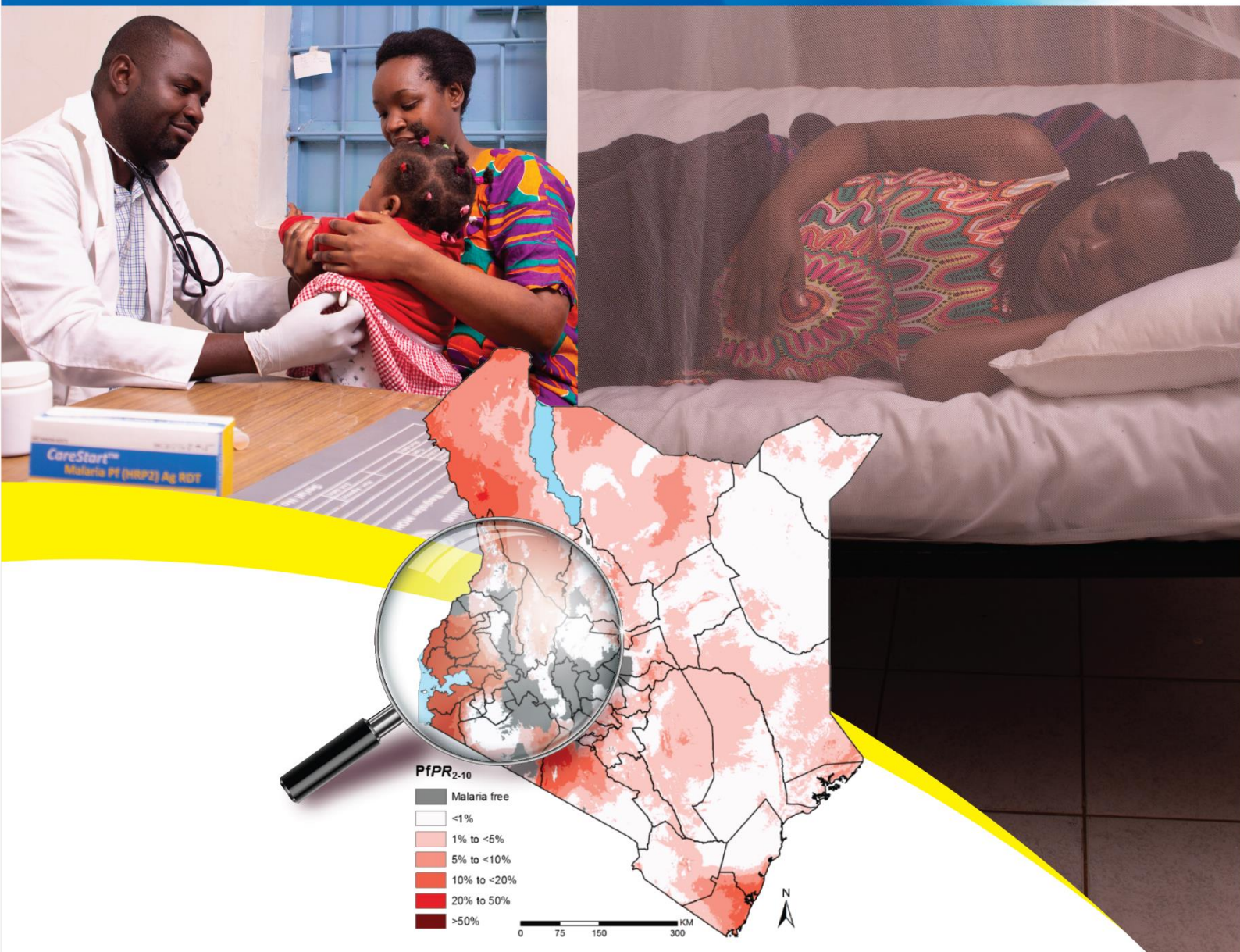
MINISTRY OF HEALTH

3rd KENYA NATIONAL MALARIA FORUM

18TH AND 19TH OF SEPTEMBER 2018



MALARIA CONTROL IN DEVOLVED KENYA:
OPTIMIZING EFFORTS TOWARDS ELIMINATION

REPUBLIC OF KENYA

MINISTRY OF HEALTH

Third Kenya National Malaria Forum

Malaria Control in Devolved Kenya:
Optimising Efforts Towards Elimination

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ABBREVIATIONS

ACSM	advocacy, communication, and social mobilisation
ACT	artemisinin-based combination therapy
AMfm	Affordable Medicines Facility-malaria
ANC	antenatal care
CHMT	county health management team
CHV	community health volunteer
CSO	civil society organisation
EPR	epidemic preparedness and response
GIS	geographic information system
HIS	health information system
IPTp	intermittent preventive treatment in pregnancy
IRS	indoor residual spraying
ITN	insecticide-treated net
IVM	integrated vector management
KEMRI	Kenya Medical Research Institute
KMS	Kenya Malaria Strategy
KNMF	Kenya National Malaria Forum
LLIN	long-lasting insecticide-treated net
LSM	larval source management
MoH	Ministry of Health
MPR	Malaria Programme Review
NMCP	National Malaria Control Programme
PBO	piperonyl butoxide
*Pf*PR	*Plasmodium falciparum* parasite rate
PS Kenya	Population Services Kenya
QoC	quality of care
SBCC	social and behaviour change communication

SP	sulfadoxine-pyrimethamine
TWG	technical working group
USAID	United States Agency for International Development
USAMRU-K	United States Army Medical Research Unit–Kenya
WHO	World Health Organization

EXECUTIVE SUMMARY

The third Kenya National Malaria Forum (KNMF) was held as part of the Malaria Programme Review to bring together experts and stakeholders involved in malaria control, and to address specific needs that were relevant to contributing new knowledge from research and lessons learnt from implementing different malaria control interventions. Previous KNMFs were held to provide an opportunity for researchers, policy makers, and practitioners involved in malaria control to interact and share evidence to inform policy and practice. The third KNMF was held in the backdrop of a Malaria Programme Review, conducted to inform the development of a new Kenya Malaria Strategy (KMS). The meeting was hosted by the National Malaria Control Programme (NMCP), Ministry of Health, with support from partners, including the World Health Organization and the President's Malaria Initiative, among others. Nearly 200 experts participated in the forum, representing national governments, 47 counties, international organizations and nongovernmental organizations, and academic and research institutions.

Unlike the previous forums, the planning and organization of the Third KNMF did not issue a call for abstracts to determine the topics for presentation. Instead, a four-step approach was used, as follows:

- Consultation with thematic focal persons at the NMCP on emerging issues under each thematic area
- Consultation with thematic technical working groups to build consensus on the identified issues
- Identification of resource persons to make presentations on the state of art on the identified issues
- Work with identified experts to prepare presentations

The overall planning and organization of the of the KNMF was coordinated through a steering committee led by the Surveillance, Monitoring, Evaluation, and Operations Research technical working group at the NMCP. The Forum was held over a two-day period, 18–19 September, 2018, at the inter-Continental Hotel in Nairobi. Forty-nine abstracts were presented during the plenary and concurrent sessions. The concurrent sessions focused on major thematic areas of focus in malaria control, including the following: case management and vaccines; malaria in pregnancy; vector control; advocacy, communication, and social mobilisation; epidemic preparedness and response; surveillance, monitoring, and evaluation; and programme management. Each day started with a plenary session, devoted to presentations on emerging issues. On Day 1, seven presentations on emerging issues were presented: the status of the pilot malaria vaccines in Kenya, focusing on the emerging issues and opportunities; updates on the planned evaluations of the malaria vaccines and immunization programme; larvae source management for malaria elimination; the role of seasonal malaria chemo suppression in the Kenyan setting, moving towards malaria elimination in Kenya: challenges and opportunities, expanding the vector control toolkit, and health information systems capacity strengthening: lessons learnt and the way forward. On Day 2, emerging issues presented: experience and lessons learnt from the indoor residual spraying exit strategy in Uganda, barriers to uptake of research evidence in policy making, domestic resource mobilisation for health, guidance on resource flows for malaria control from the national treasury to the counties, and challenges and opportunities for malaria commodity management at the county level.

Overall, the third KNMF provided an opportunity for the steering committee tasked with spearheading the Malaria Programme Review, to learn from the experiences and lessons arising from the implementation of malaria control activities and draw useful insights to inform the development of the next KMS. In addition, it provided an avenue for stakeholders, especially those from research and academia, civil society organizations, and county governments, to contribute ideas and insights into the development of the KMS.

1. BACKGROUND AND INTRODUCTION

1.1 Introduction

This report outlines the approach used in the planning of the third Kenya National Malaria Forum (KNMF) and the objectives and the outcome of the Forum held on 18–19 September, 2018. The report further provides key highlights from each of the presentations and recommendations to inform the development of the next Kenya Malaria Strategy (KMS).

1.1 Background

Previous KNMFs were held to provide an opportunity for researchers, policy makers, and practitioners involved in malaria control to interact and share evidence to inform policy and practice. The third KNMF was held in the backdrop of a Malaria Programme Review (MPR), in readiness for the development of a new KMS. The forum was therefore planned to address specific needs that were relevant to contributing new knowledge from research and lessons learnt from implementing different malaria control interventions. This focus influenced the approach used in the selection of topics and presenters during the two-day event.

1.2 Overall Objective

The overall objective of the KNMF 2018 was to provide additional data from research findings and from lessons learnt in implementing malaria control interventions to provide further inputs to the MPR process.

1.3 Specific Objectives of the Third KNMF 2018

Specific objectives of the third KNMF were as follows:

- Discuss relevant research that could inform the MPR and development of a new KMS
- Share experiences and lessons learnt in implementing malaria control activities on identified thematic areas
- Provide technical updates on malaria global technical strategic directions and other topics with potential to influence the new KMS

1.4 Planning for the KNMF 2018

The planning and organization of the third KNMF forum did not follow the steps used for the identification of workshop themes and topics for presentation for previous forums. Instead, a four-step approach was used, as follows:

- Consultation with thematic focal persons at the National Malaria Control Programme (NMCP) on emerging issues under each thematic area
- Consultation with thematic technical working groups (TWGs) to build consensus on the identified issues

- Identification of resource persons to make presentations on the state of art on the identified issues
- Work with identified experts and invited presenters to prepare presentations

1.5 Selected Topics

Table 1 presents the topics that were selected following consultations with thematic focal persons and the relevant TWGs.

Table 1. Issues Identified under each malaria control intervention

Thematic area	Identified issues and topics
Program Management	Lessons learnt in the implementation of malaria control at the county level: • Ownership of malaria control interventions • Coordination of malaria control between NCMP and counties
	Challenges and opportunities for malaria commodity management at the county level
	Guidance on resource flow for malaria control from the national treasury to the counties
Surveillance, Monitoring, Evaluation, and Operational Research	Low quality of inpatient data from health information systems and laboratory data
	Limited capacity to demand and use data, especially at the county level
	Perspectives in bridging the research to policy and practice gap
	Improving completeness in reporting and quality of data at county level
	Lessons learnt in capacity building for entomological surveillance at the county level
	Strengthening surveillance system in preparation for malaria elimination
	Experience in use of artemisinin-based combination therapies (ACTs): Evidence of malarial drug resistance
Epidemic Preparedness and Response	Experience and lessons learnt in epidemic preparedness and response at the county level: • Sustained epidemic monitoring, detection, and response • Coordination of outbreak management • Skills and capacity gaps in threshold setting • Investment for emergency preparedness and response at the county level
	Systems for malaria early warning and tools for decision support system for epidemic response
Case Management	Capacity building for health workers in malaria diagnosis
	Lessons learnt in strengthening community case management using the community strategy
	Issues on supply chain management and commodity quantification
	Access to affordable malaria medicines and diagnostics through the private sector

Thematic area	Identified issues and topics
	Monitoring quality of care for outpatient departments: Trends in malaria case management
Malaria in Pregnancy	Implementation of the new antenatal care+ model: Implications for malaria control
	Innovative approaches to support community health volunteers to facilitate early referral for pregnant mothers
	Need for technical guidance on the use of ACTs in pregnancy during the first trimester
	Experience and lessons learnt in implementing community intermittent preventive treatment in pregnancy
Advocacy, Communication, and Social Mobilisation	Strategies for sustaining gains in net use through advocacy, communication, and social mobilisation
	Experiences in reinforcing behaviour change among healthcare workers to adhere to treatment guidelines (test, treat, and track)
	Communication to support demand creation for malaria services
Vector Control	Emergence of pyrethroid resistance and the way forward
	Insecticide resistance to long-lasting insecticide-treated nets (LLINs) and the role of Piperonyl butoxide and new generation nets
	Alternative channels for distributing LLINs to achieve universal coverage at the household level
	Strategies for achieving universal coverage; role of continuous net distribution
	Experience and lessons learnt in implementing indoor residual spraying (IRS) in lake endemic zone
	Exit strategy for IRS in Uganda experience and lessons learnt

1.6 Identification of Presenters

Following the selection of topics under the different thematic areas, speakers were identified in consultation with the Operational Research TWG and the guidance of respective focal persons. The NMCP sent out invitation letters to the identified speakers with a follow up by the consultant who supported the preparation of the KNMF. The consultant developed guidelines for abstract submission and shared with the identified presenters. Presenters were provided with technical guidance as needed, to ensure presentations addressed the identified gaps, with a focus on the MPR. A total of 49 abstracts were submitted.

2. KNMF 2018 PRESENTATIONS

Forty-nine presentations were made during the workshop. There were two plenary and eight concurrent sessions. All participants attended the plenary sessions, which were used to provide technical updates on topics with wider relevance to malaria control. Presentation on key malaria control thematic areas were made during the concurrent breakout sessions.

2.1 Opening Remarks

Several guests addressed the opening ceremony. The chief guest, Dr. Rashid Aman, the Chief Administrative Secretary, Ministry of Health (MoH), noted that Kenya had registered a significant decrease in malaria incidence because of technically sound malaria control strategies. He emphasized the centrality of adopting a multi-sectoral approach to malaria control in Kenya, including exploring options to align the interventions with the universal health coverage roadmap. He concluded his remarks by challenging participants to explore options for sustainable financing of malaria control interventions.

Dr. Ejersa Waqo, Head, NMCP, gave updates on the progress made in the MPR, as a precursor to developing the next KMS. Dr. Lubano Kizito, Head, Department of Planning, Monitoring & Evaluation at the Kenya Medical Research Institute (KEMRI), noted that research on the best malaria control strategies remains a top priority for KEMRI. Dr. Lubano challenged researchers to create partnerships with the county governments and spearhead research to inform malaria control strategies at the regional level and empower communities to take charge of the malaria control interventions. He also noted that stronger health information systems (HIS) were needed to support malaria surveillance and speed up development of practical solutions to malaria control in Kenya.

Professor Jim Thomas, Director, MEASURE Evaluation, echoed Dr. Lubano's sentiment regarding the importance of having strong HIS as a necessary step for malaria control to move towards the elimination agenda. While noting that HIS systems were changing fast in response to developments in computing knowledge and technology, Professor Thomas also noted that the MoH should pay attention to the basics of generating quality data that can be used in decision making.

Dr. Randolph Augustine, Chief, Health, Population, and Nutrition Office at the United States Agency for International Development (USAID) reaffirmed USAID's commitment in supporting the NMCP to implement malaria control strategies and challenged participants to ensure that the new KMS was based on evidence and lessons learnt in implementing the KMS 2014-2018.

The last guest speaker was Dr. Joyce Onsongo, the Disease Control and Prevention Officer at the World Health Organization (WHO) Kenya Country Office. Dr. Onsongo commended the collective efforts for the successful results of malaria control in the country. She challenged the MoH to increase domestic funding at county and national government levels to sustain the successes made with funding from external support and reaffirmed WHO's commitment to support the NMCP in achieving malaria elimination in Kenya.

2.2 Technical Updates

A plenary session with seven presentations was held after the opening remarks. The session provided technical updates on key emerging malaria control interventions. The key highlights included the following:

Dr. Rose Jalango, National Vaccines and Immunizations Program at the MoH, gave updates on the status of malaria vaccine testing in Kenya. She pointed out that the vaccine will be introduced on a pilot basis as part of the malaria vaccine implementation programme coordinated by WHO to assess the feasibility of administering the required four doses of the vaccine in children, the vaccine's role in reducing childhood deaths, and the vaccine's safety in the context of routine use. The Pharmacy and Poisons Board has approved the use of the malaria vaccine in Kenya for a period of 36 months, targeting 120,000 children in the lake endemic region in Kenya.

Dr. Dan James Otieno, consultant with the Malaria Vaccine Implementation Programme, WHO, provided updates on the planned three evaluations to access vaccine efficacy, safety, and impact. The three evaluations were premised on the following: results from large multi-site phase 3 trials (39% reduction in clinical and 29% reduction in severe malaria among children ages 5–17 months); positive scientific opinion by the European Medicines Agency that concluded that the benefits of the RTS,S/AS01 outweigh the risks; and the WHO recommendations based on the advisory from the Strategic Advisory Group of Experts and Malaria Policy Advisory Committee, which jointly called for pilot implementation of the vaccine to answer key outstanding questions on feasibility, safety, and impact in routine settings. Impact on mortality will be measured through a community-based mortality surveillance system comparing vaccination and non-vaccination areas. Impact on hospitalized severe malaria will be measured through sentinel hospital surveillance, comparing rates in children presenting from vaccination and non-vaccination areas.

The RTS,S/AS01 vaccine will be introduced in eight counties in Kenya, with moderate to high malaria transmission, through the routine expanded programme on immunizations. The eight counties are Bungoma, Homa Bay, Vihiga, Kisumu, Siaya, Migori, Busia, and Kakamega. The planned evaluations have three objectives: (1) determine the operational feasibility of reaching children with four doses of RTS,S/AS01 in routine immunization systems, (2) evaluate the impact of the vaccine on all-cause child mortality and severe malaria, and (3) assess the safety of the vaccine. The three evaluations began in 2016 and will be completed by 2022.The results from these evaluations will inform broader public health use of the RTS,S vaccine in moderate to high transmission settings across Africa.

Dr. Kiambo Njagi, NMCP, presented data on the growing resistance to pyrethroids and noted that larval source management (LSM) has the potential to revamp the country's efforts in vector control. LSM should focus on the vector control along the water bodies, which are potential bodies for anopheline oviposition, aim to reduce the production of adult vectors, and emphasize habitat modification and manipulation through biological and chemical larviciding. There are plans to introduce LSM in lake endemic counties as part of a bilateral agreement between Kenya and the Cuban government. LSM is recommended by WHO as part of integrated vector management (IVM) and the KMS as a vector control intervention.

Dr. Ben Andagalu, United States Army Medical Research Unit-Kenya (USAMRU-K), presented on the role of seasonal malaria chemoprophylaxis in the Kenyan setting. He noted that although the use of seasonal malaria chemoprophylaxis had led to a decrease of close to 75 percent in clinical malaria and had high levels of community acceptability, its use still faces several challenges, key among them, logistical burden, difficulties in achieving compliance of the three-day dosage, incomplete coverage, drug resistance, and delayed acquisition of immunity among children under five years.

Dr. Peter Ouma, Maseno University, presented technical updates on the challenges and opportunities for malaria control as the country pursues a malaria elimination agenda. He noted that the path towards malaria elimination should address three core pillars: (1) promoting universal access to malaria prevention, diagnosis, and treatment; (2) accelerating efforts towards elimination; and (3) transforming malaria surveillance into a core intervention in malaria control. He called for strategic shift in malaria surveillance from passive case detection to active case detection. A surveillance system for malaria elimination must include the following: support early detection, diagnosis, and treatment of infections; support investigation of cases to determine likely location of infection and case classification; and allow investigation of foci to determine causes of transmission and development of a focus response plan. Some of the opportunities that can be leveraged while pursuing an elimination agenda include the current global focus championed by WHO and other partners, intensified vector control efforts through high coverage of long-lasting insecticide-treated nets (LLINs), leveraging community health workers to expand case management interventions including community surveillance, and high levels of community awareness of malaria control interventions.

Dr. Evan Mathenge, KEMRI, made a presentation calling for the need to introduce new tools for vector control to supplement LLINs and indoor residual spraying (IRS). The need for new tools was informed by emerging evidence on mosquitoes' feeding habits and growing resistance to pyrethroids. The introduction of new tools for vector control require strengthening of technical capacity, creation of enabling legislation, and adoption of the recommendations from the IVM strategy.

Professor Jim Thomas, MEASURE Evaluation, outlined the recent advances in HIS that were driving the thinking in relation to HIS strengthening. First, he noted that the global strategy in HIS was changing as a result of improved coordination of efforts as evidenced by the Health Data Collaborative initiative, increased capacity to interoperate disparate data systems, resulting in greater synergy and leveraging of efforts, and greater convergence and alignment of systems. Second, the changes in technology have profound effects on efforts to strengthen HIS. Some of these changes include advances in machine learning, efforts to balance power and security, and the rise of human-centred designs. Third, there have been shifts in thinking, occasioned by advances in evaluations using routine health information, growing demand for data disaggregation at multiple levels, use of complexity methods, and changes in the type of questions that the HIS is expected to answer. Professor Thomas recommended that efforts to strengthen the HIS should be driven by the type of questions that need to be answered, should focus on building capacity of the people who use the HIS, and then strengthen the system (hardware). He stressed the need to focus on strengthening HIS in a few settings to learn what works before rolling it out countrywide. Professor Thomas also emphasized the need to tailor HIS strengthening activities to the different stages of HIS maturation.

The plenary session in Day 2 focused on sharing experiences and lessons learnt in malaria control. **Dr. Agaba Bosco,** NMCP, Uganda, presented the Ugandan experience and lessons learnt in the implementation of IRS in the country. Drawing from Uganda's resurgence of a malaria epidemic after only five months of IRS withdrawal, Dr. Bosco noted that IRS exit strategy should be planned from the initiation of the program and backed by a robust epidemic preparedness and response (EPR) system that is capable of detecting epidemics and coordinating planning and response.

Discussion from the plenary focused on the need for an IRS exit strategy to develop a plan to sustain the fragile gains in malaria control using this intervention. Such plans should be based on a detailed analysis that includes an assessment of receptivity, vulnerability, active disease surveillance, and capacity for case management. Key messages when planning an IRS exit strategy include the following:

- There is a need to develop a robust plan for the deployment of additional vector control tools before exit.
- The IRS strategy should be clear on how it will be rolled out with other vector control tools and support interventions beyond insecticide resistance management.
- The exit strategy should ensure universal coverage and the use of LLINs.
- The exit strategy should consider levels of test positivity rates.
- Withdrawal of IRS should happen only after interrupting malaria transmission in an area.

Dr. Solomon Nzioka, WHO, made a presentation on the barriers to uptake of research evidence in policymaking. His presentation highlighted the commonly reported barriers to use of research evidence in policymaking. The most frequently reported barriers to evidence uptake were poor access to good quality relevant research and lack of timely research output. Other barriers include the lack of awareness, access, relevance, and motivation to use research evidence. Dr. Nzioka also highlighted collaboration among researchers and policymakers, with improved relationships and skills as the most frequently reported facilitators in turning research evidence into policy. Some highlights from his presentation are as follows: (1) limited empirical evidence on the process by which policymakers use research evidence for decision making; (2) the need to appreciate that although research is scientific, decision making is not, and researchers need to enlist the expertise of knowledge managers to bridge the gap; (3) the need to develop a framework for decision making to help researchers appreciate and take advantage of the decision-making spectrum; and (4) the need to develop an electronic platform to share research findings and improve linkage between researchers and policymakers at the subnational level.

Dr. Daniel Mwai, Health Financing Specialist, University of Nairobi, made a presentation on the health financing landscape in Kenya. He noted that although the Government of Kenya contributes 41 percent of the health budget, households were contributing 27 percent and donors contributed 18 percent. The remaining shortfall was mainly financed by corporations. He further noted that overall, the health spending as a proportion of the gross domestic product stood at 8.2 percent, a figure that is below the Abuja declaration. Overall, malaria control funding has decreased over the last four years and is now threatening the gains that have been made. The dwindling of resources was blamed on several factors, key among them: (1) limited allocation of resource by the Government of Kenya, funding agencies, or other entities; (2) lack of transparency in overall partner budgetary allocations, particularly at the county level; (3) lack of robust indicators to capture financial data on financial sustainability; (4) inadequate linkage

between programmatic targets and funding; and (5) insufficient advocacy tools for domestic resource mobilisation at national and county levels for the malaria programme.

Recommendations for spearheading domestic resource mobilisation in financing malaria control include the following: (1) increasing advocacy towards pooling of funds to better use the pre-payment schemes for insurance, (2) finalising the Resource Mobilisation Strategy through a consultative process and developing other tools to be used to lobby for more funding, and (3) developing indicators to support the collection of data on sustainability and accountability. Some of the suggested indicators include proportion of malaria budget to total health budget and proportion of partner contribution to malaria budget.

Plenary discussions following the presentation emphasised the important role of domestic resource mobilisation to shore up the funding deficit occasioned by shrinking donor resources, the need to ring-fence finances meant for health to ensure that they are not diverted into non-health expenditure, and the need to strengthen the capacity of counties to undertake budget and expenditure analysis as part of improving allocative and technical efficiency.

Dr. Peter Kimuu, National Treasury, provided guidance on resource flow for malaria control from the National Treasury to the counties. Dr. Kimuu outlined the current financing arrangements for malaria control intervention and provided a breakdown of how resources from the Global Fund to Fight AIDS, Tuberculosis and Malaria were disbursed to the counties. He underscored the need to align current Global Fund grants with intergovernmental fiscal fund flow and management to promote efficiency in fund flow. Some of the options that are under discussion include changing the Global Fund financial disbursement to correspond with activity-based budgeting and financial and programmatic reporting as stipulated in the public finance management Act 2012 and relevant laws, changing the regulations to allow counties to act as sub-recipients, or providing funds to counties in the form of conditional grants.

Dr. Victor Sumbi, Chemonics, made a presentation on challenges and opportunities for malaria commodity management at the county level. The presentation was based on experiences and lessons learnt by Afya Ugavi, a USAID-funded project that supports supply chain systems strengthening at national and county level. The policy of test, treat, and track for malaria control is premised on continuous availability of commodities for testing (microscopy or rapid diagnostic tests) and artemisinin-based combination therapies (ACTs) for treatment. The presentation highlighted the key challenges to commodity management at the county level. These include the limited use of routine supply chain data to support commodity quantification, poor oversight by county and subcounty officials, and the poor quality of data (mismatch in commodity data recorded in the facility registers and the monthly summary forms). Other challenges include overreliance on partner support for commodity management activities and poor working relations between counties, which limits inter-county redistribution of excess medicines.

Opportunities to address these challenges include the deployment of proven interventions to improve the supply chain. These tools may include the use of routine DHIS 2 data for decision making and upgrading the Excel data analytical tool to an online app, linked to DHIS 2.

2.3 Summary of Presentations from Concurrent Sessions

This summary is derived from the 37 presentations that were made during the 8 concurrent sessions of the conference. Table 2 presents the number of presentations under each thematic area and session.

Table 2. Number of presentations per session

Thematic area and session	No. of presentations
Case Management	5
Surveillance, Monitoring, Evaluation, and Operations Research	12
Advocacy, Communication, and Social Mobilisation/Civil Society	8
Vector Control	5
Malaria in Pregnancy	4
Epidemic Preparedness and Response	3
Total	**37**

Session 1: Case Management and Vaccines

Two presentations examined the role played by community health volunteers in improving the uptake of malaria interventions at the community level. The first presentation by **Patrick Igunza,**[1] African Medical Research Foundation, focused on the lessons learnt in strengthening community case management using the community strategy. The aim of the project was to increase access to malaria diagnosis and treatment using community health workers and community health volunteers (CHVs) in 10 counties in the Western and Nyanza regions. The responsibilities of the CVHs included testing and treating patients at the community level, referring pregnant women and patients with complicated malaria, and generating data and reporting. The CHVs diagnosed malaria using malaria rapid diagnostic tests and treated uncomplicated cases using ACTs. Some of the major achievements of this project included high coverage of community case management at the community level, reduction of malaria complications, and increased satisfaction with services offered by the CHVs.

The second presentation by **Joseph Kipkoech,** Moi University, School of Public Health, shared lessons learnt from an innovative approach to improve antimalarial use in the retail sector. The project aim was to create a partnership between community health workers and retail medicine outlets to improve malaria diagnosis at the community level. The project was based on the finding that 50 percent of suspected malaria cases are treated through retail sector, but less than 10 percent ever receive a diagnostic test.

The CHVs targeted those purchasing antimalarial drugs in retail drug shops[2] and offered free malaria rapid diagnostic tests. Those with a positive result were given a voucher to purchase an ACT at discounted prices. Those testing negative were referred to the health facilities to seek treatment for their symptoms.

There was an increase in the uptake of testing and use of ACTs. It was estimated that this intervention saved more than 2 million lives and reduced the number of people using ACTs without taking a test. The program recommended that private retail outlets should be included in strategies for improving rational

[1] Patrick Igunza made the presentation on behalf of Jared Oule, who had submitted the abstract.
[2] A cluster of shops were identified. The shops that consented to being part of the study and ensuring that the drug was consistently in supply received subsidized prices for ACTs as an incentive.

use of ACTs and that providing ACT subsidies conditional on a positive test is feasible and could greatly enhance the sustainability of private sector ACT subsidy programs.

Key lessons learnt from the two presentations are that the community strategy is an effective approach to increase the uptake of malaria control services at the community level and that the community strategy can be used to promote health service integration at the community level. The African Medical Research Foundation project also demonstrated that the use of CHVs to deliver malaria case management services at the community level expands access.

A presentation by **Patricia Njiri,** Clinton Health Access Initiative, on access to affordable malaria medicines and diagnostics through the private sector, examined the role played by the private sector in increasing availability and affordability of ACTs in the private sector, and promoting rational use of malaria commodities. The presentation highlighted the success achieved through the Affordable Medicines Facility-malaria (AMFm) project by negotiating with manufacturers to reduce the price of ACTs through different strategies, including subsidies and co-payment. In addition, AMFm has played a critical role in promoting the effective use of ACTs through community sensitisation and monitoring routine first-line buyers by reporting on the ACT quantities imported and distributed through the private sector.

Based on the achievement of AMFm, the presentation concluded that the private sector is well organized, and capable of facilitating availability of products and services that promote good public health. It emerged, however, that the NMCP did not have a designated focal person to coordinate the malaria commodities subsidy program and relied on partners.

The last two presentations in the session on case management highlighted the use of data drawn from quality of care (QoC) surveys in malaria programming. The presentation by **Dr. Walter Otieno,** USAMRU-K showcased the use of QoC data to promote the availability of case management commodities and services, improve coverage of health workers with supportive interventions, promote knowledge of health workers about malaria case management standards, and enhance health workers' adherence to outpatient and inpatient guidelines for malaria.

Overall, data from the QoC surveys were used to inform the monitoring of progress on case management interventions, inform decisions on supportive supervision activities, and inform the training needs and areas for supportive supervision, drug management, and resource mobilisation.

The presentation by **Prof. Dejan Zurovac,** KEMRI Wellcome Trust Research Programme, on lessons learnt in implementing QoC surveys and their utility for programming outlined how the biannual QoC surveys led to practical recommendations to improve case management practices, including providing evidence for the development of case management guidelines, informing the development of job aids, and informing recommendations of first-line treatment, among others.

These presentations showed that QoC surveys play a critical role in improving malaria case management and will need to be revamped as the county approaches malaria elimination. In addition, QoC surveys will need to be integrated into quality improvement initiatives at the subnational level where services are being delivered.

Session 2: Surveillance, Monitoring, Evaluation, and Operational Research

Presentations for this session focused on highlighting systematic and behavioural barriers to the use of data for decision making on various aspects of malaria control, and the innovations with proven evidence to address the challenges and experiences in strengthening surveillance systems for malaria control interventions.

In the first set of presentations, **Dr. Evan Mathenge,** KEMRI, outlined barriers to use of research evidence in informing policy. These include limited interaction between policymakers and researchers, lack of resources to pursue policy-relevant research studies, limited understanding of the policymaking cycle among researchers, and the inability of researchers to identify and exploit the policy dialogue space. The presentation also pointed out that researchers often use scientific jargon that is not readily understood by policymakers.

Samuel Cheburet and **Nancy Amayo,** HIS, MoH, examined the causes of low quality of inpatient and laboratory data in DHIS 2. The following factors were highlighted as contributing to the low quality of inpatient data: poor Internet connectivity (the current DHIS 2 infrastructure does not support offline data entry, existence of parallel programs that duplicate the reporting responsibilities, staff shortages, and lack of follow-up on data improvement plans arising from data quality audits. Other challenges highlighted were collection of irrelevant data, lack of a culture of information use, and low reporting rates for laboratory and inpatient data from health facilities.

Recommendations to improve availability of inpatient data in the HIS included development of quality assurance methods as part of the medical records review, development of business processes with clear milestones on data entry and reviewing, data handling and analysis to guarantee quality, institution of proper documentation of patient care processes, and support for a dedicated person to report inpatient data.

Suggestions to improve the quality of laboratory data in the HIS included promoting the use of laboratory data to create demand for quality data, supporting data quality audits focusing on the laboratory data, institutionalising data quality assurance protocols at different levels from the laboratory to DHIS 2, and ensuring availability of laboratory reporting tools at the facility level.

Dr. Francis Njoroge, County Malaria Control Coordinator, Garissa, shared experiences on improving reporting rates and data quality in DHIS 2. Some of the strategies that had improved reporting were conducting frequent data quality audits to ensure standardised data were collected and providing support to County Health Records and Information Officers and the newly employed staff to ensure proper data entry and documentation. Other strategies were providing training to CHVs to improve their knowledge and understanding of the data they collect and report from their communities to the health facilities.

Reporting is affected by staff shortages, including heavy workloads and high staff turnover. Although there was heavy reliance on CHVs for the collection of data prior to sending them to the health facilities, most of the CHVs have no training. Limited resources to support regular data review meetings, supportive supervision, and data quality audits had a direct impact on the ability to report in a timely manner.

Recommendations to improve reporting included increasing the number of Health Records and Information Officers at the subcounty health facility level to ease workload, developing a structured approach to orienting new staff on reporting after deployment, and providing logistical support to CHVs to facilitate their data reporting. Other strategies include increasing the frequency of data reviews and ensuring that those involved in data collection are present during the data reviews.

Dr. Lilyana Dayo, County Malaria Coordinator, Kisumu, presented on reasons for limited capacity to use data at the county level and reported that poor quality of data is a major reason for not using the data. In addition to the poor quality, several behavioural barriers to data use were an inability to balance between reliance on evidence and pragmatism while making decisions, limited capacity to contextualize data, and poor data use culture in which data are collected only for compliance purposes. Discussions on possible solutions highlighted the need for leadership of the health department at the county level to allocate adequate resources towards health information management, ensure compliance with data collection and reporting guidelines, and build skills on data use for all cadre of health workers.

Dr. Rose Nzyioka, Health Information Governance and Data Analytics project, made a presentation on using geographic information system (GIS) maps to visualise areas with poor coverage of malaria interventions and subsequently create demand for data at the county level. The presentation showcased how the county health management team (CHMT) in Kwale used geospatial maps to target malaria control interventions to subcounties with poor outcomes by focusing on hotspots and problem areas for improved efficiency and effectiveness of interventions. GIS champions drawn from the CHMT were instrumental in disseminating spatial information products to the county health leadership, which facilitated faster adoption among the subcounty and non-CHMT champions. In counties where demand for GIS products was sustained through a county management directive institutionalising the use of GIS to develop and present performance reports, the champions had greater traction. The CHMTs in Kwale and Kilifi have adopted the use of GIS to target net distribution activities to hotspot areas for better results.

In the second set of presentations on strengthening surveillance systems, **Prof. Charles M. Mbogo,** Chief Research Scientist, KEMRI/Wellcome Trust Research Programme, examined the role of entomological surveillance in malaria elimination in Kenya. It was reported that although LLINs and IRS are highly effective for control, they are insufficient to eliminate malaria transmission in many settings because of operational constraints, growing resistance to available insecticides, and mosquitoes that behaviourally avoid contact with these interventions. Given a range of new vector control products with the capacity to target a greater diversity of adult mosquito feeding habits, it should soon be feasible to effectively tackle a broader range of mosquito species and settings. This potential, however, is hindered by the absence of routine programmatic entomological surveillance data and a lack of capacity for data processing, analysis, and interpretation. Entomological surveillance provides a temporal and spatial understanding of vector species, specific population dynamics, and behavioural traits that have impact on disease transmission, intervention effectiveness, and residual transmission. Entomological data are necessary to guide targeting of interventions and provide a platform to evaluate complementary strategies and tools. As Kenya gears up for malaria elimination, entomological surveillance becomes increasingly important to target and eliminate pockets of remaining transmission. The entomological surveillance framework that is currently under development is expected to provide the NMCP with operational guidance on entomological indicators to characterise transmission and how to conduct routine

surveillance and foci investigation. A functional and sustainable vector surveillance system with the expertise and infrastructural and material capacity for entomological surveillance is needed to spearhead the elimination phase.

Lenson Kariuki, Vector Borne Diseases Control Unit, shared experiences learnt from capacity building in 47 counties on malaria entomological surveillance and monitoring of insecticide resistance from 2014. The main objective was to strengthen the technical capacity and provide the necessary equipment and supplies for effective vector surveillance and management of insecticide resistance. Health workers mainly comprising medical entomologists and parasitologists in Vector Borne Diseases Control Unit stations and public health officers involved in vector control and laboratory technologists were trained on mosquito bionomics, identification, mosquito sampling techniques, mosquito rearing techniques, insecticide resistance monitoring, data management, and development of county entomological work plans. The training was followed by malaria entomological surveillance in the counties through mentorship by the national level. The trained health workers collected data on malaria vectors in each county, and further analysis of samples was done in KEMRI centres in Nairobi and Kilifi. As at the time of the MPR, 240 health workers across the 47 counties had been trained. Following the training, the counties were expected to conduct two rounds of entomological surveillance, as well as insecticide resistance monitoring. The majority of the counties (44) only managed one round of entomological surveillance rather than the recommended two. The data collected are therefore not adequate to inform the counties on malaria endemicity as intended.

The presentation by **Dr. Wendy O'Meara,** Moi University School of Public Health, emphasized the need to develop a better understanding of factors contributing to changing patterns of malaria endemicity. The presentation was based on the spatial and temporal data collected from 36 health facilities in rural Turkana between January 2016 and July 2018. The data showed that Turkana County recorded year-round malaria cases with seasonal peaks present in at least three sequential years. It was suspected that the importation of parasites, possibly in conjunction with travel during the elections, contributed to a seasonal increase in 2017. The data pointed to the need to develop effective monitoring and intervention strategies for this emerging endemic zone because of changing patterns of urbanization. These findings demonstrate the importance of surveillance tools that are capable of monitoring changing malaria endemicity, especially in areas previously classified as seasonal transmission.

The third set of presentations examined experiences and lessons learnt in monitoring antimalaria drug resistance in different settings. Antimalarial resistance is currently a major global concern due to the recent emergence of resistance to artemisinin and its partner drugs in South East Asia. Its potential to spread globally presents an imminent challenge to the malaria community, since it threatens to reverse gains made in the global reduction of the malaria burden over the past decade.

Dr. Hosea Akala, KEMRI/United States Army Medical Research Unit, presented findings from a study carried out in western Kenya that explored the value of malaria parasite genetic and in vitro susceptibility data from a countrywide malaria drug resistance surveillance study that was interspersed with clinical efficacy studies to measure differences in parasite response to drugs.

The data showed a significant change in parasite genotype, with key molecular determinants of artemether-lumefantrine selection almost reaching saturation, perhaps indicating the need to closely

monitor parasite genotypic, phenotypic, and clinical dynamics in response to continued use of artemether-lumefantrine. Discussion following this presentation underscored the value of promoting adherence to the ACT dosing regimen and the rational use of antimalarial drugs to avert the development of drug resistance.

The presentation by **Dr. Lynette Isabella Oyier**, KEMRI/WT, on molecular surveillance of ACT resistance markers in Kenya outlined how the assessment of molecular markers was supporting the early detection of *Plasmodium falciparum* antimalarial resistance and providing an understanding of the evolutionary changes in the parasite. The utility of molecular surveillance has been underscored in previous studies that have prompted changes in antimalarial drug policy from chloroquine to sulfadoxine-pyrimethamine (SP) and the current ACTs. Molecular surveillance has been used across the various malaria zones in Kenya and temporally in Kilifi to demonstrate changes in drug resistant genotype frequencies. Antimalarial therapeutic efficacy trials have been conducted in malaria endemic regions in Kenya to determine the efficacy of the current national first- and second-line therapies for uncomplicated malaria. Molecular analyses complement these trials to determine the true efficacy of the national treatment strategies. There are also new molecular tools being developed by the global malaria community to enhance molecular surveillance. The study concluded that molecular surveillance should be a mainstream activity for monitoring antimalarial resistance nationally and informing policymakers on proper targeting of malaria control and treatment strategies.

Policymakers at the NMCP were encouraged to collaborate with researchers to undertake molecular surveillance using samples from routine medical care. Using such collaborations, the NMCP can generate a national map of drug resistance from samples collected, especially during outbreaks. In addition, therapeutic efficacy studies can be used to monitor populations that might harbour resistant mutations as well as asymptomatic infections after mass drug administration.

The presentation by **Dr. Sophie Githinji,** MEASURE Evaluation, ICF, on strengthening surveillance systems in preparation for malaria elimination, underscored the central role that malaria surveillance is expected to play in preparing the country towards malaria elimination. The NMCP has made significant achievements in strengthening malaria surveillance over the last five years. This was evidenced by the introduction of quarterly malaria surveillance bulletins to track key malaria indicators at the national and county levels, and expansion of entomological surveillance beyond the endemic and epidemic counties. The presentation highlighted several gaps remaining, especially those relating the capacity of routine HIS, low reporting of inpatient morbidity and mortality data, low reporting from the private health sector, incomplete counting of malaria cases, and inconsistencies in data reported through routine reporting systems.

The presentation emphasized the need for a strategic shift in malaria surveillance, to focus on identification, management, and clearance of transmission foci, establishment of systems for characterizing, classifying, and investigating every malaria case, and establishment of systems for active case detection.

Discussions following the presentation focused on the need for adequate investments in infrastructure and human resource capacity to transform malaria surveillance into a core intervention in line with global policies. Recommendations made included strengthening compliance with the policy on test, treat and

track in which all suspected malaria cases are tested using quality assured microscopy or rapid diagnostic tests, recorded, and all confirmed cases reported in DHIS 2.

Session 3: Advocacy, Communication, and Social Mobilisation

Presentations on advocacy, communication, and social mobilisation (ACSM) addressed the behavioural issues relating to adherence to malaria treatment guidelines, strategies for maintaining gains made in net use, the role of ACSM in advocating malaria resources, and communication to create demand for malaria services. In addition, the civil society shared experiences in mobilising communities towards positive malaria action. The desk review of literature as part of the MPR showed that although adherence to treatment guidelines had improved from 16 percent in 2010 to 59 percent in 2017, 41 percent of treatment decisions did not adhere to the treatment guidelines.

The first presentation by **Prof. Grace Irimu**, KEMRI/WT, shared experiences from a body of work aimed at promoting adherence to treatment guidelines. The study involved complex interventions to address different facets of the health system and comprised the development and distribution of patient admission records to improve the documentation of the process of care and better classification, develop packet guidelines and job aids, and provide supportive supervision using champions. Some of the behavioural issues that were highlighted included limited documentation of the process of care, which often led to wrong classification and wrong treatment. Malaria case classification is not commonly done (uncomplicated malaria), and most of the unclassified cases are not severe. At the hospital level, the high turnover and dependence on clinical interns was cited as a major factor contributing to non-adherence with guidelines. Other factors were weak systems for disseminating guidelines and monitoring their uptake, dependence on quick technological fixes rather than targeting clinician behaviour, and the limited capacity to generate and use information as part of decision making in the clinical setting.

Discussions following the presentation pointed to the need to embrace a systems approach for the efforts to improve adherence to treatment guidelines. Some of the suggested interventions include audit and feedback, simple job aids and the use of pocket guidelines, and supportive leadership and capacity building through mentorship and supportive supervision.

Population Services Kenya (PS Kenya) presented on the lessons learnt from interventions aimed at sustaining gains made in malaria control, and creating demand for malaria interventions. In the first presentation, **Nancy Njoki,** shared the lessons learnt from strategies for sustaining gains in net use through social and behaviour change communication (SBCC). The presentation was based on findings from an evaluation of a malaria SBCC campaign dubbed "Msimu wowote" that aimed at addressing risk perception by increasing consistent use of LLINs throughout the year. The project was implemented in Nyanza, Western, and Coast regions. A 360 "surround and engage" communication approach under the social ecological model was used. This approach relies on a combination of existing communication messages and channels to create multiple opportunities for behaviour change of the targeted audience. The intervention targeted behaviour at the individual, household, and community levels. At the individual level, CHVs who had been trained by the CHMT on an engagement technique were used to educate and address the barriers to using LLINs. At the household level, social support was leveraged as a tipping point for behaviour change using local vernacular stations in the key regions as well as the Healthcare

channel. The Healthcare channel is an alternative media outlet that conveys advertisements and social marketing messages to a wide rural and peri-urban audience in Kenya.

Short messages were developed and shared through a two-way interactive process, with questions received from consumers that PS Kenya responded to with support from the NMCP's ACSM team. At the community level, the campaign created a supportive cultural and physical environment through different platforms, such as outdoor messaging using posters, digital screens in the Coast region, and branding of 10 buses plying the Western region as support for consistent and correct net usage throughout all the seasons. At the societal level, the project aimed at shaping and influencing policies and regulatory frameworks through editorial coverage and continuous radio and TV expert interviews.

The proportion of people who believed that they were at risk of malaria only during the rainy season decreased from 35 percent to 25 percent nationally, with a notable reduction in the coast endemic region, (Kenya Malaria Indicator Survey, 2015), a direct contribution of this campaign. In addition, a baseline survey undertaken by Health Communication and Marketing in 2018 showed 60 percent of respondents quoting the campaign's tagline as the most memorable campaign. Radio had the highest reach at 58 percent, followed by CHVs at 31 percent, community events at 20 percent, and TV at 19 percent. Billboards were at 13 percent, followed by SMS at 11 percent, TVs in health facilities at 10 percent, and bus branding at 2 percent. Interestingly, health workers were not listed as a source of information on net use.

Radio and CHVs were the most effective channels for health communication. In addition, the CHVs played an important role in reinforcing radio messages through the word of mouth. Findings from this evaluation suggest that using a mix of strategies to convey information on malaria control interventions has a better reach and impact.

The second presentation by **Dr. Margaret Njenga,** PS Kenya, examined the main source of information on key malaria control interventions. This 2017 study was undertaken because the target of 80 percent use of all malaria interventions stipulated in the KMS 2009-2018 has not been met. The study was conducted to determine the key sources and most trusted sources of information on net use, intermittent preventive treatment in pregnancy (IPTp) uptake, and case management among target populations.

The findings showed that information on net use and the mode of distribution were mainly received through radio, TV, and posters. Interpersonal communication was the most trusted source for information on net use. Interestingly, few antenatal care (ANC) clinics provided details of IPTp medication. Sources of information on IPTp included radio, TV, health care workers at the health facility, CHVs, word of mouth, chiefs, and village elders. Trusted and preferred sources included health care providers, word of mouth from women who had used the IPTp drug, and the media. Key sources of information on malaria case management included health facilities, TV, radio, the PS Kenya group, church, CHVs, their children, posters at the hospitals, drama at the market, posters, magazines, musicians, and roadshows. Sources of information on malaria case management preferred and trusted by respondents included health facilities, CHVs, school, radio, posters, religious institutions, and women's groups.

These findings have implications for ACSM, in that behaviour change communication should be informed by both the most trusted source of information and the key decision maker to achieve desired changes.

Over the last four years, Kenya has experienced a decrease in funding levels for malaria control interventions. Domestic resource mobilisation presents an opportunity that should be taken advantage of, especially following devolution, because funding for health care services, including malaria control, is now vested with the county governments. The presentation by **Zeba Siaanoi,** Malaria No More, was based on lessons learnt from implementing an advocacy initiative to promote increased funding for malaria control interventions in Kwale and Busia Counties. The intervention involved engaging several stakeholders, including the civil society organisations (CSOs) for demand creation, the county assemblies for approval of budgets, and the County Executive for political goodwill and buy-in. The engagement involved a series of capacity-building initiatives to make a case for why counties should invest in malaria control. Some of the results from this initiative included an increased budgetary allocation totalling to Ksh 19 million in the two counties. After the pilot, Malaria No More expanded the advocacy to Mombasa and Kilifi Counties to replicate the model. By June 2018, the four counties had increased their budgetary allocation to health, with close to Ksh 68 million going towards malaria control. Some of the key lessons learnt included the importance of engaging the health leadership at the technical and political level and creating buy-in among the personnel involved in planning and budgeting. In addition, promoting advocacy to support constant follow-up with all actors, keeping them engaged in what is happening in the counties, and embracing the CSO to amplify the agenda and apply soft pressure are important considerations to support domestic resource mobilisation.

Discussion following the presentation emphasized the importance of developing messages that clearly identify the resources needed and the value of working with the CSO to employ soft pressure to influence decisions on resource allocation rather than confronting the county leadership.

The Kenya National Alliance Against Malaria held a roundtable discussion to share lessons learnt in advocating malaria control interventions at the community level. Discussants were drawn from civil society groups working in four epidemiological zones in Kenya. **Edward Mwangi** made a presentation on taking malaria to the community by emphasizing the importance of using a community rights lens and gender perspectives while designing malaria control interventions. It was noted that although the KMS addressed the role of gender in the uptake of malaria control interventions, the use of a community rights perspective was not well articulated. As a result, the Kenya National Alliance Against Malaria noted that some special populations were not well targeted by the conventional advocacy and communication approaches such as radio, TV, and the print materials that are used for mobilising the community for malaria control. The special groups include those with visual impairment and the deaf, among others. The NMCP was challenged to develop a clear approach to engage and involve CSOs in the development of malaria control strategies and interventions, and to promote community engagement and inclusiveness. In addition, it was noted that CSOs have the potential to play an important role in mobilising the community towards positive malaria control actions. The CSOs, however, require technical and financial support from the NMCP and other stakeholders involved in malaria control at the community level. Other CSO networks drawn from the different epidemiological zones highlighted their experiences in supporting malaria control activities at the community level. **Jasho Bomu,** Coastal Malaria Advocacy Network, shared experiences in supporting larvae source management and creating awareness on malaria control

interventions at the household level. **Eric Omondi,** Lake Endemic Malaria Advocacy Network, shared lessons and experiences from advocating increased resource allocation for malaria control in the lake region through participation in public participation forums spearheaded by the county governments. He noted that meaningful participation in such forums was limited by access to data on resource allocation and outcome measurements.

Georgina Ngugi, Low Seasonal Transmission Advocacy Network, noted that the changing land use practices and climate change were contributing to the upsurge of malaria in areas currently classified as low transmission. CSOs supporting malaria control in such areas should play an active role in educating the community to adopt appropriate malaria control practices.

Session 4: Vector Control

The session on vector control had five presentations that focused on emerging issues in vector control, including pyrethroid resistance, strategies to achieve universal coverage of LLINs, economic evaluation of LLIN distribution channels, and the impact of IRS on the entomological profile of targeted regions. **Muriu Karoki,** NMCP, made the first presentation on the emergence of pyrethroid resistance and the way forward.

The use of LLINs for malaria control has proved to be very effective over the years. It is estimated that the use of LLINs has prevented about 68 percent of malaria cases between 2010 and 2015. There has been a massive increase in the deployment of insecticide-based vector control tools in sub Saharan Africa. The number of ITNs delivered to endemic countries increased, from 6 million in 2004 to 178 million in 2015. There has been a concomitant reduction in malaria cases and deaths but an increase in pyrethroid resistance among local malaria vectors worldwide. In Kenya, pyrethroid resistance has been reported in the lake and coast endemic zones and parts of the central and northern regions. The resistance has been reported in all classes of insecticides (pyrethroids, organochlorines [DDT], organophosphates, and carbamates). Pyrethroid resistance was the most commonly reported; in 2014, three-quarters of the countries monitoring this insecticide class reported resistance. DDT resistance is often detected where tested, although testing has been limited, particularly in countries where DDT use is banned.

Two main innovations currently in the pipeline to address the challenge posed by pyrethroid resistance were discussed. First is the use of LLINs containing pyrethroids plus the insecticide synergist piperonyl butoxide (PBO). Studies have shown that LLINs containing PBO are substantially better at killing insecticide-resistant mosquitoes in some locations. Although PBO nets are expensive compared to standard LLINs, a mathematical modelling study predicted that PBO nets will be cost effective. A second set of LLIN innovations involve combining pyrethroids with a second insecticide or molecules with a different mode of action, such as permethrin and pyriproxyfen an insect growth regulator, or alphacypermethrin and chlorfenapyr, a pyrolle class of insecticide. Both products are currently undergoing evaluation by the World Health Organization Pesticide Evaluation Scheme.

It was noted that currently there are limited tools for dealing with resistance to pyrethroids used in nets. To assist in the innovation process, programs should consider pilot implementation of available tools to generate additional evidence to guide decision making around future procurement and deployment and to facilitate product advancement. PBO nets and other new LLIN innovations should be tried in areas with high pyrethroid resistance and areas where it is currently not feasible to implement IRS.

The second presentation by **Dr. Vincent Were,** Centre for Applied Health Research and Delivery focused on the economic evaluation of LLIN distribution channels in Kenya. The presentation was based on a two-arm cost-effectiveness study to compare provider costs and household coverage (effects) of two combinations of five LLIN distribution channels in Kenya. A retrospective analysis from the provider perspective comparing two combinations of five LLIN distribution channels was undertaken, with the control arm where mass campaigns were used and the intervention arm where community health volunteers distributed the nets instead of a mass campaign. Other net distribution channels (e.g., ANC clinics, social marketing, and commercial outlets) were used in both intervention and control arm. A structured standard costing tool and service provider questionnaires were used to collect data on the number of nets or net vouchers distributed and the costs for each channel at both national and local levels. A community-based, post-intervention cross-sectional survey was conducted in the intervention and control arms.

Total number of nets/vouchers and cost per net/voucher were computed both from the supply (nets/vouchers distributed) and demand side (LLINs in households). The major cost drivers were identified, as well as the relative cost to the health system per channel. The cost per LLIN/voucher distributed was calculated using supplier reported numbers of nets/vouchers distributed, divided by total cost per channel. In the post-intervention household survey, information was obtained on household assets—to compute an asset index score—and on LLIN ownership, net use, and sources of nets. Household survey data were combined with cost data to estimate the cost per net distributed by each channel across the sub-county. Standard LLIN indicators in the control and intervention arms were compared and used to estimate the expected LLIN coverage outcomes throughout the subcounty and to estimate the relative cost-effectiveness of each arms' contribution to increasing universal LLIN coverage.

In Kenya, nets have been distributed through five major channels: mass distribution, through CHVs, routine distribution through ANC clinics, social marketing, and the use of commercial outlets. Most people got their LLINs through mass distribution. There are no data on delivery cost and which approach was best. For LLIN promotion, 6 percent of cost went to mobilisation, which is $6,500 for social marketing.

Results of the study showed that mass distribution was the most important source of nets overall and in all households, regardless of net coverage status in the pooled and control arms, and the use of the CHVs was the most important source of LLINs in intervention households and the second most important source of nets overall in the pooled and control arms. The use of ANC was the next most important source of nets. The use of social marketing was the least important.

Using supplier reported data on nets/vouchers distributed, mass distribution had the lowest total cost per net distributed ($3.61), followed by social marketing ($5.16), ANC ($5.16), and CHVs ($7.23). When household survey (demand side) data was used to estimate cost per net distributed, mass distribution had the lowest cost per net distributed ($3.13), and CHVs had the second lowest cost ($10.84), followed by ANC ($28.14). Social marketing had the highest cost ($92.41). The average cost per household with one net between two people in the pooled population was lower in the control arm ($22.39) than in the intervention arm ($30.41). The marginal cost per house with one net between two people was also lower in the control arm ($66.90) than the intervention arm ($83.44).

The study showed that mass distribution campaigns plus other channels are the most effective and cost-effective way to achieve universal coverage. None of the channels was pro-poor; community-level distribution appeared to be more equitable than the other channels, but the difference was not statistically significant. The main limitation on the distribution of nets was not the total capacity of each channel, but rather the quantity of nets available per distribution channel. This may have reduced the cost effectiveness of some channels and limited the effects of economies of scale. The study concluded that combinations of multiple channels were required to reach and maintain high levels of LLIN use and achieve equitable LLIN ownership and usage.

Dr. Margaret Njenga, PS Kenya, made a presentation on the role of continuous community net distribution as a strategy for achieving universal coverage. The study was conducted against the backdrop of findings that showed a marginal increase in LLIN ownership from 57 percent to 63% percent, while use of LLINs increased from 32 percent to 48 percent, perhaps suggesting that meeting the target for universal coverage and sustaining it is still a challenge. The continuous community net distribution involved sensitizing CHVs, identifying net needs at the household level, issuing vouchers for those requiring the means to collect them from participating outlets, and conducting interpersonal communication and small group sessions on the importance of sleeping under a treated net. The findings showed that the number of people who slept under a net the previous night increased in both intervention and control areas. In addition, more people showed confidence to hang a net in both in intervention and control areas. Overall, the continuous community net distribution resulted in an increase in net ownership and use.

The third presentation was made by **Bernard Abongo,** Africa Indoor Residual Spraying project, focusing on the entomological impact of IRS using Actellic 300CS in Migori County. It was noted that the current vector control toolkit was facing several challenges; key among them were sustained malaria transmission and changes in indoor resting and biting behaviour by mosquitoes. The presentation was based on lessons learnt from undertaking IRS in Migori County using organophosphate–pirimiphos methyl (Actellic 300CS). The use of Actellic 300CS followed the cessation of IRS with pyrethroid insecticides due to increasing pyrethroid resistance. Entomological monitoring was conducted using indoor United States Centers for Disease Control and Prevention (CDC) light trap and pyrethrum spray collection before and after IRS in six treatment sites and six control sites. The monitoring examined mosquito species densities and composition, biting time and location, insecticide resistance status, and sporozoite rates.

Additional human landing collections were performed to assess biting behaviour together with larval collections for insecticide resistance testing. The residual effect of the insecticide was assessed monthly by exposing susceptible *An. gambiae s.s.* Kisumu strain to sprayed surfaces.

The results showed that IRS with Actellic 300CS was highly effective against *An. funestus* with a 94 percent decrease in indoor host seeking and a 97 percent decrease in indoor resting in the treatment sites compared to the control sites post-IRS. Before IRS, *An. funestus* comprised more than 80 percent of all Anopheles mosquitoes collected in both intervention and non-intervention sites. After IRS, *An. arabiensis*, whilst not showing a significant increase in numbers, accounted for 80 percent of Anopheles collected by pyrethrum spray collection and more than 60 percent of those collected by the United States Centers for Disease Control and Prevention light trap in the sprayed sites post-IRS. There was a significant reduction in sporozoite infection rates post-IRS, with no sporozoite infections detected in sprayed sites after IRS.

Parity rates dropped from more than 90 percent before spraying to less than 10 percent post-spray, and exposure to bites by *An. funestus* were reduced to undetected levels post-spray. *Anopheles funestus* and *An. arabiensis* were fully susceptible to pirimiphos methyl and resistant to pyrethroids. The residual effect of the insecticide was 10 months on mud and concrete walls with more than 80 percent mortality of exposed mosquitoes.

In addition to demonstrating the decrease of malaria species *(An. funestus),* clinical data from the outpatient department and the laboratories showed a decrease in malaria cases in areas where IRS was undertaken. However, the different biting behaviours of *An. funestus* (from 5 p.m. to 11 a.m.) posed challenges to the use of LLINs, which are premised on night biting. This challenge was further highlighted by the presentation by **Dr. David Tchouassi**, International Centre for Insect Physiology and Ecology, who noted that in addition to its different biting habit, *An. funestus* has different species with different feeding habits, which pose challenges to malaria control interventions that focus on the indoor environment. The presentation highlighted the existence of a previously unreported potential malaria vector in the funestus group, whose COI or ITS2 sequences did not match those in reference sequence databases. The new species was found to be infected with the plasmodium parasite and displayed high human-feeding abilities.

Discussions following the presentations underscored the importance of active surveillance through application of molecular approaches to unravel novel parasite-vector associations and genetic structuring for effective malaria control and elimination.

Session 5: Malaria in Pregnancy

This session had five presentation that shared lessons learnt in various aspects of malaria in pregnancy, including opportunities for delivering malaria control interventions using the maternal and child health and the community strategy. The first presentation by **Dr. Peter Ouma,** Maseno University, explored the implications of the ANC+ for malaria control, in terms of opportunities and targeting of interventions. ANC+ is the current recommendation by the WHO for antenatal care, which promote a minimum of eight contacts between pregnant women and the health system instead of the previously recommended four ANC visits. Because delivery of interventions for malaria prevention and control in pregnant women is routinely done at the ANC platform, fostering a strong partnership between the NMCP and the National Reproductive Health Program is imperative for good program outcomes. The shift from four to eight ANC visits presents ample opportunity for delivery of IPTp, but it may also lead to confusion in health care workers on when to provide IPTp.

Discussions focused on the advantages of the new recommendations, in terms of increasing the number of contacts with the health system for pregnant women. The increased contacts should be used to provide advice on importance of early IPTp dosing to avoid complications with the placenta. Clients should also be advised that IPTp can be taken on an empty or full stomach, but if taken together with folic acid, it can cause nausea. Use of an ITN is absolutely necessary early in the pregnancy. IPTp is not given before 13 weeks. IPTp should be given to women who come late as long as they are in second trimester. WHO does not recommend a maximum dosage of IPTp-SP but gives the minimum dosage. Increased SP dosage is good. SPs are expiring in facilities. Uptake should be enhanced to avoid expiries. Ensure that opportunities to give IPTp are not lost.

It was noted that counselling for pregnant mothers was missing, and the WHO model acknowledges that there are inadequate ANC services, and this is partly the reason why eight visits have been recommended. Lack of counselling is being addressed in the new malaria program, and SBCC messages are included. According to the dispensing guidelines, SP should be given at the ANC clinic and not at the pharmacy.

The second presentation by **Dr. Augustine Ngindu**, Jhpiego Kenya, focused on innovative approaches to facilitate early referral for pregnant mothers using the CHVs. The presentation was premised on the finding that the number of pregnant women receiving the recommended doses for IPTp remained below the national target. Malaria in pregnancy is associated with poor pregnancy outcomes, including intra-uterine growth retardation, anaemia, stillbirth, and neonatal death. The KMS recommends that all pregnant women in the 14 malaria endemic counties to receive at least three doses of SP at the ANC clinic. According to the 2015 Kenya Malaria Indicator Survey, the proportion of pregnant women receiving at least three recommended doses of IPTp was low at 38 percent.

The presentation was based on findings of a pilot study by the Maternal and Child Health Integrated Program that used CHVs in Bungoma County to sensitise pregnant women on the of use IPTp to reduce the effects of malaria in pregnancy. As part of the strategy to influence change in start of early ANC attendance, the CHVs were used to identify pregnant women in the community, register them, and follow up with them on a monthly basis to ensure that they attend ANC visits as scheduled and refer defaulters and late starters for ANC. Data quality audits were conducted periodically to check the quality of data collected by CHVs. Data on first ANC attendance between 2015 and 2017 were collected from ANC registers to assess changes in ANC attendance. Data on the proportion of pregnant women receiving IPTp1 and IPTp2 doses were taken from DHIS 2. Between 2014 and 2017, the Maternal and Child Survival Program replicated the Bungoma experience on use of CHVs in Kisumu, Homa Bay, and Migori Counties, focusing on dissemination of SBCC messages to change their health-seeking behaviour in start of ANC attendance from the third to the first trimester. The CHVs sent short messages using SMS to women in the community. IPTp uptake increased in Bungoma (up to 63%) due to CHV involvement, areas without CHV involvement did not see increases in IPTp uptake. To scale up use of CHVs, community health assistants were trained, who in turn trained CHVs. There was performance monitoring of CHVs. The CHVs registered and followed up with pregnant women to ensure that they started ANC visits early. Most women (52%) start IPTp in the third trimester, which is late. Some CHVs received a stipend from the Global Fund, but two-thirds of CHVs were voluntary. It was hard to convince the unpaid CHVs to take on the tasks without pay while the other third were paid. They ended up not covering the community units as required. CHVs were given lunch and fare reimbursement as appreciation, which was a bit of a challenge. Recommendations from the study were as follows: advocacy to incentivise CHVs should continue at national and county levels, the CHV approach is important and should be applied further in more counties, there is a need to ensure that women have ANC cards to help with IPTp uptake, there is a need for follow-up by CHVs to ensure that the women carry their cards to the facility, and women who are HIV+ should be allowed to keep their cards at home for privacy purposes.

In conclusion, the use of CHVs to disseminate SBCC messages can be an important tool in influencing changes in health-seeking behaviour. The efforts by the CHVs may be an important contributing factor to the increase in uptake of both IPTp1 and IPTp2 by more than 25 percentage points for the four counties during the three-year project period.

The third presentation by **Dr. Hoseah Akala,** KEMRI USAMRU, on the use of ACTs in pregnancy during the first trimester examined new evidence from observation studies in various parts of the world. Preclinical studies have demonstrated that artemisinin derivatives are embryotoxic and can induce foetal death and congenital anomalies at doses close to the therapeutic range in multiple animal species. As a result, WHO recommends the use of quinine with clindamycin as the first-line treatment for uncomplicated malaria in the first trimester. Based on this evidence, the use of ACTs was only permissible if the recommended regimen is unavailable or not tolerated. This recommendation faces several compliance-related problems, and alternatives are needed to improve pregnancy outcomes. Data from observational studies conducted in various parts of the world, however, suggest that ACTs may be safe to use even in the first trimester. The contentious issues that remain include how much more data and what type of data are required to conclusively make decisions regarding whether ACTs should be used in the first trimester.

The last presentation on experiences and lessons learnt in implementing community IPTp, was delivered by **Dr. Samuel Onditi.** The presentation was premised on findings from the 2015 Kenya Malaria Indicator Survey, which showed that only 38 percent of pregnant women received the recommended three doses of IPT against the national target of 80 percent, despite a high ANC attendance rate of 94 percent for women who receive services from a skilled provider. Dr. Onditi presented lessons learnt from an intervention implemented in Kisumu West Subcounty to increase ANC attendance and IPTp uptake. In this project, CHVs were engaged to promote ANC uptake and distribute IPTp to pregnant mothers. Technical support included training, supervision, and the development of data collection tools. Existing data were used to monitor ANC attendance and IPTp uptake using DHIS 2 between December 2013 and August 2014.

The lessons learnt included that CHVs were acceptable to the community and could therefore be used as an avenue to promote uptake of IPTp. In addition, CHVs can be a credible source of information on ANC and IPTp, can play a persuasive role in mobilising women for ANC visits and providing information regarding the use of SP, and can play an active role in addressing cultural barriers that hinder attendance to ANC clinics. The CHVs can also play an important role in promoting referrals to the health facilities as appropriate and provide counselling to those who might have experienced a bad encounter on their first visit. In most cases, CHVs lacked the skills to identify a pregnancy and would require training on the directly observed treatment, short course approach if community administration of IPTp-SP is adopted.

Session 6: Epidemic Preparedness and Response

Presentations on EPR mainly explored the experiences and lessons learnt in implementing EPR at the subnational level. The first presentation by **Dr. Godfrey Otomu,** Kisii County shared experiences from Kisii County, which is an epidemic-prone region on the Western Highlands of Kenya. Kisii experiences two peaks of malaria epidemics, between April and June due to long rains, and between September and November due to short rains. This is attributed to climatic conditions that favour minimum temperatures around 18° C, which sustain vector breeding and result in increased intensity of malaria transmission. The whole population is vulnerable, and the case fatality rate during an epidemic can be up to 10 times greater than that experienced in regions where malaria cases occur regularly. In response to this, the county developed an EPR plan that has been implemented over the last five years. As part of the plan, a malaria

control subcommittee and a TWG were formed to coordinate the planning and response activities, and dedicated malaria control coordinators at the county and subcounty levels were appointed. In addition, at least five health facilities were selected in each subcounty to be sentinel sites for weekly malaria monitoring. Data for threshold setting were collected retrospectively for a period of five years, and malaria epidemic trends were monitored in all the sentinel sites on a weekly basis. The trend reports are disseminated from the facility level to the subcounty, county, and finally to NMCP personnel. Other coordination structures that have facilitated EPR plan include the formation of a malaria TWG, initiation of a county reference laboratory, training of quality assurance personnel from each subcounty, training in mosquito vector surveillance (female anopheles), and the availability of drugs for malaria case management at the health facility and through CHVs.

The success of Kisii County was attributed to the presence of a dedicated team to manage and coordinate malaria control at the county level, capacity building in laboratory quality assurance, entomological surveillance to map breeding sites, and weekly routine monitoring. In addition, the experience from Kisii County underscored the importance of a robust case management and SBCC strategy in managing malaria outbreaks. Some of the issues that undermined the county's ability to respond to malaria epidemics in a timely manner include limited financial resources to support response to epidemics and limited skills among members of the various committees that were established, especially at the subcounty level.

Discussions following the presentation emphasised the need for various health teams and committees to work to leverage resources for early detection and response to malaria epidemics, the importance of building the capacity of the health workforce, including the CHVs, at the subcounty and community levels to support early detection, and the need to develop decision support systems that can support these teams to make decisions quickly to facilitate a quick response.

The second presentation by **Dr. Solomon Nzioka,** WHO, focused on the new systems and technology for malaria early warning and tools for decision support system for epidemic response, examining the new tools for malaria epidemic detection using climate data. The presentation was based on findings from the Malaria Early Warning Systems project, which examined the association between climate change and public health. The project was undertaken in conjunction with the Kenya Metrological Service to establish the possibility of predicting an epidemic. In the absence of sustained population-based interventions, increasing temperatures and changes in the hydrological cycle associated with climate change are likely to increase the number and intensity of malaria outbreaks in Kenya in fragile geographic regions such as the highlands.

The most important factor in reducing the impact of an epidemic is a timely response, with the implementation of effective preventive or control measures after an epidemic has been predicted or detected. The key to a decisive reaction for the prevention and control of malaria epidemics is to be prepared, which requires the development of robust early warning and early detection systems that are directly linked to prevention and control programmes for a rapid response. Improved prediction, prevention, and control of epidemics are key technical goals of malaria control, especially in climate-sensitive regions like the epidemic-prone zones in Kenya. The Kenya project provided insights that any efforts to define the association between malaria and climatic factors that use annual means or seasonal means were likely not to detect any strong associations. The study further established that rainfall

increased precipitously by a trend factor of 2.4 in inter-monthly autoregressive series. Strong models explaining the inherent high variations in inter-monthly and inter-annual malaria, rainfall, and temperature were developed using time-series analysis. Finally, two malaria prediction models were developed. The two models have been validated and found to be effective at altitudes between mean altitudes 2200 M and 2400 M. In addition, the two models have the capacity to predict epidemics and provide guidance to public health officials on steps to be taken as part of malaria epidemic preparedness and response. Discussions mainly focused on the need to support the operationalisation of the two models for use in decision making regarding epidemic preparedness. Some of the suggestions to achieve this include supporting counties to use the models for routine use and building the capacity of health managers and other decision makers at the CHMT level to use these tools for decision making.

The last presentation by **Peter Macharia,** KEMRI WT, highlighted findings from a study on malaria risk mapping and stratifications and lessons for malaria control. Although the presentation was made during the EPR session, the lessons learnt have implications for malaria beyond EPR. The presentation was premised on the recommendation of the Global Technical Strategy 2030, which requires stratification of the malaria burden at the subnational level to inform the development of targeted malaria control interventions for different epidemiological zones (principle of one size does not fit it all). A subnational stratification of malaria burden based on the analysis of past and contemporary malaria data, risk factors, and the environment is important for developing malaria control interventions that correspond with variations in the intensity of malaria transmission in Kenya. The presentation was based on data from 5,020 *Plasmodium falciparum* parasite rate (*Pf*PR) surveys in 3,701 communities between 1980 and 2015 in Kenya, which was further used to develop a spatio-temporal geostatistical model to predict annual malaria risk for children ages 2–10 years (PfPR$_{2–10}$) at 1x1 km spatial resolution from 1990 to 2015. Changing PfPR$_{2-10}$ was compared to plausible explanatory variables. The fitted model was used to categorize areas with varying degrees of prediction probability for two thresholds: PfPR$_{2-10}$ <1% and PfPR$_{2-10}$ ≥30%.

Nationally, there was an 88 percent decrease in the mean modelled PfPR$_{2-10,}$ from 21.2 percent (ICR: 13.8–32.1%) in 1990 to 2.6 percent (ICR: 1.8–3.9%) in 2015. The most significant decrease began in 2003. Decreasing prevalence was not equal across the country and did not directly coincide with scaled vector control coverage or changing therapeutics. Over the period 2013–2015, of Kenya's 47 counties, 23 had an average PfPR$_{2-10}$ of <1 percent; 4 counties remained at ≥30 percent. Using a metric of 80 percent probability, 8.5 percent of Kenya's 2015 population lives in areas with PfPR$_{2-10}$ ≥30 percent, and 61 percent live in areas where PfPR$_{2-10}$ is <1 percent.

Based on these findings, it was concluded that Kenya has made substantial progress in reducing the prevalence of malaria over the last 26 years. Areas with consistently very low (<1% PfPR$_{2-10)}$ require a revised approach to malaria control that supports elimination. Some suggested interventions include increased coverage of quality laboratory and clinical services, improved surveillance and reporting for fast detection, and prompt treatment with effective antimalarial drugs.

3. SUMMARY OF KEY ISSUES FROM PLENARY DISCUSSIONS

Key highlights from the presentations with a bearing on the next malaria strategy are as follows:

- There is growing resistance to pyrethroids. This will require the use of new and robust molecules to safeguard gains from net use.
- There is a need to consider stratification of net use according to epidemiological zones to ensure that nets are proportionately distributed according to need.
- Net use remains suboptimal, and LLIN distribution and promotion of use should be scaled up.
- The community strategy should be strengthened to support various malaria control interventions at the community level. There is a need to address regulatory bottlenecks to allow CHVs to support community case management.
- There is limited capacity in commodity management at the county and subcounty levels. Some of the strategies to address this include dissemination of guidelines and tools and development of standard operating procedures.
- The uptake of IPTp remains suboptimal due to late presentation at ANC and limited provider knowledge. There is a need re-classify regions depending on the IPTp uptake and develop region-specific strategies to promote uptake.
- Adherence to case management guidelines by health workers is low. There is a need to address the behavioural, technical, and logistical challenges that promote treating without testing.
- There is a need to integrate EPR into surveillance to strengthen malaria control efforts towards elimination.
- There is a need to strengthen capacity for threshold setting in target counties in preparation for subnational malaria elimination.
- Overall data demand and use at the county level remains low.
- Barrier analysis should be undertaken as one primer for increased use of malaria control interventions and ACSM messages should be tailored appropriately.
- A private sector implementation plan is needed to guide engagement with private health facilities and outlets and sustain the achievements realised under the co-payment mechanism.
- Capacity for domestic resource mobilisation to support malaria control activities at the subnational level needs to be built.
- Partnership coordination, multi-sectoral collaboration, and private sector engagement is weak at the subnational level.
- Mechanisms for coordination between the national and county governments should be strengthened.

APPENDIX 1: GUIDELINES FOR SESSION CHAIRS AND RAPPORTEURS

Introduction

This aim of this document is to provide some basic information on the tasks a rapporteur should ensure during the Kenya National Malaria Forum sessions. The key role for the rapporteur is to report the key issues and discussion points given by the speakers, and to keep track of the questions and answers of the session. At the end of the session, he or she must prepare a short synthesis report (typically one page) with the most significant conclusions of the session, in terms of ideas, concepts, results, scientific questions and problems, and debates, as appropriate.

Before the Session

Reading the Abstracts

The rapporteur should read the abstracts of the session assigned. This will help the rapporteurs familiarize themselves with the topic and focus of the presentations, to pre-identify the most interesting information and some links between the papers.

During the Presentations

During each presentation, the rapporteur should extract the most significant information, including the details not given in the abstract. Where possible, the rapporteur will have a copy of the PowerPoint presentation before the session.

During the Discussion

During the discussion, the rapporteur should keep track of all questions, answers, and debates.

After the Session

After the session, typically within the same day, the rapporteur should prepare a *synthesis brief* that includes the title of the session, the name of the chairperson and the name of the rapporteur, *key ideas, and significant results or useful information for all presentations.*

The brief should be based on the on the presentations and on the track of the questions and answers arising from the presentations. It should highlight the following:

- List of most significant new data and results, new knowledge, lessons learnt, best practices, etc.
- Policy implications and recommendations

All rapporteur briefs should be submitted following completion of the session to the Dr. Geoffrey Lairumbi on the following email: larumbig@gmail.com.

APPENDIX 2: GUIDELINES FOR KNMF 2018 SESSION CHAIRS

Thank you for generously agreeing to be a session chair during the Kenya Malaria Forum.

Please check the programme to re-confirm the day, time, and room of the session you have been allocated. Whilst we don't anticipate any changes, please check the program again prior to your session.

Below are some tips to assist you with the chairing process. Most importantly, please ensure you start and finish all presentations on time and keep to the order in the program.

Before the Session

- Review the abstracts for your session which are available in the abstract book and use the information to introduce the speakers.
- Please be in your room 10 minutes prior to the commencement of your session to meet the presenters and familiarise yourself with the room.
- Introduce yourself to the presenters and ensure that the presentations are loaded into the presentation laptop.
- There will be a space reserved for the session chair in the front row of each room with time cards (5 minutes, 2 minutes, 1 minute) to alert presenters on timing.
- Advise the presenters that you will be signalling them on time when they have to stop.

During the Session

- Begin the session by communicating any housekeeping rules such as mobile phones on silent mode, etc.
- Introduce each presentation with the title, the presenter, and the presenter's affiliation.
- If a presentation is withdrawn or a presenter does not arrive, do not bring the next presentation forward, use the time for questions. Delegates will be planning to come to your session based on the published session times. You will be given further instructions by the Kenya Malaria Forum organizers, if an alternative presentation can be arranged in time.
- At the end of each presentation, be prepared to ask a question yourself, if time allows and no questions are forthcoming from the audience.
- Use the opportunity for questions and answers to refocus the discussion to responding to emerging issues from the Malaria Programme Review desk review (see one-page briefs).

APPENDIX 3: GUIDELINES FOR PREPARING ABSTRACTS AND PRESENTATIONS

Introduction

The National Malaria Control Programme in currently undertaking a Malaria Programme Review that will culminate in the development of a new malaria control strategy for Kenya. To inform this process, the programme will hold a special malaria forum to provide further input to the process by sharing experiences and lessons learnt in implementing malaria control interventions. The focus of the presentations during this year's Kenya Malaria Forum will be on the lessons learnt and policy implications for malaria control in Kenya.

Guidelines for Abstracts

- **Background:** Summarise the purpose, scope, and objectives of the project that will be the subject of the presentation.
- **Description:** Describe the programme, project, or policy that is the subject of your presentation, including the setting and location, the structure, key population (if applicable), and activities and interventions undertaken in support of the programme, project, or policy.
- **Lessons learned**: Present as clearly and in as much detail as possible the findings and outcomes of the programme, project, or policy; include an analysis or evaluation of lessons learnt and best practices. Please summarise any specific results that support your lessons learnt and best practices.
- **Conclusions:** Explain the significance of your findings and outcomes of the programme, project, or policy for malaria control and future implications of the results.

The abstract should clearly identify the presenter and authors and their institutional affiliations, and should not exceed 350 words.

Guidelines for Presentation

Overall, the presentations should:

- Clearly identify the presenter and authors and institutional affiliations
- Clearly identify the program area and thematic area of focus
- Identify key findings, lessons learnt, best practices, and implications for malaria control in Kenya
- Provide recommendations and next steps with a focus on informing the development of the next malaria strategy for Kenya

Your presentation will not be more than **15 minutes** and should focus on:

- Concise synthesis of evidence, lessons learnt, or key recommendations to inform the development of the next malaria strategy

Please send the abstract of your presentation to Dr. Geoffrey Lairumbi on Lairumbig@gmail.com, on or before Friday, 31 August, 2018.

APPENDIX 4: PRESENTERS

Name	Topic	Telephone number	Email
1. Dr. Rose Jalango	Status of pilot malaria vaccine testing in Kenya: Emerging issues and opportunities	0722702898	eddah.rose@gmail.com
2. Dr. Dan J. Otieno	Planned evaluation of MVIP	0716088639	otienodj@gmail.com
3. Dr. Peter Ouma	Moving towards malaria elimination in Kenya: Challenges and opportunities-	0726158175	oumapet2015@gmail.com
4. Ben Andagalu	Role of seasonal malaria chemo suppression (SMC) in the Kenyan setting	0716004851	ben.andagalu@usamru-k.org
5. Dr. Kiambi Njagi	Larvae source management for malaria pre-elimination	0720323247	kiambonjagi@gmail.com
6. Dr. Evan Mathenge	Expanding the vector control toolkit: New tools for vector control	0722879839	mathengeevan@gmail.com
7. Dr. Jim Thomas	HIS capacity strengthening: Lessons learnt and way forward	+1 (919) 445-9314	jim.thomas@unc.edu
8. Prof Grace Irimu	Socio behavioural issues affecting adherence to treatment guidelines	0722564600	GIrimu@kemri-wellcome.org
9. Jared Oule	Lessons learnt in strengthening community case management using the community strategy	0723819725	Jared.oule@amref.org
10. Dr. Diana Menya	Innovative approach to improve antimalarial use in the retail sector	0720352579	dianamenya@gmail.com
11. Patricia Njiri	Access to affordable malaria medicines and diagnostics through the private sector	0722617120	pnjiri@clinitonhealthaccess.org
12. Dr. Walter Otieno	Monitoring quality of care for OPD and IPD: Lessons learnt and utility for programming	0733905496	walter.otieno@usamru-k.org / otieno.walter66@gmail.com
13. Prof. Dejan Zurovac	Lessons Learnt in implementing quality of care surveys and their utility for programing	0733639329	dzurovac@kemri-wellcome.org
14. Dr. Evan Mathenge	Barriers to sharing research evidence with policy makers: Researchers' perspectives	0722879839	mathengeevan@gmail.com
15. Nancy Amayo	The quality of laboratory data in the HIS: Challenges, opportunities	0721991652	amayonancy@yahoo.com.

Name	Topic	Telephone number	Email
16. Samuel Cheburet	Low quality of inpatient data from HIS: Challenges, opportunities, and way forward	0721624338	samuelcheburet@gmail.com
17. Lilyan Dayo	Limited capacity to demand and use data at the county level	0724981254	lilyanadayo@gmail.com
18. Dr. Rose Nzyoka	Use of geospatial analysis to drive demand and use of data for decision making	0786915407	rose.nzyoka@thepallidiumgroupgroup.com
19. Dr. Francis Njoroge	Improving completeness in reporting and quality of data at the county level	0729682838	drnjorogef@gmail.com
20. Lenson Kariuki	Lessons learnt in capacity building for entomological surveillance at the county level	(NMCP)	ensonkariuki84@gmail.com
21. Prof. Charles Mbogo	Role of entomological surveillance in malaria pre-elimination	0722950014	cmbogo@kemri-wellcome.org
22. Dr. Sophie Githinji	Strengthening surveillance system in preparation for malaria elimination	0731176566	Sophie.Githinji@icf.com
23. Dr. Wendy O'Meara	Spatial and temporal analysis of malaria in Turkana county based on routine reporting data	0728 306 521	wendypomeara@gmail.com
24. Francis Kimani	Field experience on ACTs testing: Issues	(NMCP)	
25. Dr. Isabella Oyier	Molecular surveillance of ACTs resistance in Kenya	0735090938	LiOchola@kemri-wellcome.org
26. Stephen Muiruri	Guidance on resource flow for malaria control from treasury to the counties		muiruri2000@yahoo.com
27. Daniel Mwai	Domestic resource mobilisation for health: Lessons for malaria program funding	0720757539	mwaidaniel@gmail.com
28. Victor Sumbi	Challenges and opportunities for malaria commodity management at the county level	0722320244	Vsumbi@ghsc-psm.org
29. Dr. Margaret Njenga	Communication to support demand creation for malaria services	0724079008	Mnjenga@pskenya.org
30. Zeba Siaanoi	Role of ACSM in domestic resource mobilisation for malaria control		zeba.siaanoi@malarianomore.org
31. Nancy Njoki	Strategies for sustaining gains in net use through socio-behaviour change communication (SBCC)	0721848671	nnjoki@pskenya.org

Name	Topic	Telephone number	Email
32. Dr. Luna Kamau	Vector control session	0724751333	LKamau@kemri.org
33. Muriu Karoki	Emergence of pyrethroid resistance and the way forward	072251527	muriukaroki@gmail.com
34. Vincent Were	Economic evaluation of LLIN distribution channels in Kenya	0721876573	vincentwere@gmail.com
35. Dr. Margaret Njenga	Strategies for achieving universal coverage; role of continuous net distribution	0724079008	mnjenga@pskenya.org
36. Agaba Bosco	Exit strategy for IRS in Uganda: Experience and lessons learnt	+256772902105	Bbagaba_bosco@yahoo.com
37. Bernard Abongo	Entomological Impact of IRS with ctellic 300CS in Migori County	0726825290	Bernard_Abongo@pmivectorlink.com
38. Dr. David Tchouassi	Anopheles funestus mosquitoes and malaria transmission in Kenya	0718972370	dtchouassi@icipe.org
39. Dr. Godfrey Otomu	Experience and lessons learnt in EPR at the county level	0722274383	Dr.otomu@gmail.com
40. Dr. Solomon Nzioka	New systems and technology for malaria early warning and tools for decision support system for epidemic response	0733947957	nziokas@who.int
41. Peter Macharia	Malaria risk mapping and stratifications: Lessons for malaria control	0711170493	PMacharia@kemri-wellcome.org
42. Dr. Peter Ouma	Implementation of the new ANC+ model: Implication for malaria control	0726158175	oumapet2015@gmail.com
43. Ben Andagalu	Use of ACTs in pregnancy during the first trimester.	0716004851	ben.andagalu@usamru-k.org
44. Dr. Augustine Ngindu	Innovative approaches to support CHVs to facilitate early referral for pregnant mothers	0721906245 / 0707257106	Augustine.Ngindu@jhpiego.org
45. Dr. Samuel Onditi	Experience and lessons learnt in implementing community IPTp	0722306981	Onditisam2014@gmail.com
46. Dr. Maurice Odindo	CSO session (accountability for malaria control at the community)	0722279233	modindo@communityinitiative.org
47. Edward Mwangi	Taking malaria to the community: A civil society perspective	0721983953	edward.mwangi@kenaam.org
48. Jasho Bomu	Experiences of malaria implementation at community level in the coastal region in Kenya	0721840989	jashobomu@gmail.com

Name	Topic	Telephone number	Email
49. Stephen Ngososei	Role of CSOs and communities in Highland endemic region in Kenya	0722275582	Risdev58@yahoo.com
50. Eric Omondi	Role of CSOs and communities in strengthening health systems in high malaria transmission areas	0723215230	macaldererick@gmail.com
51. Georgina Ngugi	Experiences of malaria control programs in low transmission settings	0729662663	gina.ngugi@gmail.com

APPENDIX 5: BOOK OF ABSTRACTS

The Malaria Forum 2018: Overview

The 2018 Kenya Malaria Forum (KMF) is being held as part of the ongoing Malaria Programme Review to provide additional data to inform the development of next Kenya Malaria Strategy.

The topics that are being addressed during the KMF were identified by the respective focal persons at the National Malaria Control Programme, in consultation with respective technical working groups.

The forum will use a mixture of plenary sessions, in which all participants will take part, and concurrent sessions in the break-out rooms. The concurrent sessions focus on major thematic areas of malaria control such as malaria case management, vaccines, vector control, epidemic preparedness and response, surveillance, monitoring, and evaluation, and programme management running through these two main sessions. Day 1 of the forum begins with plenary sessions on technical updates focusing on key malaria control focal areas. The plenary session is followed by concurrent sessions on malaria case management, vector control, and advocacy, communication, and social mobilisation for malaria control. A similar pattern will be followed on Day 2.

A warm welcome to all of you and we hope you enjoy your stay with us in Nairobi.

KMF 2018 Technical Committee Members

Dr. Kiambo Njagi, NMCP/MoH; Dr. Daniel Wacira, PMI/USAID; Dr. Mildred Sheishia, PMI/USAID; Dr. Robert Perry, PMI/CDC; Dr. Willis Akhwale, MPR Lead Consultant; Hellen Gatakaa, MPR Consultant; Dr. Lairumbi Geoffrey, KMF Consultant; Dr. Rose Nzyoka, HIGDA/Palladium Group; Dr. James Mukabi, PATH; Theresa Ndavi, Palladium Group; Dr. Chris Odero, PATH; and Diana Menya, Moi University, School of Public Health.

KMF 2018 Logistics Committee Members

Andrew Wamari, NMCP; Jacinta Opondo, NMCP; Dr. Sophie Githinji, MEASURE Evaluation; Ruth Wanjala, PATH; Robert Mwaura, NMCP; James Sang, NMCP; and Regina Karonji, NMCP

Abstracts

Plenary Day 1: Emerging Issues

Status of Pilot Malaria Vaccine Testing in Kenya: Emerging Issues and Opportunities

Dr. Rose Jalango, *MoH, National Vaccines and Immunization Program*

Background: The Ministry of Health, through the National Vaccines and Immunization Program (NVIP), is tasked with the responsibility of ensuring that all eligible children receive safe and high-quality vaccines regardless of gender, geography, social, economic, and education status. NVIP plays a critical role in disease control, elimination, and eradication through introduction of life-saving vaccines.

Description: RTSS malaria vaccine is the most advanced malaria vaccine, having completed a large phase 3 clinical trial, received a favourable scientific opinion from the European Medicines Agency (EMA), a World Health Organization (WHO) policy recommendation for phased introduction and a marketing authorization for use in the phased introduction from the Kenyan Pharmacy and Poisons Board (PPB). Working together with the National Malaria Control Program (NMCP) and partners, NVIP plans to introduce RTSS malaria vaccine in 8 endemic counties in the Western part of Kenya. The malaria vaccine will be introduced in the second quarter of 2019. This presentation will highlight some of the emerging issues and opportunities associated with the introduction of the vaccine. These issues will focus on the capacity of the cold chain storage in the control, ethical issues arising from the randomization of the subcounties to give vaccine, the political consequences following the outcome of randomization and how to communicate the same, the requirement to provide 4 doses in order to achieve adequate protection in children and some vaccine doses will be given out of the traditional EPI dosing schedule. In addition, the presentation will examine some opportunities relating to capacity building in core areas including the Strengthening of Adverse Events Following Immunization (AEFI) reporting, additional Cold Chain Equipment provided to vaccinating sub-counties, major boost for second year of life immunization plans, collaboration between various MOH programs (NMCP, PPB and NVIP), and promotion of existing tools for malaria prevention in participating counties.

Conclusion: Introduction of malaria vaccine is an opportunity for Kenya to have an additional tool to further reduce the burden of malaria prevalence, particularly in the Lake endemic zone. Despite the anticipated challenges, its introduction will be a major opportunity in the participating counties to strengthen their health systems. Adequate resources would be required to mitigate any challenges during the malaria vaccine introduction.

Planned Malaria Vaccine Implementation Program Evaluations in Kenya

Dan James Otieno, *WHO, MVIP Consultant*

Background: Malaria disproportionately affects children and pregnant women. In 2016, it accounted for approximately 440,000 global child deaths, two thirds (290,000) occurring in age under 5 in sub-Saharan Africa. In Kenya, 70% of the population is at high risk, with the Lake endemic region having the highest burden and prevalence of 27% (KMIS, 2015). According KMIS, 2015, 53% of population have access to a long-lasting insecticidal net (LLIN), with the highest access seen in the lake endemic region at 70%. In children aged less than 5 years, 56% slept under an LLIN last night, with the lake endemic regions

coverage at 73%. Despite high LLIN coverage, malaria still causes high morbidity and mortality in children less than 5 years.

A l multisite Phase 3 clinical trial (2009-2014) showed that RTS,S/AS01 malaria vaccine proffered a 39% (95% CI 34, 43) reduction in clinical malaria, 31% (95% CI 9, 48) reduction in severe malaria, and a 28% reduction in blood transfusions in children vaccinated between age 5 and 17 months. Among its side effects, febrile convulsions were identified as causally related to RTS,S vaccine. Potential safety signals, considered unlikely related to RTS,S vaccine, were identified: cerebral malaria, meningitis, and gender imbalance in survival. Although vaccine efficacy was modest, impact was high, and if administered in four-doses, the vaccine has the potential to save tens of thousands of lives. Recognizing the potential high impact of the vaccine but the need to answer key questions, WHO recommended pilot phased introduction and evaluation of the RTS,S vaccine with the main goal being an "updated WHO policy recommendation on the use of the RTS,S/AS01 malaria vaccine in young children in sub-Saharan Africa."

Description: Subnational vaccine implementation will be led by the NVIP, supported by national malaria control programme (NMCP) and PPB, while evaluations will be led by WHO-selected partners. Subcounties in 8 counties will participate in the pilot introduction; half of them introducing the vaccine and the other half serving as comparator areas; assignment as either vaccinating or non-vaccinating subcounty will be done by randomization. The planned evaluations will assess the public health usefulness of RTS,S/AS01 vaccine—specifically: 1. the feasibility of delivering 4 doses of vaccine to children, 2. safety in routine use, and 3. impact on severe malaria and mortality. The feasibility evaluation will be assessed through 1. Representative cluster sample household surveys to measure population-based RTS,S vaccine uptake and coverage; 2. Monitoring of vaccine uptake and coverage through the health-facility based administrative method; 3. A healthcare utilization study which looks at qualitative factors acting as facilitators and barriers (contextual and behavioural) affecting uptake and delivery of the RTS,S vaccine over a full cohort's immunization period (2years); and 4. A health economics study, which assesses costs of vaccine introduction and implementation, cost effectiveness and the budgetary implications. The impact evaluation will utilize a community mortality surveillance approach, a network of village reporters will identify and report all deaths in the relevant age group and will conduct verbal autopsies using a standardized WHO verbal autopsy instrument.

With regard to the safety evaluation, the relationship to the RTS,S vaccine of safety signals identified through the Phase 3 trial will be addressed through in-patient surveillance at sentinel hospitals (6 as part of the WHO-led evaluation and 4 as part of a GSK-led phase 4 study). In addition, the GSK- led phase 4 study will include the enrolment of a cohort of children who will be followed prospectively to identify any adverse events following immunization (AEFI); and the MOH-led pharmacovigilance system is designed to capture rare adverse events following immunization.

Conclusion: WHO and the NVIP are piloting the first malaria vaccine, which has the potential to considerably reduce malaria morbidity and mortality, if children get 4 vaccine doses. The pilot will comprise routine vaccine introduction through the EPI, and an independent evaluation of feasibility, safety in routine use, and impact. The results will inform broader public health use of the RTS,S vaccine in moderate to high transmission settings across Africa.

Larvae Source Management for Malaria Elimination

Dr. Kiambo Njagi, *NMCP*

Globally, with the launch of Roll Back Malaria (RBM) in 1998, malaria vector interventions have been scaled up in countries where malaria is endemic with drastic reduction of malaria illness. In Kenya the vector control interventions of choice have been long lasting insecticide treated nets (LLINS) and indoor residual spray (IRS). Both LLINs and IRS are insecticide based and target adult mosquitoes. Interventions targeting adult mosquitoes for disease control have various limitations, among them differences in behaviour and emergence of resistance to the current conventional insecticides. Kenya is aiming to elimination malaria by 2030. However, malaria elimination could be compromised by emerging insecticide resistance among malaria vectors and selection pressure of mosquito populations with different behaviour patterns.

With the current vector control tools, even when expected to realize a universal coverage of ITNs through mass distribution and IRS scale up, malaria transmission may still continue. Indeed, IRS only affects endophilic mosquitoes and ITNs only target night-biting mosquitoes. These two intervention methods mainly affect anthropophilic mosquitoes that are endophagic. This suggests that more exophilic, zoophilic and/or exophagic vectors escape from contact with insecticide treated surfaces, thus maintaining a small level of transmission as observed in Western Kenya where combination of LLINs and IRS has been implemented.

It has been reported that in Africa, between 10% and 40% of malaria transmission occurs before people go to sleep. This early-indoor and outdoor transmission has the possibility to continue despite high coverage of ITNs and IRS and can be defined as "residual transmission." The current Kenya Malaria Strategy (KMS 2009-2014, *Revised*) recommends Larval Source Management (LSM) as a key vector intervention that could supplement LLINS, targeting early-indoor biting mosquitoes and those feeding outdoor. LSM may be the best approach to target outdoor transmission, thus eliminating residual transmission as well as insecticide resistance and control of other mosquito-borne diseases. Kenya is planning to implement LSM in 8 counties in malaria endemic zones through a bilateral agreement with Cuban government. This will involve use of two biological larvicides (Bactivec –*Bacillis thuriginesis* Israelis and Griselesf –*Bacillus sphaericus*).

Role of Seasonal Chemoprophylaxis in the Kenyan Setting

Ben Andagalu, *Hoseah Akala, Bernhards Ogutu, KEMRI/USAMRD-K*

Background: Malaria may be prevented by taking drugs that inhibit liver-stage (pre-erythrocytic) development (causal prophylaxis) or drugs that kill asexual blood stages (suppressive prophylaxis). Seasonal Malaria Chemoprophylaxis (SMC) is defined as the intermittent administration of full treatment courses of an antimalarial medicine during the malaria season to prevent illness, with the objective of maintaining therapeutic antimalarial drug concentrations in the blood throughout the period of greatest risk. This strategy is currently recommended by the WHO for use in the highly seasonal malaria transmission throughout the Sahel sub-region. The drug of choice initially was amodiaquine combined with sulfadoxine-pyrimethamine (SP); however, the combination of artesunate with amodiaquine has shown to be as efficacious, especially in the light of developing resistance to SP. SMC has resulted in a

significant reduction in malaria-related morbidity and mortality in the Sahel sub-region. The seasonal use of antimalarial chemoprophylaxis was first undertaken in Kenya alongside several African countries as part of pilot trials or elimination campaigns during the "eradication" projects of the 1950s and 1960s. There has been little interest in SMC in Kenya since then.

Here, we review the opportunities and challenges associated with SMC deployment in Africa and attempt to apply them in the Kenyan setting. SMC may be an additional weapon in the fight against malaria.

Moving Towards Malaria Elimination in Kenya: Opportunities and Challenges

Peter Ouma[1] *and Elizabeth Juma*[2]

1. *Maseno University School of Public Health and Community Development*
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Background: The last decade has witnessed a dramatic decline in malaria morbidity and mortality throughout the world, including sub-Saharan Africa. Building on this progress, most countries demonstrated that they can scale up their control programmes and achieve significant reductions in disease burden with potential to transition to malaria elimination. The epidemiology of malaria in Kenya has historically followed the continuum of malaria transmission from very high to very low transmission intensities. The Kenya Malaria indicator survey in 2015 showed parasite prevalence ranging from 27% in the Lake endemic region to < 1% in the central highlands. Currently there are 13 regions meeting threshold for malaria elimination as evidence by parasite prevalence < 5%, for which Kenya may consider sub-regional elimination. Consistent with the Global Technical Strategy which aims to eliminate malaria from countries from 35 more countries between 2015 and 2030, Kenya is considering a strategic plan that encompasses embarking on malaria elimination.

Although there are opportunities to anchor this effort, many challenges remain. This presentation will highlight the current malaria situation in Kenya, areas meeting threshold for sub-regional elimination, existing opportunities, challenges, and what it would take to mount a successful sub-regional malaria elimination program.

Expanding the Vector Control Toolkit: New Tools for Vector Control

Dr. Evan Mathenge, *KEMRI*

Background: Every malaria endemic country, including high-burden countries, should consider the full pathway to malaria elimination and assess its current position on that path. Vector control with long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) accounts for an estimated 78% of the 663 million malaria cases averted globally between 2000 and 2015. However, according to World Malaria Report 2017, after an unprecedented period of success in global malaria control, progress has stalled. In 2016, there were an estimated 216 million cases of malaria, an increase of about 5 million cases over 2015 with deaths reaching 445 000. Additional vector control tools as well as other malaria prevention tools are needed to supplement LLINs and IRS to dive down malaria transmission towards elimination in many settings.

Description: We identify and describe the vector control tools and strategies that are currently being used, as well as those on the near-term horizon, that have the potential to accelerate the decrease in malaria transmission. We also describe different scenarios of deploying those tools, the opportunities, challenges and gaps in knowledge and capacity for their rapid deployment.

Lessons learned: Several vector control tools are available and may be promising supplements to ITNs and IRS in specific settings. However, their wide-scale application is limited due to lack of technical capacity, lack of clear policy direction, and legislation and registration issues as well as lack of embracing integrated vector management (IVM) approach.

Conclusions: It is essential to ensure that conditions are met, at the country level, to allow optimal use of available and newly developed vector control tools to safeguard their immediate and long-term benefit. There is need to strengthen operational capacity and research to implement underutilized vector control tools in an adaptive approach.

HIS Capacity Strengthening: Lessons Learnt and the Way Forward

James Thomas, PhD, *Director of MEASURE Evaluation*

Background: MEASURE Evaluation is USAID's flagship project for strengthening health information systems (HIS). From the project's global experience, the Director, Dr. Thomas, will describe current and future directions in HIS strengthening that are relevant to malaria.

Description: Current trends in HIS strengthening are driven predominantly by four developments: changes in the global strategy, changes in technology, changes in thinking about HIS, and changes in capacity building. Dr. Thomas will describe and provide examples of each of these.

Lessons learned: The global strategy is increasingly coordinated and standardized. New technologies are enabling much needed advances, such as automated data quality checks, but technological solutions should follow, not lead, the considerations of human interactions within an HIS. Recent thinking says HIS development should be guided by the questions an HIS needs to answer rather than what technology can do. A new and valuable tool for building HIS strengthening capacity is a resource centre with evidence for best practices.

Conclusions: In strengthening an HIS, start with the questions that an HIS must answer and the contextual factors that affect HIS strengthening, not with technology and what it can achieve. Consider doing more in a few places, to work out the challenges and to provide an example for other regions.

Plenary Day 2: Emerging issues in Programme Management

Exit Strategy for IRS in Uganda: Experience and Lessons Learnt

Bosco Agaba,[1] *Charles Katureebe,*[2] *Damian Rutazaana*[2]

[1]*National Malaria Control Division,* [2]*World Health Organization Country Office*

Background: Malaria remains a major public health problem in Uganda. Indoor residual spraying (IRS) is one of the proven and highly effective malaria control measure in interrupting malaria transmission. During a 5-year period (2009-2014), the malaria program implemented IRS in 11 high transmission districts in Northern Uganda with over 95% of households protected.

Description: Despite high LLINs coverage of > 85% and other malaria interventions, an increase in malaria cases and vector population was reported 5 months after IRS withdrawal in all the former 11 IRS districts in Northern Uganda. Based on quick epidemiological and entomological assessment, it was confirmed that indeed there was an epidemic in the 11 former IRS districts. Hospital records indicated > 80% of the admissions were due to confirmed malaria with mortality reported in some facilities. The slide positivity rate had gradually risen from less than 10% during IRS to 70% - 90% in some facilities. Entomological assessment of vector population indicated a re-bound malaria vector.

Lessons learnt: There are several lessons that we have learnt from the Ugandan experience. i) *Delayed detection:* The epidemic was detected two months after onset. This implies that the surveillance system was not robust enough to detect early the upsurge. Going forward, strengthening surveillance should be part of all NMCPs as they scale up implementation. ii) *Delayed response:* WHO assessment recommended immediate, intermediate, and long-term interventions. The one round of IRS was only done 12 months later. iii) *Quality of response*: There was limited case fatality compared to the magnitude of the epidemic. iv) *Coordination of the response*: The NMCP at the ministry of health should take the lead for better coordination of an effective epidemic response. v) *Presence of vulnerability*: Despite high LLIN coverage in the area of > 85%, there was an epidemic after withdrawing IRS. vi) *The heterogeneity of the epidemic*: Despite the epidemic in the region, it wasn't uniform across the region and across districts necessitating capacity and skill to map and identify high transmission foci. vii) *Surveillance*: In addition to the epidemiological surveillance, vector and entomological surveillance systems should be developed and embedded into routine surveillance system with strong capacity for surveillance and data use at district level and health facility level because malaria tends to be focal. Routine IDSR systems may not consider some malaria specific surveillance needs. viii) *Resources*: Malaria EPR should be considered one of the top funding priorities Availability of adequate stocks of ACTs, RDTs, Artesunate, and blood for transfusion were instrumental for saving lives.

Conclusion: Post IRS gains are fragile and can potentially be lost in the absence of a carefully designed exit strategy to sustain gains before withdrawal. The scale-back of vector control should be based on a detailed analysis that includes assessment of receptivity, vulnerability, active disease surveillance, and capacity for case management.

Barriers to Uptake of Research Evidence in Policy Making

Nzioka M. Solomon, *WHO/Kenya –National Professional Officer, Public Health and Environment*

Background: Many researchers are always disappointed that research findings do not expressly find their way to decision makers menu. One plausible reason is that no one research is conclusive, owing to the many confounding factors and non-investigated dimensions that may affect to research question at hand, hence often "recommends for further research." However, systematic reviews and meta-analysis on various related studies have also rarely moved the decision-makers to the centre of the continuum; research-to-decision.

Description: This presentation is based on review of publications designed to investigate the barriers to research uptake. As there are not enough studies in this area that are specific to malaria, and since malaria control may not require unique decision-making approaches as compared to other diseases, a more generalized review with majority physicians and decision-makers as targeted study population was preferred.

Results: The most commonly investigated barriers were lack of use, lack of awareness, lack of access, lack of familiarity, lack of usefulness, lack of motivation, and external barriers. Although these barriers are not necessarily new, it is important to note that these barriers represent the perceptions held by decision-makers and are probably true. In the updated publication, 145 new studies were identified, of which over half were published after 2010 and thirteen systematic reviews were included. The most frequently reported barriers to evidence uptake were poor access to good quality relevant research, and lack of timely research output. The most frequently reported facilitators were collaboration between researchers and policymakers, and improved relationships and skills.

Conclusions: Why a research-to-decision making gap exists has had various explanations, mainly from social scientists, and various knowledge management approaches have been proposed. Overall, one is tempted to agree that whereas most researches are scientific, decision-making is rarely a scientific process. Therefore, researchers have to work extra hard with knowledge managers to bridge the decision-makers highlighted gaps and catalyse uptake of research findings.

Domestic Resource Mobilization for Health: Lessons for Malaria Program Funding, Context

Dr. Mwai Daniel, *Financing Expert, University of Nairobi*

Background: Although there has been a reduction in the burden of disease in Kenya, mainly due to delivery of targeted interventions in healthcare provision, financing of malaria control interventions remains a challenge in Kenya. Financing malaria control interventions in Kenya relies on several sources: public (government), private firms, donors, and households. These sources coupled with how the money is organised are important in addressing sustainability issues. We examine four critical questions related to malaria financing, and draw lessons to inform domestic resources mobilization for malaria control: These questions include: where does the money come from? (Sources); who manages and organizes the funds? (Agents); where does the money go? (Providers); what type of service was produced? (Functions).

Description: The resource allocation to the health sector by the national government has declined marginally from 4% in 2014/15 to 3.1% in 2017/18. The allocation to health in the county budget has,

however, increased steadily from an average of 21.5% in 2014/15 to 27% percent in 2017/18. In total, allocation increased from 7.5% in 2014/15 to 8.2% in 2017/18. In FY 2017/18 allocation to malaria at the national level was recorded as 2.3%, an increase from 1.3% in 2015/16 and 2.0% in 2016/17. Domestic funds play a major role compared to external funding for malaria. Domestic funding, although high, has potential to lead to catastrophic spending and impoverishment since out of pocket spending is substantial (23.8%). Donor funds support key strategic commodities and preventive interventions, particularly at the community level.

Conclusions: There has been a steady increase in the allocation towards health in Kenya, with 2017/18 recording 8.2% to health, which is still below the recommended 15 per cent from the 2001 Abuja Declaration. There has been an increase in the domestic investment in malaria, with government allocating resources under the MOH budget and through counterpart funding. Household spending for malaria still plays an important role in malaria financing particularly through OOP expenditure. Donor funding for malaria has reduced. Overall funding for malaria has declined over the last four years, which, if persistent, may threaten the gains already made. Some of the opportunities available for resource mobilization include the need to develop tools to lobby for more funding, building capacity to disseminate, and use of the tools. As well as developing a financing framework for malaria control interventions to foster financial sustainability. Increased efforts on advocacy on planning and budgeting are needed for the counties.

Guidance on Resource Flow for Malaria Control from the National Treasury to the Counties

Stephen Muiruri, *The National Treasury*

Background: The National Treasury has not started transferring malaria funds direct to counties. All county activities currently are implemented using the funds held by the Ministry of Health. The National Treasury has been the state Principal Recipient (PR) of Global Fund grants to support the fight against HIV/AIDS, TB and Malaria since 2002. Since the inception, the grants flow and implementation has been through the four programs, namely, National STI and Control Programme, National AIDS Control Council, National TB Program, and National Malaria Control Program under the Ministry of Health as the sub-recipient.

In 2010, the Kenya Constitution introduced new governance systems of 47 Subnational (county) Governments, which are semi-autonomous and interdependent with the National Government. The health sector was devolved where provision of health service is mandated to the County Governments, while *a* policy, quality, and standard issues were mandated to the National Government.

Description: The National Treasury is planning to implement the new Global Fund grants, 2018-2021 in line with the constitutional requirements. The National Government is committed to put in place a process that would allow efficient and effective flow of funds to the county level. Three fiscal Global Fund inter-governmental grant implementation arrangements proposed. These include: Option 1: All 47 counties become Global Fund sub-recipients (SRs) and would be assessed for their capacity in line with Global Fund SR assessment requirements. Option 2: Nine counties with highest incidence of malaria, TB, and HIV become sub-recipients. Taking into consideration the pattern of the three diseases incidents, nine counties with the highest incidence of HIV/AIDS, malaria and TB can be selected as sub-recipients to serve as pilot for engaging other counties in future grants. Option 3: Global Fund grants as a

conditional grant to counties. Under this option, Global Funds grants can be transferred to counties by National Treasury as conditional grants without the counties being made sub-recipients. Conditional transfers are ring-fenced funds to encourage the County Governments to carry out specific programmes or activities, or to support a sector in a bid to achieve national policy objectives. Conditional grants to counties would be transferred in line with of the Constitution of Kenya 2010.

In addition to the three options, the National Treasury is in process of coming up with a criteria to be used to split the grant activities for the national programs and counties according to their mandates outlined in the Constitution of Kenya.

This presentation will examine the above options and explore other possible avenues that counties can assess their funding to support health programmes.

Challenges and Opportunities for Malaria Commodity Management at the County Level in Kenya

Dr. Victor Sumbi, *B. Pharm, MPH, MSc Health Economics and Pharmaco-economics, SPSM*

Background: Continuous availability of malaria diagnostics and life-saving anti-malarial medicines is critical in implementing the test, treat, and track strategy for malaria control. The USAID-funded Afya Ugavi project supports strengthening of commodity management and reporting systems in focus counties; as well as use of strategic information across all counties to improve the supply chain across the whole country.

Description: A baseline assessment conducted at project inception in November 2016 found that only 15% of health facilities were stocked within the recommended levels for first-line anti-malarial commodities. Just 71% of health facilities were submitting their commodity reports on time in the DHIS 2 platform. Moreover, there were reports of health facility stockouts of anti-malarial despite adequate stocks at the central medical stores.

Results: One of the root causes for sub-optimal performance was identified as lack of a platform to assist the health commodity managers to make informed supply-chain decisions. Afya Ugavi worked with NMCP and county health managers to assess the information needs for commodity managers (at county and sub-county level) to make informed decisions. Thereafter, Afya Ugavi developed an Excel-based analytical tool to extract, aggregate, and analyse DHIS commodity data to provide information on identified supply chain indicators, and to rationalize quantities of anti-malarials medicines and RDTs to be requested from KEMSA based on historical consumption rates. Information from this tool was discussed and used in various forums (e.g., the commodity security TWG meetings and health facility in charges' meetings to inform interventions). For the lake endemic counties, by June 2018, commodity on time reporting rate had improved to 98.4%, while the percentage of facilities stocking anti-malarials within the recommended levels increased to 20% despite challenges with central level stock outs and short expiry stocks because of a prolonged health worker strike in 2017. The proportion of health facilities reporting stock out of all ACTs reduced from a high of 19% in early 2017 to just 4% in the quarter ending June 2018.

Conclusion: Continued utilization of commodity data for decision making can improve commodity management and support the realization of universal availability and efficient management of malaria medicines and diagnostics.

Case Management and Vaccines

Increasing Access to Malaria Diagnosis and Treatment: Lessons Learned in Strengthening Community Case Management of Malaria in Ten Counties in Western Kenya

Oule J.[1], *Igunza P.[1], Mungai M.[1], Muhula S.[1], Karanja J.[1]*

[1]Amref Health Africa

Background: Community Case Management of Malaria (CCMM) is one of the key strategies for increasing access to early diagnosis and treatment of uncomplicated malaria. The CCMM is anchored on community strategy and involves using trained community health volunteers (CHVs) to diagnose malaria using Rapid Diagnostic Test kits (mRDTs). Uncomplicated malaria cases confirmed through the test are treated with Artemisinin-based Combination Therapy (ACTs) as per the national treatment guidelines. All patients with fever who test negative for mRDT are referred to link health facility for further management. Key activities done to support CCMM include Community Health Unit (CHU)/link facility support supervision conducted every quarter, which aims to improve CHVs skills in diagnosis and treatment of malaria; provision of monthly performance-based stipend to CHVs as a motivator to their work; integrated outreaches aimed at reaching more people with malaria services.

Description: An evaluation of the implementation of CCMM was conducted in December 2017 to determine achievement of envisaged outcomes and facilitators and barriers to implementation. A mixed methods cross-sectional survey was conducted in the ten counties that implemented CCMM. A total of 1134 household heads and in their absence the next in command completed the household questionnaire. Ten FGDs with CHVs and 56 key informant interviews with stakeholders were also conducted.

Results: A total of 7350 CHVs and 1470 CHEWs were trained on community case management of malaria. Overall, the CHVs facilitated the testing of 404,228 community members for malaria and treated 299,795 cases at the community level against target of 198,610 and 169,248 respectively.

Of the 1134 community members surveyed, 98.6% (n=1118) were aware of CHVs services and 92% (n=1043) had received services from CHVs. 71.4% (n=809) reported that a CHV visited them at least once every month. Malaria topped the list of services offered by the CHVs at 77%, followed by water sanitation and hygiene (WASH) at 46.1% and health education at 43.3%.

Interviews with healthcare workers revealed that there has been a noticeable reduction in malaria complications seen at the health facilities due to early detection and treatment provided by the CHVs at the household level. In addition, there was a perceived shift in health seeking behaviour among community members, with a reduction in those using herbal drugs and self-medications as they preferred to seek advice from the CHVs instead.

Conclusions: CCMM significantly contributes to reduction in malaria morbidity and mortality by increasing access to early diagnosis and treatment services. Community members readily access and are

generally satisfied with malaria services offered by CHVs. There is a need to streamline delivery of malaria commodities and other health care products essential for diagnosis and treatment of malaria at community level. Coverage of CCMM needs to be expanded from the present 30% so that more communities are reached with the services.

Innovative Approach to Improve Antimalarial Use in the Retail Sector

Joseph Kipkoech, *Moi University, School of Public Health*

Background: More than half of artemisinin combination therapies (ACTs) consumed globally are dispensed in the retail sector. Malaria diagnostic testing is largely absent from the retail sector and, as a result, individuals without malaria consume 66-80% of ACTs sold over-the-counter, leading to overconsumption and poor targeting. In Kenya, ACTs sold over-the-counter are available at heavily subsidized prices, possibly contributing to their misuse. Inappropriate use of ACTs can have serious implications for the spread of drug resistance and leads to poor outcomes for non-malaria patients treated with incorrect drugs.

Description: We evaluated the public health impact of an innovative strategy that targets ACT subsidies to confirmed malaria cases by coupling free diagnostic testing with a diagnosis-dependent ACT subsidy. Our intervention was specifically designed to reach individuals purchasing drugs over-the-counter and to incorporate the retail sector, which delivers the majority of ACTs in Kenya. In this study, the CHWs provided free malaria testing in the community using simple point-of-care malaria rapid diagnostic tests and issued a voucher to anyone with a positive test, which could be redeemed at a retail medicine outlet to exchange for a discounted ACT. We tested the effect of this intervention on testing before treatment and correct use of ACTs in a cluster-randomized controlled trial in 32 community clusters in western Kenya (Webuye East, Webuye West, and Kiminini subcounties, total population in study clusters approximately 160,000).

Results: In our study area, two-thirds of families seek care in the informal or retail health sector and ACT consumption is high. Eligible clusters had retail outlets selling ACTs and existing community health worker (CHW) programs and were randomly assigned 1:1 to control and intervention arms. Between July 2015 and May 2017, 32,404 community members were tested for malaria and 10,870 vouchers were issued. To assess our outcomes, 7416 randomly selected participants with recent fever from all 32 clusters were surveyed. At baseline, 67.6% (n=1362) of individuals with a recent fever took an ACT for their illness and 40.3% (n=810) of all participants took an ACT purchased from a retail outlet. After 18 months, the intervention improved the proportion of fevers tested before treatment by 25% (Adjusted Risk Ratio=1.25, 95% CI: 1.09-1.44, p=0.005). Rational use of ACTs in the intervention area increased from 41.7% at baseline to 59.6% and was 40% higher in the intervention arm at 18 months (Adj RR 1.40, 95% CI: 1.19-1.64).

Conclusions: Diagnosis-dependent ACT subsidies and community-based interventions that include the private sector can have an important impact on diagnostic testing and population-wide rational use of ACTs. Targeting of the ACT subsidy itself to those with a positive malaria diagnostic test may also improve sustainability and reduce the cost of retail sector ACT subsidies.

Access to Affordable Medicines and Diagnostics in the Private Sector

Patricia Njiri, *CHAI*

Background: Access to Affordable Medicines for Malaria (AMFm) is a subsidy scheme hosted by the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund). The scheme comprises three key elements: (i) price reductions through negotiations with ACT manufacturers; (ii) a buyer subsidy through a "co-payment" for ACTs at the top of the global supply chain; and (iii) supporting interventions to promote appropriate use of ACTs. The four main objectives of AMFm are: (i) to increase ACT affordability; (ii) to increase ACT availability; (iii) to increase ACT use, including among vulnerable groups; and (iv) to "crowd out" oral artemisinin monotherapies, chloroquine and sulfadoxine-pyrimethamine (SP) by gaining market share.

Description: The role of CHAI was to work with NMCP to implement the AMFm on the supply and demand side. On the supply side, CHAI coordinated FLBs eligible to participate in the project and worked with them to define the parameters of engaging in the subsidized antimalarial market. On the demand side, CHAI in addition supported NMCP in the rolling out of supportive interventions which were intended to promote appropriate use of subsidized ACTs. The project was implemented countrywide, primarily targeting private sector drug outlets. The implementation of AMFm involved provision of both technical and financial support during the training of health workers, ACT demand generation activities, community level case management, and regularity support through pharmacovigilance, drug quality testing, and field inspection visits

Lessons learned: Three key lessons were learnt during the implementation of the AMFm. First, the introduction of subsidy increased ACT affordability, uptake, and crowd out the use of monotherapies and other non QAACTs. Second, training of health workers on malaria case management improves quality of care for malaria, and third, appropriate and targeted demand generation activities increase public awareness in an intervention and safeguard elements such as recommended retail prices of products and services.

Conclusions: The AMFm and later co-payment mechanism met its objective of increasing availability, affordability, and market share of ACTs in the private sector. Despite this, several issues relating to the sustainability of such ventures have arisen. First, it is apparent that the success of drug subsidy programs requires significant funding outlay. Second, subsidy programs should have a finite implementation period and a clear exit strategy, and lastly, there is a need for a broad stakeholder engagement to facilitate successful roll out of innovative approaches targeting the private sector.

Monitoring Quality of Care for OPD and IPD: Lessons Learnt and Utility for Programming

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Background: Malaria remains a major public health problem in Kenya, accounting for 16% of outpatient consultations. Its transmission and infection is determined largely by altitude, rainfall patterns, and temperature. All four species of *Plasmodium* that infect humans occur in Kenya, with *Plasmodium falciparum,*

which causes the most severe form of the disease, the most common, accounting for over 99% of all malaria infections in the country. The incidence of malaria infection has fallen, but severe malaria, however, remains a major cause of admission and mortality in Kenyan hospitals. In 2012, the National Malaria Control Programme (NMCP) launched the new guidelines for the management of severe malaria, recommending change of treatment from quinine to parenteral artesunate. Despite the fall in cases, malaria remains an important cause of morbidity and mortality, especially in children, pregnant women, and the non-immune travellers. It is therefore important to look at the quality of both outpatient and inpatient care to better control the transmission.

In this presentation, we will look at the current malaria situation, clinical malaria indices, some of the multi-centre transmission studies, discuss some of the results and some of the indicators of falling prevalence in the various age groups and how to better use these data in malaria control.

Lessons Learnt in Implementing Quality of Care Surveys in Kenya, and Their Utility for Programming

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Background: Malaria case-management based on test and treat policy for uncomplicated malaria and artesunate treatment for severe malaria is one of the key components of the Kenyan Malaria Strategy. Recognizing limitations of the routine information systems, NMCP with the support of KEMRI-WTRP has implemented biannual national health facility surveys to monitor health systems' readiness and health workers' case-management practices in accordance with national guidelines. Cross-sectional outpatient surveys on the random sample of 170 health facilities have been initiated in 2010 while in 2016 the inpatient surveys were launched at all 47 county referral hospitals and in 2017 extended to further 43 faith-based hospitals.

Description: To monitor programmatic coverage with interventions, data collection methods included health facility assessments and health worker interviews, while to monitor case-management practices real-time outpatient exit interviews were undertaken during the outpatient surveys and data extraction from paediatric and medical ward admission files during the inpatient surveys. For each of the two distinct surveys, descriptive national-level analysis with exploratory stratifications are undertaken on approximately 40 key indicators at the health facility, health worker, and patient levels. For each survey round the implementation processes comprising field workers' training, data collection, data entry, management, and analysis are completed within a two-month period. Few examples of the readiness and case-management indicators with trends over time, gaps towards targets, and some patient, spatial and facility specifics important for program informing will be presented at the conference. Beside the primary purpose of the activity to monitor progress of the KMS, the additional use of survey data and the field activity in itself was multifield and ranged from high-level reporting to donors over revising annual and periodic malaria operational and programmatic plans to the feeding of the results into on-going case-

management support activities and finally in the use of the facility contacts with health workers to disseminate guidelines, job-aids, feedback, and summarized results at the point of care. Several lessons learned, including potential facilitators and challenges for the activity implementation such as recognition of the quality-of-care topic, effective collaboration, implementation modality and ownership, links with various support activities including current and future considerations for the extension of the activity in scope and on scale, will be also discussed at the forum. In conclusion, Kenyan NMCP is one of the rare malaria control programs across Africa who has successfully implemented malaria quality of care monitoring and is able to track planned, valid, and nationally representative readiness and case-management indicators.

Surveillance Monitoring Evaluation and Operations Research

Barriers to Sharing Research Evidence with Policy Makers Researchers' Perspectives

***Dr. Evan Mathenge**, KEMRI*

Background: Viable and appropriate policies are necessary for sustainable disease burden reduction.

Policies are made by policy makers, the persons bestowed with the power, either by society or a group of people in a society, to make decisions However, research should provide an important input in policy formulation. Many international statements have urged researchers, policy makers, and health care providers to collaborate in efforts to bridge the gaps between research, policy, and practice.

Description: We reviewed literature on research policy gaps and casually engaged researchers and policy makers on their views on the subject. The findings were then consolidated.

Lessons learned: Researchers frequently argue that policy makers ignore the research they produce, while policy makers argue that academic research is seldom relevant to their needs. There are also limited platforms where researchers and policy makers converge to forge a common understanding

Conclusions: There is a need for a research-informed understanding of the factors and processes that promote and prevent effective linkages between researchers and policy makers in order to develop more realistic efforts to address the research/policy gap.

The Quality of Inpatient Data from HIS: Challenges, Opportunities and Way Forward

***Samuel Cheburet,** CRVS, MOH*

Background: Global demand for high-quality data on morbidity and mortality are critically ingredient for guiding health programming, policy, and informing decision making. In Kenya, the availability of comprehensive, complete, accurate, timely, and reliable data, especially on mortality and cause of death, remain a huge challenge.

Description: There are several factors that affect the quality of inpatient data in the HIS, key among them, the physician knowledge and skills and the general process of care at the health facility level. In addition, proper certification of the course of death by clinicians plays a critical role in promoting availability of quality data on cause of death. However, poor coding and certification undermine the

quality of inpatient data that are reported in the HIS. Some of the reasons behind the poor coding and certification include the diagnostic capacity of the hospital, type of hospitals, forms design, the skills and competencies of the personnel doing the coding, inappropriate recording/coding of data, and limited interest among physicians/certifiers in completing the Medical Certificate of Cause of Death (MCCD). Building the capacity of the coder (health records and information officers), who translate the data ICD and report the case-based data through District Health Information Software (DHIS2), is important.

Conclusion: A systems approach to improving the quality of in-patient morbidity and mortality data is required. Some of the low hanging fruit for improving the quality of morbidity and mortality data include improving the quality of documentation of the process of care, promoting review of and its use in programming, and allocation of adequate resource to support capacity building, quality assurance, and supervision.

Limited Capacity to Demand and Use Data at the County Level: A Case of Kisumu County

Lilyana Dayo, *CMCC Kisumu*

Background: Planning and decision making at every level of the healthcare system requires dependable information that is delivered at the right time. Although data are collected at the various levels within the county healthcare system, their demand and use remain sub optimal. Although efforts to support collection and use of data from the community and health facilities have received substantial investments by donors, national, and county governments over the years, several barriers remain that impede the use of health data for decision making. These barriers include those relating to the quality of data, inability to balance between evidence and other pragmatic considerations by the decision makers, and the limited capacity of health care workers at these levels to contextualize the evidence from data.

Description: Data quality audit on key malaria indicators was undertaken in seven subcounties between January to March 2017 to identify barriers to data demand and use at the health facility level in Kisumu. Nine (9) health facilities were chosen from each of the subcounties depending on what health care services they provided as per the Kenya Essential Package for Health Services. The selected health facilities from each subcounty included the subcounty hospital, two health centres, two dispensaries, and two private health facilities. During the audit, a comparison of data in the source documents, summary register, and the DHIS2 platform was done for all the indicators. Lastly, a systems assessment questionnaire was administered to the health care workers at the facility.

Results: Most health facilities did not have the appropriate tools for data reporting, and often relied on improvised tools that introduce inconsistencies and affect the quality of data collected. This was further compounded by the fact that majority of the health workers did not verify the data before submission to the subcounty. Other barriers included limited reporting, especially among the privately owned health facilities and when they did, they relied on non-standard MOH source and summary tools and registers, and heavy workload among health workers due to staff shortages.

Conclusion: Although the importance of using data to inform decision making is well appreciated, there is need to address systemic bottlenecks that hinder availability of quality data, and their use in informing decision making. There is a need to allocate adequate resources towards health information management and ensure compliance with data collection and reporting at all levels. Health workers at the county level

need support and technical skills to package and interpret data in ways that are beneficial to decision making.

Use of Geospatial Analysis to Support Use of Data for Decision Making

Dr. Rose Nzyioka, *HIGDA, Palladium Group*

Background: HIGDA is a USAID-funded strategic information project that aims to increase capacity of national programs in conducting data analytics, including spatial data analytics, to improve use of evidence in policy and programmatic decision making. The scope of the HIGDA project is in Health Informatics Governance and Data Analytics.

Description: The use of geospatial analysis is aimed at addressing the weak capacity in data analytics and increase evidence-based decision making in program planning, budget advocacy, and policy development. GIS champions were identified from the initial engagements with county teams, to include information producers and users in their current roles, e.g., CHMT members (health and data program managers such as CMCCs and CHRIOs). The capacity of the champions to use GIS was strengthened through targeted short modular courses. The courses target competencies in the formulation of questions of interest, data extraction and consolidation of datasets from various sources including DHIS2 and KHMFL, use of GIS for visualization of outcomes of interest by place, and use of GIS for spatial analysis (e.g., hotspot analysis). The post training intervention was multipronged and involved mentoring and providing TA to the GIS champions through face-to-face and remote interactions. In addition, a network of champions was created on a social media platform, to facilitate peer to peer interaction and learning.

Lessons learned: Several lessons have been learnt regarding promoting use of data in decision making. First, while the information needs by the CHMTs had not been refined, the uptake of information products that disaggregated all variables such as outcomes, outputs, activities, and inputs into the county health system was almost universal. County health leadership were able to target interventions and manage the malaria program by focusing on hotspots and problem areas for improved efficiency and effectiveness of interventions. Second, GIS champions who were members of CHMT used this opportunity to present spatial information products to the county health leadership, which facilitated faster adoption among the subcounty and non-CHMT champions. In counties where demand for GIS products was sustained through a county management directive institutionalizing use of GIS to develop- and present performance reports, the champions had greater traction. Based on this, some counties, such as decided that all reports and presentation must be disaggregated by place. The CHMT in Kwale has since adopted targeting net distribution activities by the county and county partners to hotspot areas for better results. Kilifi County is also now using GIS to identify of subcounties where malaria case management activities should be prioritized for maximum reduction of morbidity and mortality

Conclusions: GIS as a tool for analysis and visualization of county health program burden, performance, inputs, outputs, and outcomes enables the CHMT to manage the malaria program locally, while contributing to a national goal. Selection of GIS champions, engagement in the post training support, and the access to decision making platforms such as CHMT where they create demand for information are critical intervention points for successful uptake of use GIS. The use of this information to make policy, program planning, and implementation decisions is ongoing, and the next step is the use of spatial information products for advocacy.

Improving Completeness in Reporting and Quality of Data at the County Level: Experiences and Lessons Learnt

Dr. Francis Njoroge, *CMCC, Garissa County*

Background: Health planning and provision is now a function of the county government. Proper planning is, however, dependent on availability of quality data from both the routine and routine sources. Counties continue to face several systemic and behavioural challenges that together, determine the availability of quality health data that can be used for planning and support decision making. In relation to malaria control, quality data play an important role in supporting decision making and inform malaria control strategies.

Description: We draw on experiences from Garissa County and discuss some of the strategies that have been used to improve reporting rates and the quality of data in the DHIS. Some of the strategies that have improved reporting include frequent data quality audits to ensure standardized data are collected and providing support to CHRIOs and the newly employed staff to ensure proper data entry and documentation. Other strategies include providing training to CHVs to improve their knowledge and understanding of the data they collect and report from the community to the health facilities.

Lessons learnt: Human resources related factors play a crucial role in promoting timely reporting of health data. Reporting is affected by staff shortages and heavy workload as well as high turnover. Although there is heavy reliance of CHVs in collection of data prior to sending to the health facilities, most of them have no training. Limited resources to support regular data review meetings, support supervision, and DQAs have a direct impact on the quality

Recommendations: There is a need for devolved units to prioritize hiring more health care personnel, including HRIOs, develop a structured approach to orientation new staff on reporting after deployment, and build capacity of CHVs on reporting. Other system challenges, such as irregular data review meetings, lack of resources for support supervision and DQAs, and provision of reporting tools, should be addressed.

Role of Entomological Surveillance in Malaria Elimination in Kenya

Prof. Charles M. Mbogo, *Chief Research Scientist, KEMRI/WT*

Background: Vector control using long lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) accounts for most of the malaria burden reductions achieved recently in Africa and elsewhere. LLINs and IRS are highly effective but are insufficient to eliminate malaria transmission in many settings because of operational constraints, growing resistance to available insecticides, and mosquitoes that behaviourally avoid contact with these interventions. Given that a range of new vector control products are now emerging that target a greater diversity of adult mosquito behaviours, it should soon be feasible to effectively tackle a broader range of mosquito species and settings. However, the primary obstacles to further progress towards more effective malaria vector control are now paucities of routine programmatic entomological surveillance, and capacity for data processing, analysis, and interpretation. Entomological surveillance provides a temporal and spatial understanding of vector species, specific population dynamics, and behavioural traits that have impact on disease transmission, intervention effectiveness, and

residual transmission. This intelligence guides intervention selection and deployment in time and space and provides a platform to evaluate complementary strategies and tools. In an elimination setting, entomological surveillance becomes increasingly important in foci of transmission to target and eliminate pockets of remaining transmission.

Description: There is currently no operational framework for National Malaria Control Program use to guide entomological surveillance for elimination, including foci investigation and characterisation of residual transmission. We are currently developing an entomological surveillance framework to provide operational guidance to NMCP on how to collect essential entomological indicators to 1) characterize transmission, 2) conduct routine surveillance, 3) and conduct foci investigation. This discussion will explore the steps and opportunities for malaria control as we approach the elimination stage.

Strengthening Surveillance Systems in Preparation for Malaria Elimination

***Sophie Githinji*[1]**, *Agneta Mbithi*[1], *Rebecca Kiptui*[2]

[1] *MEASURE Evaluation, ICF, Nairobi, Kenya,* [2] *National Malaria Control Programme, Ministry of Health, Kenya*

Background: Strengthening malaria surveillance is crucial for accelerating progress towards elimination and attainment of malaria free status. Transforming malaria surveillance into a core intervention is one of the three pillars of the global technical strategy for malaria. The revised WHO malaria surveillance manual published in 2018 advises countries to establish robust surveillance systems that address the heterogeneity of the disease within their boundaries.

Description: The Kenya National Malaria Control Program is conducting a program review to evaluate achievements made during the implementation of the Kenya Malaria Strategy (KMS) 2009-2018 and to inform the development of the next strategy. The review entailed a detailed desk review of key policy and strategic documents, surveys, and reports of implemented activities. Field visits and structured dialogues with stakeholders were held to understand challenges and bottlenecks to program implementation and lessons learnt during the period of the strategy. A special malaria forum has been organized for researchers to contribute to the program review by sharing evidence gathered from relevant studies that could inform development of the next strategy.

Findings: The review documented a reduction in the total confirmed outpatient malaria cases from 57/1000 of population in 2012-2013 to 36/1000 in 2017. Routine data from sixteen counties in low risk and seasonal transmission zones showed consistently low monthly test positivity rates below 5% from 2016. Reporting rates from public health facilities increased from 70% in 2013-14 to 88% in 2017. Testing of suspected malaria cases in public health facilities increased from 24% in 2010 to 64% in 2017, and adherence to national treatment guidelines improved from 10% to 59% over the same period. Major achievements made in malaria surveillance during the period under review included introduction of quarterly malaria surveillance bulletins to track key malaria indicators at the national level and in selected counties and expansion of entomological surveillance beyond the endemic and epidemic counties. The review identified key gaps in reporting of inpatient morbidity and mortality data, low reporting from private health sector, incomplete counting of malaria cases, and inconsistencies in data reported through routine reporting systems.

Recommendations: Mandatory reporting of outpatient and inpatient data by all public and private health facilities needs to be enforced to ensure that all malaria cases are counted. All suspected malaria cases must be tested using quality assured microscopy or rapid diagnostic tests. Systems for monitoring and evaluating the surveillance system, including data quality, should be strengthened. Surveillance systems for malaria elimination, including case and focus investigation, active case detection, and laboratory quality control, need to be established in low risk counties.

Conclusion: Adequate investments in infrastructure and human resource capacity are needed to transform malaria surveillance into a core intervention in line with global policies.

Lessons Learnt in Capacity Building for Entomological Surveillance at the County Level

Lenson Kariuki, *VBDCU*

Background: Malaria entomological surveillance and insecticide resistance monitoring is crucial to gather required evidence to align vector control interventions with the expected impact. However, most malaria endemic countries, including Kenya, lack adequate technical skills and logistical capacity to generate this information. The current Kenya Malaria Strategy (revised KMS 2009-2014) recommends targeted malaria entomological surveillance bi-annually.

Description: In a bid to achieve this, the National Malaria Control Programme (NMCP), Vector Borne Diseases Control Unit (VBDCU), and KEMRI embarked on capacity building in 47 counties on malaria entomological surveillance and monitoring of insecticide resistance from year 2014. The main objective was to strengthen the technical capacity and provide the necessary equipment/supplies for effective vector surveillance and management of insecticide resistance. Health workers, mainly comprising the medical entomologist and parasitologist in VBDCU stations, Public Health Officers involved in vector control, and laboratory technologists were trained on mosquito bionomics, identification, mosquito sampling techniques, mosquito rearing techniques, insecticide resistance monitoring, data management, and development of county entomological work plans. This was then followed by malaria entomological surveillance in the counties through mentorship by the national level. In this surveillance, the trained health workers collected data on malaria vectors in each county, and further analysis of samples was done in KEMRI Nairobi and Kilifi.

Results: About 240 health workers have been trained on basic malaria entomology, and a national database has been established. Through these health workers, malaria vector surveillance has been conducted in 44 counties, and malaria vector distribution maps have been developed to guide planning and implementation of malaria vector control interventions. Procurement of entomological equipment has been done and is still in progress in order to equip each county with adequate entomological equipment.

Conclusion: Only one round of malaria entomological surveillance has been conducted, in all the counties against the recommended two rounds. This information generated from the single round of surveillance is therefore insufficient to guide malaria prevention and control interventions in each county. In addition, insecticide resistance monitoring has not been conducted due to inadequate resources. To achieve optimal outcomes of malaria entomological surveillance and insecticide resistance monitoring,

there is need to scale up technical capacity as well as strengthen logistical support. Additionally, counties need to prioritize malaria entomological surveillance by provision of the necessary support and resources.

Spatial and Temporal Analysis of Malaria in Turkana County Based on Routine Reporting Data

Dr. Wendy O'Meara, *Moi University, School of Public Health*

Background: In sub-Saharan Africa, three-times more people live in pre-elimination areas in 2015 than in 2000. However, climate change and changing land-use patterns are creating environments suitable for malaria transmission in geographic areas that did not previously support stable transmission. Increasing human migration further complicates this problem by introducing parasites into newly emerging, epidemic-prone ecosystems, sparking outbreaks in populations lacking pre-existing immunity. Turkana County is a remote county in northwest Kenya that has experienced tremendous growth in the last 10 years due to devolution and increased resources for development, as well as investment in oil exploration and extraction. This growth has included construction of new roads, more permanent human settlements, less pastoralist migration, and more circulation of visitors from outside of Turkana often originating from malaria-endemic areas. Over the same time period, Turkana has experienced increasing malaria transmission and local epidemics that have had devastating consequences.

Description and lessons learned: Here we present data from January 2016-July 2018 extracted from routine reports generated by public and private facilities across Turkana County to describe the recent temporal and spatial distribution of malaria cases reporting to the formal health sector. We compare monthly reports generated in facilities with laboratories (MOH 706) with reports from a wider range of facilities offering rapid diagnostic testing (IDSR). We find evidence of year-round malaria cases with seasonal peaks present in at least three sequential years, similar to the Coast Endemic zones. These results are robust to the type of diagnostic test used. The timing of the seasonal peak varies across the county. The highest burden falls on children under 5 years of age as reflected in the ratio of cases in children under 5 years to cases in patients over 5 years. During the 2017 seasonal increase in transmission, there is some evidence to implicate importation of parasites possibly in conjunction with travel during the elections.

Conclusions: A better understanding of the factors contributing to the changing pattern of malaria in Turkana is required. Our goal is to help design more effective monitoring and intervention strategies for this emerging endemic zone. In particular, we want to understand the relative contribution of endemic transmission, imported cases, and transmission chains triggered by imported cases. Our current work includes collecting travel history from symptomatic and asymptomatic cases, reactive case detection at sentinel facilities, and analysing genetic diversity in locally acquired and imported cases in order to better understand the transmission dynamics of malaria in Turkana County.

Temporal and Spatial Antimalarial Drug Sensitivity in Kenya

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Background: The level of parasite mixing within and between geographic loci and across time affects the durability and effectiveness of control interventions. Based on this understanding, information on the parasite populations should be integrated into control efforts.

Description: This study was conducted in Western Kenya. We explored the value of malaria parasite genetic and in vitro susceptibility data from our countrywide malaria drug resistance surveillance study, interspersed with clinical efficacy studies to measure differences in parasite response to drugs. 47 parasite isolates collected before artemisinin-based combination therapy (pre-ACT; 1995-2003) and 745 after AL introduction (post-ACT; 2008-2014) were genotyped for frequency of polymorphisms in drug resistance alleles within pfcrt, pfmdr1, pfdhfr, and pfdhps genes. IC50s were determined for a subset of samples. 118/745 samples from 2013 to 2014 were from an efficacy trial of which 68 had clearance half-lives. The associations of parasite haplotype with the IC50s of artemether and lumefantrine, and clearance rates were determined.

Results: There were significant differences between pre-ACT and post-ACT genotypes pfcrt-K76 and N86 codons ($p < 0.0001$). The prevalence of pfcrt K76 and N86 increased from 6.4% in 1995-1996 to 93.2% in 2014 and 0.0% in 2002-2003 to 92.4% in 2014, respectively. 100.0% of the pre-ACT parasites carried T + YYY, while 99.3% of post-ACT parasites carried K + NFD. There was significant correlation ($p = 0.04$) between lumefantrine IC_{50} and polymorphism at pfmdr1 codon 184. SP mutations remained high across the period. There was no difference in parasite clearance half-lives based on genetic haplotype profiles.

Conclusion: This study shows there is a significant change in parasite genotype, with key molecular determinants of AL selection almost reaching saturation. The implications of these findings on current treatment are not clear since AL remains highly efficacious. However, there is need to closely monitor parasite genotypic, phenotypic, and clinical dynamics in response to continued use of AL in western Kenya.

Molecular Surveillance of ACT Resistance Markers in Kenya: Lessons Learnt and Way Forward

Dr. Lynette Isabella Oyier, *KEMRI/WT*

Background: Antimalarial resistance is currently a major global concern due to the recent emergence of resistance to artemisinin and its partner drugs in South East Asia. Its potential to spread globally presents an imminent challenge to the malaria community, since it threatens to reverse the gains made in the global reduction of the malaria burden over the past decade. From historical experience, the availability of a molecular tool to monitor resistance has informed the appropriate and timely change in drug use. The presentation will provide the historical context of antimalarial resistance, the current knowledge in the field, an update of the ongoing research, and the way forward.

Description: Drug resistance limits the efficacy of antimalarials, putting a significant strain on malaria control programs. It is the ability of the malaria parasite to survive or multiply despite administration and absorption of the drug within the limits of host tolerability. The key driver of antimalarial resistance is the genetic diversity of the parasite, *Plasmodium falciparum*. The development of resistance to antimalarials is a two-step process, involving a genetic event that produces a mutant parasite clone followed by the selection and increase in frequency of the mutant in the presence of drug pressure, upon administration of antimalarials. In some cases, withdrawal of a drug to which many parasites are resistant has led to an increase in sensitive genotypes, suggesting that mutant parasites have reduced biological fitness than sensitive parasites in the absence of drug pressure.

The assessment of molecular markers therefore enhances the early detection of *Plasmodium falciparum* antimalarial resistance and provides an understanding of the evolutionary changes in the parasite at these loci. The utility of molecular surveillance has been underscored in previous studies that have prompted changes in antimalarial drug policy from the chloroquine to Fansidar and currently Coartem/Artekin. Molecular surveillance has been used across the various malaria zones in Kenya and temporally in Kilifi to demonstrate changes in drug resistant genotype frequencies. Furthermore, antimalarial therapeutic efficacy trials have been conducted in malaria endemic regions in Kenya to determine the efficacy of the current national first and second therapies for uncomplicated malaria. Molecular analyses complement these trials to determine the true efficacy of the national treatment strategies. There are also new molecular tools being developed by the global malaria community to enhance molecular surveillance.

Lessons learned: Molecular surveillance provides an invaluable platform to monitor antimalarial resistance in therapeutic efficacy trials and at a population level to inform evolutionary changes in the parasite population. For instance, since the cessation of chloroquine use in the late 90s, there has been a significant increase in the chloroquine sensitive population in Kilifi, albeit not to levels where chloroquine could be recommended for use. Additionally, parasites resistant to pyrimethamine (a component of the drug Fansidar) are 100% mutant in the Kilifi population, indicating that pyrimethamine can no longer be used for the treatment of malaria. Other genetic loci which are potentially associated with altering the activity of artemisinin combination therapies also show changes in genetic frequencies over time, suggesting they may be under drug pressure. There is currently no evidence of the markers of resistance to artemisinin in malaria endemic regions in Kenya and over time in Kilifi. Current molecular analysis of the therapeutic efficacy trials indicate as of 2013, the parasites in circulation retain sensitivity to the first and second line national treatments.

Conclusions: Molecular surveillance should be a mainstay activity for monitoring antimalarial resistance nationally as it is rapid and samples can be obtained from routine medical care practice, making it an inexpensive approach to continuous monitoring for resistance. The new molecular tools that have been developed provide an even more rapid and extensive approach to drug resistance monitoring and can result in the generation of a national map of resistance, thus informing how to focus malaria control and treatment strategies.

Advocacy, Communication, and Social Mobilization

Socio Behavioural Issues Affecting Adherence to Treatment Guidelines

Prof Grace Irimu, *MMed, MBChB. PhD., Paediatrician and Public Health Specialist, University of Nairobi.*

Background: Malaria is a major cause of admission and inpatient mortality in malaria endemic areas in children aged less than 5 years. Quality of care remains a challenge. We present processes of care for management of children admitted in 13 Kenyan hospitals participating in a Clinical Information Network (CIN) and describe lessons learnt.

Methods: We analysed data for children aged 1±59 months collected retrospectively from medical records after discharge. We demonstrate the influence of audit-feedback on trend of change on quality of care for malaria patients: assessment, classification, and treatment.

Results: Performance change varied across time, hospitals, and selected indicators.

Conclusion: Our observational data suggest some change in multiple indicators of adherence to guidelines recommendations (aspects of quality of care) can be achieved in low-resource hospitals using complex interventions that include audit and feedback, simple job aids, and leadership capacity building.

Strategies for Maintaining Gains in Net Use Through SBCC

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[1] *Population Services Kenya,* [2] *NMCP*

Background: In Kenya, 52 out of every 1000 children born do not live to the age of five years (KDHS 2014), with malaria placing more than 70% of the population at risk. The Kenya Malaria Communication Strategy (2016-2021) recognizes strategic communication as an integral component to achieving the vision of a malaria free Kenya through four strategic interventions that include strengthening structures for the delivery of ACSM interventions at all levels and strengthening community based social and behaviour change communication activities. Population Services Kenya under the Health Communication and Marketing (HCM) Program, a 5 year PMI USAID program, works with NMCP to roll out campaigns to increase utilization of malaria interventions by communities. PS Kenya implemented an evidence-based behaviour change campaign dubbed "Msimu wowote" that aimed at addressing risk perception through increasing consistent use of LLINs throughout the year with a focus in Nyanza, Western, and Coast regions. PS Kenya carried out a malaria SBCC effectiveness evaluation to determine the effectiveness of the campaigns using the KMIS 2015 as a baseline.

Description: Using a 360 "surround and engage" communication approach under the social ecological model, PS Kenya leveraged on a surround and engage strategy using a combination of existing communication messages and channels, creating multiple opportunities for behaviour change for caregivers of children under the age of 5 years. At individual level, focus was on individual barriers using community health volunteers (CHVs) who have been trained by the CHMT on an engagement technique, education through listening. At the household level, social support was leveraged as a tipping point for behaviour change using local vernacular stations in the key regions as well as the Healthcare channel

health facilities in the country. With approval from NMCP, short messages were developed and shared to be accessed through a web portal and could also be accessed live through a two-way interactive process with questions received from consumers and responded to by the PS Kenya with support from the NMCP ACSM. At the community level, the campaign created a supportive cultural and physical environment through different platforms. These included outdoor messaging using posters, digital screens in Coast, and branding of 10 *Nyaugenya* buses plying the Western region as support for consistent and correct net usage throughout all the seasons. At the societal level, the project aimed at shaping and influencing policies and regulatory frameworks through editorial coverage and continuous radio and TV expert interviews.

Lessons learned: The proportion of people who believe that they are at risk of malaria only during the rainy season decreased from 35% to 25% nationally with a notable reduction in the coast endemic region, (KMIS 2015), a direct contribution of this campaign. In addition, a baseline survey undertaken by HCM in 2018 showed 60% of respondents quoting the campaign's tagline as the most memorable campaign. Radio had the most reach at 58%, followed by CHVs at 32%, community events at 20%, and TV at 19%. Billboards were at 12%, followed by SMS at 11%, health facilities and bus branding followed at 10% and 2%, respectively.

Conclusion: Radio and CHVs were the most effective channels for health communication. Community health volunteers compliment radio with word of mouth, which has been proven as a very effective approach because it is based on current and realistic circumstances. Investments, however, need to be domesticated at the county level to ensure understanding and appreciation of this approach to maximize utilization of existing systems like the community health strategy. Complementing interpersonal communication and contemporary avenues like radio, and SMS that communities are attuned to need to be exploited as behaviour change is a process needing multiple channels to maintain and maximize opportunities for behaviour change.

Role of ACSM in Domestic Resource Mobilization for Malaria Control

Zeba Siaanoi, *Malaria No More*

Background: Funding for malaria control interventions in Kenya has declined over the last four years. This calls for developing innovative strategies to mobilize resources, especially from non-traditional sources. Domestic resource mobilization presents an opportunity that should be exploited, especially following devolution, where funding for health care services including for malaria control is now vested with the county governments. Malaria no More, a leading global advocacy agency whose ambition is to end malaria globally, has successfully demonstrated that it is possible to engage county governments to specifically allocate budget towards malaria control.

Description: In Kenya, Malaria No More started its advocacy initiative in July 2016. It piloted a model to promote advocacy for increased funding for malaria control interventions in Kwale and Busia Counties by engaging several stakeholders, including the civil society organisations for demand creation, the county assemblies for approval of budgets, and the Executive for political goodwill and buy-in. This engagement involved a series of capacity building initiatives to make a case for why the counties should invest in malaria control. The pilot was undertaken over an 8 month period. Some of the results from this initiative include an increased budgetary allocation totalling to Kenya Shillings 19 million in the two counties. After

the pilot, Malaria No More expanded the advocacy to Mombasa and Kilifi Counties to replicate the model. By June 2018, the four counties have increased their budgetary allocation to health, with close to Ksh 68 million going towards malaria control.

Lessons learnt: Some of the key lessons learnt include the importance of engaging the health leadership at the technical and political level and creating buy-in among the personnel involved in planning and budget making. In addition, advocacy to support constant follow-up with all actors, and keeping them engaged on the goings-on at the counties and embracing the CSO to amplify the agenda and apply soft pressure, are important considerations to support domestic resource mobilization.

Communication to Support Demand Creation for Malaria Services

Njenga M, *Njoki N, Mwangi J, Essendi H, Mdawida B.*

Background: The Kenya Malaria Strategy 2009-2018 recognizes strategic communication as an integral component to achieve the vision of a malaria free Kenya as outlined in its 5th strategic objective that seeks to increase the utilization of malaria control interventions to 80% by communities. From KMIS 2010 to 2015, there has been an increase in LLIN ownership from 57% to 63%; LLIN use from 32% to 48%; fever seeking behaviour for treatment within 24 hours from 59% to 72%; and accessing 3 doses of IPTp from 11% to 38%. However, the desired target of 80% utilization of all malaria interventions is yet to be achieved as communities are not adequately utilizing malaria control interventions due to varied barriers.

Description: A qualitative study was conducted in 2017 to determine the key sources and most trusted sources of information on net use, IPTp uptake, and case management among target populations. The study was conducted in areas representing three epidemiological zones, including highland epidemic (Kisii; Nandi, and Narok), coastal endemic (Kwale; Kilifi North, Kilifi, and Mombasa) and lake endemic counties (Kisumu, Migori, and Bungoma). A total of 47 focus group discussions, 32 key informant interviews, 18 in-home visits, and 12 in-depth interviews/journey mappings were undertaken among care givers of children under 5 years, decision makers, and pregnant women.

Lessons learned: In terms of net use, mass net distribution was the most quoted distribution channel for achieving universal coverage. Most people received information on net use from radio, TV, and posters. Interpersonal communication was the most trusted source for information on net use.

Few ANC clinics provided details of IPTp medication. Sources of information about IPTp included radio, television, health care workers at the health facility, CHVs, word of mouth, chiefs, and village elders. Trusted and preferred sources included health care providers, word of mouth from women who had used the IPTp drug, and media. On the other hand, key sources of information on malaria case management include health facilities, TV, radio, PS Kenya group, church, community health volunteers, their children, posters at the hospitals, drama at the market, posters displayed at chemists, posters displayed on the ferry, magazines, musicians, and roadshows. Sources preferred and trusted by respondents include health facilities, CHVs, school, radio, posters, religious intuitions, and women's groups.

Conclusion: Behaviour change communication should be cognizant of the most effective and trusted communication channels on net use, IPTp, and case management. Key decision makers and primary

caregivers should be targeted to facilitate behaviour change and increase utilization of malaria control interventions.

Vector Control

Emergence of Pyrethroid Resistance and Mitigation Efforts: Role of PBO Nets and Next Generation Nets in Sustaining the Efficacy of Long Lasting Insecticide Treated Nets in Malaria Control

Dr. Nabie Bayoh, *PAMCA*

Background: The control of malaria currently relies on a handful of insecticide classes and on pyrethroids in particular. All long lasting insecticide treated nets (LLINs) are treated with pyrethroids. The prevention of about 68% of the malaria cases from 2010-2015 has been attributed to the use of LLINs. There is growing concern that these advances may be disrupted or even reversed due to the emergence and widespread occurrence of pyrethroid resistance. Though it is still unclear how insecticide resistance will affect malaria cases and deaths, there is adequate justification to interrupt the trend. Here, the extent of pyrethroid resistance and current efforts to manage or control its impact on the efficacy of LLINs against local malaria vectors is presented.

Description: There has been a massive increase in the deployment of insecticide-based vector control tools in sub Saharan Africa. The number of ITNs delivered to endemic countries increased from 6 million in 2004 to 178 million in 2015. There has been a concomitant reduction in malaria cases and deaths but an increase in pyrethroid resistance among local malaria vectors worldwide. In Kenya, pyrethroid resistance has been reported in the lake and coast endemic zones, parts of central and northern regions. There is concern worldwide that if nothing is done and insecticide resistance eventually leads to widespread failure of pyrethroids, much of the progress achieved in reducing the burden of malaria would be lost. For this reason, a group of experts was convened by WHO in 2010 to identify technical strategies for preserving the effectiveness of the insecticides used for malaria control: One of the five strategies was to develop new innovative vector control tools. Efforts have since been made to develop new tools and alternative insecticide classes for LLINs with varying success.

Lessons learned: The first innovation in LLINs has been nets containing pyrethroids plus the insecticide synergist piperonyl butoxide (PBO). Studies have shown that PBO LLINs (Permanet 3.0 and Olyset Plus) are substantially better at killing insecticide resistant mosquitoes in some locations. Though PBO nets are more expensive compared to standard LLINs, a mathematical modelling study predicted that PBO nets will be cost effective. A second set of LLIN innovations include combining pyrethroids with a second insecticide or molecules with different mode of action (e.g., Olyset®Duo (permethrin and pyriproxyfen an insect growth regulator), Interceptor G2 (alphacypermethrin and chlorfenapyr, a pyrolle class of insecticide)). Both products are currently undergoing WHOPES evaluation.

Conclusions: There are currently very limited tools available for tackling resistance to pyrethroids in nets. To assist in the innovation process, programs should consider pilot implementation of available tools to generate additional evidence to guide decision making around future procurement and deployment and to facilitate product advancement. PBO nets and other new LLIN innovations should be tried in areas with high pyrethroid resistance and where it is currently not feasible to implement IRS.

Economic Evaluation of LLINs distribution channels in Kenya—Efficiency and Equity Outcomes in Malaria-Endemic Region, Western Kenya

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Background: In malaria endemic countries, long-lasting insecticide-treated bed nets (LLINs) have been distributed through various delivery channels. In Kenya, five channels of distributing LLINS have been used in the implementation of malaria control programmes, with variable results in population coverage. At the request of policy makers, we conducted a two-arm cost-effectiveness study to compare provider costs and household coverage (effects) of two combinations of five LLIN distribution channels in Kenya.

Description: We conducted a retrospective analysis from the provider perspective, comparing two combinations of five LLIN distribution channels: control arm where channels were mass campaigns, ante-natal clinics, social marketing, and commercial outlets; and the intervention arm was as above, yet, instead of a mass campaign, community health volunteers distributed the nets. A randomised post-intervention household survey and service provider questionnaires collected data on the number of nets or net vouchers distributed and the costs for each channel. Total bed nets per household and total and unit cost per channel were computed and major cost drivers were identified, as well as and the relative cost to the health system per channel. The cost per LLIN/voucher distributed was calculated using supplier reported numbers of nets/vouchers distributed, divided by total cost per channel. In the post-intervention household survey, information on household assets—to compute an asset index score—and on LLIN ownership, net use, and sources of nets was obtained. Household survey data was combined with cost data to estimate the cost per net distributed by each channel across the sub-county. Standard LLIN indicators in the control and intervention arms were compared and used to estimate the expected LLIN coverage outcomes throughout the sub-county and used to estimate the relative cost-effectiveness of each arms' contribution to increasing universal LLIN coverage. Likewise, equity impact of each channel and combination of channels was compared using a concentration index (CI).

Results: Significantly higher proportions of households had one net between two persons (UC), and significantly higher proportions of people and children under five slept under a net the night before the survey in the control arm compared with the intervention arm. MD channel was the most important source of nets overall and in all households, regardless of net coverage status in the pooled and control arms, whereas CHV was the most important source in intervention households, and the second most important source of net overall in the pooled and control arms. ANC was the next most important source of nets, with SM being the least important. CHV had the highest total cost of any channel ($208,979), followed by ANC ($188,447) and MD ($104,115). SM had the lowest total cost. Using supplier reported data on nets/vouchers distributed, MD had the lowest total cost per net distributed ($3.61), followed by SM ($5.16), CHV ($7.23), and ANC ($5.16). When household survey (demand side) data are used to estimate cost per net distributed, MD has the lowest cost per net distributed ($3.13), and CHV has the second lowest cost ($10.84), followed by ANC ($28.14). SM has the highest cost ($92.41). The average cost per house with one net between two people in the pooled population was lower ($22.39) in the

control arm than in the intervention arm ($30.41). The marginal cost per house with one net between two people was also lower in the control ($66.90) than the intervention ($83.44) arm. Net ownership in the sampled households revealed higher quantities of nets owned in wealthier households (CI = 0.024). CHV followed by MD appeared to be the least inequitable channels, although 95% confidence intervals overlapped for the CI on all channels, limiting the confidence of these findings.

Conclusion: Concerted effort with multiple distribution channels can achieve high levels of net ownership and contributes towards achieving policy goals of universal LLIN coverage. Mass distribution campaigns plus other channels are the most effective and cost-effective way to achieve universal coverage. None of the channels is pro-poor; however, community-level distribution appears to be more equitable than the other channels, but the difference is not statistically robust. The main limitation on distribution of nets was not the total capacity of each channel, but rather the quantity of nets available per distribution channel. Likely, this has reduced the cost effectiveness of some channels and limited the effects of economies of scale. The study shows that combinations of multiple channels are required to reach and maintain high levels of LLIN use and achieve equitable LLIN ownership.

Strategies for Achieving Universal Coverage Role of Continuous Net Distribution

Njenga M, *Mwangi J, Njoki N, Essendi H, Mdawida B.*

Background: Long lasting insecticidal nets (LLINs) are recognized as a core malaria prevention tool for use by populations at risk of malaria in Kenya and globally. The Kenya Malaria Strategy 2009 – 2018 targets to have at least 80% of people living in malaria risk areas using appropriate malaria preventive interventions by 2018. Channels for distribution of LLINs in order to achieve and sustain universal coverage include mass distribution every 3 years, routine distribution through antenatal care and child welfare clinics, and social marketing of subsidized LLINs. From KMIS 2010 to 2015, there has been an increase in LLIN ownership from 57% to 63%; LLIN use from 32% to 48%. Sustaining high coverage and use levels is still a challenge; therefore other complementary distribution mechanisms are needed to reach the 80% target levels and sustain them over time.

Description: Through PMI, USAID funding and in collaboration with NMCP and Busia County, PS Kenya, under the Health Communication and Marketing Program, piloted the feasibility of continuous community net distribution (CCND) in Samia subcounty, Busia County from 2013 to 2015. The subcounty was divided into intervention and control sites. Community health volunteers (CHVs) in the intervention sites were sensitized on continuous LLINs distribution. A pull-driven distribution mechanism was adopted, and LLIN need was determined at household level using CHVs. CHVs verify the net need by visiting households and upon verification on need for a net, give a coupon to the HH head to redeem the LLIN at the nearest distribution point for free. Trained CHVs integrated active interpersonal communication to encourage net use at both household level and at small group sessions.

During the pilot period, a total of 28,928 nets were distributed to 12,315 households in the intervention area. CHVs saved 4,013 nets that were found viable (i.e., still in usable condition or torn but repairable).

Lessons learned: There was an increase in universal net coverage (1 net for every 2 people) in the intervention site from 50.5% to 78.7% and a drop in the control site from 49.7% to 44.6%. In addition,

85% of respondents indicated confidence to hang a net at end line as compared to 73% at baseline. This is attributed to the interpersonal communication sessions facilitated by the CHVs.

Reported net use (HH members who slept under bed net the previous night) increased in the intervention sites from 91% to 96%, while a 2-point reduction was observed in the control sites during the same period from 88% to 86%. There was also an increase in reported net use for children in the intervention site from 70.1% to 86.8% and a drop in the control site from 70.9% to 65.3%.

Conclusion: Net ownership and use was found to be higher in the intervention sites after CCND, indicating that continuous community net distribution had positive impact on net ownership and use. CHVs are pivotal in implementing a CCND program. Continuous community net distribution should be utilized as a complementary channel to sustain universal LLIN coverage.

Entomological Impact of Indoor Residual Spraying with Pirimiphos Methyl (Actellic 300CS®) in Migori County, Western Kenya

Bernard Abong'o, *John E. Gimnig, Steve Torr, Bradley Longman, Diana Omoke, Feiko ter Kuile, Eric Ochomo, Kiambo Njagi, Robert Perry, Martin J. Donnelly, Richard Oxborough*

Background: Indoor residual spraying (IRS) is one of the major strategies for malaria prevention in at risk populations. In western Kenya, IRS with an organophosphate–pirimiphos methyl (Actellic 300CS®) – was conducted in 2017 in Migori County after IRS with pyrethroid insecticides was ceased due to increasing pyrethroid resistance.

Description: Entomological monitoring was conducted by indoor CDC light trap and pyrethrum spray collection (PSC) before and after IRS in six treatment sites and six control sites. Additional human landing collections (HLC) were performed to assess biting behaviour, together with larval collections for insecticide resistance testing. The residual effect of the insecticide was assessed monthly by exposing susceptible *An. gambiae s.s.* Kisumu strain to sprayed surfaces.

Results: IRS was shown to be highly effective against *An. funestus,* with a 94% decline in indoor host seeking and 97% decline in indoor resting in the treatment vs control sites post-IRS. Before IRS, *An. funestus* comprised over 80% of all *Anopheles* mosquitoes collected in both intervention and non-intervention sites. After IRS, *An. arabiensis*, whilst not showing a significant increase in numbers, accounted for 80% of *Anopheles* collected by PSC and over 60% of those collected by CDC light trap in the sprayed sites post IRS. There was a significant reduction in sporozoite infection rates post IRS, with no sporozoite infections detected in sprayed sites after IRS. Parity rates dropped from over 90% before spraying to under 10% post-spray, while exposure to bites by *An. funestus* ware reduced to undetected levels post-spray. *Anopheles funestus* and *An. arabiensis* were fully susceptible to pirimiphos methyl and resistant to pyrethroids. The residual effect of the insecticide was 10 months on mud and concrete walls, with over 80% mortality of exposed mosquitoes, indicating appropriately timed IRS with this insecticide could provide protection through the two main transmission seasons.

Conclusion: IRS with Actellic 300CS® is highly effective against pyrethroid resistant *An. funestus,* substantially lowing entomological indicators of transmission. While there was negligible impact on

An. arabiensis, An. funestus was the primary malaria vector in the area and the near complete elimination of *An. funestus* populations is likely to have resulted in substantial malaria case reductions

Anopheles Funestus **Mosquitoes and Malaria Transmission in Kenya**

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Background: Active entomological surveillance remains integral to effective intervention strategies against malaria control and elimination. This is important to inform fine-tuning of control strategies in the event of changing local conditions or discern cryptic species contributing to stealth transmission.

Description: We applied molecular approaches to analyse the bionomic traits (species composition, *Plasmodium* infectivity, blood meal sources) and genetic structure of wild-caught *A. funestus senso lato* (s.l.) specimens from multiple sites in Kenya, covering the major malaria endemic areas of western, Rift Valley, and coastal areas.

Lessons learned: *Anopheles funestus* s.s. remains the main vector species in the Funestus group; however, we found occurrence of *An. longipalpis* C and for the first time, naturally infected with *Plasmodium falciparum*. Also, we unravel a previously unreported potential malaria vector in the Funestus group whose *COI* or ITS2 sequences did not match those in reference sequence databases i) found to be infected with the *Plasmodium* parasite and ii) displayed high human-feeding abilities. *Anopheles funestus* was found to segregate into 3 unique genetic clusters in Kenya, based on microsatellite analysis, with the clusters mirroring the degree of *Plasmodium* infectivity and thus, malaria prevalence in Kenya.

Conclusions: Our findings underscore the importance of active surveillance through application of molecular approaches to unravel novel parasite-vector associations and genetic structuring with important implications for effective malaria control and elimination.

Malaria in Pregnancy

WHO Guideline on Antenatal Care (2016) and Its Impact on the Provision of Intermittent Preventive Treatment for Malaria in Pregnancy (IPTp)

Peter Ouma[1] *and Peter Njiru*[2]

1. *Maseno University School of Public Health and Community Development*
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Background: The delivery of high-quality antenatal care (ANC) is essential for successful malaria in pregnancy (MiP) programming. WHO's recent recommendations on antenatal care for a positive pregnancy experience (2016) now promote a minimum of eight contacts between pregnant women and the health system versus the previously recommended four ANC visits. Since delivery of interventions for malaria prevention and control in pregnant women is routinely done at the antenatal care (ANC) platform, fostering a strong partnership between the National Malaria Control Program and the National Reproductive Health Program is imperative for good program outcomes. While the shift from 4 to 8 ANC visits presents ample opportunity for delivery of IPTp, it may also lead to confusion of on the part

of the health care worker on when to provide intermittent preventive treatment for malaria in pregnancy (IPTp). In this presentation, we highlight the background, the features, and implications of this new model on the prevention of MiP. In addition, we aim get a consensus which may lead to a uniform guideline for routine IPTp implementation in the context of this new model.

Innovative Approaches to Support CHVs to Facilitate Early Referral for Pregnant Women

Dr. Augustine Ngindu, *Jhpiego Kenya*

Background: Malaria in pregnancy is associated with poor pregnancy outcomes, including intra-uterine growth retardation, anaemia, stillbirth, and neonatal death. The Kenya malaria strategy recommends that all pregnant women in the 14 malaria endemic counties receive at least three doses of sulfadoxine pyrimethamine at an antenatal care clinic. The proportion of pregnant women receiving at least 3 recommended doses of IPTp has remained low 38% (KMIS 2015). In an effort to improve IPTp coverage, the country has been using CHVs in selected sites as an innovative approach to promote MIP at community level.

Methods: MCHIP in a pilot study 2012 - 2013 used CHVs in Bungoma to sensitize pregnant women to use IPTp to reduce effects of malaria in pregnancy. There was increase in IPTp coverage from the known level of 25% in 2010 to 63% in 2013, but 52% of the pregnant women started ANC attendance in the 3rd trimester. MCSP in 2014-2017 replicated the Bungoma experience on use of CHVs in 3 counties—Kisumu, Homa Bay, and Migori—focusing on dissemination of social behaviour change communication (SBCC) messages to change their health seeking behaviour in start of ANC attendance from third to first trimester. In an effort to influence change in start of early ANC attendance, CHVs identified pregnant women, registered, followed them up monthly to ensure they attend ANC visits as scheduled, and referred defaulters and late starters for ANC. Data quality audits were conducted periodically to check on the quality of data collected by CHVs. Data on 1st ANC attendance between 2015 and 2017 were collected from ANC registers to determine any change in ANC attendance. Data on proportion of pregnant women receiving IPTp1 and IPTp2 doses were taken from DHIS 2.

Results: The CHVs reached 259,389 out of an expected 450,808 pregnant women with the SBCC messages. Data on 1st ANC attendance showed that there was minimal change in proportion of women starting in 1st trimester 11%-12%, with an increasing trend in those starting in the 2nd trimester 51%-54%, and a reducing trend in those starting in the 3rd trimester 38%-34%. DHIS 2 data showed that IPTp uptake at facility level increased by >25% (IPTp1 51%-79%, IPTp2 42%-68%).

Conclusion: Use of CHVs who disseminate SBCC messages can be an important tool in influencing changes in health-seeking behaviour, as demonstrated in the project with shifts in the proportion of pregnant women starting 1st ANC attendance from third to second trimester. The CHVs' efforts may be an important contributing factor to the increase in uptake of both IPTp1 and IPTp2 by over 25 percentage points for the 4 counties during the 3-year project period. The use of CHVs to sensitize pregnant women can be considered a good practice that can be used to scale up uptake of interventions.

Use of ACTs in Pregnancy During the First Trimester

***Ben Andagalu**, Hoseah Akala, Bernhards Ogutu, KEMRI/USAMRU*

Background: Malaria, especially *Plasmodium falciparum* infection, during pregnancy is associated with severe effects on maternal and foetal health. Therefore, it is important to ensure that effective prevention measures and treatments reach pregnant women in malaria endemic areas. The World Health Organization (WHO) recommends that all cases of malaria during pregnancy should be treated promptly with an effective anti-malarial drug. In the general non-pregnant population, artemisinin-based combination therapy (ACT) is the currently recommended first-line treatment for uncomplicated *P. falciparum* malaria and is known to be effective and well tolerated ACT is also recommended for the treatment of *P. falciparum* malaria in pregnancy, except in the first trimester of pregnancy.

Description: Preclinical studies have demonstrated that artemisinin derivatives are embryotoxic and can induce foetal death and congenital anomalies at doses close to the therapeutic range in multiple animal species. As a result, the WHO recommends the use of quinine with clindamycin as the first line treatment for uncomplicated malaria in the first trimester of pregnancy—ACTs can only be used if the recommended regimen is not available or not tolerated. This recommended regimen is fraught with compliance problems and alternatives need to be sought.

A review of the literature on the use of ACTs in the first trimester of pregnancy and safety outcomes is presented here.

Conclusion: The data are from observational studies conducted in various parts of the world. The data seem to suggest that ACTs may be safe to use even in the first trimester. The contentious issues that remain to be tackled include how much more data, and what type of data, are required to conclusively make decisions regarding whether ACTs should be used in the first trimester.

Experience and Lessons Learnt in Implementing Community IPTp

Samwel Onditi

Background: Globally, despite clear gains in malaria control, the delivery of malaria in pregnancy (MiP) interventions remains suboptimal. While Kenya has made progress in advancing MiP programs, intermittent preventive treatment in pregnancy (IPTp) coverage remains significantly low, which prevents Kenya from achieving its global targets. Currently, IPTp coverage has remained below the national target of 80% despite a high ANC attendance of 94% in women who receive services from a skilled provider. The Kenya Malaria Indicator survey 2015 showed that only 38% of pregnant women received the currently recommended three doses. It is therefore important to understand contributors to this continued low uptake and explore alternative ways to enable further progress.

Description: The Kisumu West subcounty district medical team, in collaboration with PATH, designed and implemented a community-based IPTp distribution project to increase ANC attendance and IPTp uptake. The project conducted a qualitative assessment to better understand the social and cultural context impacting MIP program implementation. Subsequently, the project collected quantitative data from community health volunteers (CHVs) in four community health units (CHUs) linked to three health facilities (HFs). The CHVs were engaged to promote ANC uptake and distribute IPTp to pregnant

mothers. Technical support included training, supervision, and the development of data collection tools. Existing data were used to monitor ANC attendance and IPTp uptake using the DHIS 2 database between December 2013 and September 2014.

Lessons learned: Community health volunteers undertook the task with enthusiasm as this provided them with a sense of recognition and satisfaction. The community accepted the CHVs' distribution and appreciated their knowledgeability on ANC and IPTp. Pregnant women would skip follow-up visits and advise their peers similarly if the 1st visit encounter was unpleasant. Most pregnant women have no reservations in taking the SPs if they can access them even from CHVs. There was no decrease in ANC attendance noted, and ANC4 was higher in intervention than non-intervention HFs. The project noted data quality concerns with the DHIS 2 as it does not indicate if women were reached early or late in pregnancy.

Conclusions: There are a complexity of reasons for low ANC compliance and low IPTp-SP uptake, but CHVs can play a vital role in increasing IPTp-SP uptake without decreasing ANC attendance in the link health facilities.

Epidemic Preparedness and Response

Experience and Lessons Learnt in Implementing EPR in Kisii County

Dr. Godfrey Otomu, *CHD, Kisii County*

Background: Kisii County is one of the malaria epidemic prone regions of Western highlands of Kenya where malaria transmission is seasonal, with considerable year-to-year variation. The county has a total of Nine (9) subcounties, and EPR strategy is being implemented in all these subcounties. Malaria is still one of the major health problems in Kisii County, being number three among the top ten diseases in both <5 years and >5 years. This area usually experiences two peaks of epidemics, normally between April-June and September- November of every year due to both long and short rains received, respectively. This is attributed to climatic conditions, which favour sustainability of minimum temperatures around 18º C, that sustain vector breeding, resulting in increased intensity of malaria transmission. The whole population is therefore vulnerable, and case fatality rate during an epidemic can be up to ten times greater than those experienced in regions where malaria cases regularly occur. In response to this, the county developed an EPR plan, which has been implemented over the last five years.

Description: County management designated a Malaria Coordinator in each subcounty, and provided training in Epidemic Preparedness and Response (EPR), with support from the County Malaria Control Coordinator. At least five (5) health facilities were selected in each subcounty to be sentinel sites for weekly malaria monitoring with the help of the Subcounty Health Management Teams. Baseline data were collected retrospectively for the previous five years for threshold setting. Based on this structure, the county has been monitoring malaria epidemic trends from the 45 sentinel health facilities on a weekly basis. The trend reports are disseminated from the facility level to the subcounty, county, and finally to the NMCP personnel. Other coordination structures that have facilitated this include the formation of malaria TWG, initiation of a county reference laboratory, training of quality assurance personnel from each subcounty, DVBD unit with trained personnel for mosquito vector surveillance (female *Anopheles*),

and ensuring availability of drugs for malaria case management through CHVs and at the health facility level.

Lesson learnt: Good leadership is critical for sustained epidemic monitoring, detection, and response. It also plays an important in the coordination of outbreak management and capacity building in key areas relating to EPR. In addition, team work and total involvement of all the key players is critical to success of EPR at the county level.

Conclusion: Good plans both for EPR and SBCC can easily be used for resource mobilization to help in controlling epidemics in the country. Given enough support for activities such as focalized IRS, personnel capacity building for more skills and knowledge, Kisii County can evidently control malaria cases and hence be rated as one of the pre- elimination counties in Kenya.

New Systems and Technologies for Malaria Early Warning and Tools for Decision Support System for Epidemic Response

Nzioka M. Solomon, *WHO/Kenya, National Professional Officer, Public Health and Environment*

Background: In Kenya, the equatorial climate factor brings with it the rain characteristics of the country with two annual rainy seasons, namely long rains from April to June and short rains from October to December. The rainfall is sometimes heavy around April to May, causing annual flooding that is usually accompanied by an outbreak of malaria and diarrheal diseases within certain geographic regions. At the international level, the topical issue of the 21st century is the immediate and long-term effects of climate change in the world and specifically to developing countries that are already overburdened by other communicable diseases such as malaria.

Description: Malaria is the most important vector-borne disease in the world today, causing an estimated three million deaths worldwide, 90% of which occur in sub-Saharan Africa (Greenwood and Mutabingwa 2002). It is a disease of tropical and temperate countries between the latitudinal limits of northern Korea and southern Africa, with prevalence increasing generally towards the equator. In the absence of sustained population-based interventions, increasing temperatures and changes in the hydrological cycle associated with climate change are likely to increase the number and intensity of outbreaks of malaria in Kenya in fragile geographic regions such as the highlands. To this effect, the World Health Assembly passed specific resolution WHA61.19, which provides for governments to strengthen the capacity of health systems in monitoring and minimizing public health impacts of climate change. As a result, WHO supported implementation of a global initiative on climate change and adaptability to protect human health (2010-2016), a project implemented in Kenya amongst other six countries.

Lessons learned: The Kenya project provided insights that any efforts to define the association between malaria and climatic factors that use annual means or seasonal means were likely not to detect any strong associations. The study further established that rainfall increased precipitously by a trend factor of 2.4 on in inter-monthly autoregressive series. Strong models explaining the inherent high variations in inter-monthly and inter-annual malaria, rainfall, and temperature were developed using time-series analysis. Finally, two malaria prediction models were developed, a three-month in advance prediction aimed at finding high utility in primary malaria epidemic alerts. This is envisioned to galvanize public health

preventive action at times of an impending positive epidemic by providing at least three months for health action.

Conclusions: It is important that key climate-sensitive health risks are identified with enough lead-time for effective response, which requires that climate change-induced changes and drivers of health-risks are determined, as well as climate data and related health data are reported in timely and reliable manner. The resulting models were effectively validated and found to have high utility at zone altitudes between mean altitudes 2200 M and 2400 M. The results compared very closely with published literature.

Malaria Risk Mapping and Stratifications: Lessons for Malaria Control

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Background: Variations in the intensity of malaria transmission in Kenya require tailoring of interventions appropriate to the corresponding level of transmission necessitating sub-national stratification of malaria burden based on the analysis of past and contemporary malaria data, risk factors, and the environment. Thus maps of malaria risk obtained through robust approaches are needed to assess the impact of control and identify areas where targeted malaria control strategies require adaptation to maximize future impact. We analysed *Plasmodium falciparum* prevalence (*Pf*PR) data and highlighted areas confidently within two important policy relevant thresholds to allow either the revision of malaria strategies to those that support pre-elimination or those that require additional control efforts.

Description: We assembled 5020 *Pf*PR surveys in 3701 communities between 1980 and 2015 in Kenya. We fitted a spatio-temporal geostatistical model to predict annual malaria risk for children aged 2–10 years ($PfPR_{2–10}$) at 1x1 km spatial resolution from 1990 to 2015. Changing $PfPR_{2-10}$ was compared against plausible explanatory variables. The fitted model was used to categorize areas with varying degrees of prediction probability for two thresholds: $PfPR_{2-10}$ <1% and $PfPR_{2-10}$ ≥30%.

Lessons learned: Nationally, there was an 88% reduction in the mean modelled $PfPR_{2-10}$ from 21.2% (ICR: 13.8-32.1%) in 1990 to 2.6% (ICR: 1.8-3.9%) in 2015. The most significant decline began in 2003. Declining prevalence was not equal across the country and did not directly coincide with scaled vector control coverage or changing therapeutics. Over the period 2013-2015, of Kenya's 47 counties, 23 had an average $PfPR_{2-10}$ of <1%; 4 counties remained ≥30%. Using a metric of 80% probability, 8.5% of Kenya's 2015 population live in areas with $PfPR_{2-10}$ ≥ 30%, while 61% live in areas where $PfPR_{2-10}$ is <1%.

Conclusions: Kenya has made substantial progress in reducing the prevalence of malaria over the last 26 years. Areas confidently and consistently with <1% $PfPR_{2-10}$ require a revised approach to control and a possible consideration of strategies that support pre-elimination. Conversely, there remains intractable

areas (*Pf*PR$_{2-10}$ ≥30%) where current levels and approaches to control might be inadequate and will require expansion of vector control and use of other innovative approaches to control both the parasite and the vector.

Social Accountability for Malaria Control at the Community Level

Taking Malaria to the Community: A Rapid Analysis of the Kenya Malaria Strategy Commitment to Gender and Human Right

Edward W. Mwangi, *Kenya NGO Alliance Against Malaria*

Background: Public health programs like malaria are refocusing their energies to address their program through different lenses arising from emerging health models that seek to address the target populations holistically. Attention to human rights, gender dynamics, and community engagement are becoming an essential cornerstone in designing of the 21st public health programs. The Sustainable Development Goals provide a central platform to address malaria from multidimensional perspectives by defining the drivers of malaria within the concept of "leave no one behind."

Description: The assessment aimed to examine how issues relating to gender, human rights, and community engagement were addressed in the Kenya Malaria Strategic Plan 2014-2018. While acknowledging that all public health programs, including malaria, are expected to incorporate the above issues, there is need for deliberate implementation of these principles by identifying specific activities that seeks to deliver the intervention.

Results: Based on this assessment, a key achievement of the KMS 2014-2018 in relation to attention to gender, human rights, and community engagement includes the analysis of community population survey data by endemicity, locale, wealth, sex, and age-related dataset, resulting in targeted/focused interventions developed and rolled out in the implementation of KMSP. The inclusion of community rights and gender in the KMSP as a fundamental consideration for malaria intervention is in the right direction and should be followed with a tracking mechanism for realizing these principles. Social protection programs initiated by the government targeting vulnerable populations in Kenya such as free maternity programs, NHIF for the vulnerable population amongst others. However, it was noted that the malaria program focuses on universal coverage for malaria intervention in both prevention and case management; there are no sufficient data to account for a population that is marginalized or vulnerable to other social-cultural factors such as disability, poverty, or locality.

Conclusions: The NMCP should prioritize aid memoirs and working framework with crucial civil societies for delivery of the malaria interventions, especially for the vulnerable populations. The NMCP should have a gender framework building on the MOH gender policy/strategy for its program interventions. The malaria partners and stakeholders should be trained on integrating gender into malaria programming. Lastly, there is a need to ensure that the national health information system incorporates dissemination of routine data by sex/gender and age in the data summary tools.

Experiences from Malaria Implementation at Community Level in the Coastal Region in Kenya

Jasho Bomu, *Coastal Malaria Advocacy Network*

Background: Community involvement has become an essential component of the National Malaria Control Strategy in Kenya, resulting in the organization of groups charged with addressing mosquito and malaria-related concerns within the community. Community health volunteers are among the trained community members on case management of malaria who should identify by tracking, testing, and treating malaria cases at the household level.

Description: The Coastal Malaria Advocacy Network has been supporting community groups to participate in the malaria vector control activities such as treating of water bodies with used engine oil to limit larvae behind adult mosquitos. Other activities that are undertaken by the community groups include spraying the houses with permethrin obtained from social enterprise and private sector, the sewing, dipping, and selling of insecticide-treated bed nets (ITN), the removal of stagnant water bodies, the organization of community clean-up days, and the development and sale of products such as neem soap, which acts as a mosquito repellent.

Lessons learned: Several lessons have been learnt that can inform community mobilization towards malaria control at the local level. First, there is good understanding among the community that malaria is a serious problem that requires their support to overcome. Second, community involvement and uptake of malaria interventions is influenced by opinion leaders at different levels, including parents and other caregivers of children, influencers such as teachers, health workers, and the media, and other communicators, the community leaders, local administrators, local government officials, and the health care workers

Conclusions: Community groups are willing to participate in control operations, but lack government and technical support. There are obvious benefits of strengthening the capacity of CSOs to engage with malaria control activities. Inter-sectoral support from MOH, private sector, and other stakeholder is needed to support the CSOs in mobilizing communities for positive malaria prevention practices.

Role of Civil Society Organizations and Communities in Strengthening Health Systems in High Malaria Transmission Areas

Erick Okoth, *Blue Cross Nyatike*

Background: CSOs and community organizations have a unique ability to interact with affected communities, react quickly to community needs and issues, and engage with affected and vulnerable groups. They provide direct services to communities and advocate for improved services and policy environments. This enables them to build a community's contribution to health, and to influence the development, reach, implementation, and oversight of public systems and policies, thus contributing to achievement of sustainable development goals. CSOs are increasingly implementing interventions that encourage sustainability of responses, empower key populations, and promote health, social, and structural changes in the fight against diseases, especially malaria, HIV, and TB.

Description: As assessment of the contribution of CSOs and communities in strengthening health systems in high malaria transmission areas of Kenya was carried out in two counties, Migori and Kilifi,

representing the lake and coast endemic regions. Twenty-four (24) CUs were selected based on their proximity to Lake Victoria and Indian Ocean. Document reviews and on-site assessments and observations were conducted using a structured tool. The five main assessment areas were: malaria activities implemented in the county and how the activities support the health systems, malaria specific advocacy activities conducted, number of CHVs trained on CCMM and are practicing, number of health care workers supported.

Results: A total of 870 CHVs out of the 1770 in Migori were trained and actively involved in implementing community case management of malaria (CCMM). 75% of CHVs also support their link health facilities through the CHV link desk where they support in monitoring growth, give health talks, and sometimes support in triaging of clients. CSOs supported by GF Malaria are supporting DQA and support supervision in all the 47 counties. The number of under-fives treated with ACT on the basis of a positive RDT increased by 51%, from 993 in 2016 to 2020 in 2017. Similarly, the number of over 5 years (RDT+ve) cases treated with ACT increased by 46% from 1290 in 2016 to 2401 in 2017.

Conclusion: CSOs and community health units play a critical role in malaria prevention and HSS in lake and coast endemic regions through advocacy of increased allocation for malaria specific activities, supporting DQA and support supervision, payment of airtime for malaria data in DHIS, increase access and uptake of malaria services, create strong linkages with care, spread health promotion messages, and reduce barriers and stigma related to net use, malaria testing and treatment.

Experiences of Malaria Control in Low Transmission Settings—A Case Study of Mwea Division in Kirinyaga County

Georgina Ngugi, *Tom Nabwire: Low and Seasonal Transmission Advocacy Network*

Background: Malaria remains a leading cause of morbidity and mortality in Kenya. In Mwea Division, for instance, malaria is among the three leading causes of morbidity in the division, accounting for 21.6% of the cases (Kirinyaga CIDP, 2013). Land use and other human activities are making the previous low-risk regions to present a conducive environment for malaria transmission. These two factors have resulted in exposing populations that traditionally were not exposed to malaria to the risk of infection, resulting in high morbidity in the event of transmission occurring.

Description: An open-ended questionnaire and focus group discussions to gather information on the community knowledge of malaria control strategies in Mwea, including the role of the vector in malaria transmission, was undertaken.

Findings: Results of the findings showed that malaria was perceived to be a significant health problem in the study area by 90% of respondents, and 93% of respondents recognized the role of mosquitoes in malaria transmission. Several misconception relating to how malaria is transmitted were reported, which might undermine the uptake of malaria control interventions in these areas. The misconceptions include malaria such as being rained on (11%), wet and cold conditions (8%), taking of raw foods like raw groundnuts or taking fruits in early cold mornings (5%), and not putting heavy clothes during cold moments (3%).

Conclusion: There is a growing need to sustain investments in malaria control in low transmission areas to prevent an upsurge of malaria transmission. The modification of the build environment and other land use practices, such as irrigation schemes and construction of dams, is leading to increased malaria transmission. Community based organizations can play an important role in educating the community on malaria control strategies to create awareness and promote uptake of appropriate malaria control interventions.

APPENDIX 6: KENYA NATIONAL MALARIA FORUM PROGRAM

Special Kenya Malaria Forum
Venue: Hotel Intercontinental, Nairobi
2018 Programme

DAY 1, SEPTEMBER 18, 2018

Arrival and Registration, 8–8:30 a.m.

Main Plenary, Mara North Ballroom
Chair: Dr. Peter Cherutich
8:30–10 a.m.
Opening Remarks:

1. NMCP
2. COG
3. Director KEMRI
4. USAID Kenya East Africa Representative
5. WHO Representative
6. DMS
7. PS
8. CAS

Tea Break, 10–10:30 a.m.

Main Plenary Emerging Issues
10:30 a.m.–1 p.m.

Chair: KEMRI Director
Rapporteur: Dr. Rebecca Kiptui

1. Status of pilot malaria vaccine testing in Kenya: Emerging issues and opportunities, **Dr. Rose Jalango**, **MoH (NVIP)**
2. Planned evaluation of MVIP, **Dr. Dan James Otieno, WHO, MVIP**
3. Larvae source management for malaria pre-elimination, **Dr. Kiambo Njagi, NMCP**
4. Role of seasonal malaria chemo suppression (SMC) in the Kenyan setting, **Ben Andagalu, USAMRU, Kenya**
5. Moving towards malaria elimination in Kenya: Challenges and opportunities, **Dr. Peter Ouma, Maseno University**
6. Expanding the vector control toolkit: New tools for vector control, **Dr. Evan Mathenge, KEMRI**
7. HIS capacity strengthening: Lessons learnt and way forward, **Dr. Jim Thomas, MEASURE Evaluation**

Lunch Break, 1–2 p.m.

Concurrent Sessions
2–4 p.m.

Session 1: Case Management/Vaccines
Chair: Dr. Beatrice Mutai
Rapporteur: Samuel Kigen

Lessons learnt in strengthening community case management using the community strategy, **Jared Oule, AMREF Health**

Innovative approach to improve antimalarial use in the retail sector, **Joseph Kipkoech, Moi University, School of Public Health**

Access to affordable malaria medicines and diagnostics through the private sector, **Patricia Njiri, CHAI**

Monitoring quality of care for OPD and IPD: Lessons learnt and utility for programming, **Dr. Walter Otieno, USAMRU-Kenya**

Lessons learnt in implementing quality of care surveys and their utility for programing, **Prof. Dejan Zurovac, KEMRI WT**

Session 2: Surveillance, Monitoring, Evaluation, and Operations Research
Chair: Dr. Rebecca Kiptui
Rapporteur: Hellen Gatakaa

Barriers to sharing research evidence with policy makers researchers' perspectives, **Dr. Evan Mathenge, KEMRI**

The quality of inpatient data from HIS: Challenges, opportunities and way forward, **Samuel Cheburet, HIS, MOH**

The quality of laboratory data in the HIS: Challenges, opportunities, **Nancy Amayo, MOH**

Limited capacity to demand and use data at the county level, **Lilyana Dayo, CMCC, Kisumu**

Use of geospatial analysis to drive demand and use of data for decision making, **Dr. Rose Nzyioka, HIGDA**

Improving completeness in reporting and quality of data at county level, **Dr. Francis. Njoroge, CMCC, Garissa**

Role of entomological surveillance in malaria elimination, **Prof. Charles Mbogo, KEMRI WT**

Tea Break, 4–4:15 p.m.

Concurrent Sessions
4:15–5 p.m.

Session 3: Advocacy, Communication, and Social Mobilisation
Chair: Ben Adika
Rapporteur: Jacinta Opondo

Socio behavioral issues affecting adherence to treatment guidelines, **Prof. Grace Irimu, KEMRI WT**

Strategies for sustaining gains in net use through socio-behavior change communication (SBCC), **Nancy Njoki, PS Kenya**

Role of ACSM in domestic resource mobilization for malaria control, **Zeba Siaanoi, Malaria No More**

Communication to support demand creation for malaria services, **Dr. Margaret Njenga, PS Kenya**

Session 4: Surveillance, Monitoring, Evaluation, and Operations Research
Chair: Dr. Rebecca Kiptui
Rapporteur: Hellen Gatakaa

Strengthening surveillance system in preparation for malaria elimination, **Dr. Sophie Githinji, MEASURE Evaluation**

Lessons learnt in capacity building for entomological surveillance at the county level, **Lenson Kariuki, VBDCU**

Spatial and temporal analysis of malaria in Turkana county based on routine reporting data, **Dr. Wendy O'Meara, Moi University, School of Public Health**

Temporal and spatial antimalarial drug sensitivity in Kenya, **Dr. Hoseah M. Akala, KEMRI/USAMRU**

Molecular surveillance of ACTs resistance in Kenya, **Dr. Lynette Isabella Oyier, KEMRI WT**

Wrap up for the day
5–5:10 p.m.

DAY 2: SEPTEMBER 19, 2018
Venue: Mara North Ballroom

Main Plenary, Mara North Ballroom
Chair: Dr. Willis Ahkwale
Rapporteur: Deborah Ikonge
8–10 a.m.

1. Exit strategy for IRS in Uganda: Experience and lessons learnt, **Dr. Agaba Bosco, National Disease Control, Uganda**
2. Barriers to uptake of research evidence in policy making, **Dr. Solomon Nzioka, WHO**
3. Domestic resource mobilization for health: Lessons for malaria program funding, **Daniel Mwai, Independent Consultant**
4. Guidance on resource flow for malaria control from treasury to the counties, **Stephen Muiruri, The National Treasury**
5. Challenges and opportunities for malaria commodity management at the county level, **Victor Sumbi, Chemonics**

Tea Break, 10–10:30 a.m.

Concurrent Sessions
10:30 a.m.–12:30 p.m.

Session 5: Vector Control
Chair: Dr. Luna Kamau
Rapporteur: Damaris Matoke

Emergence of pyrethroid resistance and the way forward, **Nabie Bayoh, PAMCA**

Economic evaluation of LLIN distribution channels in Kenya, **Dr. Vincent Were**

Strategies for achieving universal coverage; role of continuous net distribution, **Dr. Margaret Njenga, PS Kenya**

Entomological Impact of IRS with Actellic 300 CS in Migori County, **Bernard Abongo, AIRS, Kenya**

Anopheles funestus mosquitoes and malaria transmission in Kenya,
Dr. David Tchouassi, ICIPE

Session 6: Malaria in Pregnancy
Chair: Dr. Lynette Isabella
Rapporteur: Dr. Esther Kinyeru

Implementation of the new ANC+ model: Implication for malaria control, **Dr. Peter Ouma, Maseno University**

Innovative approaches to support CHVs to facilitate early referral for pregnant mothers, **Dr. Augustine Ngindu, Jhpiego Kenya**

Use of ACTs in pregnancy during the 1st trimester, **Ben Andagalu, USAMRU, Kenya**

Experience and lessons learnt in implementing community IPTp, **Dr. Samuel Onditi**

Lunch Break, 12:30–2 p.m.

Concurrent Sessions
2–4 p.m.

Session 7: Epidemic Preparedness and Response
Chair: Dr. Steve Munga
Rapporteur: James Sang

Experience and lessons learnt in EPR at the county level, **Dr. Godfrey Otomu, CDH Kisii**

- Sustained epidemic monitoring, detection and response
- Coordination of outbreak management
- Skills and capacity gaps in threshold setting
- Investment for EPR at the county level

New systems and technology for malaria early warning and tools for decision support system for epidemic response, **Dr. Solomon Nzioka, WHO**

Malaria risk mapping and stratifications: Lessons for malaria control, **Peter Macharia, KEMRI WT**

Session 8: Accountability for Malaria Control at the Community Level: Experiences and Lessons Learnt by CSOs
Chair: Dr. Maurice Odindo
Rapporteur: Dennis Mwangi

Taking malaria control to the community: A civil society perspective, **Edward Mwangi, KeNAAM**

Panel discussion: The future of malaria control at the community level: A regional advocacy network perspective
Moderator: Edward Mwangi

Experiences of malaria implementation at community level in the coastal region in Kenya, **Jasho Bomu, Coastal Malaria Advocacy Network**

Role of CSOs and communities in Highland endemic region in Kenya, **Stephen Ngososei, Highland Advocacy Network**

Role of CSOs and communities in strengthening health systems in high malaria transmission area, **Eric Omondi, Lake Endemic Malaria Advocacy Network**

Experiences of malaria control programs in low transmission settings, **Georgina Ngugi, Low & Seasonal Advocacy Network**

Tea Break, 4–4:20 p.m.

Main Plenary, Mara North Ballroom
4:20–5 p.m.

Implications for malaria programme review and the next KMS, **Dr. Willis Akhwale, Lead Consultant, MPR**

Wrap up of the two-day forum and closing ceremony, **Dr. Waqo Ejersa, Head, NMCP**

MINISTRY OF HEALTH

3rd KENYA NATIONAL MALARIA FORUM

18TH AND 19TH OF SEPTEMBER 2018