., Prado, M., Garcés, J.L., Salas Peraza, D., & Marín Rodríguez, R. (2020). Health policy impacts on malaria transmission in Costa Rica. *Parasitology*, 147(9), 999–1007. https://doi.org/10.1017/S0031182020000621

Guatemala

Cohen, R., Sarceño Cardona, J., Solares Navarro, E., Padilla, N., Reyes, L., Pinto Villar, R.J., Masuoka, P., Bernart, C., Peruski, L.F., & Bryan, J.P. (2017). Outbreak investigation of *Plasmodium vivax* malaria in a region of Guatemala targeted for malaria elimination. *The American Journal of Tropical Medicine and Hygiene*, 96(4), 819–825. https://doi.org/10.4269/ajtmh.15-0698

Lennon, S.E., Miranda, A., Henao, J., Vallejo, A.F., Pérez, J., Álvarez, Á., Arévalo-Herrera, M., & Herrera, S. (2016). Malaria elimination challenges in Mesoamerica: evidence of submicroscopic malaria reservoirs in Guatemala. *Malaria Journal*, 15, Article number: 441. https://doi.org/10.1186/s12936-016-1500-6

UCSF Global Health Group, Malaria Elimination Initiative. (2016). *Eliminating Malaria in Guatemala*. Retrieved from https://globalhealthsciences.ucsf.edu

Panama

Calzada, J.E., Marquez, R., Rigg, C., Victoria, C., De La Cruz, M., Chaves, L.F., et al. (2015). Characterization of a recent malaria outbreak in the autonomous indigenous region of Guna Yala, Panama. *Malaria Journal*; 14:459.

Hurtado, L., Cumbrera, A., Rigg, C., Perea, M., Santamaría, A.M., Chaves, L.F., Moreno, D., Romero, L., Lasso, J., Caceres, L., Saldaña, A., & Calzada, J.E. (2020). Long-term transmission patterns and public health policies leading to malaria elimination in Panamá. *Malaria Journal*, 19, Article number: 265. https://doi.org/10.1186/s12936-020-03329-y

UCSF Global Health Group, Malaria Elimination Initiative. (2016). *Eliminating Malaria in Panama*. Retrieved from https://shrinkingthemalariamap.org/resources/eliminating-malaria-pana

Cambodia

Chhim, S., Piola, P., Housen, T., Herbreteau, V., Tol, B. Malaria in Cambodia: a retrospective analysis of a changing epidemiology (2006–2019). *International Journal of Environmental Research and Public Health.* 2021;18(1960). doi:10.3390/ijerph18041960

Duru, V., Witkowski, B., Ménard, D. (2016). *Plasmodium falciparum* resistance to artemisinin derivatives and piperaquine: a major challenge for malaria elimination in Cambodia. *American Journal of Tropical Medicine and Hygiene*. Dec 7;95(6):1228-1238. doi: 10.4269/ajtmh.16-0234.

Iv, S., Nguon, C., Kong, P., et al. (2024). Intermittent preventive treatment for forest goers by forest malaria workers: an observational study on a key intervention for malaria elimination in Cambodia. *Lancet Regional Health Western Pacific*; 47:101093. doi:10.1016/j.lanwpc.2024.101093.

Sovannaroth, S., Ngor, P., Khy, V., et al. (2022). Accelerating malaria elimination in Cambodia: an intensified approach for targeting at-risk populations. *Malaria Journal*;21(209). doi:10.1186/s12936-022-04234-2

U.S. President's Malaria Initiative. Cambodia Malaria Operational Plan FY 2023. Available at: www.pmi.gov. Accessed December 28, 2024.

Annex L: Sub-national Capacities Requested (ROS)

Category	Madagascar	DRC	PNG	Kenya	Nigeria	Ghana
Data and M&E	Enhance data analysis and real-time availability. Conduct quality audits of data.	M&E Data analysis. Conduct annual household surveys to monitor net use and care effectiveness.	Ensure data availability. Provide tools for data capture and reporting forms.	Use data analysis to prioritize interventions.	Strengthen M&E and data reporting systems.	Provide financial resources and cartography training.
Financial Management	Monitor and control fund use through GF representative. Prioritize financing with realistic contributions from the government and TFPs.	Ensure adequate financial resources. Improve budget allocation processes.	Strengthen technical, financial, and managerial capacities. Provide essential materials to support program operations.	Strengthen technical, financial, and managerial capacities. Standardize operating procedures for managing finances.	Monitor budget implementation to inform planning. Develop program management skills.	Prioritize financial management and oversight. Ensure effective fund utilization tailored to interventions.
Procurement/Materials	Strengthen information communication infrastructure (e.g., laptops, tablets, and internet).	Provide solar panels for areas lacking power.	Enhance supply chain management.	Ensure availability of vehicles for efficient transportation.	Strengthen the supply chain.	Supply malaria management commodities.
Capacity Building	Provide training on data management. Provide regular training and supervision on malaria case management and research.	Develop leadership skills, including strategic planning and malaria elimination strategies. Expand capacity building for sub-national research.	Strengthen technical and capacity building. Train community health promoters to deliver malaria prevention messages.	Enhance capacity building. Conduct supportive visits to health facilities and empower staff.	Strengthen technical, managerial, and financial capacities of sub-national teams. Provide technical assistance for effective human resource utilization.	Enhance capacity for program staff. Develop and distribute technical job aids and conduct staff training.
Human Resources	Finance the 15 additional national coordination units.	Recruit technical, financial, ICT experts, and entomologists.	Develop human resources with a focus on social innovation.	Recruit additional human resources.	Increase and train human resources to meet program needs.	Address staff shortages and turnover through training.
Program Management	Strengthen community engagement, partnerships, and collaboration.	Enhance coordination among institutions.	Develop effective recruitment processes and a supportive work culture.	Clearly define roles and responsibilities.	Multi-sectoral collaboration.	Foster better collaboration among stakeholders.