CAMA
Corporate Alliance on Malaria in Africa

# World Malaria Day Webinar 2026

# Outcome Report

**Date:** Tuesday 28th April 2026

**Theme:** Smart Vector Control for Workforce and Community Protection: Harnessing Technology to Strengthen LLIN and IRS Impact in Urban and Rural Settings

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First printing April 2026



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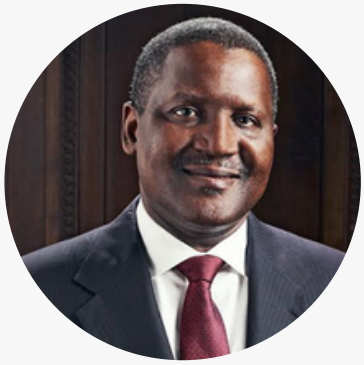
# Our Founders

## Mr. Aigboje Aig-Imoukhuede FCIB, CON

**Aigboje Aig-Imoukhuede is the Founder and Chairman of Africa Initiative for Governance (AIG), a not-for-profit organisation, established to be a catalyst for high public sector performance in Africa by bringing proven private sector innovation, leadership and funding to the public sector in a private-public partnership to attract, inspire and support future leaders of Africa's public sector.**

**Mr. Aig-Imoukhuede is also the Founder and Chairman of Coronation Capital Limited, an Africa-focused private equity and proprietary investment firm established in 2014. Prior to this, he was Group Managing Director and Chief Executive Officer of Access Bank Plc, where he led the transformation of the bank to rank amongst Africa's leading banks. Commander of the Order of the Niger "CON", conferred by the Federal Republic of Nigeria, for his contributions to the development of banking and finance, and Ernst & Young Entrepreneur of the Year (West Africa).**



## Mr. Aliko Dangote GCON

**Aliko Dangote is the Founder and President/Chief Executive of the Dangote Group, the largest conglomerate in West Africa. The Group currently has a presence in 17 African countries and is a market leader in cement on the continent. One of the Group's subsidiaries, Dangote Cement Plc, is the largest listed company in West Africa and the first Nigerian company to join the Forbes Global 2000 Companies list.**

**The Group has diversified into other sectors of the Nigerian economy including agriculture and is currently constructing the largest petroleum refinery, petrochemical plant and fertilizer complex in Africa.**

**Internationally, Dangote sits on the board of the Corporate Council on Africa and is a member of the Steering Committee of the United Nations Secretary-General's Global Education First Initiative, the Clinton Global Initiative, the McKinsey Advisory Council, and the International Business Council of the World Economic Forum.**

# Leaders of the Alliance

## Amaechi Michael Okobi - Chief Brand and Communications Officer, Access Corporation

Amaechi Michael Okobi is the Chief Brand and Communications Officer for Access Corporation. In this role, he oversees the positioning of the Access Corporation brand, including all banking and non-banking subsidiaries, across various markets. Prior to this role, Amaechi served as the Group Head of Corporate Communications for Access Bank, a position he held since joining the organization in 2014.

Amaechi is a marketing and communications professional with over 25 years of experience with global and Nigerian retail brands such as Revlon Inc., Nigerian Breweries Plc, Globacom Ltd, and Diageo Plc. His experience cuts across marketing; communications; brand management; market growth strategy; reputation management; and public relations.

## Zouera Youssoufou - MD/CEO, Aliko Dangote Foundation

Zouera Youssoufou is the Managing Director/CEO of the Aliko Dangote Foundation (ADF), the largest private Foundation on Africa, based in Lagos. In this role, she leads the Foundation's efforts to improve the health, nutrition, education and economic empowerment outcomes for the needy, primarily in Nigeria and in Africa.

She sits on several Boards including the African Business Coalition for Health (ABCHealth), Women's World Banking, Private Sector Health Alliance of Nigeria, ONE Global Leadership Circle, Center for the Strategic Studies on Africa, and International Institute for Sustainable Development (IISD). As of March 2020, Zouera also coordinates the Secretariat of CACOVID, the Nigerian Private sector coalition against Covid-19.

## Michael Steinberg - Health & Medical Specialist, Risk, Partnerships & Strategy, Chevron

Michael Steinberg is the Health & Medical Specialist, Risk, Partnerships & Strategy,- Chevron and a Population health management and public health professional with over twenty years of experience as a leader and manager. He has experience in various International assignments; a health subject matter expert; Corporate Pandemic Response Team member; Business Continuity process coordinator; communications lead; external partnerships lead, engagement and social investment lead; project, process, event and program manager; strategic planning and management; strong facilitation and training experience. Under his co-leadership, CAMA continues to play a vital role in advancing private-sector engagement and scaling impactful malaria control interventions across the continent.

**“Geographically, the disease is heavily concentrated. Nigeria alone accounts for approximately 32% of global malaria deaths, translating to an estimated 185,000 deaths annually, alongside a significant share of global cases.**

**Together with Democratic Republic of the Congo, Uganda, and Mozambique, these four countries contribute to nearly half of all malaria cases worldwide. This concentration highlights where interventions, financing, and policy attention must be most strategically directed for maximum impact.”**

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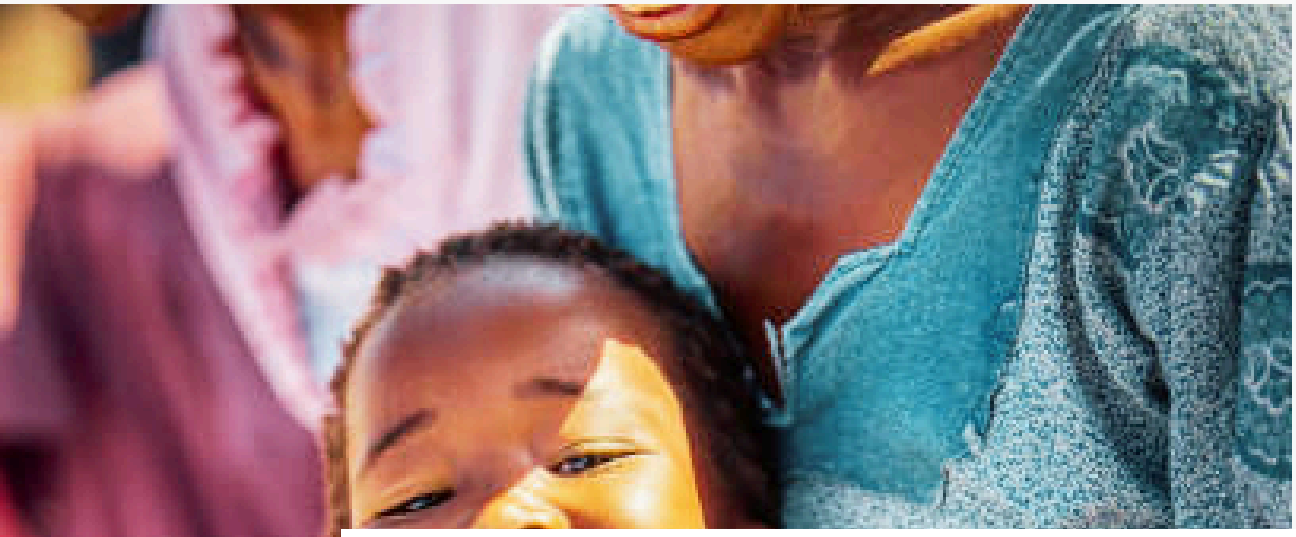

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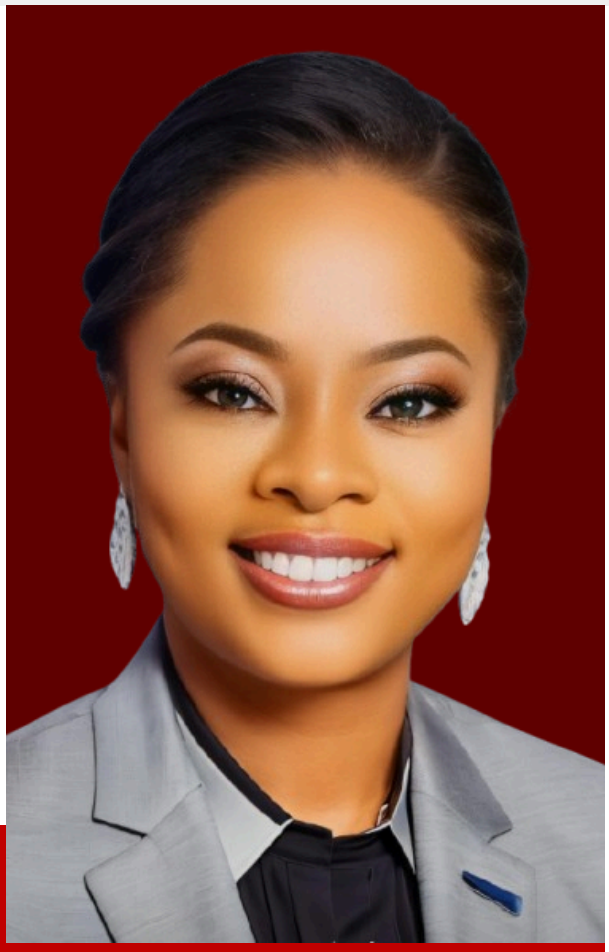
# Message from the CEO

**Dr. Mories Atoki**
Lead, CAMA Office
CEO, ABCHealth



**“Malaria control is no longer about the presence of tools, but the precision of their deployment, driven by data, strengthened by workforce systems, and optimized through smart, adaptive vector control.”**

Across Africa’s malaria control landscape, one reality is becoming increasingly difficult to ignore: tools alone are not enough—performance is now the real frontier.

The Corporate Alliance on Malaria in Africa (CAMA) convenes this World Malaria Day webinar under a deliberate focus: Smart Vector Control for Workforce and Community Protection: Harnessing Technology to Strengthen LLIN and IRS Impact in Urban and Rural Settings. The framing is intentional. Long-Lasting Insecticidal Nets (LLINs) and Indoor Residual Spraying (IRS) remain foundational interventions, but their effectiveness is increasingly shaped by how intelligently they are deployed, tracked, and optimized in real time.

What we are dealing with today is a gap in precision. In urban settlements where housing density shifts rapidly and informal structures evolve without notice, and in rural communities where access constraints distort coverage consistency, vector control systems must now operate with the discipline of data and the speed of adaptive intelligence. This is where technology ceases to be optional.

Digital mapping systems, geospatial surveillance, and predictive entomological modelling are no longer experimental add-ons—they are becoming the operational backbone for determining where LLIN distribution will have maximum compliance impact, and where IRS cycles must be recalibrated based on vector resistance patterns and seasonal transmission shifts. Without this layer, programme efficiency plateaus regardless of funding volume.

Community health workers, environmental officers, and implementation partners are now functioning as the primary data capture nodes in the malaria response system. The difference between routine reporting and real-time intelligence is the difference between reacting to outbreaks and preventing them. Training, digital literacy, and tool integration must therefore be treated as core infrastructure, not support activity.

The task ahead is straightforward in definition but complex in execution: make every intervention count twice, first in coverage, then in measurable transmission reduction. CAMA will continue to convene, align, and support partners committed to this shift. The urgency is not abstract; it is reflected in every preventable infection that occurs where tools exist but systems underperform. We move forward with clarity: smarter vector control is no longer an innovation agenda. It is an operational necessity.

# Members of the Alliance

## Leadership Council

## Affiliate Membership

# Background

For a long time, malaria control programmes across Africa have leaned heavily on two interventions: Long-Lasting Insecticidal Nets (LLINs) and Indoor Residual Spraying (IRS). Their contribution is undeniable. They have reduced illness and saved lives at scale. But their performance is no longer as steady as it once was. The conditions around malaria transmission have shifted, and the way these tools are used has not always kept up.

The contemporary malaria transmission landscape is no longer static or uniform. In urban settings, transmission is shaped by population density, informal housing structures, poor drainage systems, and localized vector breeding habitats that differ significantly from classical rural ecologies. Conversely, rural areas continue to experience entrenched transmission driven by agricultural practices, proximity to breeding sites, and limited access to health services. This duality demands a reconfiguration of vector control strategies—one that moves beyond blanket deployment of LLINs and IRS toward precision-driven, data-informed interventions.

What is changing is not the tools themselves, but how they are managed. There is a growing move toward what is often described as smart vector control. In practical terms, this means relying less on routine cycles and more on evidence that reflects current conditions. Data from the field, on weather, mosquito behavior, and human movement—feeds into decisions about when and where to act.

A critical technical limitation of traditional LLIN distribution lies in the assumption of consistent usage and durability over time. Field evidence increasingly demonstrates variability in net usage, physical degradation, and declining insecticidal efficacy, particularly in high-transmission and high-density environments. Smart monitoring systems, leveraging mobile data collection, sensor-enabled tracking, and community-level reporting platforms, offer the ability to assess net integrity, usage patterns, and replacement needs in near real-time. This shifts LLIN deployment from a static coverage model to a dynamic lifecycle management system.

Similarly, IRS implementation faces operational bottlenecks that reduce its effectiveness. These include suboptimal targeting of spray areas, inconsistent application quality, and limited post-spray evaluation. The incorporation of Geographic Information Systems (GIS), satellite imagery, and drone-assisted mapping allows for precise identification of high-risk zones, enabling targeted spraying that maximizes epidemiological impact while minimizing resource wastage. Furthermore, digital spray monitoring tools can track applicator performance, insecticide dosage, and spatial coverage, ensuring adherence to technical standards.

One of the most pressing technical challenges underpinning both LLIN and IRS interventions is insecticide resistance. The widespread resistance of Anopheles mosquito populations to pyrethroids—the primary class of insecticides used in LLINs, has significantly eroded intervention efficacy. Addressing this requires not only the deployment of next-generation nets (e.g., dual-active ingredient LLINs) and alternative IRS formulations, but also the establishment of robust resistance surveillance systems. Molecular diagnostics, entomological monitoring platforms, and integrated data repositories are essential for detecting resistance patterns and informing adaptive vector control strategies.

Urban malaria presents an additional layer of complexity. Unlike rural transmission, which is often seasonal and geographically predictable, urban transmission is fragmented and influenced by micro-environments such as construction sites, waste accumulation zones, and

water storage practices. Traditional LLIN and IRS approaches, designed for homogeneous rural settings, are often misaligned with these realities. Smart vector control in urban areas must therefore incorporate environmental management data, urban planning inputs, and community behavioral insights to effectively interrupt transmission cycles.

Workforce protection introduces another dimension to this discourse. Occupational exposure, particularly among agricultural workers, miners, construction workers, and informal sector participants—remains an under-addressed driver of malaria transmission. Standard household-based interventions do not adequately cover these populations, many of whom operate outside conventional sleeping hours or reside in temporary shelters. Technology-enabled solutions, such as wearable repellents, spatial repellents in work environments, and mobile health platforms for early diagnosis and reporting, are emerging as complementary tools within the smart vector control ecosystem.

Financing constraints further complicate the landscape. While LLIN and IRS programs have traditionally been supported by donor funding, the integration of digital technologies introduces new cost structures that require sustainable financing models. Public-private partnerships, outcome-based financing, and innovative procurement mechanisms are increasingly necessary to bridge this gap. Community engagement also remains a decisive factor. The success of smart vector control is contingent not only on technological sophistication but on user acceptance and behavioral compliance. Misuse of LLINs, resistance to IRS campaigns, and low trust in digital systems can undermine even the most technically sound interventions. As such, community-centered design and participatory approaches must be embedded within all technological deployments.

In summary, the evolution from conventional vector control to smart, technology-enabled systems represents a critical inflection point in malaria control efforts across Africa. Strengthening the impact of LLIN and IRS interventions requires a convergence of epidemiological intelligence, digital innovation, operational efficiency, and community trust. Without this integration, existing tools will continue to deliver diminishing returns in the face of changing transmission dynamics and biological resistance.

The webinar examined how data-driven tools and digital systems can improve the way LLIN and IRS interventions are planned, targeted, and monitored across varying transmission settings.

It provided a platform to unpack the differences between urban and rural malaria transmission, with a focus on aligning vector control approaches to context-specific realities rather than uniform deployment.

The session highlighted the growing impact of insecticide resistance on current interventions and drew attention to the need for continuous surveillance and the adoption of newer vector control products.

It brought into focus the gap in protection for high-risk workforce populations, particularly those whose exposure falls outside traditional household-based interventions, and discussed emerging response options.

# Opening & Keynotes' Insights

**“Malaria remains one of Africa's most persistent public health challenges, but because it reminds us that progress depends as much on how we act as on what we deploy”**

**Esther Graham** -
Sustainability Professional, Access Bank

The session opened with a formal welcome that was both warm in tone and clear in its intellectual framing. Appreciation was expressed for the convening of participants under a theme described as highly relevant, addressing not only the technical dimensions of malaria vector control but also the broader question of how intervention strategies are designed, implemented, and sustained over time.

The webinar was positioned as more than a ceremonial recognition of World Malaria Day, but as a functional platform for advancing practical, continent-wide malaria control strategies. Emphasis was placed on the integration of smart vector control tools, drawing on institutional experience to demonstrate their relevance in real-world operational contexts. The discussion further highlighted the importance of addressing both urban and rural environments in malaria interventions. It was noted that transmission dynamics, infrastructure capacity, and community behaviours differ significantly between densely populated urban centres and remote rural settings. As a result, effective vector control strategies must move away from uniform, one-size-fits-all models and instead adopt context-specific, data-informed deployment approaches. This includes tailoring interventions to local epidemiological patterns, environmental conditions, and population mobility, in order to maximise impact and sustainability across diverse settings.

A core focus of the address was the multi-dimensional toll malaria inflicts on African development. By linking public health to economics, the co-chair framed malaria as a barrier to regional prosperity:

- Humanitarian Toll: Africa remains the global epicenter of malaria, with young children and pregnant women suffering the highest morbidity and mortality rates.
- Livelihood Erosion: Recurrent infections drain household incomes through medical costs and lost wages, trapping families in cycles of poverty and stalling human capital development.
- Corporate Productivity: For businesses operating across Africa, malaria drives absenteeism, increases healthcare expenditures, and lowers operational efficiency.

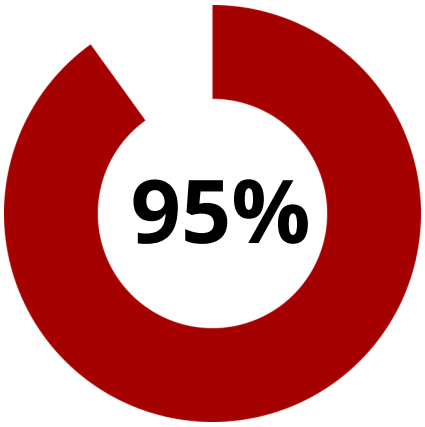
The address balanced praise for established vector control tools with a realistic view of their field execution. While acknowledging that LLINs and IRS are evidence-based, historically proven pillars of sub-Saharan malaria reduction, the co-chair noted that their real-world impact depends entirely on deployment quality. Operational challenges frequently weaken these interventions:

- LLINs suffer from supply chain gaps, inconsistent household usage, and poor maintenance.
- IRS campaigns face hurdles regarding timing, chemical resistance management, and gaining household entry.

Consequently, she called for "intelligent, equitable, and contextual application." This means deploying data-driven systems to target interventions where they are most needed, ensuring vulnerable populations are not left behind and have equitable access to prevention, diagnosis, and treatment interventions.

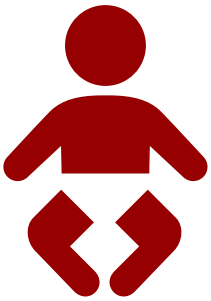
Because malaria intersects with healthcare, agriculture, urban planning, logistics, and governance, it cannot be solved in isolation. A successful LLIN campaign, for example, requires coordination between manufacturers, shipping firms, local ministries, and community health workers.
The opening address called on participants to dismantle professional silos, examine what is working, and determine how emerging technologies can complement legacy infrastructure. Progress relies on continuous, iterative collaboration rather than isolated, short-term projects that disappear once initial funding ends. Given that CAMA’s membership includes diverse industries, every organization possesses unique data on workforce health initiatives.

## The Continental Burden

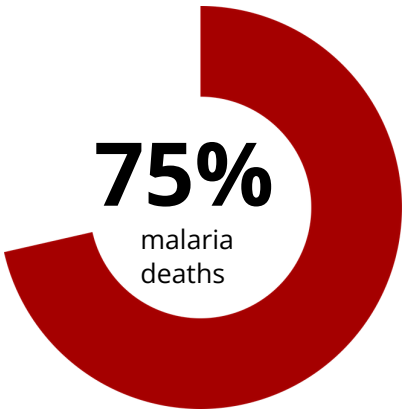



**282** million malaria cases worldwide

**265** million cases accounted in Africa region by WHO



Young children remain the most vulnerable demographic




under 5 crisis in Africa

## High-Burden Concentration

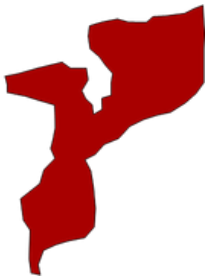
The "Top 5" Hotspots: Over half of all global cases are concentrated in

Nigeria

Uganda

Democratic Republic of Congo

Ethiopia



Mozambique

## Biological & Financial Macro Threats

The optimization of smart technology is urgently required because traditional control methods are facing unprecedented structural headwinds:

- Insecticide Resistance: Mosquito resistance to pyrethroids (the primary chemical used in standard bed nets) has been actively confirmed in 48 out of 53 monitored countries in Africa.
- Invasive Vectors: Anopheles stephensi, an invasive mosquito species that thrives in urban water containers and bypasses traditional rural control models, has now successfully expanded into 9 African countries.
- The Funding Gap: Global malaria funding stands at roughly US$ 3.9 billion, which is less than half of the annual financial resources required to properly achieve international elimination targets.

**“Progress depends not on more tools, but on precise execution, driven by data, strengthened by partnerships, and enabled by systems that convert intelligence into timely, coordinated, and accountable action across interventions.”**

**Dr. Jide Idris** -
Director-General, Nigerian Centre for Disease Control & Prevention

Delivering the webinar’s opening keynote address, Dr. Jide Idris, Director-General of the Nigeria Centre for Disease Control and Prevention (NCDC), provided a highly technical, systems-level diagnostic appraisal of contemporary vector-borne disease control in Africa. Rooting his analysis in extensive subnational governance experience as the former Commissioner for Health for Lagos State, he eschewed conventional epidemiological rhetoric to frame the enduring malaria burden not as a failure of biomedical innovation, but as a direct consequence of operational vulnerabilities, fragmented execution, and structural deficits in precision targeting. He asserted that the primary barrier to malaria elimination across the continent is no longer the unavailability of efficacious tools, but rather the persistence of weak implementation frameworks, imprecise geographic targeting, and delayed response mechanisms. Expressing gratitude to the Corporate Alliance on Malaria in Africa (CAMA) and ABCHealth for convening a multi-sectoral cohort of public health practitioners, clinical researchers, industrial innovators, and development partners, the Director-General emphasized that the discourse surrounding smart vector control must be treated not as an abstract academic exercise, but as a deeply operational and personal imperative demanding immediate structural reform.

The NCDC Director-General observed that the sheer heterogeneity of urban ecosystems renders centralized, top-down public health strategies obsolete, underscoring the axiomatic reality that no singular sovereign government possesses the fiscal, logistical, or analytical capacity to achieve elimination independently. This operational reality necessitates a paradigm shift toward shared institutional ownership and the institutionalization of highly adaptive health systems. By reframing malaria control from a localized, vertical disease program into a broader systems challenge, the address positioned vector-borne pathogens as acute, systemic risks that simultaneously compromise macroeconomic stability, strain national health systems, and disrupt societal cohesion. This systemic vulnerability is further compounded by the concurrent escalation of co-endemic, climate-sensitive arboviral threats, such as dengue and chikungunya, which demand unified, integrated surveillance architectures capable of responding to multi-pathogen vectors.

Simultaneously, a profound geopolitical and scientific transition is occurring across sub-Saharan Africa, as the continent actively shifts from being a historical recipient of external biomedical solutions to becoming an active laboratory for globally relevant public health innovation. Resource constraints and historical infrastructure deficits have catalyzed the development of integrated, highly scalable methodologies that offer critical lessons for global health security. The Director-General posited that the trajectory of modern malaria control depends entirely on high-resolution precision medicine and targeted vector management. While traditional interventions—specifically Long-Lasting Insecticide-Treated Nets (LLINs) and Indoor Residual Spraying (IRS)—remain foundational pillars of vector control, their clinical and epidemiological efficacy is increasingly compromised by burgeoning physiological and behavioral insecticide resistance among Anopheles populations.

Consequently, overcoming these biological headwinds requires an unprecedented level of granularity in geographic targeting, continuous entomological monitoring, and agile programmatic adaptation. Reflecting on subnational data from Lagos, where longitudinal entomological surveys and Geographic Information System (GIS) mapping revealed stark, localized variations in parasite prevalence across contiguous municipal areas, the address reinforced the scientific reality that blanket, non-differentiated intervention coverage yields diminishing returns, confirming that spatial and epidemiological precision is the definitive determinant of impact.

**"Elimination depends on coordinated delivery systems, private sector engagement, and innovation that aligns technology, behaviour, and financing for scalable, sustainable impact."**

**David McGuire** -
Founder/President, Adirondack Consulting

Reflecting on over 25 years of operational experience in malaria endemic regions, David McGuire began with foundational public-private frameworks in Ghana and extending through leadership of major global initiatives including USAID's NetMark project and the Innovative Vector Control Consortium's (IVCC) Next Generation Indoor Residual Spraying (IRS) and New Nets projects, the current landscape demands an analytical review of global intervention frameworks.

Vector control remains the historical anchor of global anti-malaria campaigns. Over the past two decades, these interventions have averted more than two billion malaria cases and preserved an estimated 14 million lives globally, with the vast majority of this impact concentrated within Sub-Saharan Africa.

While long-lasting insecticidal nets (LLINs) have served as the primary mechanism driving these reductions, historical epidemiologic data confirms that single-modality reliance is insufficient for elimination. No nation has successfully achieved zero indigenous transmission without implementing a multi-tiered vector management matrix that pairs LLIN deployment with complementary tools, such as Indoor Residual Spraying (IRS) and Larval Source Management (LSM).

## Current Epidemiological and Operational Headwinds

The contemporary vector control paradigm is restricted by a compounding matrix of biological, environmental, and financial challenges:

- Insecticide Resistance & Behavioral Adaptation: Vector populations are displaying heightened metabolic and target-site resistance to traditional chemical classes. Simultaneously, an evolutionary shift toward outdoor, early-evening biting patterns bypasses the protective window of indoor interventions.
- Urbanization of Transmission: The rapid growth of urban malaria presents complex, highly dense vectors capes that traditional rural distribution frameworks fail to address adequately.

- Macro-Financial Retraction: Declining international donor financing introduces structural vulnerabilities, threatening the continuity of commodity procurement and programmatic execution.

## Shift from Biological Barriers to Implementation Science

The primary constraints to elimination has evolved past basic biological and funding limitations; it is fundamentally an issue of delivery systems and deployment optimization. Extensive field data indicates that despite high rates of net ownership driven by mass distribution campaigns, actual product usage rates remain suboptimal.

This operational gap underlines a critical requirement: product design and distribution mechanisms must evolve beyond mere commodity drops. Interventions must be designed with deep consideration for local socio-behavioral dynamics, household architectures, and community-level economic drivers.

Concurrently, the technical pipeline is undergoing significant acceleration. The deployment of advanced tools offers a clear pathway forward:

- Precision Digital Tools: The integration of artificial intelligence (AI) and geo-spatial analytics to map vector density, allowing national programs to transition from blanket distributions to highly targeted, predictive resource allocation.

## Triad of Social, Commercial, and Structural Innovation

| Pillar | Strategic Focus | Operational Output |
|---|---|---|
| **Social Innovation** | Advanced Demand Generation | Shifts community perception from passive net ownership to active, continuous utilization. |
| **Commercial Innovation** | Market-Based Access Models | Stimulates commercial supply chains to provide affordable, high-efficacy products independently of public sector campaigns. |
| **Structural Integration** | Public-Private Partnerships | Engages the private sector directly in product R&D, cold-chain logistics, and regional manufacturing. |

Technical Innovation] + [Social/Commercial Innovation] = Scalable Vector Elimination

├── Next-Gen Dual LLINs
├── Spatial Emanators
├── Spatial Emanators

├── Market-Based Access
├──AI & Digital Platforms
├──Local Manufacturing

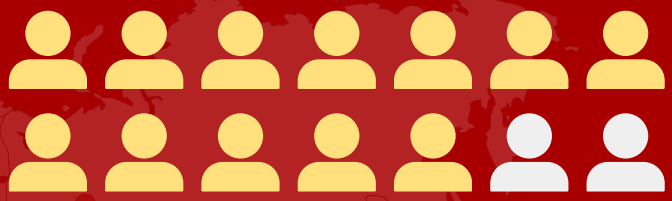
- Next-Generation Nets: Interventions incorporating dual-active ingredients (such as chlorfenapyr or PBO synergists) to neutralize metabolic resistance.
- Spatial Emanators: Passive, low-maintenance chemical dispersal systems addressing outdoor and transitional transmission spaces.

Unlocking operational scale requires pairing technological breakthroughs with comprehensive social and commercial innovation. The historic approach of treating private enterprise merely as a vendor or donor must be abandoned in favor of deep strategic integration.

**“Progress against malaria is measurable: billions of cases averted, millions of lives saved, with Africa carrying both the greatest burden and the greatest share of impact through targeted, proven interventions.”**

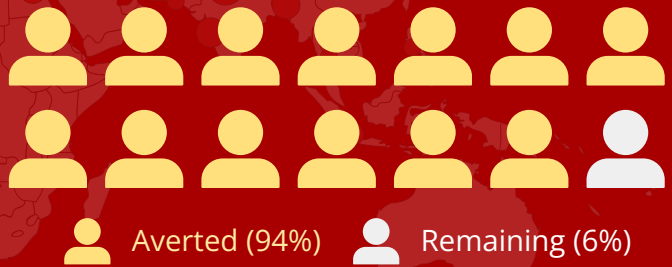
## 2.1 billion

malaria cases averted



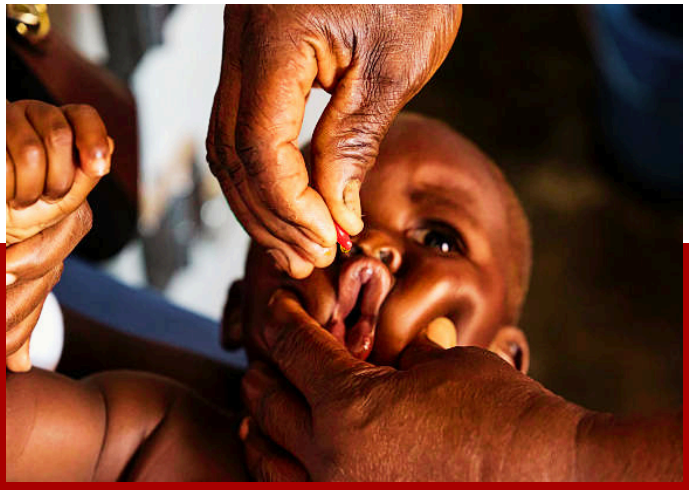

## 11.7 million

deaths prevented



**“LLINs and IRS remain the foundation of malaria control, and technology must strengthen them by enabling smarter targeting, and adaptive delivery that sustains impact and prevents resurgence.”**

**Patrick Sieyes** -
Director-General, Strategic Partnerships and External Affairs, Vestergaard



## Strategic Orientation: Defending and Optimizing the Structural Foundation of Vector Control

Patrick Sieyes reinstated that, in establishing the operational and strategic direction for modern malaria control, analysis must be anchored by a core epidemiological reality: long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) remain the indispensable foundation of global malaria control and elimination strategies. Data from the Malaria Atlas Project underscores this reality, demonstrating that LLINs and IRS collectively account for approximately 77% of all malaria cases averted since the turn of the century. Strikingly, insecticidal nets alone are responsible for 72% of that total.

The critical importance of these baseline interventions stems from the exponential dynamics of malaria transmission. In high-burden settings, the reproduction number of the parasite is remarkably high; a single untreated infection can quickly generate hundreds, or even thousands, of secondary cases within an unprotected population.

Consequently, LLINs and IRS cannot be viewed as optional, secondary, or legacy modalities. They are the keystone interventions that depress transmission to levels where other medical innovations—including newly deployed vaccines and next-generation biologics, become structurally viable.

## The Economics of Prevention and the Risk of Resurgence

Financing frameworks must prioritize the continuous maintenance and defense of this vector control foundation. The fiscal resources required to sustain effective, population-wide LLIN and IRS coverage are nominal when weighed against the catastrophic economic and clinical costs of programmatic failure. Historical and contemporary data warn against the premature withdrawal or disruption of these programs.

When foundational vector control tools fail or are retracted, transmission dynamics rebound with extreme velocity. An operational warning is found in recent data from Uganda, where the discontinuation of IRS campaigns triggered a devastating sixteen-fold increase in malaria cases within a single twelve-month cycle.

Operational Precedent: The withdrawal of indoor residual spraying in targeted districts of Uganda resulted in a 1,600% transmission rebound within one year, illustrating how rapidly control gains erode without continuous baseline protection.

## Technology as an Operational Enabler

Technological integration delivers critical optimization across four core operational vectors:

Granular Clarity: Digital surveillance infrastructure and molecular resistance mapping provide an unclouded view of current field realities, highlighting exactly where vector populations are building behavioral or chemical defenses.

Precision Targeting: Micro-stratification data allows national programs to move away from inefficient, uniform distribution models. Instead, resources are deployed to match specific tools with the precise geographical and temporal risk profiles of distinct communities.

Efficacy Protection: Continuous real-time monitoring and rapid post-deployment feedback loops allow managers to identify gaps in coverage or shifts in vector behavior early, enabling rapid, data-backed course corrections.

Structural Accountability: Machine-scannable supply chains and digital reporting dashboards introduce radical transparency to distribution logistics, improving decision-making pipelines and ensuring that commodities reliably reach the intended workforce and communities.

## Driving Innovation to Sustain Impact at Scale

The strategic objective facing vector control stakeholders is not to choose between legacy tools and emerging technologies, but to determine how digital innovation, advanced data analytics, and public-private partnerships can be integrated to keep proven interventions working at peak efficacy.

Technology strengthens impact only when it is directed toward defending, optimizing, and scaling the foundational interventions that have driven the global fight against malaria for decades. If this baseline is protected through smarter execution and cross-sector collaboration, the pathway toward complete eradication remains structurally viable. Conversely, if the foundation is neglected in pursuit of unproven distractions, that pathway will close rapidly.

The immediate operational mandate for national programs, donors, and private sector partners is clear: focus innovation where it delivers the highest absolute level of community protection, sustains impact across deep distribution networks, and keeps vector control parameters well ahead of an evolving biological risk landscape.

**“Vector control remains the foundation of malaria reduction; AI is only a tool, dependent on quality local data, strong governance, and integration with frontline systems to improve decisions and outcomes.”**

**Dr. Peter Billingsley** -
Founder, The Vital Narrative

## The Dichotomy of Technological Integration in Public Health

While vector control remains the undisputed foundation of global malaria reduction, operational failures in this domain yield immediate and severe epidemiological resurgences. In entering the discourse on digital transformation and Artificial Intelligence (AI) within vector control, a critical distinction must be maintained: AI functions strictly as an operational enabler, not a biological cure.

The prevailing enthusiasm surrounding machine learning in public health must be tempered by rigorous quality engineering. Suboptimal technological tools yield suboptimal public health outcomes; poorly specified, validated, or deployed algorithms can introduce profound systemic risks and actively harm public health efforts. Absolute quality assurance, algorithmic validation, and operational fidelity must remain at the center of all digital interventions.

## Data Architecture, Quality, and Governance Frameworks

The performance envelope of any artificial intelligence system is strictly bounded by the fidelity of its underlying data streams. To prevent catastrophic model drift and ensure clinical relevance, analytical models must rely on data that meets three strict criteria:

- Locality: Data must reflect the precise micro-epidemiological dynamics of the specific catchment area, recognizing that transmission vectors vary heavily across short geographical distances.
- Temporality: Input variables must be current, abandoning reliance on static, historical archives that fail to capture sudden environmental shifts.
- Continuity: Surveillance pipelines must be continuously updated to match the rapid evolution of malaria transmission patterns and the shifting profiles of metabolic and behavioral insecticide resistance.

Furthermore, the rapid expansion of AI-driven surveillance introduces complex challenges in data governance. The massive volume of telemetry, demographic, and geospatial information generated requires secure storage architecture, highly responsible management practices, and standardized data interoperability protocols.

Regional oversight is vital in this domain. African institutions—most notably the Africa Centers for Disease Control and Prevention (Africa CDC)—are uniquely positioned to establish, regulate, and lead these data governance frameworks, ensuring continental data sovereignty and standardized public health metrics.

## Mitigating the Research-to-Implementation Divergence

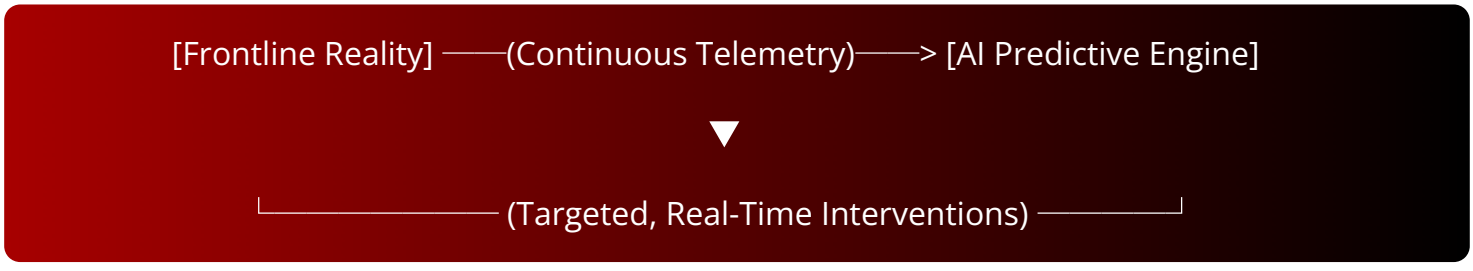
A primary risk of advanced computational modeling is the potential to widen the systemic gap between academic research and field-level implementation. Highly sophisticated predictive models must not distance strategic decision-making frameworks from frontline operational realities.

To maintain practical utility, the personnel closest to field implementation, community health workers, local vector control technicians, and district program managers, must remain centrally integrated into the co-design, iteration, and practical application of these digital systems. Technology must democratize field insights rather than stratify management.

## Applied Case Studies in Precision Vector Surveillance

When properly engineered, artificial intelligence fundamentally optimizes vector control by facilitating superior data collection, generating high-fidelity predictive models, anticipating regional risks, and enabling the adaptation of field interventions in real time. This operational optimization allows national programs to maximize resource efficiency, achieving higher impact under tight budgetary constraints.

| Region / Initiative | Technological Deployment | Operational Impact |
|---|---|---|
| **Kenya** | Real-time digital surveillance systems | Rapid tracking and containment mapping of highly invasive, urban-adapted vector species like Anopheles stephensi. |
| **Bioko Island** | Deeply digitized, end-to-end malaria control registries | Precise spatial tracking of indoor residual spraying coverage and household-level intervention histories. |
| **The Amazon Basin** | Predictive environmental outbreak modeling | Early-warning alerts based on hydrological and meteorological data to pre-emptively deploy resources before transmission spikes. |
| **Global Deployments** | AI-powered computer vision and optical identification tools | Accelerated, automated entomological classification of mosquito species and resistance traits at scale. |




The future of global eradication campaigns will not be forged by automated systems operating in isolation. Maximizing public health impact requires the structural integration of data silos, breaking down historical barriers to connect disparate streams across four pillars:

- Vector Control Metrics: Continuous tracking of LLIN durability, usage rates, and IRS deployment timelines.
- Vaccine Logistics: Spatial mapping of immunization coverage and pediatric demographic data.
- Resistance Monitoring: Genomic and bioassay tracking of insecticidal breakdown and vector mutations.
- Epidemiological Surveillance: Real-time clinical case mapping and diagnostic test positivity rates.

Linking these components creates a highly responsive, unified system. The ultimate goal of integrating artificial intelligence into vector control is to transition global health frameworks from a historically defensive, reactive posture into a predictive model that anticipates and outpaces the vector landscape.

# Panelists' Insights

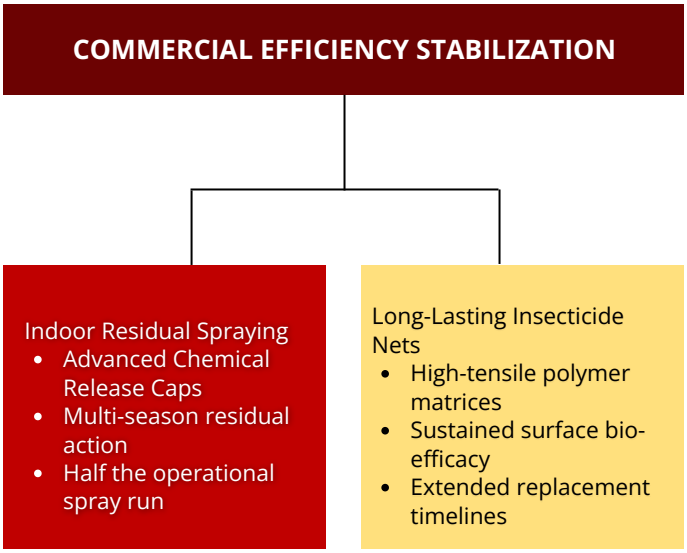
## Structuring Commercial Solutions for Public Health Priority

Balancing industrial market realities with urgent public health mandates requires commercial manufacturers to evolve beyond the legacy model of transactional commodity supply. Leading actors within the commercial vector control sector are actively redesigning development pipelines to optimize three core performance metrics: affordability, long-term field durability, and logistical efficiency. This approach ensures that sophisticated intervention tools remain accessible to both highly visible national programs and marginalized, low-income rural communities.

In an era defined by macro-economic pressure and volatile global supply lines, commercial innovation is focused on total cost-of-ownership reduction rather than simple unit-price compression. By engineering tools that optimize field operations, the commercial sector lowers the execution costs borne by national malaria control programs and international implementing partners.

## Technical Enhancements in IRS Formulation and Net Longevity

Commercial research and development has achieved significant operational efficiencies across the two primary modalities of baseline vector control:




## Advanced Indoor Residual Spraying (IRS) Formulations

The primary cost driver of indoor residual spraying is not chemical procurement, but the immense logistical and human capital expenditure required to execute a field campaign. Commercial entities are actively

**"Commercial vector control is evolving through affordable, high-performance IRS and LLIN innovations, supported by strong partnerships, in high-burden settings."**

**Christine Ochieng**
Head of Commercial Operations, Vector Control , Sub-Saharan Africa, Envu

mitigating this challenge by engineering advanced chemical release matrices that extend residual bio-efficacy over long periods. By formulating active ingredients that remain chemically stable on diverse wall surfaces (including mud, brick, and plaster) throughout an entire multi-month transmission season, these next-generation compounds eliminate the need for mid-season re-spraying. Halving the required frequency of field deployment runs drastically lowers labor, transport, and warehousing costs for implementing agencies.

## High-Durability Long-Lasting Insecticidal Nets (LLINs)

Within the LLIN product space, commercial innovation is centered on physical and chemical durability. If a distributed net suffers premature structural tearing or rapid insecticidal decay under real-world household conditions, the cost-per-person-year of protection rises sharply. Commercial engineering now integrates high-tensile polymer matrices with controlled-release insecticidal coatings designed to withstand severe

mechanical wear and repeated washing cycles. Ensuring that a net retains full protective efficacy across its intended multi-year lifespan allows national programs to extend replacement cycles, stabilize multi-year budgetary forecasts, and protect remote populations continuously without premature coverage gaps.

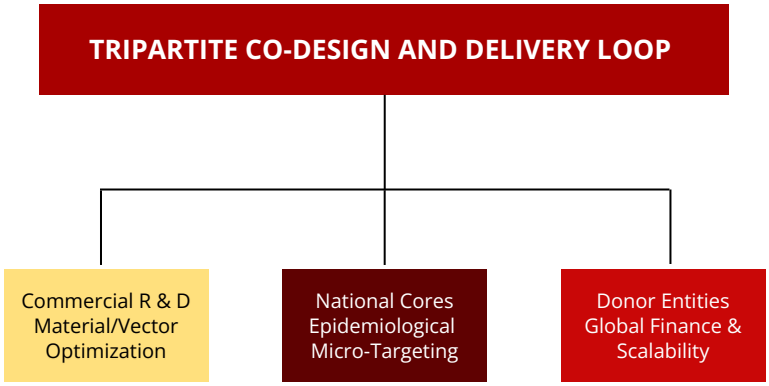
## Lifecycle Value and Collaborative Optimization

This structural transition signifies that the private sector is delivering continuous operational performance and lifecycle value across the entire deployment chain, rather than isolated, one-time commodities. Product engineering is deliberately aligned with the field realities faced by spray teams and logistics managers in complex terrains.

| Component | Technical Strategy | Systemic Value |
|---|---|---|
| **Formulation Stability** | Extended chemical active-ingredient retention | Minimizes programmatic vulnerabilities to unexpected shifts in seasonal rainfall and transmission peaks. |
| **Material Resistance** | High-tensile textile polymers | Extends field survival of nets, minimizing the need for emergency top-up distributions. |
| **Operational Synergy** | Pre-optimized, user-centric packaging | Accelerates daily field loading operations and reduces localized deployment waste. |

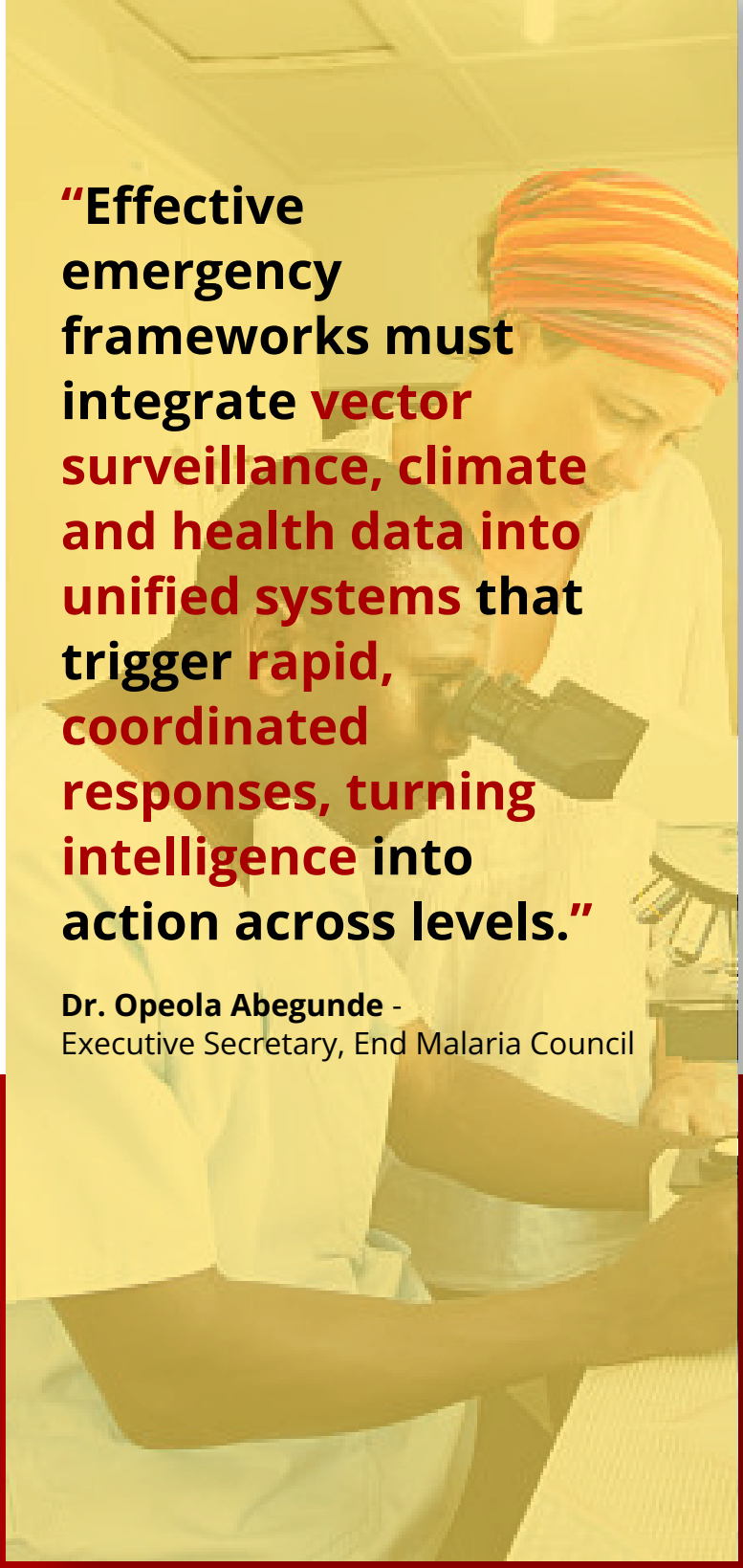
## Deep Institutional Integration for Scalable Impact

The maximum public health impact of these commercial breakthroughs can only be realized when product innovation is paired with deep institutional collaboration. Private sector innovators are establishing deep strategic partnerships that connect national malaria control programs, field-level implementing agencies, and international donor organizations.




This tripartite integration optimizes communication channels, eliminates historical supply chain inefficiencies, and ensures that highly sophisticated vector control technologies are deployed according to exact technical specifications. In a highly resource-constrained global health environment, priorities must shift toward tools and corporate partners that offer the highest absolute return on investment in terms of cases averted per dollar spent. The necessary intervention toolkits are fully developed and commercially viable; securing a definitive reduction in the global malaria burden requires prioritizing these high-impact, durability-engineered solutions within integrated deployment frameworks.

Furthermore, this focus on operational durability directly addresses the geographic inequities that historically left remote, infrastructure-poor rural populations vulnerable to transmission rebounds. By matching long-lasting chemical and material profiles with the harsh environmental realities of these underserved regions, the commercial sector transforms vector control commodities into resilient public health infrastructure, ensuring that limited deployment budgets yield sustained, equitable protection across both dense urban centers and the most distant rural frontiers.



**“Effective emergency frameworks must integrate vector surveillance, climate and health data into unified systems that trigger rapid, coordinated responses, turning intelligence into action across levels.”**

**Dr. Opeola Abegunde** -
Executive Secretary, End Malaria Council

## Reconceptualizing Malaria as a Macro-Economic Priority

In evaluating global eradication efforts, the operational landscape of Nigeria demands singular attention. The nation bears the highest absolute malaria burden globally, representing over a quarter of all global cases and nearly a third of related mortalities. Consequently, managing this epidemiological crisis cannot be treated purely as a localized medical or public health issue. Within the strategic framework of national development, malaria elimination is categorized as an urgent macroeconomic and sovereign priority.

The mandate of specialized oversight bodies, such as the Nigeria End Malaria Council, focuses on high-level institutional advocacy, multi-sectoral resource mobilization, and structural accountability. Rather than managing direct field implementations, the core objective is to dismantle administrative silos and catalyze coordinated action across government ministries, private sector alliances, and international development partners.

## Reconceptualizing Malaria as a Macro-Economic Priority

The primary constraints in contemporary vector control is not a scarcity of intervention modalities or a deficit in raw statistical data. High-burden settings currently possess extensive data streams; the critical operational failure lies in the latency between data acquisition and field-level execution. To optimize vector control interventions such as Long-Lasting Insecticidal Nets (LLINs) and Indoor Residual Spraying (IRS) in both urban and rural environments, three structural pivots must be executed:

**Systemic Surveillance Integration:** Data architectures must move away from isolated silos. Integrated platforms must dynamically merge routine clinical health data (such as facility-level diagnostic positivity rates) with active entomological vector surveillance and macro-climate intelligence (including precipitation anomalies and ambient humidity tracking) into a single decision-making engine.

**Automated Response Thresholds:** The presence of predictive data must be legally and operationally tied to predetermined response protocols. When vector surveillance crosses a specific threshold—such as an spike in density or a detected shift in metabolic insecticide resistance—it must automatically trigger localized vector containment efforts within hours or days, bypassing standard multi-month administrative approval loops.

**Subnational Capacity and Decentralized Financing:** True operational speed is determined at the grassroots level. Local governments and district health authorities must be directly equipped with the necessary digital tools, legal autonomy, and flexible financing structures to deploy vector control resources immediately upon receiving early-warning data signals.

## Cross-Sector Optimization and Corporate Alliances

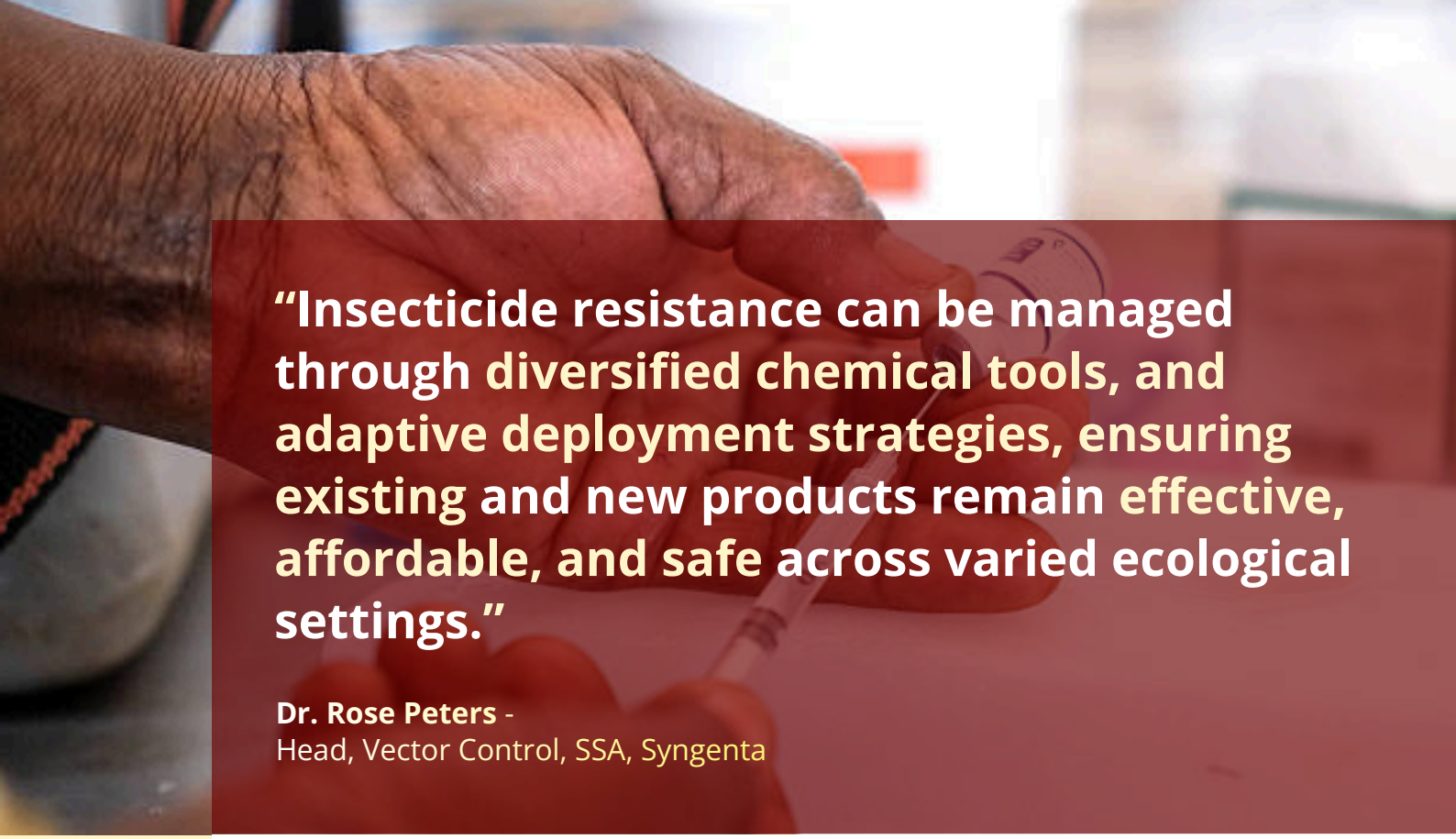
Mitigating structural delays requires establishing multi-sectoral accountability frameworks that mobilize non-traditional resources during transmission spikes. This integrated approach ensures that when an epidemiological anomaly is detected, public resources, private capital, and logistics networks are deployed in a synchronized manner.

| Focus Area | Collaborative Mechanism | Programmatic Safeguard |
|---|---|---|
| **Public-Private Integration** | Joint logistics and supply chain networks | Eliminates stockouts of essential vector control commodities during seasonal spikes. |
| **Cross-Sector Finance** | Blended financing structures and domestic capital | Insulates local malaria programs from international donor budget cuts. |
| **Accountability Metrics** | Transparent, data-driven scorecards | Tracks vector control performance continuously across all government levels. |

## The Mandate for Public-Private Integration Platforms

The tools, analytical data, and cross-sector partnerships required to compress transmission dynamics are already fully available. The primary barrier to achieving a malaria-free status is the execution gap. Institutional platforms, such as the Corporate Alliance on Malaria in Africa (CAMA), provide a vital framework for integrating private sector operational capacities directly into national health architectures.

By leveraging corporate logistics, project management models, and corporate capital, national programs can transition from a historically passive approach to a dynamic, data-driven execution model. If these operational frameworks are systematically aligned, the public health sector can close the execution gap, protect the workforce, and significantly accelerate progress toward complete malaria elimination.



**“Insecticide resistance can be managed through diversified chemical tools, and adaptive deployment strategies, ensuring existing and new products remain effective, affordable, and safe across varied ecological settings.”**

**Dr. Rose Peters** -
Head, Vector Control, SSA, Syngenta

## Agrochemical Class Diversification and the Post-Pyrethroid Landscape

The long-term efficacy of long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) is structurally threatened by widespread vector resistance to traditional chemical classes, most notably legacy pyrethroids. In response to this biological pressure, the vector control and agrochemical sectors have transformed chemical pipelines, shifting away from a reliance on a single class of active ingredients.

Modern chemical manufacturing focuses on formulating and commercializing long-lasting vector control products across multiple, distinct chemical classes. This expansion introduces novel modes of action—such as next-generation pyrroles, neonicotinoids, and organophosphates—re-establishing high mortality rates among vector populations that carry metabolic or target-site resistance mutations.

**EVOLUTION TO MULTI-CLASS INTERVENTION MATRICES**

Legacy Mono-Culture (Fail)
Continuous Pyrethroid Exposure

- Target Site Mutations (Kdr)
- Metabolic breakdown pathways
- Programmatic failure/rebound

Multi-Class Resistance Matrix
Alternation, Mosaics, Combinations

- Rotational chemical classes
- Neutralizes target-site resistance
- Preserves lifespan of assets

## Strategic Optimization of the Extant Insecticide Portfolio

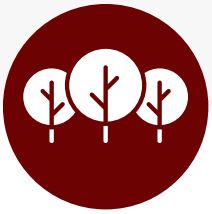
The global vector control framework does not necessarily require the immediate, continuous discovery of entirely new chemical molecules to maintain effective control. The current portfolio of public health insecticides remains highly capable of driving down transmission metrics affordably, provided deployment follows strict resistance-management protocols rather than uniform, long-term application.

Achieving this optimization requires integrating advanced resistance-surveillance data with procurement and distribution pipelines. Rather than waiting for complete operational failure, modern vector control programs leverage molecular and bioassay data to map emerging resistance patterns early. This proactive data acquisition allows implementing agencies to shift chemical classes before resistance genes become fixed within a local vector population, maximizing the cost-effectiveness and operational lifespan of both new and legacy formulations.

## Applied Operational Frameworks: The Mosaic Approach

The practical viability of managing vector resistance through spatial and temporal diversification is clearly demonstrated by successful sub-Saharan implementation models. A prominent example is found in the national malaria control strategy of Zimbabwe, which utilizes a structured mosaic approach for indoor residual spraying campaigns:

**Spatial Stratification:** Adjoining geographic zones or districts are systematically assigned distinct chemical classes with completely different modes of action (e.g., alternating between organophosphates and next-generation neonicotinoids).



**Preventing Selection Pressure:** By breaking up the chemical landscape, vector populations moving across districts face changing selection pressures, preventing the rapid accumulation of resistance genes to any single insecticide.

**Preserving Legacy Compounds:** This targeted spatial rotation preserves the utility and field-level effectiveness of older, highly affordable insecticides within the broader IRS matrix, preventing their premature obsolescence.

## Dismantling Silos via Big Data Integration

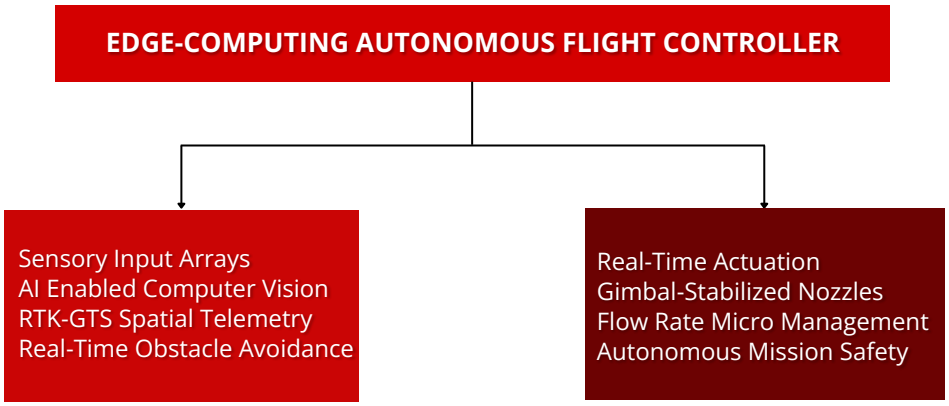
Overcoming vector resistance and achieving malaria elimination requires breaking down long-standing operational silos across the agrochemical industry, public health sectors, research institutions, and digital technology fields. The necessary physical commodities and data inputs are already available; the critical requirement is the strategic application of big data analytics.

| Data Stream | Analytical Input | Strategic Outcome |
|---|---|---|
| **Entomological Surveillance** | Real-time resistance mapping and bioassay tracking | High-precision choice of insecticidal products tailored to current local susceptibility. |
| **Agrochemical Pipelines** | Operational data from agricultural pest control programs | Pre-empts cross-resistance risks arising from insecticide use in commercial farming. |
| **Logistical Analytics** | Dynamic supply chain monitoring | Automates the delivery of matching insecticide classes to correct zones before transmission seasons begin. |

## Hardware Architecture and Precision Aerial Deployment Systems

The integration of robotics and unmanned aerial vehicle (UAV) platforms represents a shift from blanket, manual vector interventions to high-precision, automated environmental management. In developing advanced automated hardware specifically for malaria vector control, the engineering focus centers on multi-tier aerial systems optimized for targeted chemical deployment.

Specialized agricultural and environmental drones are engineered to carry payloads up to 5 liters of active anti-malarial compounds. These platforms utilize variable-altitude flight algorithms, operating at both high altitudes for landscape-level mapping and ultra-low altitudes for precise, targeted chemical deposition. This dual-altitude operational profile maximizes coverage efficiency while minimizing environmental drift, significantly lowering the volume of chemical agents required per hectare compared to traditional manual or broadcast methods.




The flight control systems of these precision platforms combine edge-computing and advanced hardware integration to navigate complex ecological landscapes:

AI-Enabled Computer Vision: Onboard cameras capture high-resolution imagery, feeding data directly into high-speed microcontrollers to classify larval habitats and potential adult resting sites in real time.

Precision Navigation: Real-Time Kinematic GPS (RTK-GPS) provides centimeter-level spatial telemetry, ensuring repeatable and accurate flight path execution.

Gimbal-Stabilized Nozzles: Spray nozzles are mounted on multi-axis active gimbals, dynamically adjusting their orientation relative to flight velocity and wind vector inputs to ensure exact targeting.

Obstacle Avoidance: Multi-directional sensor arrays (such as LiDAR or ultrasonic sensors) scan the environment continuously, allowing safe autonomous operation beneath canopy covers or around dense rural structures.

**"Robotics and drones enable precision vector control through AI-guided spraying, real-time hotspot detection, and autonomous navigation, improving safety, efficiency, and scalability in both indoor environments and hard-to-reach outdoor settings."**

**Mike Ojumu** -
Robotics Engineer, Multitech Robotics

## Nano-Robotics and Micro-Spatial Indoor Targeting

Beyond landscape-scale outdoor applications, autonomous intervention architectures are expanding into micro-spatial indoor environments. Traditional Indoor Residual Spraying (IRS) depends heavily on human operators, introducing issues with application uniformity and exposing workers to concentrated chemicals.

To address these limitations, development is underway on indoor nano-drone systems designed for household-level vector management. These micro-UAVs utilize indoor positioning systems (IPS) to navigate structural interiors safely without GPS signal availability.

**[Simultaneous Localization & Mapping] ⟶ [Hotspot Thermography Detection] ⟶ [Controlled Micro-Chemical Release]**

Operating autonomously, these nano-platforms execute simultaneous localization and mapping (SLAM) algorithms to generate a 3D digital twin of a building's interior. Using advanced sensors, the micro-drones detect micro-climatic and thermal indicators that pinpoint mosquito resting hotspots on walls and ceilings. Once a target area is identified, the platform delivers a controlled micro-spray of insecticide directly to the vector resting site, maximizing biological impact while significantly reducing human pesticide exposure and chemical waste.

## Hybrid Fleet Stratification and Bio-Inspired Networks

To scale these robotic interventions across diverse geographic terrains, deployment frameworks employ a stratified fleet strategy that matches specific aircraft designs with targeted operational goals:

| Aircraft Configuration | Technical Profile | Operational Role |
|---|---|---|
| **Rotary-Wing Copters** | High-payload capacity, vertical takeoff, precision hovering capabilities. | Micro-targeting of active larval breeding sites and localized hotspot spraying. |
| **Fixed-Wing Platforms** | Long-range endurance, high aerodynamic efficiency, extended battery life. | Large-scale environmental surveillance, macro-mapping, and hydrological tracking. |
| **VTOL Hybrid Systems** | Vertical takeoff combined with efficient horizontal forward flight profiles. | Rapid access and data collection across remote, topographically isolated terrains. |

This multi-tiered fleet operates as an integrated, bio-inspired engineering network. Rather than deploying isolated units, aerial drones, autonomous ground rovers, and static Internet-of-Things (IoT) sensor arrays are linked into a single, collaborative ecosystem. Ground sensors track environmental variables—such as localized soil moisture and temperature shifts—and send this data up to aerial platforms. This automated data loop allows the drone fleet to dynamically adjust mission profiles, prioritizing high-risk zones for immediate larval source management (LSM) runs.

**“AI strengthens vector control by converting surveillance and clinical data into predictive intelligence, enabling earlier outbreak detection and more precise, timely deployment of interventions across communities and national systems.”**

**Dr. David Muganzi**-
Founder, Mal AI

## Transforming Diagnostic Touchpoints into Distributed Surveillance Nodes

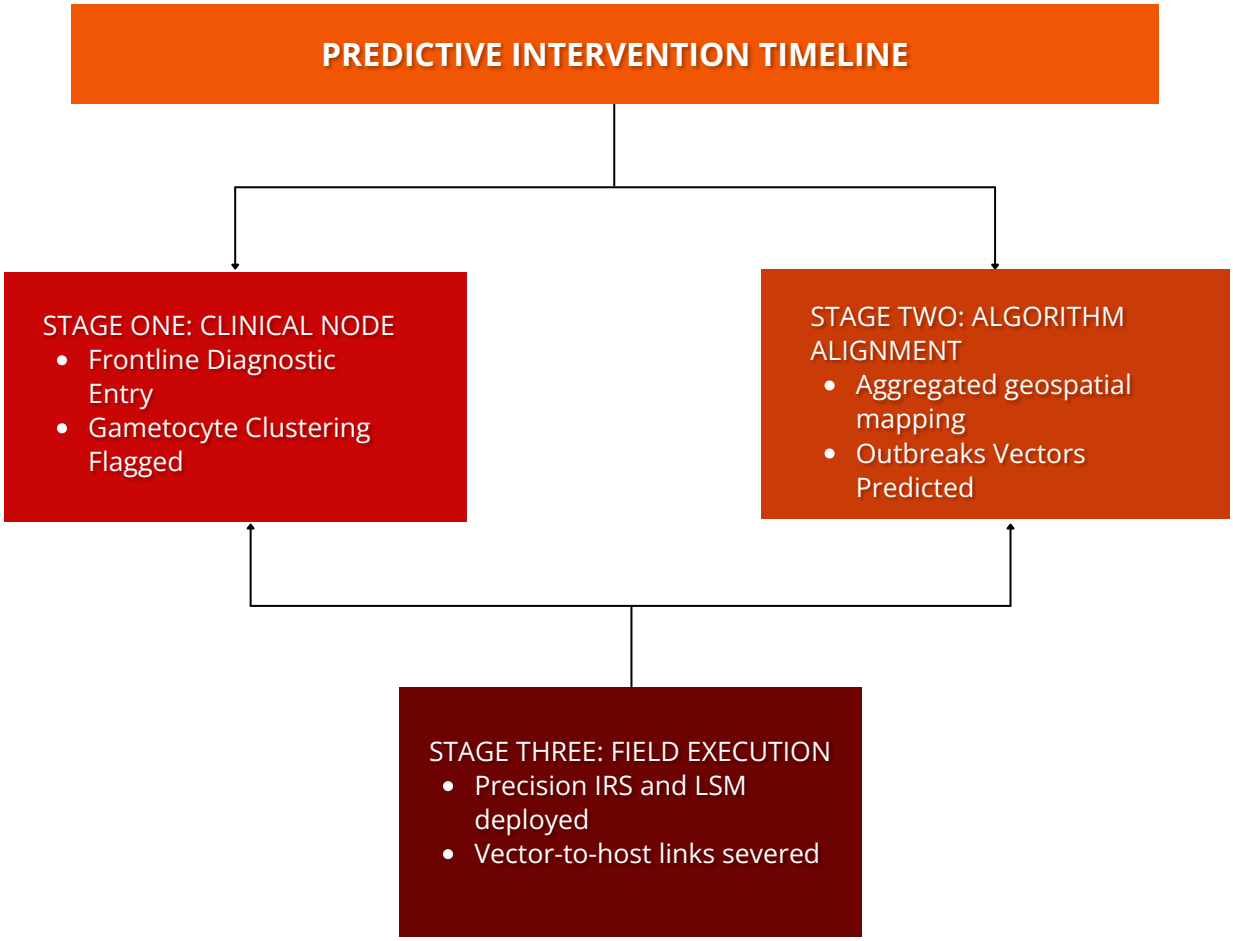
The foundational mechanism of historical malaria elimination campaigns centers on precise, targeted vector control. In modern public health architectures, maximizing the impact of available resources, such as Long-Lasting Insecticidal Nets (LLINs) and Indoor Residual Spraying (IRS) —requires moving away from uniform, calendar-driven distributions toward data-driven, precision-timed interventions.

This operational shift is made possible by integrating artificial intelligence (AI) directly into existing clinical pathways. Rather than relying solely on separate, intermittent field-level entomological surveys, this system configures every primary diagnostic point (such as point-of-care rapid diagnostic testing and clinical microscopy stations) into a distributed, real-time surveillance node.

By streaming dynamic diagnostic telemetry directly from frontline clinics into centralized machine learning models, public health programs can map transmission intensity with zero reporting lag. This integration bridges the historical gap between clinical medicine and field vector control, converting daily patient diagnostics into actionable environmental intelligence.

## Gametocyte Mapping and Predictive Outbreak Kinetics

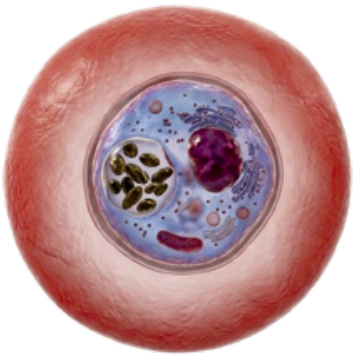
The application of predictive analytics to clinical data streams allows for the identification of specific biological markers that precede wider transmission spikes. A key metric monitored within this framework is the localized incidence of gametocyte-positive cases. Because gametocytes represent the transmissible life-stage of the Plasmodium parasite from humans back to mosquitoes, clustering these cases indicates a highly active, localized transmission reservoir.




When artificial intelligence models aggregate and visualize these gametocyte clusters alongside micro-climatic and demographic data, the system achieves two primary operational goals:

Early Warning Detection: Algorithms identify anomalous transmission patterns weeks before they manifest as broad community outbreaks, shifting national strategies from a reactive posture to pre-emptive containment.

Micro-Targeted Vector Deployment: Instead of executing expensive, region-wide spraying campaigns, implementing partners can deploy targeted IRS or Larval Source Management (LSM) directly to the specific neighborhoods or household clusters acting as primary transmission drivers.



## Plasmodium Parasite

**“Precision vector control powered by data and technology enables smarter targeting, stronger accountability, and collective action needed to accelerate progress toward malaria elimination.”**

**Dr. Francis Aminu** -
Director, Health & Nutrition
Aliko Dangote Foundation

## Institutional Integration of Health and Nutritional Interventions

Within the structural framework of continental development agendas, malaria is recognized as an interconnected health and economic variable that directly impacts workforce productivity, community resilience, and child development. Consequently, specialized philanthropic institutions, such as the Aliko Dangote Foundation, treat malaria control as an integrated pillar of their broader health and nutrition agendas.

Rather than viewing disease eradication through isolated clinical or therapeutic lenses, corporate and private philanthropic models position malaria suppression as a foundational requirement for sustainable socioeconomic advancement. This approach aligns directly with large-scale interventions designed to improve community nutritional baselines and human capital outcomes across sub-Saharan Africa.

## Transitioning to Precision Targeting and Resource Optimization

The contemporary operational landscape requires a shift away from traditional, blanket public health interventions. Historical distribution models characterized by uniform, unstratified commodity allocation often result in significant resource waste, programmatic inefficiencies, and localized coverage gaps.

To maximize the impact of essential vector control assets, such as Long-Lasting Insecticidal Nets (LLINs) and Indoor Residual Spraying (IRS), deployment strategies are transitioning to precision-targeted models driven by advanced data analytics and spatial modeling tools:

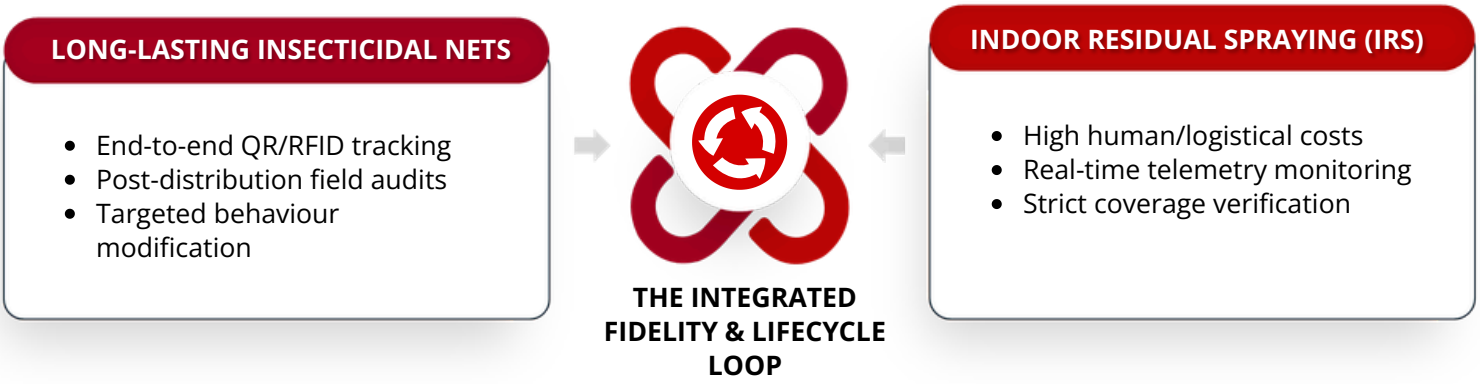
High-Resolution Hotspot Identification: Integrating digital mapping platforms and clinical surveillance data allows public health programs to identify precise geographic clusters driving high transmission.

Targeted Commodity Allocation: Pinpointing high-burden zones allows implementing partners to allocate commodities to areas with the highest epidemiological need, maximizing the cost-effectiveness of fixed procurement budgets.

Tailored Environmental Adaptations: Precision data systems enable vector control strategies to adapt dynamically to distinct urban and rural contexts, ensuring that intervention mixtures are tailored to the specific vector behavior and exposure risks of each landscape.

## Behavioral Fidelity, Operational Accountability, and Lifecycle Tracking

The long-term success of precise vector control depends on combining physical commodity distribution with structured behavioral tracking and strict operational accountability. Physical asset delivery alone does not automatically lead to immediate disease reduction.




For long-lasting insecticidal nets, achieving high public health value requires ensuring proper and consistent utilization among target populations. This necessitates implementing end-to-end supply chain tracking, post-distribution field audits, and targeted behavior-change communication programs to bridge the gap between net ownership and active use.

Concurrently, while indoor residual spraying remains a highly effective intervention modality, it is inherently resource-intensive, requiring extensive field logistics and specialized personnel. Managing these high execution costs requires embedding digital verification tools and transparent reporting loops within spray campaigns. This ensures strict tracking of house-spray rates, chemical application densities, and overall operational efficiency.

## Triple-Helix System Optimization

Integrating technical innovations, behavioral monitoring, and targeted logistics creates a resilient, data-driven prevention matrix. This combination delivers measurable improvements across three primary areas of public health management:

| Performance Vector | Analytical Driver | Systemic Return |
|---|---|---|
| **Financial Efficiency** | Predictive resource targeting and micro-stratification. | Minimizes asset misallocation, maximizing the cases-averted ratio per financial unit spent. |
| **Ecological Stewardship** | Targeted, data-justified chemical applications. | Reduces localized chemical loading, slowing down the development of environmental insecticide resistance. |
| **Programmatic Resilience** | Real-time surveillance feedback loops. | Allows field teams to adapt to sudden changes in vector transmission dynamics and environmental risks. |

# Conclusion & Key Takeaways

- Defend Foundational Interventions: Prioritize and maintain continuous coverage of LLINs and IRS as the non-negotiable anchors of global malaria elimination to prevent immediate transmission rebounds.
- Deploy Precision Micro-Targeting: Shift from inefficient blanket distributions to data-driven micro-stratification, matching specific vector tools to exact urban and rural environmental hotspots.
- Leverage Technology as an Enabler: Integrate AI, robotics, and drone technologies to automate surveillance, map resistance patterns, and maximize the precision of field operations.
- Convert Diagnostics into Live Surveillance: Connect frontline clinical touchpoints and gametocyte tracking into dynamic data networks to trigger localized containment within days instead of months.
- Procure for Operational Durability: Partner with commercial manufacturers specializing in high-tensile polymers and extended-release chemicals to reduce replacement costs and maximize asset lifespans.
- Implement Insecticide Mosaic Strategies: Utilize big data to coordinate spatial chemical rotations and mosaic deployments, actively neutralizing vector resistance while preserving legacy compounds.
- Integrate Private Sector Strategic Allies: Formally embed corporate partners into national planning and domestic manufacturing frameworks to insulate programs from declining international donor funds.
- Decentralize Subnational Execution Capacity: Equip local government authorities with direct financing, digital toolkits, and autonomous decision-making power to accelerate real-time outbreak responses.

## Future Outlook

Looking ahead, malaria elimination will rely on a shift from rigid, calendar-driven commodity drops to a highly adaptive, localized response system. Over the next decade, uniform campaigns will give way to cloud-based analytics that pinpoint exactly where and when to deploy resources. Frontline clinics will function as early-warning nodes, allowing a spike in positive tests to automatically trigger targeted vector control—such as deploying localized drone teams to urban breeding sites or distributing next-generation nets to vulnerable rural households.

To sustain this transition amid flattening international donor streams, endemic nations must build regional manufacturing hubs and integrate private sector logistics directly into national health frameworks. Ultimately, success will belong to programs that decentralize operations, handing real-time funding and digital tools over to local health authorities who can disrupt transmission pathways within days rather than months.

# Acknowledgements

On behalf of the African Business Coalition for Health (ABCHealth), the Corporate Alliance on Malaria in Africa (CAMA) extends its sincere appreciation to its distinguished leadership, Aliko Dangote, President of Dangote Industries Limited and Co-Founder of ABCHealth; Aigboje Aig-Imoukhuede, Chairman of Access Corporation and Co-Founder of ABCHealth; Ms. Zouera Youssoufou, Managing Director/CEO of the Aliko Dangote Foundation and Board Member of ABCHealth; and Dr. Mories Atoki, Chief Executive Officer of ABCHealth—whose collective vision, stewardship, and unwavering commitment continue to position ABCHealth as a trusted platform for private-sector leadership in Africa's health transformation. Their guidance remains foundational to the Coalition's work in advancing resilient health systems, catalyzing innovation, and strengthening the role of the private sector as a co-architect of sustainable healthcare solutions across the continent.

Profound appreciation is extended to all distinguished facilitators, speakers, panelists, partners, and stakeholders who participated in the CAMA World Malaria Day Webinar. The session provided a high-level platform for strategic dialogue, technical exchange, and cross-sectoral alignment, reinforcing the critical role of data, technology, and private sector partnerships in accelerating malaria elimination across Africa. The depth of engagement demonstrated by participants reflects a shared commitment to transitioning beyond traditional programmatic silos, expanding collective thinking, and contributing to measurable reductions in the malaria burden across both urban and rural settings.

The Alliance further recognizes the sustained technical contributions, operational insights, and strategic leadership of its participating member and partner organizations, whose efforts continue to underpin Africa's malaria response architecture. The active engagement of CAMA Members and Partners, has been instrumental in advancing smart vector control frameworks. These contributions continue to drive forward innovation in long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS), geospatial mapping, artificial intelligence-driven outbreak prediction, automated drone technologies, and multi-sectoral accountability mechanisms.

CAMA, anchored operationally by the African Business Coalition on Health (ABCHealth) as its Secretariat and coordination office, remains committed to strengthening multi-sectoral partnerships, enhancing implementation frameworks, and advancing data-driven, evidence-based interventions toward malaria elimination. The collective commitment of members and partners continues to serve as a critical driver in accelerating Africa's progress toward a malaria-free future, while ensuring alignment with national, regional, and subnational health priorities.

The Alliance further acknowledges with appreciation the thoughtful feedback, technical inputs, and strategic recommendations provided by the expert panelists and participants throughout the webinar. These contributions are instrumental in refining the roadmap for integrated vector management, strengthening public-private delivery channels, and enhancing the effectiveness of private-sector engagement in public health. The insights shared will continue to inform adaptive program design, improve execution efficiency at scale, and ensure that interventions remain highly precise, evidence-based, and responsive to evolving epidemiological and environmental needs.

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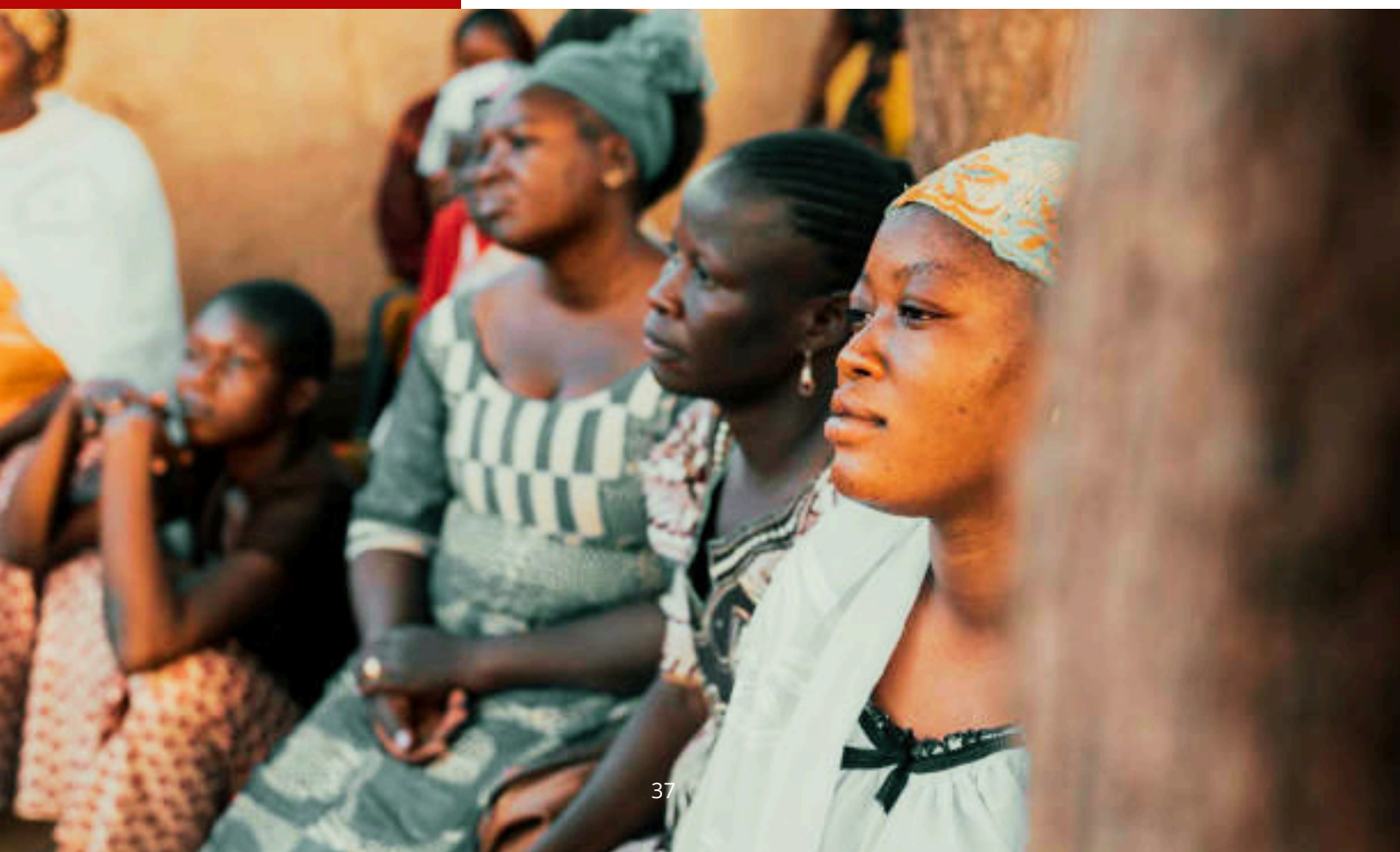
- Dr. Mories Atoki - Lead, CAMA Office, CEO, ABCHealth

# Acronym Key

**ABCHealth** – African Business Coalition for Health
**ADF** – Aliko Dangote Foundation
**AI** – Artificial Intelligence
**CACOVID** – Coalition Against COVID-19
**CAMA** – Corporate Alliance on Malaria in Africa
**CON** – Commander of the Order of the Niger
**FCIB** – Fellow of the Chartered Institute of Bankers
**GCON** – Grand Commander of the Order of the Niger
**GIS** – Geographic Information System
**IPS** – Indoor Positioning System
**IISD** – International Institute for Sustainable Development
**IoT** – Internet of Things
**IRS** – Indoor Residual Spraying
**IVCC** – Innovative Vector Control Consortium
**LLIN / LLINs** – Long-Lasting Insecticidal Net(s)
**LSM** – Larval Source Management
**MD/CEO** – Managing Director / Chief Executive Officer
**NCDC** – Nigeria Centre for Disease Control and Prevention
**R&D** – Research and Development
**RTK-GPS** – Real-Time Kinematic Global Positioning System
**SLAM** – Simultaneous Localization and Mapping
**UAV** – Unmanned Aerial Vehicle
**USAID** – United States Agency for International Development
**WHO** – World Health Organization



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# Join the Alliance

As the expectation for more cross-sector dialogue and collaboration becomes a mainstay in global health, CAMA has grown in its work over the years. Organizations willing to support the Alliance and to particpate actively in our activities may engage eitehr at the leadership level or the alliance level.

## Leadership level ($25K)

- Membership of the CAMA Leadership Council
- Introductions by CAMA team to Ministry officials & policy leaders, business leaders, NGOs and others in our network
- High-level visibility through the CAMA website, with featured membership page for your organization
- Priority access to events & speaking opportunities at CAMA and partner events
- Communications opportunities through our multimedia & social media channels; this may include features on your organization, podcast interviews & case studies in CAMA reports
- Input into strategic decision-making when CAMA's activities are being considered
- Priority for invitations to events (e.g. at UNGA, Business & Health Summit etc.) Opportunities to interact with governments, contribute to health policy development and raise awareness through specific malaria campaigns in countries where CAMA works
- Access to high-level technical guidance on malaria programming in countries where CAMA works. All of the benefits included in the Alliance level.

## Alliance level ($10K)

- Access to networking opportunities with government officials, policy managers, business leaders & other key stakeholders
- Visibility for your organization in CAMA newsletters, updates, and web/print publications
- Participate in CAMA events, including workshops & conferences
- Communication opportunities through our social media channels
- Logos on the CAMA website members' page

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